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# Performance and Volatility Modelling for Shariah Compliant Stocks in Malaysia Using Exponentially Weighted Moving Average

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*Abstract*-- **The diversity of investment in Malaysia provides an excellent platform to gauge volatility. Malaysia as an emerging market with a rich Islamic culture serves as an inspiration to randomly model a portfolio of 50 Shariah compliant stock returns from 2015 to 2020. The systematic risk of a company's stock returns is measured by computing the volatility and downside volatility for the said period. The Exponentially Weighted Moving Average (EWMA) method is used to outline the risk levels of Shariah compliant stocks for the recent stipulated period. The results indicate a statistical difference between beta and downside beta for Shariah compliant portfolio. This signals investors to be cognisant of the semi-variant characteristics of returns in estimating volatility. Meanwhile, there is no significant difference in performance using the Sharpe and Sortino ratio on the beta and downside beta scores respectively. Consequently, this suggests that investors can always measure performance to a sufficient degree of accuracy regardless of their volatility choice.**

*Keywords*— **Beta; Downside beta; Shariah-compliant stocks; EWMA; Sortino ratio; Sharpe ratio.**

## I. BACKGROUND OF STUDY

### *A. Overview*

The purpose of this section is to give an introduction to the research topic and key fundamental frameworks that lay the foundation of the study. This section also covers the problem statement, research questions, research objectives, the scope of the research as well as the structure of the study.

### *B. Introduction*

First introduced by [1], the introduction of the Beta function in the Capital Asset Pricing Model (CAPM) is a common method used in outlying systematic risks. An alternate measure of risk is the downside beta in asset pricing, presented by [2]. The downside beta model focuses on downside loss rather than the common Capital Asset Pricing Model (CAPM) practice of merging both downside and upside risk as one. This alternative approach to the mean-variance theory by [1] is regarded as the mean semi variance theory. In the same year, both Markowitz and Roy were simultaneously working on models that inform our judgement on efficient portfolio diversification. The principal outcome of their research proposes that for any equally weighted levels of risk, investors will always prefer to choose a portfolio that earns a higher return. This is in practical terms regarded as an efficient frontier. The Ordinary Least Squares (OLS) method is a good approximation for calculating beta.

The volatility ($\beta_{im}$) is given by:

$$\beta_{im} = \frac{E\{[((R_i - R_f) - E(R_i - R_f)]\, x\, [(R_m - R_f) - E(R_m - R_f)]\}}{E[(R_m - R_f) - E(R_m - R_f)]^2} \quad (1)$$

Where,
$R_i$: Expected return on $i^{th}$ Asset,
$R_f$ : Risk free rate,
$R_M$ : Return on the market,
$(R_M - R_f)$ : Market risk premium.

On the other hand, researcher [2] was more particular on downside beta (downside risk) and believed that investors care

more about not encountering losses than having gains. He is famously attributed with the phrase "safety first". Conversely, "Safety First-rule is not used in asset pricing until researcher [3] who replace variance with semi variance as the first official version of downside beta based CAPM" as indicated by research [4]. Additionally, the same research proposed that Downside CAPM (DCAPM) performed better compared to variance-based CAPM. The CAPM aggregates both downside and upside risks while semi variance clearly distinguishes between the two.
The downside beta is given by researcher [5] as:

$$\beta_i^- = \frac{Cov(r_i, r_m \,|r_m < u_m)}{Var(r_m \,|r_m < u_m)} \qquad (2)$$

where,
$r_i$ : The return on the $i^{th}$ asset,
$r_m$ : Return on the market,
$U_m$ : The average market excess return.

There are evidently fundamental pillars through which Shariah complaint stocks differentiate themselves from Conventional stocks. Some of these principles involve the reluctance to participate in practices involving uncertainty "Gharar" and speculation "Maysir", unwillingness in trading haram goods and not involved in taking interests after transactions.

### C. Problem Statement

It is established that with Shariah-compliant stocks, certain features distinguish it from its Conventional counterparts, such as its prohibition in taking interests, disengagement in trading forbidden "haram" products, and even participation in gambling. Nevertheless, both methods of trading have their unique advantages and disadvantages. However, there is arguably very limited literature on downside beta for stocks in Malaysia. This study intends to contribute to the growing literature surrounding the risk associated nature of businesses in Malaysia.
In addition, the modelling of downside beta is very important in an environment where market volatility cannot be avoided. However, there is very little research focused on downside beta and its implications on Shariah-compliant and Conventional stocks. Therefore, studying the characteristics of downside beta can greatly increase the accuracy in making risk averted decisions. Furthermore, in-depth knowledge of downside beta can help portfolios to maintain their value during market crises.

### D. Research Objectives

The objectives of the study are to:

1. Model the beta and downside beta of Shariah compliant portfolio using EWMA
2. Assess the level of performance for Shariah compliant portfolio.

### E. Importance of the Study

The rising interest in Shariah compliant businesses and Malaysia's growing interest in the fintech (finance and technology) industry, as indicated by researcher [6], serves as motivation for this research. The highly valued participation of Malaysia in the Islamic funds market necessitates the writing of this research. As of 2018, researcher [7] provides that Malaysia was ranked as part of the top three (3) country listings in terms of global Islamic funds alongside Iran and Saudi Arabia. The study will fulfill the urge to understand Shariah compliant stocks' volatile nature in an emerging market. The study results can be a guide for growing economies with a diverse portfolio that includes Shariah compliant stocks. Furthermore, the findings of the research will add up to the limited literature in the area of both beta and downside beta.

### F. Scope and Limitation of the Study

The scope of the study is limited to only Shariah compliant portfolio returns. Additionally, while a wide range of methods can successfully model both beta and downside beta, this research focuses only on the Exponentially Weighted Moving Average (EWMA). The EWMA is widely accepted as a good estimator of volatility, both in the financial management environment as well as the digital front, as indicated by researcher [8].

## II. LITERATURE REVIEW

### G. Introduction

In order to gain a strategic investment scheme, it is important to be able to predict simulations of market behaviours. This assures a clear qualitative description of how one can make an optimal investment with a sufficient enough controlled risk and return through measured covariance against the market.
As a result, the Greek letter beta ($\beta = 1$) is introduced for the wave movement of risk exhibited by the general market. Thus, security risks are measured in relation to market risk. Any aggressive security will have a $\beta > 1$ and defensive securities will have a $\beta < 1$. In place of a security's position in that spectrum, portfolios will react in retrospect if the market returns are negative (downside beta). The study focuses on analysing the beta and downside beta of 50 Shariah-compliant stock returns of firms in Malaysia.
The raw data for modelling for the volatility is retrieved from [9]. The downside beta is filtered to contain only returns below the zero threshold. The data obtained for the daily returns of Shariah-compliant stocks as at the publishing of this research is in line with listed Shariah-compliant firms on FTSE Bursa Malaysia EMAS SHARIA, which is a recognized Shariah compliant index in Malaysia. Furthermore, the method used for the modelling of the volatility is the EWMA.
This is enticed by the emerging Malaysian market growth over the last few years and its effectiveness in refining this data with better precision and accountability. The data will be sorted daily for the whole 5-year period.

The listings for the 50 Shariah-compliant stock closings is each treated independently. In calculating the beta for Shariah compliant portfolio, the log returns will be computed. However, for downside beta, the daily downside log returns are used instead. Furthermore, the returns are subtracted from a target return (set at 0). This is the by-line that differentiates upside from downside betas. The standard deviation, which represents the volatility is then computed for all the 50 Shariah-compliant stocks over the 5-year period. This provides enough sample size to monitor the downside betas in Shariah-compliant stocks.

