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Faculty of Islamic Economics and Business
Universitas Islam Negeri Sultan Maulana Hasanuddin Banten
Jalan Jenderal Sudirman No. 30 Serang 42118

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Phone: +62254 200323 || Fax: +62254 200022 || Website: www. journal.islamiconomic.or.id

ESTIMATION OF MULTIVARIATE-GARCH MODELS TO STOCK RETURN AN ISLAMIC BANKS IN INDONESIA AND MALAYSIA

Zaini Ibrahim,[1] Anita,[2*] Siti Marfu'ah,[3] Nurul Fitriani [4]

[1 2 3 4] Universitas Islam Negeri Sultan Maulana Hasanuddin Banten, Indonesia

[*] Corresponding author: anita.febi@uinbanten.ac.id

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Abstract:

This study aims to forecast Islamic banking stock returns and compare the performance of Sharia-compliant bank shares in Indonesia and Malaysia. Employing the Conditional Capital Asset Pricing Model (C-CAPM) integrated with Multivariate-GARCH techniques (including GARCH, EGARCH, and IGARCH), the research addresses common issues of heteroscedasticity and non-normality found in conventional financial models. The results reveal that Islamic bank shares in both countries are efficient and deemed investable. The highest actual return in Indonesia was recorded by BRIS (37.7%), while in Malaysia it was KFH (35.7%). However, the Welch F-test confirms that there is no statistically significant difference between the expected returns of Islamic bank shares in Indonesia and Malaysia, indicating a convergence in cross-country performance. The novelty of this study lies in the application of advanced multivariate GARCH models within the Islamic finance context, coupled with a rare comparative insight across two leading Southeast Asian economies. This research contributes to the Islamic finance literature by enhancing modelling accuracy for return prediction and by offering evidence of stock efficiency in Islamic capital markets. The practical implications include informed guidance for investors seeking optimal Sharia-compliant investment portfolios and for policymakers aiming to strengthen Islamic equity market development within the ASEAN region.

A. INTRODUCTION

Like Malaysia, Indonesia has a vital role in the growth and development of Islamic banks worldwide. The Indonesian government also supported the development of Islamic banking in 1992, and formally with the issuance of Law No. 7

of 1992. Then, after the enactment of Law No. 21 of 2008 concerning Islamic Banking. Islamic banks in Indonesia now have a clear legal basis. Bank Indonesia stated that as of September 2022, the number of Islamic Banks in Indonesia will be twelve Islamic Commercial Banks (BUS) and twenty-one Islamic Business Units (UUS), which has decreased from previously twenty-two UUS and one hundred twenty-three Islamic Rural Financing Banks (BPRS) (SyariahPedia, 2022). More specifically, Indonesia and Malaysia are the two countries with the most significant asset growth compared to other countries. Based on financial reports up to 2020, the performance of Islamic banking in Indonesia shows asset growth, reaching an average of 46.7%, with total assets going IDR 1,497.44 trillion or USD 91,49 billion. Meanwhile, asset growth in Malaysia reached 63.38 billion ringgit or IDR 2,789.30 trillion (Puspaningtyas & Zuraya, 2020).

Regarding improving financial performance, Islamic banking in Indonesia still needs to occupy a strategic position in the national banking industry because this achievement only meets 5% of the total industry. There is still a great need for development strategies apart from government support. Indonesia has its uniqueness in the journey of Islamic financial instruments. The spirit of the Islamic economy grows from the bottom (bottom-up), so, naturally, the growth is not too massive compared to Malaysia, where a set of rules and policies for optimizing Islamic banks have been issued and implemented since 1983, marked by the ratification of the Islamic Banking Act. This top-down movement has allegedly made Malaysia A pioneer in the growth of Islamic banking in the Southeast Asia region. With this progress. So, it's not strange. Suppose the steps taken by Malaysian Islamic banks to carry out an IPO since 1992. They are following in these footsteps; Islamic banking in Indonesia only took action on the stock exchange in 2013 by Panin Dubai Syariah bank and was followed by seven other Islamic banks, which carried out an IPO. Going public provides several benefits, including increasing liquidity or fresh funding, which can improve the bank's financial condition, increase company value, and enhance a positive image. The impact of going public is that the public can openly monitor the bank's performance-especially financial performance, especially for shareholders.

