



## Quantitative Sharia-Screening Effect on Portfolio Performance and Volatility: Evidence from Indonesia

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**Abstract:** The aim of this study is to examine the comparative performance and volatility between Sharia and conventional portfolios listed on the Indonesia Stock Exchange (IDX) and to investigate the effect of quantitative (debt-ratio) screening on the Sharia-and-conventional-portfolios returns specifically applied in the selected public firms with the inter-industrial low-correlations. Applying a non-parametric test, the autoregressive integrated moving average (ARIMA) model, and the regression analysis, the results suggest that there is no difference in performance between Sharia and conventional portfolios; Sharia portfolios show the lower risks than conventional portfolios. Using quantitative Sharia-screening, the debt-to-equity ratio (DER) affects Sharia-portfolio returns, but not conventional-portfolio returns. This study contributes to providing country-specific evidence on applying quantitative Sharia-screening. Taking notice of the existing high-profile debt-ratio and applying the relatively loose standard of quantitative Sharia-screening for the public firms in Indonesia, this suggests that a country-specific quantitative Sharia-screening standard should be supported.

**Keywords:** *Quantitative Sharia-Screening, Debt-Ratio, Sharia-Portfolio Return, Conventional-Portfolio Return, and Portfolio Volatility.*

Article History

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### Introduction


Sharia screening is a relatively new phenomenon for Islamic finance. Up to the 1970s, Muslim communities reluctantly took part in the stock market due to the Sharia constraints on the capital market. In the 1990s, a breakthrough occurred in connection with stock investments, and Muslims were allowed to participate in the stock market under certain conditions (Htay et al., 2013). The selection of Sharia-compliant companies is carried out through a Sharia-screening process based on two parameters: qualitative and quantitative. In considering a firm's status, qualitative criteria are used to ensure that they are not involved in several activities such as financial services based on *riba* (usury), *gharar* (speculation), *maisir* (gambling), and production or trade for non-halal goods such as alcohol and pork while the quantitative screening address three angles such as the level of earnings, income from interest and other items, and cash-flow level and accounts receivable (Sani & Othman, 2013).

Sharia screening is run by different providers of Sharia indices and all providers should be under the conditions set by the respective Sharia supervisory bodies. However, there is no consistent Sharia-screening standard among the users from all the respective countries. No Sharia-screening standard for practice is considered to hinder the progress of the Islamic capital market and can decrease investors' confidence in the future (Htay et al., 2013). The different standards in quantitative Sharia screening, especially in debt screening, exist among the respective countries as depicted in Table 1.

The difference in quantitative Sharia screening, according to Pok (2012), occurs due to a combination of the following factors: *first*, the use of different denominators. For example, the DJIM index calculates a firm's value using market capitalization, while other indices use total assets or total

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equity. The *second* is the use of different threshold levels. Most indices use a higher-than-33% threshold, while others use a 33.33% threshold (MSCI Islamic Index) and 37% (Meezan, Pakistan). In Indonesia, JII and ISSI use the debt screening regulated by the National Sharia Board – Indonesian Council of Ulama (DSN-MUI) and Financial Services Authority (OJK), applying an 82% threshold for the debt-to-equity ratio (DER) or a 45% threshold for the debt-to-asset ratio (DAR); *third*, emphasis on applying different qualifications of income and business activities among index users such as Malaysia Stock Exchange, while most countries place more emphasis on the financial ratio qualifications, as adopted in most of the world's premier indices.

Table 1. Comparative Debt-Ratio Screening among the Providers of Sharia Indices

No.	Providers of Sharia Indices	Debt Screening	Researchers
1.	Dow Jones Islamic Market Index (DJIMI) (US)	Interest-based debt: Max 33% out of the average market cap.	Rahman et al. (2010), Bellalah et al. (2013), Htay et al. (2013), and El-Alaoui et al. (2018).
2.	FTSE Global Islamic Indexes (UK)	Interest-based debt: Max 33% out of the total asset	Bellalah et al. (2013) and Htay et al. (2013).
3.	Standard & Poor's Shariah Index (The US)	Interest-based debt: Max 33% out of the average market cap.	Bellalah et al. (2013) and Htay et al. (2013).
4.	MSCI Islamic Indices Series (UK)	Interest-based debt: Max 33.33% out of the total asset.	Bellalah et al. (2013) and Htay et al. (2013).
5.	Meezan (Pakistan)	Interest-based debt: Max 37% out of the total asset.	Sani and Othman. (2013).
6.	Kuala Lumpur Stock Exchange Shariah Index (Malaysia)	Interest-based debt: Max 37% out of total equity.	Rahman et al. (2010).
		Interest-based debt: Max 33% out of the total asset (revised in 2012).	Zainudin et al. (2014).
7.	Jakarta Islamic Index, Indeks Saham Syariah Indonesia (ISSI) (Indonesia)	Interest-based debt: Max 82% out of total equity or 45% out of total asset.	Fielnanda (2017).

Source: This description was adapted from the respective references.

Bauer et al. (2005) argue that ethical investment will perform poorly in the long-run because an ethical investment portfolio is a subset of a market portfolio. As such, it has limited diversification. Ethical screening tends to eliminate large companies from the investment market, and as a result, the remaining companies tend to be smaller and have volatile returns (Hassan & Girard, 2010). Hence, investors who will allocate capital under their religious beliefs certainly want to know whether the portfolio selected through the Sharia-screening procedure shows a different performance relative to conventional portfolios since there are 'fears' that the Sharia-screened portfolios tend to perform poorer than conventional/unscreened ones (Grossman & Sharpe, 1986). Previous studies have shown some Sharia screening either from a qualitative or descriptive or quantitative point of view. Derigs and Marzban (2008) analyzed the impact of the adoption of Sharia screening by various Shariah indices to show that Sharia-screening procedures in practice were not consistent in terms of the distinction between *halal* and *haram*. This shows that, at present, no universal understanding applies to all the generally accepted things.

Rahman et al. (2010) compared screening criteria using a descriptive-exploratory analysis between the Kuala Lumpur Stock Exchange Shariah Index (KLSESI) and the Dow Jones Islamic Market Index (DJIMI). They used the criteria of the leverage ratio and liquidity ratio applied by DJIMI to select Sharia-compliant stocks on the Bursa Malaysia. The results show a difference in screening. Concerning quantitative Sharia screening, Pok (2012) investigated whether the use of quantitative Sharia screening criteria on the Bursa Malaysia could be considered more liberal than those index providers from the Dow Jones Islamic Market (DJIM), Standard & Poor's (S&P), and Sharia FTSE. As a result, the differences in quantitative screening among those indices exist due to, *inter alia*, the

use of different formulas to calculate ratios, the use of different thresholds, and the different emphases applied by the indices from the respective countries.

In this study, we investigate the differences in performance and volatility of Sharia and conventional stock portfolios. Besides, we also examine the effect of quantitative Sharia screening, namely the ratio of leverage on returns and volatility of stock portfolios. In Indonesia, Sharia-screening literature, especially focusing on quantitative screening, is still limited. Research related to portfolio performance in Indonesia, *inter alia*, was conducted by [Setiawan and Oktariza \(2013\)](#) and [Listyaningsih and Krishnamurti \(2015\)](#). [Setiawan and Oktariza \(2013\)](#) looked into the effect of financial ratios, including debt-to-equity ratio (DER), on portfolio returns. To the best of our knowledge, however, they did not discuss financial ratios which were specifically only related to a variety of quantitative Sharia screening. As such, this study aims to investigate whether or not the differences in performance and volatility between Sharia and conventional stock portfolios listed on the Indonesia Stock Exchange (IDX) arise. Also, this study is intended to check into the effect of quantitative Sharia screening (using debt ratios) on returns for Sharia and conventional stock portfolios.

To arrive at these ends, the next discussion will be arranged as follows. [Section 2](#) will present literature review and hypothesis development; [Section 3](#) will explain methodology; [Section 4](#) will be concerned with the results and discussion; and [Section 5](#) will summarize all the above discussion to make a conclusion and implications.

## Literature Review and Hypothesis Development

Most of the previous studies on the performance of indices either for ethical or Sharia or conventional indices do not exhibit any difference. For instance, [Bauer et al. \(2005\)](#) compared the performance of ethical and conventional mutual funds in three countries such as Germany, the United Kingdom, and the United States during the period of 1990-2001 using the Carhart multi-factor model. They found no statistically significant difference between ethical and conventional mutual funds. [Albaity and Ahmad \(2008\)](#) tested the return and risk performance of the Kuala Lumpur Shariah Index (KLSI) and compared it with the Kuala Lumpur Composite Index (KLCI). The results suggest no statistically significant difference in risk adjusted-return between Sharia and conventional indices during a 1999-to-2005 period. They also used co-integration tests to look into the short-term and long-term relationships of the two indices. They found that the indices moved together and in the same direction. Likewise, in [Hassan and Girard \(2010\)](#)'s study, the performance of seven indices selected from the Dow Jones Islamic Market (DJIM) was examined and was compared with conventional indices using several measures such as Sharpe-ratio, Treynor-ratio, the selectivity of Jensen and Fama, and Carhart's four-factor model using a co-integration test. The results show no difference between the two indices being compared.