Finally, in computing the performance of Shariah compliant portfolio, the research will employ the Sharpe ratio as well as the Sortino ratio as a test. The Sharpe ratio measures the beta to return performance of the Shariah compliant portfolio. Also, the Sortino is a comparative measure of performance and is used to compute the downside beta to return performance of the Shariah compliant portfolio. The greater the Sharpe and Sortino ratio, the higher the reward an investor earns per relative beta/downside beta.

The aim of this study is in large part, to model the characteristics of beta and downside beta for Shariah compliant Malaysian firms. This involves a meticulous analysis on historical stock returns for Shariah-compliant stocks.

### *H. Downside beta*

The concept of safety-first, as portrayed by researcher [2] is the backbone of downside beta. It made the pronounced distinction of an investor's appetite to differentiate between higher and lower co-moments. Essentially, it reaffirms that investors generally have asymmetric value functions which motivates them to pay keen attention to the distribution of positive and negative returns. The profoundness of downside beta is that investors are more concerned with losses. The formula below captures downside beta's influence in the return of an investment.

$$R_i = R_f + \beta_{im}^{-}\left(R_M - R_f\right) + \varepsilon_i \qquad (3)$$

where,
$R_i$: Expected return on $i^{th}$ Asset,
$R_f$ : Risk free rate,
$\beta_i^{-}$ : Downside beta,
$R_M$ : Return on the market,
$\left(R_M - R_f\right)$ : Market risk premium.
$\varepsilon_i \sim (0, \sigma^2)$ : *Residual*

As such, reference [1] recognized this important distinction in his portfolio maximization model. Other early contributors in the modelling of risk return trade-offs included [3] and [10]. Shortly after, researchers [11], [12] and [13] also made improvements to the lower partial moment-CAPM or downside beta. The general CAPM beta is given as:

$$\beta_im = \left(\frac{E\{[(\llbracket(R)\rrbracket_i - R_f) - E(R_i - R_f)]x\,[(R_m - R_f) - E(R_m - R_f)]\}}{E[(R_m - R_f) - E(R_m - R_f)]^2}\right) \qquad (4)$$

The research on downside beta by researcher [3] was set to differentiate between variance and semi variance for justifying the equilibrium price of risky assets. The aim is to provide a substitute to the expected return variance (EV) by a two parameter portfolio selection model called the Expected Value Semi Variance (E-S) Model. In this model, the introduction of the minimum operator acts on the market portfolio and seeks to choose the lowest possible value. The equation is given by:

$$\beta_{im}^{(HW)} = \frac{E\{[(R_i - R_f)]\ x\ min[\left(R_m - R_f\right), 0]\}}{E\{min[\left(R_m - R_f\right), 0]^2\}} \qquad (5)$$

Where,
$R_i$ : Return on the $i^{th}$ asset,
$R_f$ : Risk free rate,
$R_m$ : Return on market portfolio.

Other measures of downside beta is given by reference [12] involves setting a defined target instead of the risk free rate. This target is generally set at the equity market mean return. Reference [13] also made contributions to the computation of downside beta by demonstrating that downside beta is a more responsive volatility test compared to normal beta in emerging markets.

The Capital Asset Pricing Model (CAPM) is a means of giving a quantitative assessment of the relationship between systematic risk and expected return of an asset. This laid the groundwork for the CAPM formula which was later developed by references [14] and [15]. The CAPM states that required rate of return on an asset, given its level of risk, is:

$$R_i = R_f + \beta(R_M - R_f) \qquad (6)$$

where,
$R_i$: Expected return on $i^{th}$ Asset,
$R_f$ : Risk free rate,
$\beta$ : Systematic Risk,
$R_M$ : Return on the market,
$\left(R_M - R_f\right)$ : Market risk premium.

### *I. The CAPM*

The basis of the CAPM is rooted on the mean variance theory. This theory aims to maximize returns through relying only on the mean and variance of portfolio returns.

$$\beta_{im} = \frac{Cov\ (r_i\ , r_m\ )}{\sigma^2(r_m)} = \frac{Cov(\ r_i\ r_m)}{Var(r_m)} \qquad (7)$$

Note that $\beta$ is an integral of both upside gains and downside losses.

Beta is obtained by dividing the covariance of the asset return relative to the market, by the variance of the market. Beta measures the covariance of the stock with the market relative to the variance of the market. Therefore, if there is no market risk premium, the expected return will simply equal the risk free rate of return. However, as investors are compensated for taking risk, the expected return is no longer set at the risk free

rate. A correlation between $\beta$ and the market risk premium positively increases the expected return.

*1) Assumptions of the model*

The model assumes that investors are risk averse in nature and will therefore hold positions on the efficient frontier. Essentially, where there are multiple portfolios that yield equal expected returns, investors will select a portfolio that best minimizes the risk. The assumed risk is measured by the standard deviation of the returns. It also assumes that the market is in equilibrium with all investors having equal access to information. There are no transaction costs, inflation and taxes. Investors are at liberty to buy or sell any amount of shares. While all investments are held for the same amount of time, the purchase or sales of shares by individual investors cannot affect the prices. A further two assumptions were later improved in the Markowitz model by Sharp and Lintner. The first outlines that all investors have homogeneous expectations and hence, they will be indifferent in the choice of asset distributions from *t-1* to *t*. Additionally, all investors can lend and borrow at a risk free rate of interest.

*2) Concerns regarding the use of CAPM*

One issue of contention lies on the fact that the model assumes investors are risk averse in nature and are also efficient in their decisions. Therefore, the model does not differentiate between an upside gain from a downside loss (variance). However, there is growing evidence that implores a mean semi-variance behaviour over the mean variance theory which is influenced by the non-normal and asymmetrical returns, especially in emerging markets as captured by researcher [16]. It is thus arguably not an ideal model and consequently, not serving the best fit for purpose.

An additional criticism of the model is that it assumes beta to be a constant. As indicated by researcher [17] there are a wide range of literatures that argue the dynamic nature of volatility over time and therefore, representing it as a constant is not ideal. There are further publications rejecting the standard CAPM in significantly explaining the relationship between risk and return trade-off and this failure is compounded by the "incomplete information available in markets, investing in individual stocks rather than portfolios, and undiversified portfolios held by investors over short observation periods" as quoted from reference [18].

*J. CAPM and downside CAPM*

CAPM has been subjected to criticism but it is still widely used in the field of asset pricing. Its prevalence can be attributed to the fact that it is simple to execute and it has shown to be superior to both multi-factor and arbitrage models recognized by reference [19].

Regardless of its superiority, the CAPM is not the best of models to estimate risk. Several researchers have proved downside beta and semi-deviation to be more statistically significant models in estimating both stock volatility and equity discount rates. A modification of the basic CAPM to account for the separation of downside and upside gains resulted in Downside-beta CAPM (DCAPM). The DCAPM stands out over CAPM because it forgoes the assumption that investors are indifferent between upside gains and downside losses as well as normality as investigated by researcher [19].

Furthermore, there is evidence of higher predictability and explanatory power of downside beta compared to the standard beta in bearish markets as documented by references [5] and [20]

## III. METHODOLOGY

*K. Introduction*

The study observes the effects of beta and downside beta on 50 Shariah compliant stocks in Malaysia.

This chapter deals with the research design, followed by the different methods to calculate downside beta. Finally, the chapter closes up with the Sortino ratio to compare the performance of both sets of stocks with regards to downside beta. The diagram below captures the flow of the research.

*L. Research Design*

The daily stock returns was retrieved from [21] and was cross referenced with FTSE Bursa Malaysia EMAS SHARIAH listings to ensure the selected stocks fulfilled the Shariah compliant requirement. The data covered the period January 1st, 2015 to January 1st, 2020. The dataset was modified to smoothly account for days where no trading occurred. For periods where no data was recorded, the previous adjusted closing data was used instead. Furthermore, the number of trading days in a year was averaged at 252.