Take that momentum; Indonesian Islamic banking is starting to gain ground. Right at the end of 2021, Bank Syariah Indonesia (BSI) succeeded in obtaining an award at the global level organized by the Cambridge Institute of Islamic Finance (CIIF) for one hundred thirty Islamic banks in the world (BSI, 2022). Ultimately, the need to go public can be used as a long-term business development strategy for companies, including banking. PT Bank Panin Syariah (PNBS) was the first Islamic banking company to go public in 2013 to provide fresh funds to develop long-term business and banking market value. Puspitasari, in his research, found that several opportunities from banking institutions can be obtained from going public, namely, financial and market opportunities. Some factors that constitute economic opportunity include increased income, an increase in capital, and stock returns. The elements included in market opportunities are market growth opportunities and growing company competitiveness (Puspitasari, 2016).

In model forecasting, the problem that is often faced is inconsistent data. This gives rise to a vast variance from the average value. So, it is not uncommon for academics to modify the basic model with an econometric approach. In this condition, it is possible to develop the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) method. Timothy et al., since the 90s, recommended the development of a conditional CAPM model using the GARCH framework as a result of non-constant variance, which is indicated by the inability of the in-mean parameter to reach a significant value. Thiago evaluates the quality of CAPM and states that the conditional version of the CAPM can explain asset price anomalies that the unconditional version cannot explain. And concludes that the conditional CAPM explains that the asset pricing model is “anomalous” based on reasonable assumptions. Therefore. CAPM testing must adapt to flexible and reasonable assumptions (Souza, 2020). The question often arises: Which GARCH family should be used to model conditional variance? Several other models, such as T-GARCH, developed by Zakoian in 1994 or EGARCH by Nelson in 1991, are GARCH models with an asymmetric response (Luc Bauwens et al., 2012). This article will discuss the GARCH model and its family and their performance in estimating the expected return and risk of Islamic bank shares in Indonesia and Malaysia.

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Various models can be used to predict stock returns. The most conservative model relating to market risk is the Capital Asset Pricing Model. Previous researchers have proven that there is a relationship between market risk and stock returns (Azhari et al., 2020). Thus, the scope of this research is to measure the accuracy of forecasting share returns of Islamic commercial banks based on the Capital Pricing Assets Model. Several previous studies emphasized that the CAPM was included as the first capital market model introduced by William F. Sharpe in 1960. However, its existence in predicting asset prices is still reliable. Luthfi et al. carried out the accuracy of the CAPM model. Arbitrage Pricing Theory (APT) and the Fama-French Three Factor Model (FFFTM) in predicting expected returns. The results prove that CAPM provides the highest level of forecasting accuracy of the three forecasting models (Alvina et al., 2020); , as Nafik has proven that CAPM has an adequate level of validation in determining the relationship between return and risk of securities (Sari & Ryandono, 2019). Although this is still a matter of debate, academics still need to determine the suitability of the CAPM model in estimating the level of risk and return on securities (Sari & Ryandono, 2019; Simangunsong & Wirama, 2014).

In model forecasting, the problem that is often faced is inconsistent data. This gives rise to a vast variance from the average value. So, it is not uncommon for academics to modify the basic model with an econometric approach. In this condition, it is possible to develop the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) method. Timothy et al., since the 90s, recommended the development of a conditional CAPM model using the GARCH framework as a result of non-constant variance, which is indicated by the inability of the in-mean parameter to reach a significant value. Thiago evaluates the quality of CAPM and states that the conditional version of the CAPM can explain asset price anomalies that the unconditional version cannot explain. And concludes that the conditional CAPM explains that the asset pricing model is "anomalous" based on reasonable assumptions. Therefore. CAPM testing must adapt to flexible and reasonable assumptions (Souza, 2020). The question often arises: Which GARCH family should be used to model conditional variance? Several other models, such as T-GARCH, developed by Zakoian in 1994, or EGARCH by Nelson in 1991, are GARCH models with an asymmetric response (Luc Bauwens et al., 2012).