In Indonesia, [Setiawan and Oktariza \(2013\)](#) compared the performance of Sharia and conventional stock portfolios of public firms listed on the Indonesia Stock Exchange (IDX). In addition to testing the performance of stock portfolios, this study also examined the effect of financial ratios on stock returns. Regarding its performance, they did not find any difference in performance between Sharia and conventional stocks in terms of cumulative returns, standard deviations, and betas. Regarding these financial ratios, they found a significant simultaneous relationship between financial ratios and both Sharia and conventional stock returns. Likewise, [Listyaningsih and Krishnamurti \(2015\)](#) compared the performance of the Jakarta Islamic Index (JII) with other indices, both Sharia index (ISSI) and non-Sharia one, divided into two research periods, that is, 2005-2007 and 2008-2012. The results show no difference in performance between the JII index and the non-JII index. As a result, the hypotheses are stated as follows.

- H<sub>1a</sub>: There is a significant difference in performance between Sharia and conventional stock portfolios measured using the Sharpe-ratio.
- H<sub>1b</sub>: There is a significant difference in performance between Sharia and conventional stock portfolios measured using the Treynor-ratio.
- H<sub>1c</sub>: There is a significant difference in performance between Sharia and conventional stock portfolios measured using the M<sup>2</sup>-ratio.

Furthermore, the relationship between Sharia screening, performance, and volatility was investigated, *inter alia*, by Ashraf et al. (2017). They investigate the effect of quantitative Sharia screening, involving the limitation on financial leverage and investment in real assets (operating leverage), on the performance of Sharia portfolios. Given the empirical results, they found that investors sacrificed potential returns on limited portfolios (due to screening) but also avoided some risk. El-Alaoui et al. (2018) also investigated the relationship between corporate leverage, return, and stock price volatility from the perspective of Islamic finance and capital structure theory. They used mean-variance efficient frontier (MVEF) to analyze a sample of 320 firms from eight countries in Europe which were divided into two types of portfolios, i.e., low debt-portfolios and high debt-portfolios using a debt-screening threshold of 33%. The results show that changes in return and volatility occur when changes in capital structure exist. In addition, in many cases, Sharia-compliant stocks tend to have lower volatility relative to non-Sharia-compliant stocks, but there is no difference in terms of return. Hence, the hypothesis below is worth testing.

H<sub>2</sub>: The volatility of Sharia portfolio is lower than that of conventional portfolio.

Concerning financial ratios, Suharli (2005) looked into two factors that affected stock returns. The two factors included debt ratio (debt to equity ratio or DER) and the level of risk as measured by stock beta based on the capital asset pricing model (CAPM) theory. The results suggest that neither the debt ratio nor the level of risk affects stock returns. Arista and Astohar (2012) analyzed the factors that influenced stock returns, including debt-to-equity ratio (DER), the price-to-book value (PBV), earning-per-share (EPS), and return-on-assets (ROA). The results imply that DER and PBV have a significant positive effect on stock returns, while ROA and EPS have no significant effect on stock returns. For the effect of DER and stock returns, the results of this study are different from the previous results, showing that DER has no significant effect on stock returns. Setiawan and Oktariza (2013), in addition to comparing the performance of Sharia and conventional stock portfolios, also analyzed the effect of financial ratios (DER, EPS, PER, NPM, ROE, and PBV) on both Sharia and conventional stock returns. For Sharia stocks, all variables, except for NPM, have a significant effect on stock returns, while for conventional stocks, all variables, except for NPM and PBV, have a significant effect on stock returns. As such, the hypothesis is stated as follows.

H<sub>3</sub>: Debt-to-equity ratio (DER) has a positive impact on the returns of both Sharia and conventional stock portfolios.

## Methodology

### Data and Samples

This research applied the comparative-explanatory analysis to examine the effect of Sharia screening on portfolio performance and volatility and compared the results between Sharia and conventional stock portfolios in the Indonesia Stock Exchange. This research used secondary data to be arranged across firms and in time-series (panel data). Data is taken from monthly and annual data from stock prices and financial-ratios of public firms listed on the Indonesia Stock Exchange (IDX) for quantitative screening analysis. We also collected data from the official website of the Indonesia Stock Exchange ([www.idx.co.id](http://www.idx.co.id)) and Yahoo Finance ([www.finance.yahoo.com](http://www.finance.yahoo.com)).

The sample in this study was drawn from a population of stock prices and financial ratios, amounting to 173 out of 627 public firms listed on the Indonesia Stock Exchange (IDX). Both monthly and annual data were collected for five years (2013-2017). In sampling, the purposive method was adopted, i.e., selecting companies listed on the Indonesia Stock Exchange (IDX), the shares of which were compliant with Sharia and non-Sharia screening through first of all classifying them into the industrial sector. In the first step, we took seven industrial sectors (excluding the financial sector), *inter alia*, including property, trade, consumption, infrastructure, agriculture, mining, and manufacturing. Furthermore, of the seven sectors, we selected three industrial sectors, the performances (returns) of which were negatively correlated to one another (having the lowest coefficients of correlation across industrial sectors). Low correlation shows that little effect exists across the industrial sectors. In the context of the portfolio theory, low correlation leads to the lower unsystematic risk (Markowitz, 1991; Setiawan & Oktariza, 2013).

Table 2. Coefficients of Return Correlation across Industrial Sectors (2015-2017)

	Agriculture	Consumer	Infrastructure	Manufacture	Mining	Property	Trade
Agriculture	1	0.026242	<b>-0.185467</b>	0.081605	0.095016	-0.074472	<b>-0.0439</b>
Consumer		1	0.229734	0.595908	0.083677	0.25889	0.04626
Infrastructure			1	0.226076	0.05375	0.305920	<b>-0.1697</b>
Manufacture				1	0.304922	0.524755	0.15601
Mining					1	0.630240	0.33778
Property						1	0.18479
Trade							1

Source: Data was collected and adapted from [www.yahoo.finance.com](http://www.yahoo.finance.com).

Holding [Table 2](#), it appears that to observe the clearer impact of the test, only three negative correlations out of the four negative correlations are selected, involving three industries where they show a negative relationship with each other from one industry to the two other industries (see the numbers in bold in [Table 2](#), that is, linking agriculture to infrastructure, agriculture to trade, and trade to infrastructure). The three industries have been successfully collected, i.e., the trade sector with a total of 114 firms, consisting of 51 Sharia firms and 63 conventional firms, the infrastructure sector of 42 firms, consisting of 16 Sharia firms and 26 conventional ones, and the agriculture sector of 17 firms, consisting of 9 Sharia firms and 8 conventional firms. As such, the total of firms to be studied were 173 units, consisting of 76 Sharia firms and 97 conventional firms. For the regression method, we took annual data, while to analyze portfolio returns and volatility, we picked up monthly stock-price data. The selected samples were the same and taken through purposive sampling, consisting of 25 firms, each of which was from the Sharia and conventional shares for five years (2013-2017).

### Measurement of Variables and Analysis

#### Return

We used monthly and annual historical return data to be added and adjusted with adjusted-dividends and stock splits, referring to the formula used by [Hartono \(2009\)](#) as follows.

$$R_t = \left( \frac{P_t - P_{t-1}}{P_{t-1}} \right) \tag{1}$$

where,

$R_t$  = return in period  $t$

$P_t$  = stock prices in period  $t$

$P_{t-1}$  = stock prices in period  $t-1$ .

#### Portfolio Performance

To measure portfolio performance, we used three measures, including Sharpe-ratio, Treynor-ratio, and the  $M^2$ -ratio. Measurement using Sharpe-ratio or also known as reward-to-variability ratio emphasizes total risk, in this case, proxied by the standard deviation. Standard deviation indicates the magnitude of the stock-return changes to the average stock-return. In general, the higher the Sharpe-ratio is, the better the performance of the stock portfolio will be. The formula is as follows.

$$SR = \frac{R_p - R_f}{\sigma_p} \tag{2}$$

where,

$SR$  = Sharpe-ratio

$R_p$  = return of stock portfolio in period  $t$

$R_f$  = risk-free return (using the rate of Bank Indonesia)

$\sigma_p$  = total risk (standard deviation) of stock portfolio in period  $t$ .