The beta of the stock was then computed using the EWMA method. This was preceded by the computation of downside beta for the selected portfolio. Comparative analysis on the scores of beta and downside beta was done. To indicate whether the results were significant, a t-test was levered on the results.

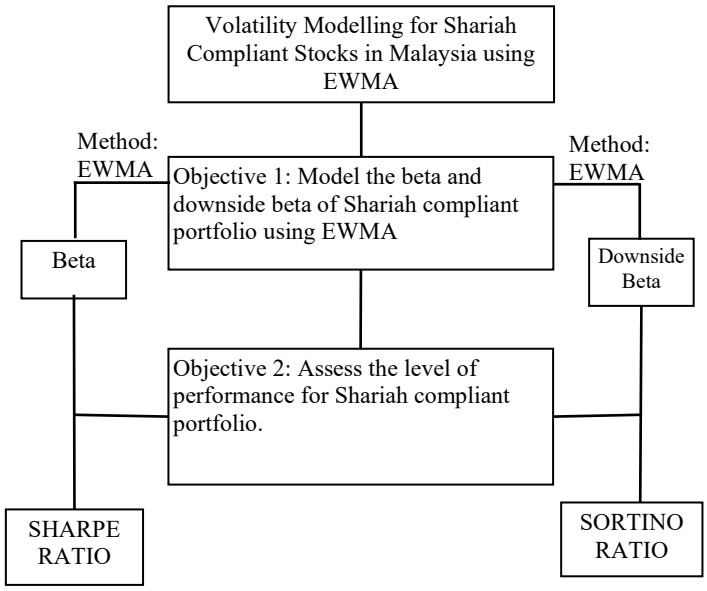


Figure 1 Flowchart indicating the structure of the research

*3) Computing Rate of Return*

Return is simply a measure of how much money an investor gains or losses on an investment. It is a fundamental index in our computation of downside beta, which ultimately discloses the level of volatility/risk. The daily stock returns ($u_{n-i}$) will be generated by:

$$Return_t = u_{n-i} = Ln\left(\frac{Price_t}{Price_{t-1}}\right) \quad (8)$$

where,
$Return_t$ : $u_{n-i}$ : Stock Return at time t,
Ln: Natural Logarithm,
$Price_t$ : Stock price at time t,
$Price_{t-1}$ : Stock price at time t – 1.

Then, the target return is set at 0. This becomes the mean ($\bar{u}$) return to differentiate the downside returns from the upside. It is denoted by:

$$\bar{u}_i = 0 \quad (9)$$

*M. EWMA Method*

Standard deviation is a measure of volatility. It is obtained through computing the squared downward deviation from a benchmark (FTSE KLCI). In more analytical terms, it is expressed by [22]:

$$\beta_{sv,i} \equiv \frac{E\,[R_m R_i \mid R_m \leq 0]}{E\,[R_m^2 \mid R_m \leq 0]} \quad (10)$$

The numerator details the covariance between the market and the stock returns while the denominator highlights the variance of the market returns.
After sorting the returns for shariah-compliant stocks and conventional stocks, the next step is to find the variance of each portfolio. Firstly, the daily returns are each subtracted from the target return (0). Then, the values obtained are each squared and summed up. Finally, the result is divided by the total number of trading days in the sample size. In statistical form, it is denoted by:

$$\sigma_n^2 = \frac{1}{m-1}\sum_{i=1}^{m}(u_{n-i} - \bar{u})^2 \quad (11)$$

where,
$\sigma^2$ : Variance,
$m$ : Number of trading days,
$u_{n-i}$ : Return on $i^{th}$ asset,
$\bar{u}$ : Return threshold that separates losses from gains.

The standard deviation is then given by taking the square root of the variance.

$$\sigma = \sqrt{\sigma^2} = \sqrt{\frac{1}{m-1}\sum_{i=1}^{m}(u_{n-i} - \bar{u})^2} \quad (12)$$

Where,
M= 37 days
NB: The volatility for the 38th day was calculated by using the returns of the first 37 days. Therefore, there is no recorded daily volatility for the first 37 days because the returns were used as statistics to inform on the volatility for the 38th working day.

The EWMA is therefore an instrument that detects smaller fluctuations in the mean of data points constrained by time. By way of assumption, the EWMA is significant only when observations are normally distributed. In our computation of volatility, the EWMA allows for flexibility in more recent periods with weights having a higher influence on the volatility as opposed to previous periods. The only innovation for the EWMA over the historical volatility is the addition of weighted averages. The addition of weights allows for the designation of higher weight magnitude to more recent returns. Therefore, the 37 days' variance are such that the 37th day carries 94% of the total weight. This is called the smoothing parameter. The 36th day is assigned a weight of (94% of the weight of day 37). The 35th day is assigned a weight of (94% of the weight the 36th day), and so on. This implies that yesterday's return has a much higher influence in predicting today's returns as compared to the long run history. It is noteworthy to recognize that the introduced weights are allocated in an exponentially declining order and the resulting EWMA figures are the annual volatility estimates.

*4) The Smoothing Parameter*

The EWMA introduces a controlling/smoothing parameter lambda ($\lambda$) which is levered on each squared periodic return. $\lambda$ is a decay factor that lies between 0 and 1. It is typically assigned a value between 85% to 96%. The decay factor's effects on the model is such that lower $\lambda$ values will suppress the influence of more distant squared returns.
A lambda of 94% is chosen in this research as it is mainstream in most financial risk management companies [23]. The weight for the most recent return will be (1-94%), the subsequent weight will be (94% of the (1-94%)) and so on. This is represented as:

$$\sigma_{t-1}^2 = \lambda\sigma_t^2 + (1-\lambda)r_{t-1}^2 \quad (13)$$

Where:
$\lambda$ : smoothing parameter
$\sigma$ : Variance
$r$ : stock return

The EWMA uses a refined method of calculating the variance such that [24]:

$$\sigma^2 = \frac{(1-\lambda)\sum_{i=1}^{m}(\lambda^{i-1})(u_{n-i} - \bar{u})^2}{m-1} \quad (14)$$

where,
$(\lambda \mid 0 < \lambda < 1)$,
$\lambda$ : Smoothing parameter.

In summary,

1. We first obtain the daily log returns for the different portfolios in our study.
2. Next, we find the return threshold that separates losses from gains. This is subtracted from the monthly log returns.
3. Then, the log returns subtracted from the return threshold is squared. This is the variance of the portfolio and is represented by equation 14.

4. Assign weights to the returns in descending order of proportions with the most recent return carrying the most weight. The weights are assigned as $(1-\lambda)\lambda^{i=0}$ to the $i^{th}$ return.
5. The squared returns are multiplied with their corresponding weights and summed up.
6. Finally, the value is divided by the total number of trading days to give the total downside variance of the portfolio. The square root of the variance yields the standard deviation.

### *N. The Sortino Ratio*

The Sortino ratio is a measure of performance for downside volatility. It was introduced by researcher [25]. The slight variation between the Sharpe and the Sortino ratios is the exclusion of upside beta in the Sortino ratio. Further researchers working on the downside framework to compute the performance of investments includes reference [26]. The Sortino ratio subtracts the target return from the average returns and divides that value with the downside volatility. A higher Sortino ratio indicates a more efficient portfolio with a higher risk to reward ratio. The average Sortino ratio for the 5-year period is calculated for Shariah-compliant portfolio.

$$Sortino\ Ratio = \frac{u_{n-i} - \bar{u}}{\sigma} \tag{15}$$

where,
$u_{n-i}$ : Portfolio return,
$\bar{u}$ : Return threshold that separates losses from gains,
$\sigma$ : Downside deviation.