Previous studies in Islamic finance have predominantly relied on traditional financial models such as the unconditional Capital Asset Pricing Model (CAPM) to estimate expected returns. However, these models often fall short in addressing key empirical challenges such as data volatility, non-normality, and heteroscedasticity-conditions that are particularly prevalent in stock return series. Moreover, there is a lack of comprehensive comparative analysis between Islamic banking sectors in different national contexts, especially using robust econometric tools that can accurately capture volatility clustering and risk dynamics. This study addresses these gaps by employing advanced econometric models from the GARCH family, including GARCH, EGARCH, and IGARCH, to enhance the accuracy of return prediction for Islamic banking stocks. By integrating these models with the Conditional CAPM framework (C-CAPM), the study overcomes the limitations of conventional modeling techniques and provides more realistic estimations under volatile market conditions.

In addition, the cross-country comparison between Indonesia and Malaysia (two of the largest Islamic banking markets) adds a novel dimension to the literature, offering empirical insights into how market efficiency and expected returns behave in different regulatory and macroeconomic environments. The use of Welch F-tests to evaluate statistical differences further strengthens the methodological rigor. So, this research thus fills a methodological and contextual gap by applying sophisticated volatility modeling techniques in a comparative Islamic finance setting, providing both academic and practical value for scholars, investors, and policymakers.

B. LITERATURE REVIEW

Stock Performance Measurement and Forecasting

The Capital Asset Pricing Model (CAPM) method is a balance model that makes it possible to determine the relevant risks and the relationship between risks for each asset if the capital market is in balance. In other words, CAPM is a model that describes the relationship between risk and expected return. ARCH/GARCH Modeling is the inconsistent condition of the stock price index and is the biggest challenge in forecasting or estimating modelling. This is due to the many disturbing factors that do not help shape the balance of stock market prices on the stock exchange. Due to the fluctuating movement of the index, unusual modelling should also be developed to minimize variance or error so that the resulting estimation model is a fit and goodness capitalization.

Thus, forecasting using a regression model is often less precise. This is because, in the regression model, the analysis focuses only on the character and behaviour of the studied variables. While in the variance mode, the modelling is formed by forming a model based on independent variables and disturbing variables outside the research model. Among them is the ARCH Model (Autoregressive Conditional Heteroscedasticity), a forecasting model first introduced by Eagle (982), which was then refined by including the error term variance of the previous period. The results of the refinement of the ARCH model are known as the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model. Several financial studies that developed the ARCH/GARCH model provided smaller coefficient results and error values (Bilondatu & Isa, 2019).

Comparative Review of CAPM and GARCH Applications in Islamic Finance

In Islamic finance literature, the use of the Capital Asset Pricing Model (CAPM) is still the dominant approach in estimating expected returns of Sharia-based stocks. Several studies, such as Sari & Ryandono and Simangunsong & Wirama, apply CAPM to measure the systematic risk of stocks in Sharia indices such as the Jakarta Islamic Index (JII). However, the conventional CAPM model assumes constant variance, whereas return fluctuations in the Sharia stock market are highly influenced by macroeconomic conditions, Muslim investor sentiment, and global volatility (Sari & Ryandono, 2019), (Simangunsong & Wirama, 2014).

In response to these limitations, the Autoregressive Conditional Heteroskedasticity (ARCH)-based approach and its development in the form of Generalized ARCH (GARCH) have begun to be adopted in recent studies. For example, Bilondatu & Isa show that GARCH is able to provide a more accurate estimate of the volatility of Sharia stocks (Bilondatu & Isa, 2019). However, most studies are still limited to a single-country context and have not fully integrated the GARCH model into the CAPM framework, especially in the cross-country and Islamic banking contexts.

