Monotonic Correlation Diagnostics of share price volatility for Shariah-compliant Islamic Bank: A New Insight of Islamic Financial Engineering

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Abstract: The objective of this paper is to analyze the relationship between volatility rates and return rates for a share price of Bank Islam Malaysia Berhad (BIMB) from the year 2010 until 2016. The maximum volatility rate is 3.96 in July 2011, while the minimum volatility rate is 0.46 in April 2014. Next, the nonparametric analysis calculated the monotonic relationship between volatility rates and return rate for a share price of BIMB. From the analysis, the significant value is 0.000. Hence, the result rejects the null hypothesis for a Spearman correlation analysis. The numerical result shows there is a monotonic association between volatility rate and return rate for a share price of BIMB. The Spearman correlation coefficient, r_s in this analysis is 0.403 indicated that there is a moderate positive correlation between volatility rate and return rate for BIMB share price.

Keywords: Islamic Bank, Volatility, Return, Spearman correlation, Financial Engineering

1. Introduction

The Malaysian Islamic banking industry has been growing up since 1982. Based on the Islamic banking statistic report from the central bank of Malaysia, there are 2 full-fledged Islamic banking institutions that are Bank Islam Malaysian Berhad and Bank Muamalat Malaysia Berhad. Table 1 shows the Islamic bank institutions in Malaysia. Today, Malaysia has been successful in implementing a dual banking system and has emerged as the first nation to have a full-fledged Islamic banking system operating on a parallel basis with the conventional banking system (Ismail, et al, 2013).

Besides the growing up a number of banking institutions, the industry has also shown promising performances of sharia-compliant companies. The report from Securities Commission of Malaysia shows that 672 out of 904 companies are a list on sharia board. This benchmark shows the outstanding performance of Islamic financing industry in the Malaysian market.

The number of Islamic banks around the world is 396 in 53 countries managing a total fund of US\$442 billion. In addition, non-main stream banks around the world which offer Islamic banking windows are 320 banks managing a fund of US\$200 billion (Nasser and Muhammed, 2013). Companies enjoy with high growth rate and profits command high price-earnings ratio and higher share price whereas companies slowing down or with fewer growth prospects are punished by lower price-earnings ratios and stock prices (Singhania and Anchalia, 2013).

However, to maintain and monitor the robust of Islamic banks performance is more difficult. There are some challenges influenced the performance of Islamic banking operations such as lack of human resources capital, limited alternatives of Islamic investments and etc. Thus, improvement and innovation should be undertaking in order to overcome the challenge faced by Islamic banking institutions. Messis and Zapranis (2014) the role of financial markets and institutions in the economy is very important since they constitute the channel of passing funds from savers to investors. A small volatility in the prices of financial assets is acceptable due to the process of allocating funds among competing uses.

Table 1: List of Islamic Banking Institutions in Malaysia

No.	Name of Islamic Bank	Ownership
1.	Affin Islamic Bank Berhad	Local
2.	Al Rajhi Banking & Investment Corporation (Malaysia) Berhad	Foreign
3.	Alliance Islamic Bank Berhad	Local
4.	AmBank Islamic Berhad	Local
5.	Asian Finance Bank Berhad	Foreign
6.	Bank Islam Malaysia Berhad	Local
7.	Bank Muamalat Malaysia Berhad	Local
8.	CIMB Islamic Bank Berhad	Local
9.	HSBC Amanah Malaysia Berhad	Foreign
10.	Hong Leong Islamic Bank Berhad	Local
11.	Kuwait Finance House (Malaysia) Berhad	Foreign
12.	Maybank Islamic Berhad	Local
13.	OCBC Al-Amin Bank Berhad	Foreign
14.	Public Islamic Bank Berhad	Local
15.	RHB Islamic Bank Berhad	Local
16.	Standard Chartered Saadiq Berhad	Foreign

Source: Central Bank of Malaysia, 2017

However, to maintain and monitor the robust of Islamic banks performance is more difficult. There are some challenges influenced the performance of Islamic banking operations such as lack of human resources capital, limited alternatives of Islamic investments and etc. Thus, improvement and innovation should be undertaking in order to overcome the challenge faced by Islamic banking institutions. Messis and Zapranis (2014) the role of financial markets and institutions in the economy is very important since they constitute the channel of passing funds from savers to investors. A small volatility in the prices of financial assets is acceptable due to the process of allocating funds among competing uses.