Measurement of stock-portfolio performance using the Treynor-ratio or also known as reward-to-volatility ratio uses past average returns as expected returns and also beta as a risk measure. In general, the performance of stock portfolios will be better if Treynor-ratio is higher. The formula is as follows.

$$TR = \frac{R_p - R_f}{\beta_p} \quad (3)$$

where,

$TR$  = Treynor-ratio

$R_p$  = return of stock portfolio in period  $t$

$R_f$  = risk-free return (using the rate of Bank Indonesia)

$\sigma_p$  = total risk (standard deviation) of the stock portfolio in period  $t$ .

$\beta_p$  = beta portfolio

Measuring portfolio performance using the Sharpe-ratio and Treynor-ratio could be easily undertaken, but it is difficult to interpret the comparison between portfolio performance and market performance. For example, a portfolio has a Sharpe-ratio of 0.60 and a market portfolio has a Sharpe-ratio of 0.75. These results indicate that the portfolio has a value below market performance. However, since the two Sharpe-ratios are two different measurements, the difference in the value of 0.15 is difficult to interpret. Graham and Harvey (1994) proposed an easier ratio to compare portfolio performance with market performance, which was later popularized by Franco Modigliani and his grandson Leah Modigliani, henceforth, known as the  $M^2$  ratio (Hartono, 2009: 637). The formula is as follows.

$$M^2 = (R_p - R_f) \frac{\sigma_M}{\sigma_p} + R_f - R_M \quad (4)$$

where,

$R_p$  = return of stock portfolio in period  $t$

$R_f$  = risk-free return (using the rate of Bank Indonesia)

$R_M$  = market return in period  $t$

$\sigma_M$  = market risk in period  $t$

$\sigma_p$  = total risk (standard deviation) of the stock portfolio in period  $t$ .

Upon measuring portfolio performance using the aforementioned three measures, the Mann-Whitney test, and t-test were run to test the difference in average portfolio performance between Sharia and conventional stocks using the Sharpe ratio, Treynor ratio, and the  $M^2$ -ratio.

### ***Time-Series Analysis***

In addition to comparing portfolio performance, this study also examines and compares portfolio volatility between Sharia and conventional stocks. Volatility testing in this study used time series analysis. According to Gujarati (2009), there are five approaches to time-based forecasting, such as the exponential smoothing method, single-equation regression method, simultaneous-equation regression model, autoregressive integrated moving average (ARIMA) model, and vector autoregression.

In this study, we employed ARIMA, derived from a combination of auto-regression with differencing-orders (AR) and moving-average (MA), for time-series analysis assuming that the data has been stationary. It is often found that data relating to economics is non-stationary; as such, modifications are needed to make distinctions to produce stationary data.

In general, the data becomes stationary if it has experienced a first-order differencing. When the first-order differencing of data is not stationary, it is necessary to run the next differencing, and so on until the data gets stationary. Thus, if the time-series data has enjoyed differencing as many times as it becomes stationary and, then, is applied to the ARMA model ( $p, q$ ), the model will become ARIMA ( $p, d, q$ ). For instance, the ARIMA model (2, 1, 3) means a model the data of which has experienced a first-order differencing, has 2 autoregressive components, and 3 moving-average components. We

have diagnosed a model using the ARCH (autoregressive conditional heteroskedasticity) tests and an autocorrelation-test to get the best ARIMA model. Furthermore, the ARIMA model is run to test and, then, compare the volatility between Sharia and conventional portfolios.

### Multiple Regression Analysis

We employed multiple-regression analysis to examine the effect of quantitative Sharia screening (using the debt-to-equity ratio) on portfolio returns of both Sharia and conventional stocks. The model is as follows.

$$R_p = \alpha_0 + \alpha_1 DER + \alpha_2 ROE + \alpha_3 PBV + \alpha_4 EPS + \alpha_5 CR + \varepsilon \quad (5)$$

where,

$R_p$  = return of stock portofolio

$DER$  = debt to equity

$ROE$  = return on equity

$PBV$  = price to book value

$EPS$  = earning per share

$CR$  = current ratio

$\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4$  dan  $\alpha_5$  = coefficients of independent variables

$\varepsilon$  = error terms.

Portfolio return is a dependent variable while DER is an independent variable as a proxy of quantitative Sharia-screening while the other four independent variables, i.e., ROE, PBV, EPS, and CR served as the control variables.

## Results and Discussion

### Comparative Performance using Sharp-Ratio, Treynor-Ratio, and M<sup>2</sup>-Ratio

Measurement of portfolio return, using the Sharpe-ratio, or also referred to as the reward-to-variability ratio (RVAR), emphasizes the total risk as measured using standard deviations. To predict future performance, historical data are employed. Historical data returns are considered as predictive future returns. To analyze portfolio performance using the Sharpe-ratio requires data such as average return on a portfolio, standard deviation, and risk-free rate. Descriptive statistics of the Sharpe-ratio, Treynor-ratio, and M<sup>2</sup>-ratio measurements of the Sharia and conventional stocks in the Indonesia Stock Exchange for the period of 2013-2017 (upon data transformation) could be highlighted in [Table 3](#).

Table 3: Descriptive Statistics and Normality Test of Sharp-Ratio, Treynor-Ratio, and M<sup>2</sup>-Ratio for Sharia and Conventional Portfolio

Statistics	Panel A: Sharp-Ratio		Panel B: Treynor-Ratio		Panel C: M <sup>2</sup> -Ratio	
	Sharia	Conv.	Sharia	Conv.	Sharia	Conv.
Mean	2.452077	2.457883	1.028214	-0.072256	-0.006239	-0.002856
Median	2.426904	2.548467	1.043537	-0.038041	-0.010602	-0.009442
Maximum	3.578835	3.945533	3.001639	2.078560	0.013513	0.205077
Minimum	1.414387	0.825954	-0.596698	-2.911.305	-0.020475	-0.020434
Std. Dev.	0.419158	0.640701	0.967411	0.727486	0.010301	0.025043
Skewness	0.440530	-0.291034	0.109983	-0.310201	0.430114	5.855803
Kurtosis	3.311188	2.872980	1.906973	5.058476	1.722423	45.36792
Jarque-Bera	4.110872	1.671164	5.852902	21.76296	12.35519	10063.56
Probability	0.128037	0.433622	0.053587	0.000019	0.002075	0.000000
Observations	113	113	113	113	125	125

Source: These results were adapted from the data run with Eviews.

Given Panel A of [Table 3](#), it appears that the Sharia portfolio has a higher minimum value of Sharpe-ratio relative to conventional stock portfolios even though the maximum value of the Sharpe-

ratio of Sharia portfolios is below the conventional portfolio. The average performance of the two portfolios shows comparable values. Likewise, the standard deviation of the Sharia stock portfolio is only slightly smaller than the conventional stock portfolio. For the normality test, it appears that the Sharpe-ratio's data for both portfolios are normally distributed, denoted by the probability value of each is 0.128037 and 0.433622, which is greater than the critical value (0.05) and the value of Jarque-Bera for each portfolio is very small, meaning that the data is normally distributed.

Since both samples were normally distributed, an independent t-test was run to show whether there was a difference in performance between Sharia and conventional stock portfolios using the Sharpe-ratio. Before the test was carried out, the homogeneity of variance test was first a prerequisite needed to determine the type of independent t-test, whether or not the assumption that variance was equal could be met. F-value was found to be higher (2.336443) than its F-critical value (1.366389), meaning that the variance was unequal. The results of the independent t-test are presented in Table 4.

Table 4. Independent t-Test for Sharpe-Ratio Performance (Two-Sample Assuming Unequal Variances)

Statistics	Sharia	Conventional
Mean	2.452077	2.457882648
Variance	0.175694	0.410497953
Observations	113	113
Hypothesized Mean Difference	0	
Df	193	
t-Stat	-0.0806	
P(T<=t) One-Tail	0.467921	
t Critical One-Tail	1.652787	
P(T<=t) Two-Tail	0.935842	
t Critical Two-Tail	1.972332	

Source: These results were adapted from the data run with Ms. Excel.

Given Table 4, the t-stat value (-0.0806) is smaller than its critical value, i.e., 1.972332; hence, we fail to reject the null hypothesis. As such, we infer that there is no difference in performance between Sharia and conventional stock portfolios using the Sharpe ratio.