The unique contribution of this study is the combination of Conditional CAPM and multivariate GARCH models in analyzing Islamic bank stocks comparatively between Indonesia and Malaysia. This approach has not been widely used in Islamic finance literature, thus providing new methodological value and empirical context.

Critical Perspective on Model Limitations and Alternative Approaches

Although the GARCH model and its derivatives (such as EGARCH and IGARCH) excel in capturing volatility dynamics, these models also have limitations. For example, the assumption of a normal distribution on the residuals in most GARCH variants does not always match the distribution of Islamic stock returns, which are often leptokurtic and skewed. In addition, the standard GARCH model does not explicitly accommodate the leverage effect, which is relevant in markets that are vulnerable to bad news, such as the financial sector. Alternatively, models such as Stochastic Volatility (SV) and Bayesian econometrics approaches have been proposed in the conventional finance literature as a way to address these limitations. However, their application in the context of Islamic finance is still very limited.

Thus, although this study provides progress through the integration of C-CAPM and multivariate GARCH, there is room for development to explore more flexible and adaptive models to the unique characteristics of Islamic markets, such as nonlinear models or machine learning-based forecasting.

C. METHODOLOGY

Autoregressive Moving Average (ARMA) Model

The ARMA model indicates a time lag. For example, the symbol AR(1) means there is a lag of 1 period in the autoregressive stage of order 1. (1) Meanwhile, MA(1) means there is a lag in the 1-period moving average, while the absence of an integrated position indicates that the data is stationary at the level. The general models AR(1) and MA(1) are expressed as:

$$z_t = \phi_0 + \sum_{i=1}^{p} \phi_i z_{t-i} - \sum_{i=1}^{q} \theta_i u_{t-1} + u_t$$

ARMA modeling is the first step in identifying a suitable univariate time series forecasting model, and this test is known as the Box-Jenkins model.

$$\alpha_t^2 = a_0 + a_1 e_{t-1}^2 \quad (2)$$

ARCH/GARCH Method

The ARCH model was first introduced by Engle (1982). The ARCH model is a time series data modelling technique that requires heteroscedasticity in the residual variance. in other words, the residual variance is a conditional function. with the following equation model: (Damodar N. Gujarati. 2013)

In general, the ARCH(p) model is expressed in the following 4th equation:

$$Y_t = \beta_0 + \beta_1 X_t + e_t \quad (3)$$

$$\sigma_t^2 = a_0 + a_1 e^2_{t-1} + a_2 e^2_{t-2} + \ldots\ldots + a_p e^2_t \quad (4)$$

Information:

α^2_t = residual variance

α_0 = constanta

e^2_{t-1} = the new residual at t-1

α_1 = constant value to 1,2……

Equation (2) states that the variance of the error term (σ^2_t) consists of two items, namely constant and the error term for the last period (lag). And the model of ε_t is expressed as conditional heteroscedasticity at ε_{t-1} . So if the variance of ε_t is based on the variance of the error term 1 of the previous period, then the equation becomes equation (4).

The ARCH modelling above has limitations. where the order magnitude (p) is too large. This will give rise to many parameters to be estimated. This resulting in an inefficient model. Limitations of the ARCH model. Then the modelling can include elements of the past period error term variance. And this method is known as the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model. Formula (5) is the most general GARCH (1.1) model equation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 e_{t-1}^2 + \lambda_1 \sigma_{t-1}^2 \quad (5)$$

Exponential ARCH/GARCH (E-GARCH)

The EGARCH model is a model developed by Nelson in 1991. This E-ARCH method is an alternative to ARCH/GARCH modeling, which is constrained by asymmetry between positive and negative returns EGARCH (1.1) model formulation is expressed in the following equation:

$$Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \varepsilon_t \quad (6)$$

$$\ln\sigma_t^2 = \alpha_0 + \alpha_1 (u_{t-1}/\sigma_{t-1}) + y|u_{t-1}/\sigma_{t-1}| + \beta_1 \ln\sigma_{t-1}^2 \quad (7)$$