### *O. The Sharpe Ratio*

The Sharpe ratio was first introduced by researcher [14]. It is widely used as a measure of performance in the financial sector. When doing a comparative study between beta and return premium, the commonly utilized method is the sharp ratio. The ratio basically subtracts the risk free rate from a security's return and then divides the result with the security's standard deviation. The Sharpe ratio is given by:

$$Sharpe\ Ratio = \frac{u_{n-i} - \bar{u}}{\sigma} \tag{16}$$

where,
$u_{n-i}$ : Portfolio return,
$\bar{u}$ : Return threshold that separates losses from gains,
$\sigma$ : Standard Deviation.

The major difference between the Sharpe ratio and the Sortino ratio is the novelty in the divisor. The Sharpe ratio maintains the denominator as the standard deviation of both upside and downside deviations.

## IV. RESULTS AND DISCUSSIONS

### *P. OBJECTIVE 1: Model the beta and downside beta of Shariah compliant portfolio using EWMA*

#### *5) DESCRIPTIVE ANALYSIS ON DOWNSIDE BETA*

The descriptive statistics on the downside stock returns is given below. The table highlights the mean log stock return of each company. It also indicates the minimum value, skewness, kurtosis and Jarque-Bera values. The data is statistically significant as represented by the probability values. The table below highlights the descriptive analysis of the Shariah-compliant portfolio.

Table I Descriptive summary for Sharia-compliant portfolio downside returns

| | ***Mean*** | ***Max*** | ***Min*** | ***Skewness*** | ***Kurtosis*** | ***Jarque-Bera*** | ***Probability*** |
|---|---|---|---|---|---|---|---|
| *ADVENTA* | -0.94% | 0 | -0.20 | -3.35 | 16.86 | 12214.21 | 0 |
| *ANCOM* | -0.83% | 0 | -0.29 | -6.20 | 93.79 | 433106.5 | 0 |
| *APM_AUTOMOTIVE* | -0.41% | 0 | -0.07 | -3.12 | 15.70 | 10316.05 | 0 |
| *ASTINO* | -0.70% | 0 | -0.09 | -2.45 | 10.65 | 4252.904 | 0 |
| *BIMB_HLDS* | -0.41% | 0 | -0.07 | -2.86 | 16.00 | 10413.2 | 0 |
| *BORNEO_OIL* | -1.15% | 0 | -0.13 | -2.65 | 9.68 | 3755.461 | 0 |
| *CB_IND_PRODUCT_HOLDING* | -0.51% | 0 | -0.09 | -3.14 | 18.54 | 14485.49 | 0 |
| *COCOALAND_HLDS* | -0.50% | 0 | -0.17 | -5.10 | 58.19 | 162498.1 | 0 |
| *COMPLETE_LOGISTIC_SERVICES* | -0.73% | 0 | -0.14 | -3.28 | 18.10 | 13986.99 | 0 |
| *DUTCH_LADY* | -0.21% | 0 | -0.08 | -6.02 | 61.05 | 181293.5 | 0 |
| *EMICO* | -1.09% | 0 | -0.15 | -2.28 | 9.75 | 3423.89 | 0 |
| *FIAMMA_HLDS* | -0.57% | 0 | -0.09 | -2.73 | 12.80 | 6496.213 | 0 |
| *GOODWAY_INTEGRATED* | -1.28% | 0 | -0.28 | -3.56 | 24.02 | 25406.32 | 0 |
| *IJM_CORP* | -0.64% | 0 | -0.15 | -4.50 | 35.54 | 58797.05 | 0 |
| *IOICORP* | -0.38% | 0 | -0.14 | -5.82 | 72.58 | 256732.8 | 0 |
| *IVORY_PROPERTIES* | -0.87% | 0 | -0.13 | -2.96 | 15.94 | 10440.2 | 0 |
| *KL_KEPONG* | -0.24% | 0 | -0.07 | -4.43 | 34.56 | 55420.27 | 0 |
| *KRETAM_PROP* | -0.71% | 0 | -0.41 | -12.25 | 251.68 | 3220917 | 0 |
| *MATRIX_CONCEPTS* | -0.37% | 0 | -0.05 | -2.74 | 12.52 | 6224.247 | 0 |
| *MESB* | -1.07% | 0 | -0.27 | -3.50 | 21.36 | 19916.94 | 0 |
| *MESINIAGA* | -0.79% | 0 | -0.18 | -3.10 | 15.49 | 10026.78 | 0 |
| *MISC* | -0.40% | 0 | -0.14 | -5.95 | 69.74 | 237096.1 | 0 |
| *NESTLE* | -0.19% | 0 | -0.11 | -9.67 | 147.11 | 1090505 | 0 |
| *NOTION* | -0.92% | 0 | -0.32 | -6.08 | 81.97 | 329264.9 | 0 |
| *NTPM* | -0.56% | 0 | -0.13 | -3.60 | 25.32 | 28372.33 | 0 |
| *PAN_MALAYSIA_HLDGS* | -1.25% | 0 | -0.33 | -3.62 | 25.35 | 28456.22 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *PANSAR* | -0.59% | 0 | -0.13 | -3.91 | 27.13 | 33173.48 | 0 |
| *PANTEC* | -0.61% | 0 | -0.10 | -2.87 | 16.13 | 10590.11 | 0 |
| *PESTECH* | -0.60% | 0 | -0.07 | -2.47 | 10.63 | 4260.767 | 0 |
| *PETRA_ENERGY* | -1.03% | 0 | -0.24 | -4.07 | 29.51 | 39680.94 | 0 |
| *PUBLIC_PACKAGES* | -0.69% | 0 | -0.12 | -2.84 | 15.97 | 10339.8 | 0 |
| *SAPIND* | -0.55% | 0 | -0.16 | -4.31 | 29.56 | 40227.17 | 0 |
| *SARAWAK_CONSOLIDATED* | -0.94% | 0 | -0.23 | -3.85 | 23.66 | 25072.24 | 0 |
| *SBCCORP* | -0.62% | 0 | -0.19 | -4.71 | 37.77 | 66927.99 | 0 |
| *SCANWOLF_CORP* | -1.09% | 0 | -0.34 | -4.30 | 35.24 | 57434.53 | 0 |
| *SCGM* | -0.65% | 0 | -0.21 | -5.58 | 63.92 | 197875.7 | 0 |
| *SHH_RESOURCES* | -0.68% | 0 | -0.15 | -3.44 | 19.28 | 16110.03 | 0 |
| *SIG_GASES* | -0.82% | 0 | -0.14 | -3.25 | 18.55 | 14654.25 | 0 |
| *SIG_INT* | -0.83% | 0 | -0.17 | -3.85 | 27.49 | 33990.71 | 0 |
| *SIME_DARBY_BHD* | -0.47% | 0 | -0.35 | -15.28 | 373.04 | 7111363 | 0 |
| *SLP_RESOURCES* | -0.68% | 0 | -0.12 | -3.19 | 16.80 | 11925.81 | 0 |
| *SPRITZER* | -0.41% | 0 | -0.09 | -3.39 | 19.26 | 16020.29 | 0 |
| *SUCCESS_TRANSFORMER* | -0.74% | 0 | -0.17 | -4.44 | 33.01 | 50511.63 | 0 |
| *SUPERLON_HLDGS* | -0.79% | 0 | -0.20 | -4.56 | 40.10 | 75271.86 | 0 |
| *TAANN* | -0.57% | 0 | -0.12 | -3.14 | 19.59 | 16233.85 | 0 |
| *TASEK* | -0.36% | 0 | -0.08 | -3.98 | 23.17 | 24249.57 | 0 |
| *TEO_SENG_CAPITAL* | -0.76% | 0 | -0.12 | -3.34 | 18.15 | 14142.2 | 0 |
| *TIME_DOTCOM* | -0.46% | 0 | -0.14 | -5.78 | 58.16 | 163819.6 | 0 |
| *TONG_HERR_RESOURCES* | -0.55% | 0 | -0.16 | -4.50 | 36.33 | 61493.09 | 0 |
| *TSH_RESOURCES* | -0.49% | 0 | -0.08 | -2.66 | 12.92 | 6537.773 | 0 |
| ***AVERAGE*** | **-0.007** | | **-0.16** | **-4.36** | **43.15** | | |

The data showed that the average mean for Shariah compliant portfolio (log) stock returns was -0.007. The highest recorded average mean was -0.0128 by Goodway Integrated. The lowest recorded average mean was Nestle, at -0.0019. The average negative skewness was -4.36. The highest negative skewed return was Sime Darby Bhd, at -15.28. The least skewed was Emico, standing at -2.28. The average kurtosis was 43.15. This was a representation of the average peak of downside returns. Sime Darby took the lead at the highest peak point with a value of 373.4 while the lowest was Borneo at 9.68.