Similar to the initial data of Sharpe-ratio, the data of Treynor-ratio is also not normally distributed, both for Sharia and conventional portfolios (see Panel B of Table 3). As a result, the data were also transformed following the same case as the Sharpe-ratio. A significant probability value of the Sharia portfolio is obtained since it is greater than the critical value of 0.05, while the probability of a conventional portfolio is less than the critical value of 0.05. In other words, Sharia-portfolio data is normally distributed while conventional portfolios are not normally distributed. As such, a non-parametric test, the Mann-Whitney test, was performed where this test did not need the normality assumption but should meet the assumption that the values of the random variables of the two groups being compared were continuously distributed instead. This test applied either two directions or one direction.

The Mann-Whitney test, also called the  $U$  test, is used as an alternative to the parametric test if the assumptions needed for the test are not satisfied. Upon testing, the results are as shown in Table 5.

Table 5. Mann-Whitney Statistical Test for Treynor-Ratio

Statistics	Values
The number of sample 1 ( $n_1$ )	113
The number of sample 2 ( $n_2$ )	113
Number of levels from $n_1$ ( $R_1$ )	12588
Number of levels from $n_2$ ( $R_2$ )	13063
Value of $U$	6622
Comparison for $U$ ( $n_1 \times n_2$ )/2	6384.5
Value of $U$ employed	$n_1 \times n_2 - 6622 = 6147$

Source: These results were adapted from the data run with Ms. Excel.



Since there are more than 20 data samples, the normal curve approach is used as follows:

1. Mean  $E(U) = \frac{(n_1 \times n_2)}{2} = 6384.5$
2. Standard deviation  $\sigma_U = \sqrt{\frac{n_1 \times n_2 (n_1 + n_2 + 1)}{12}} = 491.474$
3. Calculated Value of Z =  $\frac{U - E(U)}{\sigma_U} = \frac{6147 - 6384.5}{491.474} = -0.4832$ .

Using the significant level of  $\alpha = 0.05$ , Z-value (Z-table) amounts to  $\pm 1.96$ . Since the calculated-Z is under the acceptance area, we fail to reject the null hypothesis ( $H_0$ ). As such, we conclude that there is no different performance between Sharia and non-Sharia (conventional) portfolios when using Treynor-ratio.

Given the results of statistical tests on previous ratios, the  $M^2$  ratio is also not normally distributed (see Panel C of Table 3); hence, the non-parametric Mann-Whitney test was applied. The results are depicted as seen in Table 6.

Table 6. Mann-Whitney Statistical Test for  $M^2$ -Ratio

Statistics	Values
Number of sample 1 ( $n_1$ )	125
Number of sample 2 ( $n_2$ )	125
Number of levels from $n_1$ ( $R_1$ )	15538
Number of levels from $n_2$ ( $R_2$ )	15837
Value of $U$	7962
Comparison for U ( $n_1 \times n_2$ )/2	7812.5
U-Value employed	$n_1 \times n_2 - 7962 = 7663$

Source: These results were adapted from the data run with Ms. Excel

Since there are more than 20 data samples, the normal curve approach was applied as follows:

1. Mean  $E(U) = \frac{(n_1 \times n_2)}{2} = 7812.5$
2. Standard deviation  $\sigma_U = \sqrt{\frac{n_1 \times n_2 (n_1 + n_2 + 1)}{12}} = 571.684$
3. Calculated Value of Z =  $\frac{U - E(U)}{\sigma_U} = \frac{7663 - 7812.5}{571.684} = -0.2615$

Applying the significant level of  $\alpha = 0.05$ , Z-value (Z-table) shows  $\pm 1.96$ . Since the calculated-Z covers the acceptance area, we also failed to reject the null hypothesis ( $H_0$ ). Hence, no different performance exists between Sharia and non-Sharia (conventional) portfolios when using the  $M^2$  ratio.

Thus, these results confirm most of the previous studies regarding portfolio performance, i.e., there is no difference in performance between Sharia and conventional portfolios. These results are in line with several research results, *inter alia*, conducted by Bauer et al. (2004), Albaity and Ahmad (2008), Hassan and Girrard (2010), Setiawan and Oktariza (2013), and Listyaningsih and Krishnamurti (2015). Different results, however, were found by Ashraf et al. (2017) and El-Alaoui et al. (2018) related to portfolio performance. Ashraf et al. (2017) and El-Alaoui et al. (2018) found differences in performance, i.e., Sharia portfolio performance tended to be worse than conventional portfolios only when the research was conducted during the financial crisis (2007-2008) while during the normal market conditions, they did not find performance difference.

### Comparative Portfolio Volatility

This section explains the process of finding the best time-series model of ARIMA ( $p, d, q$ ) for Sharia and conventional portfolios and employs them to measure the volatility of each portfolio, and then compare the results. Descriptive statistics of monthly return data for Sharia and conventional stock portfolio, each of which consists of 60 observations during 2013-2017 could be exhibited in Table 7.

Table 7. Descriptive Statistics of Portfolio Return for Sharia and Conventional Stocks

Statistics	Sharia	Conventional
Mean	0.013336	0.041546
Standard Dev.	0.056853	0.107166
Skewness	-0.065571	2.900754
Kurtosis	3.940878	12.79791
Probability	0.323660	0.000000
Observations	60	60

Source: These results were adapted from the data run with Eviews.

Given Table 7, it appears that the Sharia stock portfolios over five years (2013-2017) show quite good performance (return) since it has a positive average. Likewise, it also equally does for the returns of conventional stock portfolios. When looking at its standard deviation, the conventional portfolio has a higher value than the Sharia portfolio. Standard deviation indicates the level of risk or volatility. Skewness on the Sharia portfolio with a negative value of -0.065571 indicates that more data are distributed to the left side, while for conventional portfolios, a positive inclination of 2.900754 shows that data are more distributed to the right one. This suggests that the nature of the data is asymmetrical. Furthermore, the kurtosis value of the Sharia and conventional portfolios are 3.940878 and 12.79791 respectively, indicating that both have quite high volatility.

### Testing Data Stationarity

To make sure that the data is stationary, two steps are undertaken, i.e., plotting the data and observing it through graphs (see Figure 1), and applying a unit-root statistical tests or unit-root tests.

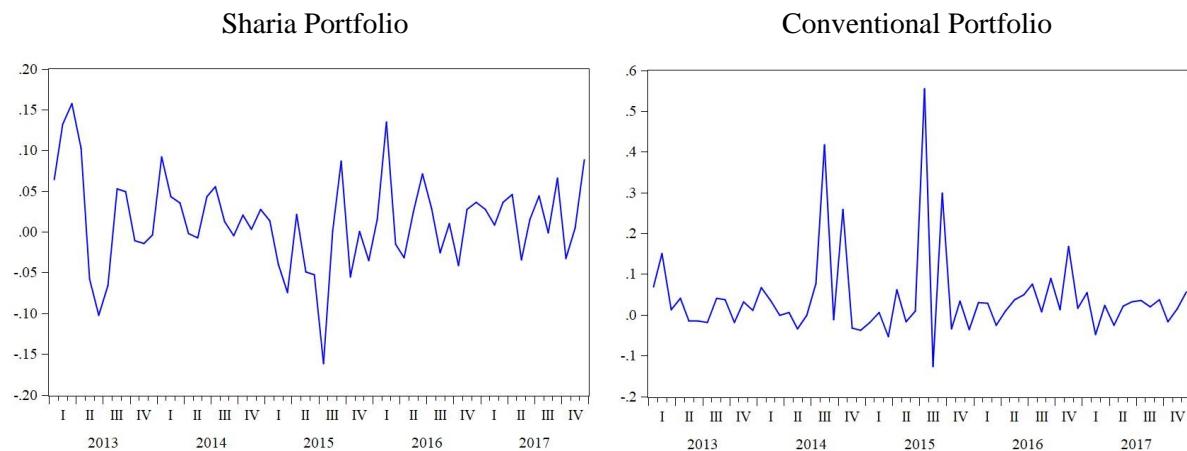


Figure 1. Plots of Sharia and Conventional Portfolio Data

Given Figure 1, it looks that both Sharia and conventional portfolio returns are experiencing a fairly stable movement or the data could be considered stationary as the movement of returns tends to move on the average of previous return movements. To confirm its validity, the stationarity test was run through the unit-root test with the augmented Dickey-Fuller (ADF) method. The results are shown in Table 8.

Given these statistical values, the ADF value for Sharia portfolio is -5.415013 while for the conventional portfolio is -4.479759 with Mackinnon's critical value of -3.546099 (1%); -2.911730 (5%); 2.593551 (10%) for the Sharia portfolio (Panel A of Table 8), while for conventional portfolios (Panel B of Table 8), Mackinnon's critical value -3.548208 (1%); -2.912631 (5%); 2.594027 (10%) respectively, where the absolute ADF value of each portfolio is greater than all the three Mackinnon's absolute critical values. While the value of the probability of Sharia portfolios is  $0.0000 < \alpha=0.05$  and the conventional portfolio probability value of 0.0006 is also smaller than  $\alpha=0.05$ . Thus, both Sharia and conventional portfolio returns are stationary.