Besides that, many types of research should be doing to improve the performance of Islamic banks in order to generate high return especially in the performance of shares price. Indeed, assessing the volatility of returns and expected losses of Islamic bank is one of the ways to monitor and manage the performance of Islamic banking institutions.

The volatility of the Islamic banks in this study is referred to the degree of variation of a trading price series over time as measured by the standard deviation. The symbol σ is used for volatility. There are many methods used by researchers to analyze the volatility of return in banking institutions such as Value at Risk (VaR) approach, E-GARCH model and etc. Even though, it is still a lack of researchers to analyze the volatility of return in Islamic banking institutions. Thus, this paper tries to fulfill this gap by analyzing the volatility of return in Bank Islam Malaysia Berhad (BIMB). This paper uses standard deviation approach to analyzing the volatility of returns of BIMB within the periods of 2010 till 2016. The main reason to evaluate the performance of BIMB is because BIMB is the first Islamic bank established in Malaysia. Besides that, BIMB is the first full-fledged Islamic banking system used a sharia contract such as *mudhrabah*, *musharakah*, *ijarah* and etc.

2. Literature Review

Relevant literature shows that the different methods are used in Islamic banking and conventional banking system. The main difference is Islamic bank system uses interest-free methods while conventional banking system uses interest-based methods. Besides that, Islamic banks are not permitted to offer a fixed rate of return and are not permitted to charge interest. Since Islamic law has been existence for more than 1400 years, but its implementation has been subjected to the willingness of the rulers in the passage of history and civilization. Although the study on financial contracts has been extensively reviewed, the role of Islamic contracts is not highlighted, except those in the historical institutional and contract theory literature (Ismail and Tohirin, 2010).

According to Ismail (2010), modern commercial banking is based on the creditor-debtor relationship between the borrower and the bank. Interest is viewed as the price of credit, reflecting the opportunities or cost of money. In order to be justifying under Islam, the banking system has to avoid interest. The most important rules that have to remember that is not all the increase, profit or gain is unlawful according to sharia law.

A unique feature of Islamic banking system is the transaction must be free from the prohibited element such as *riba*, *gharar*, and *maisir*. The basic sharia contract like *mudharabah*, *musharakah*, *ijarah* and other contracts are emerged to meet the financial requirement in the light of the teachings of Islam. Performance evolution is the key to sustained growth and development of banking institution (Abdul Hamid and Azmi, 2010).

Study regarding volatility is important because it is to measure the performance of banks. Ismal (2010) uses Value at Risk (VaR) approach to compute the volatility (risk) of returns and expected losses of Islamic bank financing in Indonesia found that the equity and debt-based financing produce sustainable returns of bank financing. He also found that the performance of service-based financing is very sensitive to the economic conditions and finds that risk of investment and expected losses are well managed. While studying the materials of Floros and Salvador (2015) regarding the effect of trading volume and open interest on the volatility of futures, markets found that market depth has an effect on the volatility of futures markets but the direction of this effect depends on the type of contract.

Akhtar and Khan (2016) analyzing the nature of volatility on the Karachi Stock Exchange and develop an understanding as to which model is most suitable for measuring volatility among those used. The results reveal that daily, weekly and monthly return series show non-normal distribution, stationary and volatility clustering. The study shows the high persistence of volatility, a mean-reverting the process and an absence of a risk premium in the Karachi Stock Exchange market with an insignificant leverage effect only in the case of weekly returns. However, a significant leverage effect is reported regarding the daily series of the Karachi Stock Exchange. In addition, to analyze the impact of global financial crises upon volatility, the findings show that the sub-periods demonstrated a slightly low volatility and the global economic crisis did not cause a rise in volatility levels.

Suzuki and Uddin (2014) used the bank rent theory to generate the theoretical underpinnings of the issue. They found that repeated transactions under *murabaha* are observed in the Islamic banking in Bangladesh. The asset-based financing gives the Bangladesh Islamic banks relatively higher Islamic bank rent opportunity for protecting their "franchise value" as Sharia-compliant lenders while responding to the periodic volatility in transaction costs of profit-and-loss sharing.

Byun and Rhee (2011) examine whether the superiority of the implied volatility using the Black and Scholes model on the forecasting performance and found that the forecasting performances of implied volatilities are improved under high volatile market or low return market.

Study focus on the determinants factor of bank performance in China found that the high level of stock market volatility could translate into higher return on equity and excess return on equity. Rather than leading to improved profitability, the labor productivity has a negative impact on economic value added (Tan and Floros, 2012).