Table II DESCRIPTIVE ANALYSIS FOR BETA STOCK RETURNS

| | Mean | Max | Min | Skewness | Kurtosis | Jarque-Bera | Probability |
|---|---|---|---|---|---|---|---|
| ADVENTA | -0.03% | 0.24 | -0.20 | 0.43 | 10.14 | 2668.82 | 0 |
| ANCOM | 0.03% | 0.28 | -0.29 | 1.13 | 28.14 | 32874.37 | 0 |
| APM_AUTOMOTIVE | -0.05% | 0.07 | -0.07 | 0.28 | 8.68 | 1679.10 | 0 |
| ASTINO | 0.00% | 0.16 | -0.09 | 0.74 | 7.62 | 1212.63 | 0 |
| BIMB_HLDS | 0.02% | 0.06 | -0.07 | 0.06 | 6.34 | 577.00 | 0 |
| BORNEO_OIL | -0.11% | 0.22 | -0.13 | 0.16 | 6.22 | 539.33 | 0 |
| CB_IND_PRODUCT_HOLDING | -0.04% | 0.11 | -0.09 | 0.80 | 11.12 | 3532.87 | 0 |
| COCOALAND_HLDS | 0.06% | 0.19 | -0.17 | 0.84 | 20.75 | 16404.90 | 0 |
| COMPLETE_LOGISTIC_SERVICES | 0.01% | 0.14 | -0.14 | 0.52 | 9.52 | 2246.54 | 0 |
| DUTCH_LADY | 0.02% | 0.05 | -0.08 | -0.90 | 20.40 | 15783.84 | 0 |
| EMICO | 0.00% | 0.44 | -0.15 | 2.71 | 30.56 | 40682.95 | 0 |
| FIAMMA_HLDS | 0.00% | 0.23 | -0.09 | 1.81 | 23.62 | 22611.97 | 0 |
| GOODWAY_INTEGRATED | -0.06% | 0.32 | -0.28 | 0.65 | 12.59 | 4834.02 | 0 |
| IJM_CORP | -0.02% | 0.09 | -0.15 | -0.67 | 11.30 | 3648.94 | 0 |
| IOICORP | 0.00% | 0.12 | -0.14 | 0.02 | 26.28 | 27950.12 | 0 |
| IVORY_PROPERTIES | -0.07% | 0.33 | -0.13 | 1.55 | 22.16 | 19428.49 | 0 |
| KL_KEPONG | 0.02% | 0.05 | -0.07 | -0.17 | 13.01 | 5178.12 | 0 |
| KRETAM_PROP | -0.01% | 0.11 | -0.41 | -3.53 | 66.79 | 212453.10 | 0 |
| MATRIX_CONCEPTS | 0.03% | 0.06 | -0.05 | 0.13 | 6.60 | 670.57 | 0 |
| MESB | -0.05% | 0.15 | -0.27 | -0.32 | 8.41 | 1533.05 | 0 |
| MESINIAGA | -0.03% | 0.26 | -0.18 | 1.27 | 15.83 | 8815.45 | 0 |
| MISC | 0.03% | 0.15 | -0.14 | 0.13 | 25.94 | 27141.29 | 0 |
| NESTLE | 0.07% | 0.07 | -0.11 | -0.70 | 36.10 | 56611.63 | 0 |
| NOTION | 0.07% | 0.14 | -0.32 | -0.42 | 16.08 | 8859.37 | 0 |
| NTPM | -0.01% | 0.11 | -0.13 | -0.09 | 8.85 | 1768.83 | 0 |
| PAN_MALAYSIA_HLDGS | -0.15% | 0.33 | -0.33 | 0.38 | 13.22 | 5415.91 | 0 |
| PANSAR | 0.08% | 0.20 | -0.13 | 0.77 | 14.10 | 6482.20 | 0 |
| PANTEC | 0.00% | 0.11 | -0.10 | 0.53 | 7.54 | 1118.80 | 0 |
| PESTECH | 0.04% | 0.08 | -0.07 | 0.33 | 5.42 | 326.25 | 0 |
| PETRA_ENERGY | -0.01% | 0.54 | -0.24 | 2.76 | 48.75 | 109546.40 | 0 |
| PUBLIC_PACKAGES | 0.09% | 0.16 | -0.12 | 0.83 | 8.82 | 1889.43 | 0 |
| SAPIND | -0.05% | 0.15 | -0.16 | -0.07 | 14.23 | 6511.78 | 0 |
| SARAWAK_CONSOLIDATED | 0.07% | 0.23 | -0.23 | 0.60 | 11.55 | 3840.60 | 0 |
| SBCCORP | -0.06% | 0.19 | -0.19 | 0.22 | 17.14 | 10330.71 | 0 |
| SCANWOLF_CORP | -0.08% | 0.68 | -0.34 | 3.00 | 56.18 | 147737.80 | 0 |
| SCGM | 0.06% | 0.12 | -0.21 | -0.31 | 14.74 | 7124.63 | 0 |
| SHH_RESOURCES | -0.04% | 0.17 | -0.15 | 0.84 | 11.83 | 4167.21 | 0 |
| SIG_GASES | 0.07% | 0.18 | -0.14 | 0.86 | 10.03 | 2703.83 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SIG_INT | -0.04% | 0.10 | -0.17 | -0.38 | 8.21 | 1429.13 | 0 |
| SIME_DARBY_BHD | -0.01% | 0.11 | -0.35 | -5.95 | 127.28 | 804065.00 | 0 |
| SLP_RESOURCES | 0.08% | 0.16 | -0.12 | 0.71 | 9.61 | 2356.64 | 0 |
| SPRITZER | 0.01% | 0.09 | -0.09 | 0.47 | 10.12 | 2660.20 | 0 |
| SUCCESS_TRANSFORMER | 0.03% | 0.24 | -0.17 | 0.77 | 16.41 | 9401.21 | 0 |
| SUPERLON_HLDGS | 0.10% | 0.16 | -0.20 | 0.13 | 11.65 | 3858.95 | 0 |
| TAANN | 0.01% | 0.11 | -0.12 | 0.21 | 8.17 | 1387.95 | 0 |
| TASEK | -0.08% | 0.12 | -0.08 | 0.65 | 20.82 | 16476.41 | 0 |
| TEO_SENG_CAPITAL | 0.01% | 0.13 | -0.12 | 0.05 | 7.41 | 1004.25 | 0 |
| TIME_DOTCOM | 0.05% | 0.14 | -0.14 | 0.14 | 22.02 | 18668.46 | 0 |
| TONG_HERR_RESOURCES | 0.01% | 0.10 | -0.16 | -0.24 | 12.40 | 4568.41 | 0 |
| TSH_RESOURCES | -0.02% | 0.17 | -0.08 | 1.29 | 17.07 | 10551.76 | 0 |

The data showed that the average mean for Shariah compliant portfolio (log) stock returns was 0.0009%. The highest recorded average mean was 0.10% by Superlon Hldgs. The lowest recorded average mean was Pan Malaysia Hldgs, at -0.15%. The average negative skewness was 0.3003. The highest negative skewed return was Sime Darby Bhd, at -5.95. The least skewed was Scanwolf Corp, standing at - 3.00. The average kurtosis was 19.155. This was a representation of the average peak of downside returns. Sime Darby took the lead at the highest peak point with a value of 127.28 while the lowest was Pestech at 5.42.