Table 8. Results of the Unit Root Tests on Sharia and Conventional Portfolio using Augmented Dickey-Fuller (ADF) Method

Panel A: Unit-root Test for Sharia Portfolio			
Augmented Dickey-Fuller test statistic		t-Statistic	Prob.*
		-5,415013	0,0000
Test critical values :	1% level	-3,546099	
	5% level	-2,911730	
	10% level	-2,593551	
Panel B: Unit-root Test for Conventional Portfolio			
Augmented Dickey-Fuller test statistic		t-Statistic	Prob.*
		-4,479759	0,0006
Test critical values :	1% level	-3,548208	
	5% level	-2,912631	
	10% level	-2,594027	

Notes: data is considered stationary if the absolute statistical value of the Augmented Dickey-Fuller (ADF) is greater than the critical value or if the ADF probability value < 0.05.

**Identifying ARIMA Models**

The initial step to set the ARIMA model ( $p, d, q$ ) is to identify the model. Identification could be carried out by observing the ACF and PACF correlograms as presented in Table 9.

Table 9. The ACF dan PACF Correlograms for Sharia Portfolio and Conventional

Sharia Portfolio							Conventional Portfolio						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob		Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
		1	0.303	0.303	5.7991	0.016			1	-0.253	-0.253	4.0253	0.045
		2	-0.124	-0.237	6.7780	0.034			2	0.327	0.281	10.877	0.004
		3	-0.141	-0.026	8.0713	0.045			3	-0.142	-0.014	12.202	0.007
		4	-0.019	0.015	8.0944	0.088			4	-0.140	-0.302	13.509	0.009
		5	0.262	0.267	12.739	0.026			5	-0.153	-0.231	15.090	0.010
		6	0.002	-0.233	12.739	0.047			6	-0.082	-0.021	15.551	0.016
		7	-0.205	-0.063	15.676	0.028			7	-0.103	-0.062	16.301	0.023
		8	-0.161	-0.059	17.540	0.025			8	-0.106	-0.254	17.102	0.029
		9	0.062	0.144	17.823	0.037			9	0.138	0.039	18.501	0.030
		10	0.170	-0.044	19.983	0.029			10	-0.128	-0.075	19.717	0.032
		11	-0.061	-0.098	20.267	0.042			11	0.387	0.248	31.066	0.001
		12	-0.093	0.079	20.939	0.051			12	-0.024	0.119	31.110	0.002
		13	-0.046	-0.006	21.104	0.071			13	0.043	-0.234	31.253	0.003
		14	0.033	-0.048	21.193	0.097			14	-0.005	-0.092	31.255	0.005
		15	0.049	-0.056	21.395	0.125			15	-0.118	0.071	32.415	0.006
		16	-0.051	0.054	21.611	0.156			16	0.014	0.183	32.432	0.009
		17	-0.034	0.013	21.708	0.196			17	-0.079	-0.057	32.975	0.011
		18	-0.079	-0.143	22.259	0.221			18	0.103	0.026	33.909	0.013
		19	0.141	0.237	24.069	0.194			19	-0.108	0.052	34.966	0.014
		20	0.043	-0.146	24.244	0.232			20	0.039	-0.097	35.108	0.020
		21	-0.086	0.020	24.956	0.249			21	-0.072	-0.036	35.608	0.024
		22	0.039	0.035	25.105	0.292			22	-0.005	-0.137	35.611	0.033
		23	-0.046	-0.017	25.319	0.334			23	0.015	-0.062	35.633	0.045
		24	0.093	0.056	26.223	0.342			24	-0.057	0.015	35.968	0.055
		25	0.042	-0.054	26.411	0.386			25	0.012	-0.031	35.983	0.072
		26	-0.176	-0.133	29.808	0.276			26	-0.058	-0.086	36.348	0.085
		27	-0.155	-0.071	32.533	0.213			27	0.059	-0.077	36.736	0.100
		28	-0.194	-0.173	36.907	0.121			28	-0.089	-0.112	37.650	0.105

As seen in Table 9, it looks that in the Sharia portfolio, the corelogram bars break out the Bartlett line (dashed line) in the first and fifth lags of both ACF and PACF, while in the conventional portfolio, the corelogram bars goes out from the Bartlett line at the first, second, and eleventh lags of ACF and PACF. Thus, there seems to be some differences in identifying the ARIMA model for Sharia and conventional portfolios. Given the corelogram above, the identified ARIMA models for Sharia portfolios come under: ARIMA (1, 0, 0), ARIMA (0, 0, 1), ARIMA (1, 0, 1), ARIMA (5, 0, 0), ARIMA (0, 0, 5), ARIMA (1, 0, 5), ARIMA (5, 0, 1), ARIMA (5, 0, 5), ARIMA ([1, 5], 0, 0) and ARIMA (0, 0, [1, 5]), while for conventional portfolios, the identified ARIMA models comprise:

ARIMA (1, 0, 0), ARIMA (0, 0, 2), ARIMA (1, 0, 2), ARIMA (0, 0, 11), ARIMA (1, 0, 11), ARIMA (0, 0, [2, 11]) and ARIMA (1, 0, [2, 11]).

### Estimating the Parameters of ARIMA Models

Upon identifying the model, the next is the process of estimating the parameters of the ARIMA model ( $p, d, q$ ). In estimating each model, a constant is added to one of the models. The following is the over-fitting (classifying the data) of the identified ARIMA model for the Sharia portfolio (Table 10).

Table 10. Identifying the ARIMA Models for Sharia Portfolio

ARIMA Model ( $p, d, q$ )		Estimated coefficients of parameters		Probability	SIC
ARIMA (1, 0, 0)	With constants	<b><math>c</math></b>	0.012653	0.2261	-2.873447
		$\phi_1$	0.312367	0.0170	
	Without constants	<b><math>\phi_1</math></b>	0.344358	0.0076	-2.917758
ARIMA (0, 0, 1)	With constants	<b><math>c</math></b>	0.013857	0.1673	-2.925348
		$\theta_1$	0.446446	0.0004	
	Without constants	<b><math>\theta_1</math></b>	0.470531	0.0001	-2.960951
ARIMA (1, 0, 1)	With constants	<b><math>c</math></b>	0.012442	0.1602	-2.880987
		$\phi_1$	-0.447148	0.0271	
		$\theta_1$	0.835522	0.0000	
	Without constants	<b><math>\phi_1</math></b>	-0.412003	0.0415	-2.915144
		<b><math>\theta_1</math></b>	0.824384	0.0000	
ARIMA (5, 0, 0)	With constants	<b><math>c</math></b>	0.005380	0.5562	-3.108492
		$\phi_5$	0.275791	0.0192	
	Without constants	<b><math>\phi_5</math></b>	0.289734	0.0117	-3.174952
ARIMA (0, 0, 5)	With constants	<b><math>c</math></b>	0.14496	0.1612	-2.907530
		$\theta_5$	0.493701	0.0000	
	Without constants	<b><math>\theta_5</math></b>	0.541918	0.0000	-2.943067
ARIMA (5, 0, 1)	With constants	<b><math>c</math></b>	0.005020	0.6949	-3.103386
		$\phi_5$	0.327482	0.0094	
		$\theta_1$	0.340007	0.0124	
	Without constants	<b><math>\phi_5</math></b>	0.336066	0.0065	-3.173323
		<b><math>\theta_1</math></b>	0.342925	0.0109	
ARIMA (1, 0, 5)	With constants	<b><math>c</math></b>	0.013330	0.3283	-2.983801
		$\phi_1$	0.309574	0.0159	
		$\theta_5$	0.448059	0.0002	
	Without constants	<b><math>\phi_1</math></b>	0.329317	0.0094	-3.036240
		<b><math>\theta_5</math></b>	0.453088	0.0001	
ARIMA (5, 0, 5)	With constants	<b><math>c</math></b>	0.010326	0.2069	-3.224076
		$\phi_5$	-0.414313	0.0008	
		$\theta_5$	0.944524	0.0000	
	Without constants	<b><math>\phi_5</math></b>	-0.418010	0.0010	-3.267284
		<b><math>\theta_5</math></b>	0.934696	0.0000	
ARIMA (0, 0, [1, 5])	With constants	<b><math>c</math></b>	0.015242	0.1814	-2.946947
		$\theta_1$	0.435078	0.0003	
		$\theta_5$	0.286117	0.0179	
	Without constants	<b><math>\theta_1</math></b>	0.451938	0.0001	-2.983898
		<b><math>\theta_5</math></b>	0.291542	0.0132	

Notes: These results were adapted from the data run with Eviews; Coefficients in bold refer to the probability value less than 0.01 or 0.05 or 0.10 respectively and have the lowest Schwarz info criterion (SIC) value.