3. Methodology

This research analyzes the relationship between volatility rates and return rates for the share price of Bank Islam Malaysia Berhad (BIMB) from the year 2010 until 2016. In analyzing the return and volatility rate, the procedure below needs to be performed.

3.1 Derivative for rate of return

This research using below equation for the rate of return for share price:

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}} \times 100\% \quad (1)$$

Where R_t is rate of return for period t , P_t is share price at period t and P_{t-1} is share price at period $t-1$.

Then, we calculate the average return for each month as below equation:

$$R_{month_average} = \frac{\sum_{t=1}^{t=n} R_t}{n} \quad (2)$$

Where $R_{month_average}$ is average rate or return for the particular month, R_t is the rate of return for period t and n is a number of trading days in each month.

3.2 Derivative of volatility

Volatility is a statistical measure of the dispersion of returns for a given security or market index. Volatility can either be measured by using the standard deviation between returns from that same security or market index.

For the volatility, the calculation derives as follow the procedure:

The deviation of return is calculated as below:

$$Deviation(D) = R_t - R_{month_average} \quad (3)$$

Then, the deviation is squared,

$$D^2 = (R_t - R_{month_average})^2 \quad (4)$$

Next, the variance for month i period is calculated as below:

$$Var_{month_i} = \frac{\sum_{t=1}^n (D^2)}{n} = \frac{\sum_{t=1}^n ((R_t - R_{month_average})^2)}{n} \quad (5)$$

The volatility for month i period is calculated as below:

$$Vol_{month_i} = \sqrt{\frac{\sum_{t=1}^n (D^2)}{n}} = \sqrt{\frac{\sum_{t=1}^n ((R_t - R_{month_average})^2)}{n}} \quad (6)$$

3.3 Derivative of the rank coefficient of correlation by spearman

Assuming that no two individuals are bracketed equal in either classification, each of the variables X and Y takes the values 1,2,.....,n

Hence, we use mean as measures of central tendency. The calculation is indicated as below:

$$\bar{x} = \bar{y} = \frac{1}{n} (1 + 2 + 3 + \dots + n) = \frac{n+1}{2} \quad (7)$$

The variance is calculated as below:

$$\sigma_x^2 = \frac{1}{n} \sum_{i=1}^n x_i^2 - \bar{x}^2 = \frac{1}{n} (1^2 + 2^2 + \dots + n^2) - \left(\frac{n+1}{2} \right)^2 = \frac{n(n+1)(2n+1)}{6n} - \left(\frac{n+1}{2} \right)^2 = \frac{n^2-1}{12} \quad (8)$$

$$\sigma_x^2 = \frac{n^2-1}{12} = \sigma_y^2 \quad (9)$$

In general, $x_i \neq y_j$ let $d_i = x_i - y_i$

$$d_i = (x_i - \bar{x}) - (y_i - \bar{y}) \quad (10)$$

Then, squaring and summing all values as below equation:

$$\sum d_i^2 = \sum [(x_i - \bar{x}) - (y_i - \bar{y})]^2 = \sum (x_i - \bar{x})^2 + \sum (y_i - \bar{y})^2 - 2 \sum (x_i - \bar{x})(y_i - \bar{y}) \quad (11)$$

Dividing both sides by n , then

$$\frac{1}{n} \sum d_i^2 = \sigma_x^2 + \sigma_y^2 - 2Cov(X, Y) = \sigma_x^2 + \sigma_y^2 - 2\rho\sigma_x\sigma_y \quad (12)$$

where, ρ is the rank correlation coefficient between X and Y.

Next, because of $\bar{x} = \bar{y}$, therefore $\sigma_x = \sigma_y$. This contributes to:

$$\frac{1}{n} \sum d_i^2 = 2\sigma_x^2 - 2\rho\sigma_x^2 = (1-\rho)2\sigma_x^2 \quad (13)$$

$$1-\rho = \frac{\sum d_i^2}{2n\sigma_x^2} \quad (14)$$

The Spearman correlation coefficient is defined as below:

$$\rho = 1 - \frac{\sum d_i^2}{2n\sigma_x^2} = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n(n^2-1)} \quad (15)$$

4. Result and discussion

The data used in this analysis is focused on long period dynamic behavior for a share price of BIMB. The data selected for this research is collected from the year of 2010 until 2016.