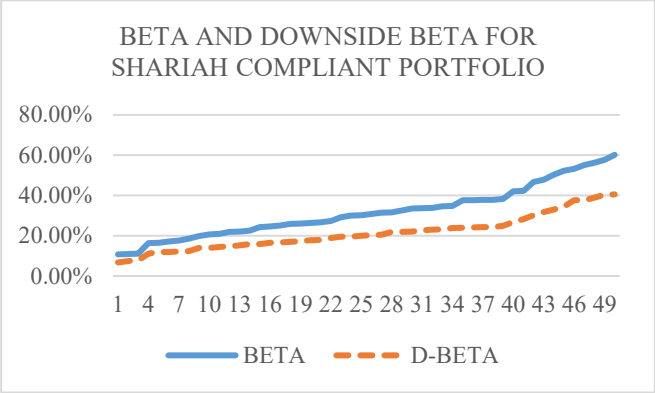


Figure 2 BETA AND DOWNSIDE BETA FOR SHARIAH COMPLIANT PORTFOLIO

The graph highlights the sorted beta and downside beta of the randomly nominated company stock return portfolios. There is a high correlation between beta and downside beta scores for Shariah compliant portfolio.

The autocorrelation matrix between beta and downside beta is given below.

Table III AUTOCORRELATION MATRIX BETWEEN BETA AND DOWNSIDE BETA

| | BETA | D-BETA |
|---|---|---|
| BETA | 1 | |
| D-BETA | 0.994848 | 1 |

### 6) *BETA AND DOWNSIDE BETA FOR PORTFOLIO*

Table IV COMPARISON OF BETA AND DOWNSIDE BETA

| ***COMPANY*** | ***BETA*** | ***D-BETA*** |
|---|---|---|
| *ADVENTA* | 47.78% | 33.06% |
| *ANCOM* | 37.73% | 24.07% |
| *APM AUTOMOTIVE* | 19.84% | 13.94% |
| *ASTINO* | 31.58% | 20.32% |
| *BIMB HLDS* | 17.64% | 11.96% |
| *BORNEO OIL* | 55.15% | 38.93% |
| *CB IND PRODUCT HOLDING* | 21.90% | 14.73% |
| *COCOALAND HLDS* | 25.08% | 15.95% |
| *COMPLETE LOGISTIC SERVICES* | 34.84% | 23.25% |
| *DUTCH LADY* | 10.91% | 7.39% |
| *EMICO* | 50.34% | 31.77% |
| *FIAMMA HLDS* | 27.35% | 17.94% |
| *GOODWAY INTEGRATED* | 60.20% | 40.53% |
| *IJM CORP* | 26.63% | 18.87% |
| *IOICORP* | 17.09% | 11.91% |
| *IVORY PROPERTIES* | 37.63% | 24.98% |
| *KL KEPONG* | 11.08% | 7.77% |
| *KRETAM PROP* | 32.53% | 22.03% |
| *MATRIX CONCEPTS* | 16.42% | 11.17% |
| *MESB* | 53.26% | 37.72% |
| *MISC* | 18.53% | 12.44% |
| *MESINIAGA* | 42.19% | 28.33% |
| *NESTLE* | 10.75% | 6.74% |
| *NOTION* | 42.09% | 26.86% |
| *NTPM* | 24.26% | 16.72% |
| *PANSAR* | 30.12% | 19.45% |
| *PANTEC* | 26.43% | 17.36% |
| *PETRA ENERGY* | 46.75% | 30.20% |
| *PAN MALAYSIA HLDGS* | 57.77% | 40.32% |
| *PUBLIC PACKAGES* | 31.50% | 19.97% |
| *SAPIND* | 30.82% | 21.95% |
| *SARAWAK CONSOLIDATED* | 52.33% | 34.49% |
| *SBCCORP* | 29.24% | 20.41% |
| *SCANWOLF CORP* | 56.22% | 37.72% |
| *SCGM* | 30.02% | 19.54% |
| *SHH RESOURCES* | 33.86% | 22.98% |
| *SIG GASES* | 38.26% | 24.34% |
| *SIG INT* | 34.63% | 23.93% |
| *SIME DARBY BHD* | 22.10% | 15.81% |
| *SLP RESOURCES* | 33.71% | 21.92% |
| *SPRITZER* | 20.66% | 13.90% |
| *SUCCESS TRANSFORMER* | 37.77% | 24.29% |
| *SUPERLON HLDGS* | 37.74% | 23.78% |
| *TAANN* | 24.56% | 16.56% |
| *TASEK* | 16.57% | 12.15% |

| | | |
|---|---|---|
| *TEO SENG CAPITAL* | 33.47% | 22.78% |
| *TIME DOTCOM* | 22.53% | 15.17% |
| *TONG HERR RESOURCES* | 26.05% | 17.74% |
| *TSH RESOURCES* | 20.99% | 14.37% |
| *PESTECH* | 25.83% | 16.95% |
| | **31.85%** | **21.35%** |

The hypothesis proposes that there is no statistical difference in the beta and downside beta values for Shariah compliant stocks. The alternative hypothesis suggests that there is a difference in the mean values for beta and downside beta.

Table V T-TEST FOR EQUAL MEAN IN BETA AND DOWNSIDE BETA SCORES

t-Test: Two-Sample Assuming Equal variance in mean values

| | BETA | D-BETA |
|---|---|---|
| Mean | 0.318546 | 0.213492 |
| Variance | 0.016521619 | 0.007486915 |
| Observations | 50 | 50 |
| Pooled Variance | 0.012004267 | |
| Hypothesized Mean Difference | 0 | |
| df | 98 | |
| t Stat | 4.794184809 | |
| P(T<=t) one-tail | 2.91283E-06 | |
| t Critical one-tail | 1.660551217 | |
| P(T<=t) two-tail | 5.82566E-06 | |
| t Critical two-tail | 1.984467455 | |

The results of the t-test (at 95% confidence interval) indicates a t-stat value of 4.79. this is within the rejection zone of the null statement. The probability value is less than the level of significance (0.05) and therefore, the null hypothesis is rejected. Consequently, the findings conclude that there is a statistical difference between the mean of beta and downside beta in Shariah compliant portfolio.

**TABLE VI:** SUMMARY RESULTS FOR BETA AND DOWNSIDE BETA FOR SHARIAH COMPLIANT PORTFOLIO

| BETA | | D-BETA | |
|---|---|---|---|
| Mean | 0.319 | Mean | 0.214 |
| Standard Error | 0.018 | Standard Error | 0.012 |
| Median | 0.305 | Median | 0.201 |
| Mode | #N/A | Mode | 0.372 |
| Standard Deviation | 0.129 | Standard Deviation | 0.087 |
| Sample Variance | 0.017 | Sample Variance | 0.008 |
| Kurtosis | -0.415 | Kurtosis | -0.117 |
| Skewness | 0.503 | Skewness | 0.638 |
| Range | 0.495 | Range | 0.338 |
| Minimum | 0.108 | Minimum | 0.067 |
| Maximum | 0.602 | Maximum | 0.405 |
| Sum | 15.927 | Sum | 10.674 |
| Count | 50 | Count | 50 |
| Confidence Level(95.0%) | 0.037 | Confidence Level(95.0%) | 0.025 |

The table above highlights the results of the beta and downside beta are significant with a 95% confidence interval. The beta estimate is significantly higher than downside beta as indicated by the earlier t-test result.