As exhibited in Table 10, the best ARIMA models ( $p, d, q$ ) is found, i.e., ARIMA (0, 0, 1), ARIMA (5, 0, 0), ARIMA (5, 0, 1), ARIMA (1, 0, 5), ARIMA (5, 0, 5), ARIMA (0, 0, [1, 5]), all of which are without constants. The best model criteria are based on a probability value that is less than the critical value (0.05) and on the lowest Schwarz info criterion (SIC) value. The next is over-fitting (classifying the data) of the identified ARIMA model for the conventional portfolio (Table 11).

Table 11. Identifying the ARIMA Models for the Conventional Portfolio

ARIMA Model ( $p, d, q$ )		Estimated coefficients of parameters		Probability	SIC
ARIMA (1, 0, 0)	With constants	<b><math>c</math></b>	0.041115	0.0004	-1.557895
		<b><math>\phi_1</math></b>	-0.252775	0.0533	
	Without constants	<b><math>\phi_1</math></b>	-0.091508	0.4864	-1.432145
ARIMA (0, 0, 2)	With constants	<b><math>c</math></b>	0.041889	0.0330	-1.716764
		<b><math>\theta_2</math></b>	0.535164	0.0000	
	Without constants	<b><math>\theta_2</math></b>	0.571666	0.0000	-1.707926
ARIMA (1, 0, 2)	With constants	<b><math>c</math></b>	0.041292	0.0147	-1.659410
		<b><math>\phi_1</math></b>	-0.168569	0.2132	
		<b><math>\theta_2</math></b>	0.518239	0.0000	
	Without constants		-0.081853	0.5424	-1.632543
			0.569334	0.0000	
ARIMA (0, 0, 11)	With constants	<b><math>c</math></b>	0.040434	0.0580	-1.899634
		<b><math>\theta_{11}</math></b>	0.865218	0.0000	
	Without constants	<b><math>\theta_{11}</math></b>	0.869727	0.0000	-1.905363
ARIMA (1, 0, 11)	With constants	<b><math>c</math></b>	0.041068	0.0034	-2.035343
		<b><math>\phi_1</math></b>	-0.448795	0.0004	
		<b><math>\theta_{11}</math></b>	0.883152	0.0000	
	Without constants	<b><math>\phi_1</math></b>	-0.366799	0.0045	-1.957221 <sup>§</sup>
		<b><math>\theta_{11}</math></b>	0.887839	0.0000	
ARIMA (0, 0, [2, 11])	With constants	<b><math>c</math></b>	0.049781	0.0217	-1.878715
		<b><math>\theta_2</math></b>	0.632266	0.0000	
		<b><math>\theta_{11}</math></b>	0.482373	0.0000	
	Without constants	<b><math>\theta_2</math></b>	0.321561	0.0010	-1.908190
		<b><math>\theta_{11}</math></b>	0.649829	0.0000	
ARIMA (1, 0, [2, 11])	With constants	<b><math>c</math></b>	0.040764	0.0049	-1.969150
		<b><math>\phi_1</math></b>	-0.430933	0.0009	
		<b><math>\theta_2</math></b>	0.027626	0.6215	
	Without constants	<b><math>\theta_{11}</math></b>	0.881848	0.0000	
		<b><math>\phi_1</math></b>	-0.324783	0.0138	-1.906741
		<b><math>\theta_2</math></b>	0.084469	0.2249	
		<b><math>\theta_{11}</math></b>	0.860613	0.0000	

Notes: These results were adapted from the data run with Eviews; Coefficients in bold refer to the probability value less than 0.01 or 0.05 or 0.10 respectively and have the lowest Schwarz info criterion (SIC) value.

Given Table 11, the best ARIMA models ( $p, d, q$ ) have been identified, comprising ARIMA (0, 0, 2) with constants and without constants, ARIMA (0, 0, 11) without constants, ARIMA (1, 0, 11) with constants and without constants, and ARIMA (0, 0, [2, 11]) with and without constants. The best model criteria are based on a probability value that is less than the alpha value of 0.05 and the smallest SIC value. The next step is to test the diagnosis of the selected ARIMA model.



### Results of Testing the Diagnosis and Selection of the Best ARIMA Models

The diagnostic test of the ARIMA model includes the ARCH (heteroscedasticity) effect test, the normality test, and the white-noise test (autocorrelation). The following is a summary of the results of the diagnostic test of the ARIMA model for the Sharia portfolio.

Table 12. Summary of the diagnostic-test results of the ARIMA model for the Sharia portfolio

Model	Heteroscedasticity	Normality	Autocorrelation
ARIMA (0, 0, 1) without constants	Yes	Yes	No
ARIMA (5, 0, 0) without constants	No	No	No
ARIMA (5, 0, 1) without constants	No	Yes	No
ARIMA (1, 0, 5) without constants	No	Yes	No
ARIMA (5, 0, 5) without constants	No	Yes	Yes
ARIMA (0, 0, [1, 5]) without constants	No	Yes	No

As highlighted in Table 12, there seems to be one model that violates the normality assumption and the other model violates the autocorrelation assumption, i.e., ARIMA (5, 0, 0) and ARIMA (5, 0, 5). As such, both models are eliminated from the model list of the best ARIMA. The next step is to compare the probability value of the heteroscedasticity test and the normality test of the model and the Q-stat value at the last lag of the autocorrelation test to get the best ARIMA model.

Table 13. Comparative statistical tests of the ARIMA models for Sharia portfolio

Model	Heteroscedasticity (Probability)	Normality (Probability)	Autocorrelation (Q-stat for the last lag)
ARIMA (0, 0, 1) without constants	0.2343	0.404305	38.342 (lag 28)
ARIMA (5, 0, 1) without constants	0.2962	0.068413	24.373 (lag 24)
ARIMA (1, 0, 5) without constants	0.0705	0.601303	29.682 (lag 24)
ARIMA (0, 0, [1, 5]) without constants	0.1388*	0.660537*	23.862* (lag 28)

Source: These results were adapted from the data run with Eviews; \*Refers to the highest probability in the normality test; \* Reflects a quite high heteroscedasticity; \* Denotes the lowest Q-stat value among the other models.

As depicted in Table 13, it looks that the ARIMA model (0, 0, [1, 5]) without constants has the highest probability in the normality test and is quite high in the heteroscedasticity test, and has the lowest Q-stat value among the other models. As a result, the model is chosen as the best ARIMA model for the Sharia portfolios and used as a measure of the volatility level for the Sharia portfolio. The equation for the ARIMA model (0, 0, [1, 5]) is stated as follows:

$$r_t = 0.451938e_{t-1} + 0.291542e_{t-5} + e_t \quad (6)$$

where,

$r_t$  = return of Sharia portfolio in period  $t$

$e_t$  = residual return of Sharia portfolio in period  $t$

$e_{t-1}$  = residual return of Sharia portfolio in period  $t - 1$

$e_{t-5}$  = residual return of Sharia portfolio in period  $t - 5$

The next step is to diagnose the ARIMA models from the conventional portfolio. The summary of the diagnosis results of the ARIMA-model tests for conventional portfolios is exhibited in Table 14. Table 14 suggests that all ARIMA models in the conventional portfolios violate the assumption of residual normality. However, the best ARIMA model could be determined since a model has already appeared to satisfy the requirements of being free from autocorrelation and heteroscedasticity problems. Taking notice in Table 14, the only model being free from autocorrelation and heteroscedasticity is the ARIMA model (0, 0, [2, 11]) with constants. Hence, the model could be

suggested to be the best ARIMA model and be employed to forecast returns for the conventional portfolios. The equation of the ARIMA model (0,0, [2,11]) with constants is presented by Equation 7.

Table 14. Summary of the diagnostic-test results of the ARIMA models for conventional portfolio

Model	Heteroscedastisity	Normality	Autocorrelation
ARIMA (0, 0, 2) with constants	No	No	Yes
ARIMA (0, 0, 2) without constants	No	No	Yes
ARIMA (0, 0, 11) without constants	No	No	Yes
ARIMA (1, 0, 11) with constants	No	No	Yes
ARIMA (1, 0, 11) without constants	No	No	Yes
ARIMA (0, 0, [2, 11]) with constants	No	No	No
ARIMA (0, 0, [2, 11]) without constants	No	No	Yes

Source: These results were adapted from the data run with Eviews.

$$r_t = 0.049781 + 0.632266e_{t-2} + 0.482373e_{t-11} + e_t \tag{7}$$

where,

$r_t$  = returns of conventional portfolio in period  $t$

$e_t$  = residual returns of conventional portfolio in period  $t$

$e_{t-2}$  = residual returns of conventional portfolio in period  $t - 2$

$e_{t-11}$  = residual returns of conventional portfolio in period  $t - 11$ .