4.1 The dynamic of share price

Figure 1 shows the dynamic movement for share price starting from January 2010 until October 2016. The initial stock price in January 2010 is MYR 1.187. Meanwhile, the stock price in October 2016 is MYR 4.259. There is large positive increment between 2010 until the end of 2013. Figure 2 and Figure 3 conclude that the data for share are not a normal distribution. From Shapiro-Wilk normality test, the significant value is 0.000. This value is below 0.05, the data significantly deviate from a normal distribution.

Figure 1: Dynamic movement of monthly share price

Figure 2: Histogram of Islamic Bank share price

Figure 3: The normal probability plot

4.2 The analysis of average return

Figure 4 shows the average return for the share price of BIMB starting from January 2010 until October 2016. The maximum return is 0.9 % in June 2011. Meanwhile, the minimum return is -0.6 % in November 2011. There is large positive return between 2011 until the end of 2013. Figure 5 and Figure 6 conclude that the data for share are not a normal distribution. From Shapiro-Wilk normality test, the significant value is 0.042. This value is below 0.05, the data significantly deviate from a normal distribution.

Figure 4: Histogram of monthly return

Figure 5: The normal probability plot

Figure 6: Average return for share price of Islamic Bank

4.3 The analysis of volatility

Figure 7 shows the volatility for the share price of BIMB starting from January 2010 until October 2016. The maximum volatility rate is 3.96 in July 2011. Meanwhile, the minimum volatility rate is 0.46 in April 2014. There is large positive volatility rate between 2011 until the end of 2013. Figure 8 and Figure 9 conclude that the data for share are not a normal distribution. From Shapiro-Wilk normality test, the significant value is 0.000. This value is below 0.05, the data significantly deviate from a normal distribution.

Figure 7: Volatility for share price of Islamic Bank

Figure 8: Histogram of monthly volatility

Figure 9: The normal probability plot

4.4 The analysis of correlation between volatility and return

From the normality analysis, it is proved that the share price, return and volatility rate is significantly deviate from a normal distribution. Therefore, a nonparametric analysis needs to be performed to analyze the association between volatility and return for the share price of BIMB. In this section, Spearman's rank-order correlation method is selected. Figure 10 shows the correlation of volatility and return for the share price of BIMB. Graphically, it shows an association between volatility rate and share price return. Then, the nonparametric analysis is selected to check the monotonic relationship between volatility rate and return for the share price of BIMB. Table 1 shows the significant value is 0.000. Therefore, the result rejects the null hypothesis for a Spearman correlation analysis. The numerical result shows there is a monotonic association between volatility rate and return rate for the share price of BIMB. The Spearman correlation coefficient, r_s in this analysis is 0.403. It implies that there is a moderate positive correlation between volatility rate and return rate for the share price of BIMB.

Figure 10: Correlation of volatility and return for share price of Islamic Bank

Table 1: Nonparametric test for Spearman’s rho analysis

Spearman’s rho	Correlation between Volatility and return	Correlation Coefficient	.403**
		Sig. (2-tailed)	.000
		N (sample size)	82

** . Correlation is significant at the 0.01 level (2-tailed).

5. Conclusion

This research tried to answer the research problem regarding whether there is any relationship of volatility rate and return rate for the share price of BIMB. In addition, the data was collected from the year 2010 until 2016. This data is involved a seven years period, therefore the non-normal distribution of data is considered.

From the analysis, this research concludes the research findings as below:

1. This research involved the dynamic movement for share price starting from January 2010 until October 2016. The initial stock price in January 2010 is MYR 1.187. Meanwhile, the stock price in October 2016 is MYR 4.259. There is large positive increment between 2010 until the end of 2013.
2. The distribution of share price, return rate, and volatility rate is a non-normal distribution. Therefore, the non-parametric analysis is selected for this research.
3. This research calculates the data of volatility for the share price of Islamic bank starting from January 2010 until October 2016. The maximum volatility rate is 3.96 in July 2011. Meanwhile, the minimum volatility rate is 0.46 in April 2014. There is large positive volatility rate between 2011 until the end of 2013.
4. The nonparametric analysis is selected to check the monotonic relationship between volatility rate and return for the share price of BIMB. From the analysis, the significant value is 0.000. Therefore, the result rejects the null hypothesis for a Spearman correlation analysis. The numerical result shows there is a monotonic association between volatility rate and return rate for the share price of BIMB. The Spearman correlation coefficient, r_s in this analysis is 0.403. It implies that there is a moderate positive correlation between volatility rate and return rate for the share price of Islamic Bank.

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