On average, downside beta is more conservative in assessing the level of portfolio risk. The volatility score for the 50 stocks on average is 31.85% while the downside records a comparative low assessment of 21.35%. Other research which estimated downside beta using different approaches, such as the rolling window technique and the BEKK technique was done by [27]. Similarly, the finding of that research indicated that the estimated downside risk of both methods is statistically significant.

### *Q. OBJECTIVE 2: Assess the level of performance for Shariah compliant portfolio*

Table VII THE PERFORMANCE INDICATOR SCORES FOR SHARIAH COMPLIANT STOCKS

| COMPANY | SORTINO RATIO | SHARPE RATIO |
|---|---|---|
| ADVENTA | -0.08% | -0.05% |
| ANCOM | 0.12% | 0.08% |
| APM AUTOMOTIVE | -0.36% | -0.26% |
| ASTINO | 0.01% | 0.01% |
| BIMB HLDS | 0.18% | 0.12% |
| BORNEO OIL | -0.28% | -0.20% |
| CB IND PRODUCT HOLDING | -0.25% | -0.17% |
| COCOALAND HLDS | 0.39% | 0.25% |
| COMPLETE LOGISTIC SERVICES | 0.03% | 0.02% |
| DUTCH LADY | 0.26% | 0.17% |
| EMICO | -0.01% | -0.01% |
| FIAMMA HLDS | -0.01% | -0.01% |
| GOODWAY INTEGRATED | -0.15% | -0.10% |
| IJM CORP | -0.12% | -0.09% |
| IOICORP | 0.04% | 0.03% |
| IVORY PROPERTIES | -0.27% | -0.18% |
| KL KEPONG | 0.22% | 0.15% |
| KRETAM PROP | -0.03% | -0.02% |
| MATRIX CONCEPTS | 0.26% | 0.18% |
| MESB | -0.13% | -0.09% |
| MISC | 0.22% | 0.15% |
| MESINIAGA | -0.10% | -0.06% |
| NESTLE | 1.09% | 0.69% |
| NOTION | 0.25% | 0.16% |
| NTPM | -0.03% | -0.02% |
| PANSAR | 0.40% | 0.26% |
| PANTEC | -0.02% | -0.01% |
| PETRA ENERGY | -0.03% | -0.02% |
| PAN MALAYSIA HLDGS | -0.36% | -0.25% |

| | | |
|---|---|---|
| PUBLIC PACKAGES | 0.45% | 0.28% |
| SAPIND | -0.22% | -0.16% |
| SARAWAK CONSOLIDATED | 0.19% | 0.13% |
| SBCCORP | -0.27% | -0.19% |
| SCANWOLF CORP | -0.21% | -0.14% |
| SCGM | 0.29% | 0.19% |
| SHH RESOURCES | -0.18% | -0.12% |
| SIG GASES | 0.27% | 0.17% |
| SIG INT | -0.18% | -0.12% |
| SIME DARBY BHD | -0.06% | -0.04% |
| SLP RESOURCES | 0.37% | 0.24% |
| SPRITZER | 0.11% | 0.07% |
| SUCCESS TRANSFORMER | 0.11% | 0.07% |
| SUPERLON HLDGS | 0.40% | 0.25% |
| TAANN | 0.05% | 0.03% |
| TASEK | -0.70% | -0.51% |
| TEO SENG CAPITAL | 0.05% | 0.04% |
| TIME DOTCOM | 0.36% | 0.24% |
| TONG HERR RESOURCES | 0.05% | 0.03% |
| TSH RESOURCES | -0.17% | -0.12% |
| PESTECH | 0.23% | 0.15% |
| **AVERAGE** | **0.04%** | **0.02%** |

The hypothesis proposes that there is no statistical difference in the performance measure of Shariah compliant stocks using the Sortino and Sharpe ratios. The alternative hypothesis suggests that there is a difference. The table below highlights the result.

Table VIII IXT-TEST FOR EQUAL MEAN IN SORTINO AND SHARPE RATIO SCORES

| | *SORTINO RATIO* | *SHARPE RATIO* |
|---|---|---|
| Mean | 0.0436% | 0.0244% |
| Variance | 0.0008% | 0.0004% |
| Observations | 50 | 50 |
| Pooled Variance | 5.83674E-06 | |
| Hypothesized Mean Difference | 0 | |
| df | 98 | |
| t Stat | 0.39747298 | |
| P(T<=t) one-tail | 0.345941561 | |
| t Critical one-tail | 1.660551217 | |
| P(T<=t) two-tail | 0.691883122 | |
| t Critical two-tail | 1.984467455 | |

The t-test is done using a confidence interval of 95%. The t-Stat (0.397) is less than the critical value (1.985), therefore, the null hypothesis is not rejected. As a result, there is no statistically significant difference in the Sortino and Sharpe ratios for Shariah compliant portfolio.

**Table X:** SUMMARY RESULTS FOR BETA AND DOWNSIDE BETA FOR SHARIAH COMPLIANT PORTFOLIO

| SORTINO RATIO | | SHARPE RATIO | |
|---|---|---|---|
| Mean | 0.0004 | Mean | 0.0002 |
| Standard Error | 0.0004 | Standard Error | 0.0003 |
| Median | 0.0002 | Median | 0.0001 |
| Mode | #N/A | Mode | #N/A |
| Standard Deviation | 0.003 | Standard Deviation | 0.002 |
| Sample Variance | 8.1 E-06 | Sample Variance | 3.6 E-06 |
| Kurtosis | 2.949 | Kurtosis | 2.53 |
| Skewness | 0.694 | Skewness | 0.406 |
| Range | 0.018 | Range | 0.012 |
| Minimum | -0.007 | Minimum | -0.005 |
| Maximum | 0.011 | Maximum | 0.007 |
| Sum | 0.0218 | Sum | 0.012 |
| Count | 50 | Count | 50 |
| Confidence Level(95.0%) | 0.0008 | Confidence Level(95.0%) | 0.0005 |

The table above highlights that all the individual scores for the Sortino ratio and the Sharpe ratio are significant at a 99% confidence interval. While the scores are significant, the proclamation still remains that results for the Sharpe ratio is indifferent in mean values when compared to the results of the Sortino ratio. The autocorrelation matrix between Sortino and Sharpe Ratio is given below.

Table XI AUTOCORRELATION MATRIX BETWEEN SORTINO AND SHARPE RATIO

| | SORTINO RATIO | SHARPE RATIO |
|---|---|---|
| SORTINO RATIO | 1 | |
| SHARPE RATIO | 0.9987 | 1 |

## V. DISCUSSION

The findings of the research will serve both risk averse investors as well as risk seeking investors. The indication that Shariah compliant portfolio records an average decrease in volatility as the portfolio grows for the randomly selected 50 companies is a focal interest to the risk averse investor. Additionally, the growth in performance of the portfolio as the number of Shariah compliant companies increase is of huge interest for the risk seeking investor, whose ultimate goal is to receive adequate compensation for the exposed risk. The Shariah compliant portfolio, as evidenced by this research, manifests as a sweet spot, with a continual decrease in risk and a gradual increase in performance. In fact, reference [28] studied the impacts of Shariah compliant investments and stock returns on the Indonesian stock market. The results collaborate with the findings of this research, indicating that the Indonesian Shariah Compliant Stock Index (ISSI) has a positive impact on the financial performance of the stock market returns. Additionally, research published by reference [29] on the Indian market showed that Shariah compliant stocks have the tendency to outperform their conventional counterparts in both volatility measures as well as performance indicators from 2013 to 2017. This further supports the findings that Shariah compliant investments have the potential to positively add

significant value in a portfolio. However, short term (contrarian) strategies are likely to provide abnormal returns for Shariah compliant investors, as indicated by researcher [30] and this should be a cause for caution.