**Forecasting**

Upon getting the best ARIMA model ( $p, d, q$ ), both for Sharia and conventional portfolios, the next step is to apply the model to estimate returns for a period of interest and can be employed to estimate returns for subsequent periods. The following graph is a comparison between the value of forecast returns and actual returns of both Sharia and conventional portfolios to look into, in general, the extent to which the values of the forecast return are close to those of the actual return.

As exhibited in Figure 2 and Figure 3, they imply that the values of the forecast return for both Sharia and conventional portfolios get near to its actual return, denoted by the forecast return curve moving to the direction of the actual-return curve consistently. Besides, many points intersect between the forecast return and the actual return, meaning that both of them have the same or nearly the same value. Thus, in summary, the ARIMA model (0, 0, [1, 5]) without constants for Sharia portfolios and the ARIMA model (0, 0, [2, 11]) with constants for conventional portfolios are quite accurate and could be employed to estimate the volatility of each portfolio.

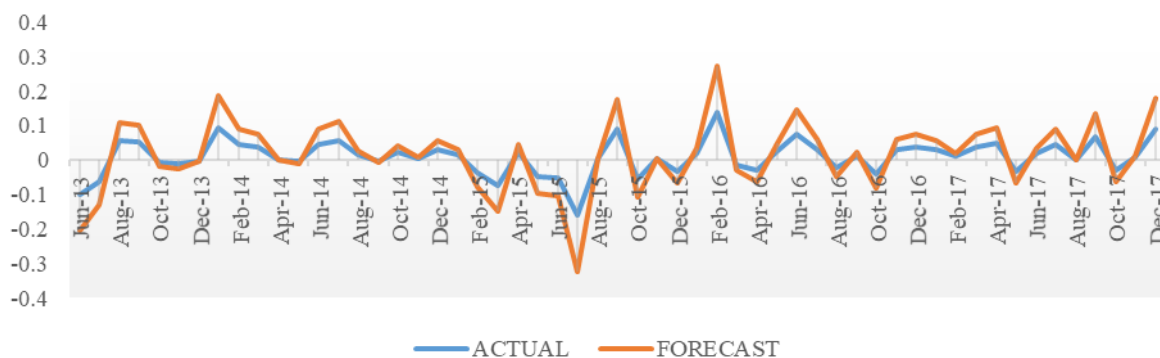


Figure 2. The Comparison between Actual Returns and Forecast Returns of ARIMA Models for Sharia Portfolio

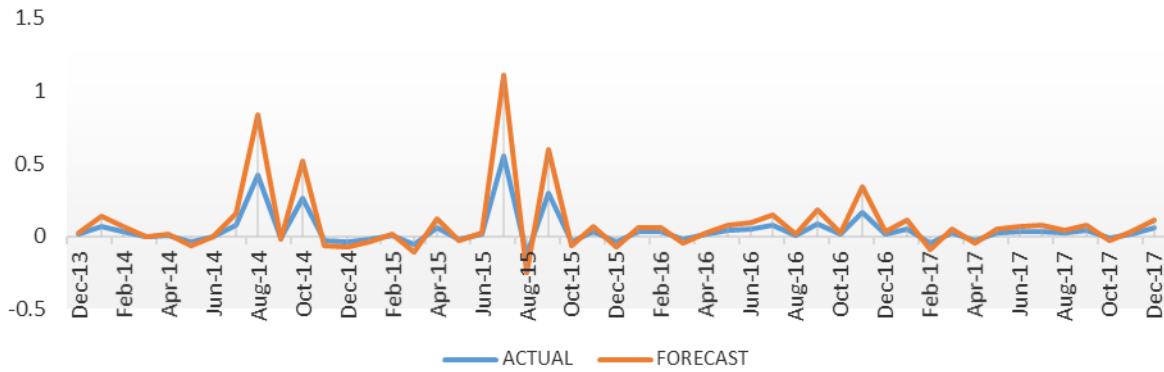
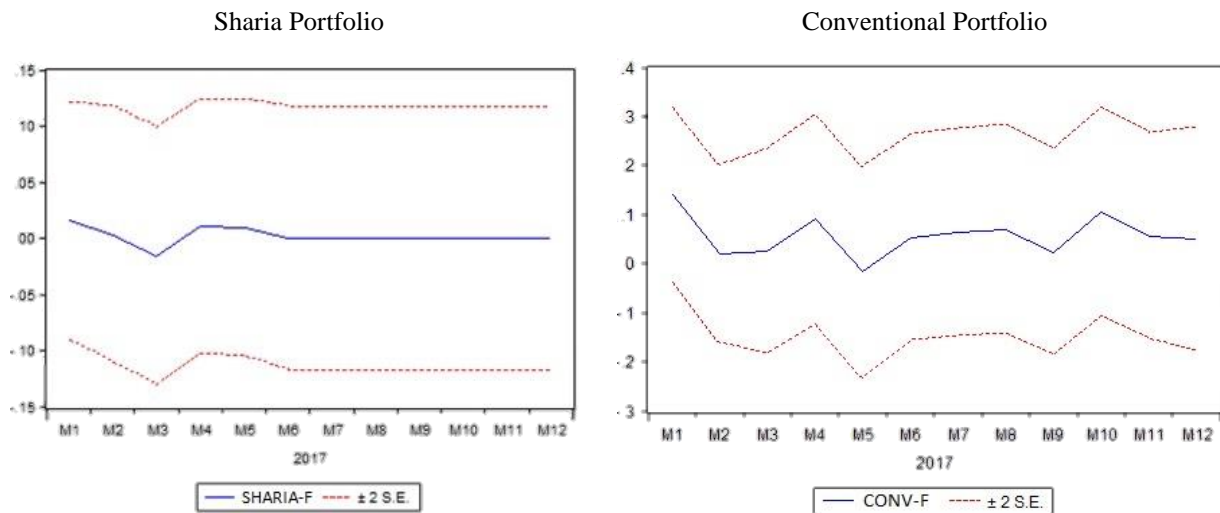


Figure 3. The Comparison between Actual Returns and Forecast Returns of ARIMA Models for Conventional Portfolio

**The Comparative Volatility of Portfolios**

The best ARIMA models for Sharia and conventional portfolios have been identified and have also been applied to forecast the returns and to determine the portfolio volatility. However, we cannot determine which ARIMA model is the best, whether the ARIMA models originate from Sharia or conventional portfolios. To answer these questions, the first step is to consider the lags and differences in the ARIMA model ( $p, d, q$ ). The greater the lags and the level of differencing for an ARIMA model are, the higher the volatility will be. Thus, the ability to predict the actual value is lower.

To make the results of the comparison clearer, a formula is utilized to measure the magnitude of the forecast error i.e., mean absolute percent error (MAPE). MAPE is calculated using absolute error in each period divided by the actual observation value during the period. The results of forecast analysis applying the Eviews program are presented in Figure 4.



Notes: Forecast of Sharia portfolio includes 12 observations from Month 1 of 2017 to Month 12 of 2017 with root mean squared error = 0.042412, mean absolute error = 0.033465, mean absolute percent error = 95.95912, and bias proportion = 0.242604.

Notes: Forecast of conventional portfolio includes 12 observations from Month 1 of 2017 to Month 12 of 2017 with root mean squared error=0.063070, mean absolute error=0.049755, mean absolute percent error=202.6239, and bias proportion=0.389270.

Figure 4. The Statistic Results of Forecast Return

The comparative values of mean absolute percent error (MAPE) from Figure 4 suggest that the value of the Sharia portfolio’s MAPE is 95.96, smaller than the conventional portfolio’s MAPE, amounting to 202.62. Thus, to sum up, the ARIMA models for the Sharia portfolios have lower

volatility than for conventional portfolios. These results are in line with the findings of [Ashraf et al. \(2017\)](#) and [El-Alaoui \(2018\)](#), suggesting that Sharia portfolio volatility proves to be lower than conventional portfolios.

### **Quantitative Sharia Screening and Its Effect on Portfolio Return**

We took the debt screening criteria in the form of a debt-to-equity ratio (DER) as a proxy for testing its effect on portfolio returns. Descriptive statistics of debt-to-equity-ratio (DER) data for Sharia and conventional portfolios are presented in [Table 15](#).

Table 15. The Comparative Descriptive Statistics of Debt-to-Equity Ratio (DER) between Sharia and Conventional Portfolio

Statistics	DER for Sharia Portfolio	DER for Conventional Portfolio
Mean	0.813040	2.731920
Median	0.710000	1.830000
Maximum	3.620000	22.46000
Minimum	0.010000	0.040000
Std. Dev.	0.650449	3.533982
Skewness	1.471310	3.594083
Kurtosis	5.637095	16.78144
Observations	125	125

[Table 15](#) suggests that the average DER of 81.3% for the Sharia portfolio is still below the threshold value of 82%, a debt screening set by DSN-MUI and the Financial Services Authority (OJK). These results suggest that DSN-MUI and OJK have consistently implemented quantitative Sharia-screening to select firms listed on the Indonesia stock exchange (IDX). Furthermore, it implies that the maximum value of DER for the Sharia portfolio is 362%. This suggests that even though it does not pass DER screening at 82%, a firm could still get through the debt-to-asset ratio (DAR) screening of 45%. As such, to choose between DER and DAR screening is optional; applying both simultaneously is not obligatory.

This shows that the implementation of Sharia screening set by DSN-MUI and OJK is still very flexible; thus, this opens up opportunities for wider diversification. Furthermore, we employed panel-data regression analysis to examine the effect of financial ratios, that was, specifically debt to equity ratio (DER) as a proxy of quantitative screening, on the returns of both Sharia and conventional portfolios. Before applying regression, the model approach was first tested, and, then, the classical-assumption test followed. The summary of the results of the model-approach test and the classical-assumption test are highlighted as follows.

Table 16. Summary of Comparative Results using a Model Approach and the Classical-Assumption Tests

Portfolio	Model Approach	Normality	Multicollinearity	Heteroscedasticity	Autocorrelation
Sharia	Fixed Effect	Yes	No	No	No
Conventional	Random Effect	Yes	No	No	No

Given [Table 16](#), it suggests that the regression models for both Sharia and conventional portfolio have passed the classical assumption test; hence, it is feasible to apply for further analysis. Upon getting the right model and classical-assumption test, the hypothesis test was then run to measure the extent to which the impact of the independent variables on the dependent variable. This test consisted of three steps: a partial test of variables, a simultaneous test, and determination test. The hypothesis test applied significance levels of 0.01, 0.05, and 0.10.

### Partial t-Test (t-Test Statistics)

The statistical t-test aims to see how much influence each of the independent variables partially (individually) in explaining the dependent variable. One way is to look at the probability value in the t-test table. If a probability < 0.01, 0.05, or 0.10, partially or individually the independent variable influences the dependent variable. The results of the t-statistical test on the Sharia portfolio are presented in Table 17.

Given Panel A of Table 17, the statistical t-test results show that, of the five independent variables, only the debt-to-equity ratio (DER) partially has a significantly positive effect on Sharia portfolio returns (the t-stat probability value is 0.0087, lower than a significance level of 0.01).

The model chosen for the Sharia portfolio is a fixed effect in which the estimated model, the F-statistic probability value of 0.074215 is less than 0.10, i.e., being significant at a 10% significance level. This suggests that the independent variables jointly influence the dependent variable; thus, the financial ratios altogether affect the returns of the Sharia portfolio. The adjusted-R squared value for the Sharia portfolio amounts to 0.2277, meaning that this model could explain the dependent variable by 22.77% while the remaining 77.23% is attributable to the other independent variables outside the model.

Table 17. t-statistics test for Sharia and Conventional Portfolio

Panel A: t-Statistics Test for Sharia

Variable	Coefficients	Std. Error	t-Statistic	Prob.
C	-4.104852	0.834496	-4.918958	0.0000
PBV	0.352946	0.215551	1.637414	0.1103
EPS	-0.000518	0.001610	-0.321483	0.7497
ROE	0.030840	0.023583	1.307735	0.1993
DER	2.174720***	0.783775	2.774675	0.0087
CR	-2.37E-05	0.000133	-0.178181	0.8596

F-test=0.074215; Adj-R<sup>2</sup>=0.2277

Panel B: t-Statistics Test for Conventional Portfolio

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.037600	0.321536	-3.227012	0.0021
PBV	-0.013079	0.010090	-1.296194	0.2001
EPS	0.000150	0.001136	0.131631	0.8957
ROE	-0.004791	0.003078	-1.556455	0.1251
DER	0.008991	0.057409	0.156613	0.8761
CR	0.000352	0.000552	0.637778	0.5262

F-test = 0.718966; Adj-R<sup>2</sup> = -0.035504

Notes: These results were adapted and run with Eviews; \*, \*\*, \*\*\* refer to a significant level at 0,10; 0,05; and 0,01 respectively.

Panel B of Table 17 demonstrates that all the independent variables (price-to-book value [PBV], earning per share [EPS], return on equity [ROE], the debt-to-equity ratio [DER], the current ratio [CR]) does not have a significant effect on conventional portfolio returns. The t-statistical table shows that the t-statistical probability value for all the independent variables is more than a critical value of 0,01 or 0,05 or 0.10. Meanwhile, this also implies that the independent variables simultaneously do not affect the dependent variable (F-statistical probability value is 0.718966, more than 0.10 for the conventional portfolio with adjusted-R squared value= -0.035504) applying the random effect for the estimated model.

Several studies related to the effect of financial ratios, especially the effect of debt-to-equity ratio (DER) on stock returns or stock portfolios have shown inconsistent results. Suharli (2005), *inter alia*, examined the effect of DER and stock beta on stock returns. The results have shown that the two



factors do not affect stock returns. Arista and Astohar (2012) and Setiawan and Oktariza (2013) also found that DER had a significantly positive effect on stock returns. These previous results are in line with this study, investigating the effect of DER on Sharia portfolio returns. The results of these two regressions differ only in terms of significance and are reaffirmed by some of the previous studies. Hence, in conclusion, the debt-to-equity ratio (DER) has a positive impact on the sharia portfolio returns.

### Conclusion and Implications

The study specifically involves the portfolios having inter-industrial low (negative)-correlations, theoretically leading to lower unsystematic (diversifiable) risk. Taking notice of the results of a statistical comparison test using the independent t-test and the Mann-Whitney non-parametric test, we sum up that there is no different performance between Sharia and conventional portfolios when employing the Sharpe-ratio, Treynor-ratio, and the M<sup>2</sup>-ratio. It means that all Hypotheses 1 (H<sub>1a</sub>, H<sub>1b</sub>, and H<sub>1c</sub>) are not supported. Thus, the Sharia portfolio has a comparable performance with conventional portfolios. This is in contrast to the ever ‘worrying’ results, originating, *inter alia*, from Grossman and Sharpe (1986) and Bauer et al. (2006).

Henceforth, given these results of testing ARIMA models, we conclude that the best ARIMA model to predict Sharia portfolio returns points to ARIMA (0, 0, [1, 5]) without constants, while the best ARIMA model to predict conventional portfolio returns falls under ARIMA (0, 0, [2, 11]) with constants. Comparing forecast graphs between Sharia and conventional portfolios, the conventional-portfolio forecast returns tend to be more volatile attributable to adopting the ARIMA model with greater lags (2 and 11 moving-averages) than the Sharia-portfolio forecast returns due to the ARIMA model with smaller lags (1 and 5 moving-averages). Besides, the percentage of absolute error or mean absolute percent error (MAPE) suggests that the value of MAPE of Sharia portfolios is found to be smaller than the conventional portfolio MAPE. In summary, the Sharia portfolio has lower volatility than the conventional portfolios. Thus, it necessarily means that Hypothesis 2 is empirically supported. Thus, when shocks occur in the stock market, Sharia portfolios prove to be more resilient than conventional ones.

Concerning the DER effect on portfolio returns, we conclude that when applying the five ratios, only the debt ratio (DER) has a significantly positive effect on the Sharia-portfolio returns, but not on the conventional portfolio returns. These results suggest that Hypothesis 3 is partially empirically supported. This result is in line with one of Durand (1952)’s theories on capital structure, that is, a traditional approach which states that, to some extent, leverage could increase the value of the firms. Contrarily, Ashraf et al. (2017) and El-Alaoui et al. (2018) found that leverage tends to worsen portfolio performance. The findings, however, were found in the period of the financial crisis (2007-2008), while, in normal market conditions, they found no difference in performance.

Thus, the presence of Sharia screening renders another ‘virtue’ to capital markets. This means that even though leverage is subject to Sharia-screening, portfolio performance remains positive, even in turn, leading to the decreased risk. As such, investors and managers do not need to worry about Sharia-screening. This evidence confirms the reasons why many firms have high-debt profiles in Indonesia and why DSN-MUI and OJK set a relatively loose threshold of 82% for the debt-to-equity ratio (DER) or 45% for the debt-to-asset ratio (DAR).

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