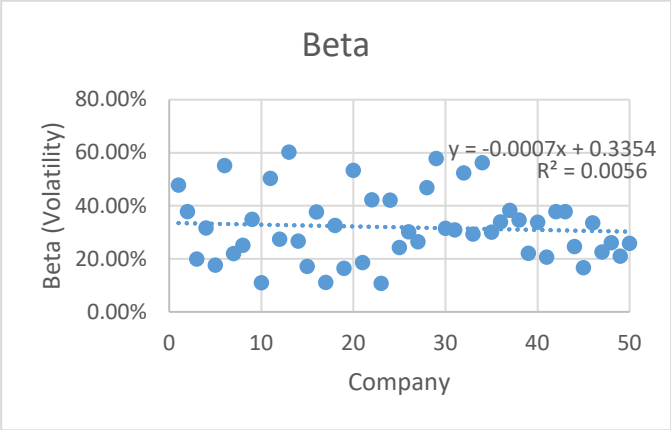


Figure 3: BETA PLOT FOR SHARIAH COMPLIANT PORTFOLIO

The plotted data above shows that as the number of Shariah compliant companies are added to the portfolio, the volatility of the portfolio keeps decreasing. The rate of decrease as at the 50th random company stands at 0.07%. Researcher [31] studied the volatility of conventional and Islamic stock markets and concluded that low frequency volatility market was lower for Islamic countries amongst other factors. This was in line with the preposition that additional Shariah compliant stocks reduced volatility in a portfolio.

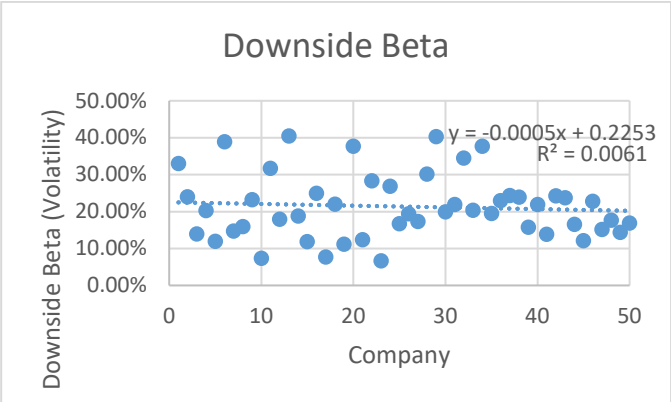


Figure 4: DOWNSIDE BETA PLOT FOR SHARIAH COMPLIANT PORTFOLIO

The plotted data above for downside beta indicates that the portfolio records a decrease in volatility as the number of companies in the portfolio grows. The slope as at the 50th random company is -0.05%. While the findings of downside beta are positively correlated with the beta scores, it is important to note this should not be overrated or used as a cushion, as presented by reference [32].

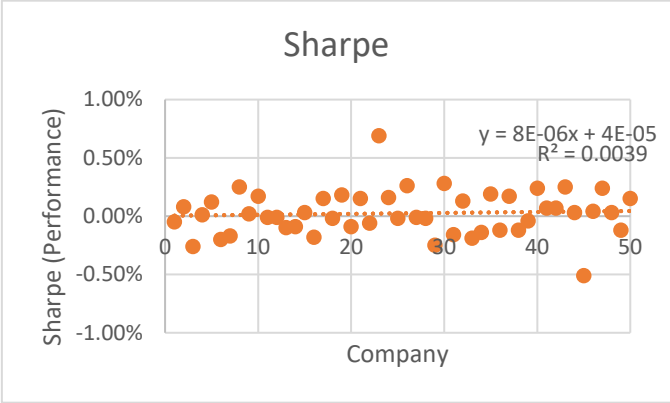


Figure 5: SHARPE RATIO PLOT FOR SHARIAH COMPLIANT PORTFOLIO

The Sharpe ratio (plotted data above) for the companies shows an increase in reward as the number of Shariah compliant companies in the portfolio increases.

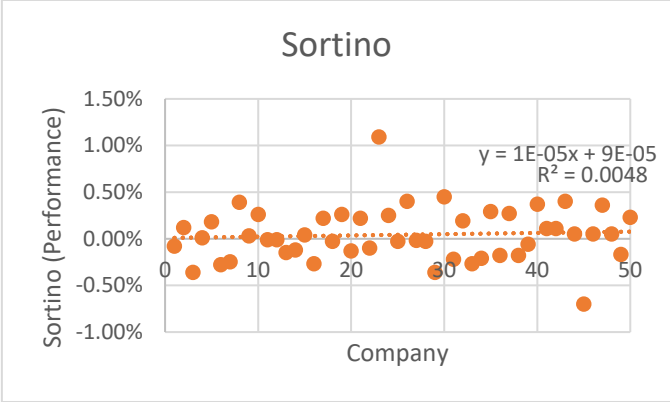


Figure 6: SHARPE RATIO PLOT FOR SHARIAH COMPLIANT PORTFOLIO

The Sortino ratio data as plotted above, is in parallel to the findings the Sharpe ratio, which indicates an increase in reward as the number of Shariah compliant companies in the portfolio increases.

## VI. CONCLUSION

The study successfully modelled beta and downside beta using the EWMA. There is a statistically significant difference that beta valuations are higher than downside beta for Sharia compliant portfolio. However, the performance reactions of the Shariah compliant portfolio is insignificant between beta and downside beta. Generally, the boundaries for $\beta$ lies between 10.75% and on an upper level of 57.77%. The average downside boundaries for SCS lies between 6.74% and 40.53%. Considering the research objective in comparing beta and downside beta in Shariah compliant portfolio, the inference is that distinguishing between upsides and downsides has substantial effects on the estimation of volatility.

After assessing the level of performance for Shariah compliant portfolio and keeping in mind the earlier conclusion, it can be established that beta and downside beta are indifferent when it comes to performance of Shariah compliant stock using the

Sharpe and Sortino ratio respectively. This opens the possibility that the Sharpe ratio is suited for beta while the Sortino ratio pairs well with downside beta. This seamless relationship opens up a more dynamic computation of volatility with sufficient accuracy.

## *R. RECOMMENDATIONS*

Although there is preference for downside beta over beta, the level of attention given to modelling series using downside beta is very limited. Therefore, future researchers can focus on using different approaches to model downside beta. Multivariate Garch is one such model to consider. Furthermore, the research can be extended to capture other portfolios such as conventional portfolio, cryptocurrency etc.

## NOMENCLATURE

$\beta$ Volatility

## *S. APPENDIX*

Table XII List of analysed Shariah compliant companies

**SHARIAH COMPLIANT PORTFOLIO**

| | |
|---|---|
| ADVENTA | PANSAR |
| ANCOM | PANTEC |
| APM AUTOMOTIVE | PETRA ENERGY |
| ASTINO | PAN MALAYSIA HLDGS |
| BIMB HLDS | PUBLIC PACKAGES |
| BORNEO OIL | SAPIND |
| CB IND PRODUCT HOLDING | SARAWAK CONSOLIDATED |
| COCOAL AND HLDS | SBC CORP |
| COMPLETE LOGISTIC SERVICES | SCANWOLF CORP |
| DUTCH LADY | SCGM |
| EMICO | SHH RESOURCES |
| FIAMMA HLDS | SIG GASES |
| GOODWAY INTEGRATED | SIG INT |
| IJM CORP | SIME DARBY BHD |
| IOI CORP | SLP RESOURCES |
| IVORY PROPERTIES | SPRITZER |
| KL KEPONG | SUCCESS TRANSFORMER |
| KRETAM PROP | SUPERLON HLDGS |
| MATRIX CONCEPTS | TAANN |
| MESB | TASEK |
| MISC | TEO SENG CAPITAL |
| MESINIAGA | TIME DOTCOM |
| NESTLE | TONG HERR RESOURCES |
| NOTION | TSH RESOURCES |
| NTPM | ZHULIAN CORP |

Source: Yahoo finance

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