Information:

χ_t : time series value at time t

μ : Average in the GARCH model

σ_t : conditional standard deviation at time-t

α_t : model residual at time t

p : sequence of ARCH component models ($\alpha_0, \alpha_1, \alpha_2 \ldots. \alpha_p$)

q : sequence of GARCH component models ($\beta_0, \beta_1, \beta_2 \ldots. \beta_p$)

Integrated-GARCH Model

If the AR polynomial of the GARCH representation in Equation (7) has a unit root. then the IGARCH model was developed. Modeling with I-GARCH indicates a simple GARCH model that has no variance and constant residuals. So the conditions for applying the IGARCH model include the sum of the ARCH and GARCH coefficients being close to or equal to one (Francq & Zakoian, 2010) . The IGARCH equation (1.1) is generally as follows:

(8)

$$a_t = \sigma_t \varepsilon_t \ , \ \ \sigma_t^2 = \omega_0 + \beta_1 \sigma_{t-1}^2 + (1-\beta_1) a_{t-1}^2 + \varepsilon_t$$

Where the error term (εt) on the random variable becomes normal with a mean of zero and a variance of one $\omega_0 \geq 0$. and $0 < \beta_1 < 1$.

Forecasting Accuracy

Among the measurements of forecasting accuracy are several formulations. Among them are:

Table 1. Forecasting Formulation

Measurement	Formulation	Criteria
Mean Absolute Error (MAE)	$MAE = \frac{\sum \lvert y1 - y' \rvert}{n}$	< 10% (Highly Accurate). 10% - 20% (Good Forecast)
Mean Absolute Percentage Error (MAPE)	$MAPE = \frac{\sum \frac{\lvert y1 - y' \rvert}{y1}}{n} X\ 100\%$	20% - 50% (Reasonable Forecast) > 50% (Inaccurate forecast)
Root Mean Square Error (RMSE)	$RMSE = \sqrt{\frac{\sum (aktual - prediksi)^2}{n}}$	

(Dasuki, 2020)

D. RESULT AND ANALYSIS

Output Analysis of the Unconditional CAPM

The formulation and results of the expected return calculation obtained from the Unconditional- CAPM method are presented in the following table:

Table 2. Expected Return CAPM Sharia Bank Shares 2020-2023

CODE	Ri	Rm	Rf	E(Rm)	β	E(Ri)
Indonesia						
BRIS	0.01450	0.00066	0.00325	- 0.00261	1.25	-0.00561
PNBS	0.003464				0.92	0.000787
BTPS	-0.006				1.03	-0.00519
Malaysia						
AFIN	0.000466	-	0.000364	-	0.49	-0.00024
RAJHI	0.003815				0.55	-0.00043

BIMB	-0.00282	0.001087	0.00145	0.44	-0.00026
KFH	0.001655			0.37	-0.000132

Source: Eviews 10.0

The calculation results in Table 2 are the average values of several Unconditional-CAPM method instruments over the period 2020 to 2023, the results of which show that there is a difference from the average monthly return data, which, in theory, is still consistent. The reason is, shares with a high systematic risk value (beta) will produce a low expected return. This is shown in the expected return level of BRIS shares with a beta value of 1.25, which actually gives the lowest expected return, namely -0.56%. In contrast to the beta value of PNBS shares of (0.92 < 1.00). provides an expected return range of 0.0787%. Where the systematic risk value is balanced according to market risk.

Based on an actual return value, it shows that BTPS shares are cheap (undervalued), so that share owners are advised to continue holding ownership of BTPS shares and for potential investors that BTPS shares are a stock candidate worth buying. BRIS shares and PNBS shares are efficient shares, so shareholders have the potential to gain capital gains.

Meanwhile, the results of calculating expected returns from Sharia bank shares in Malaysia are categorized as defensive shares. All samples show a low level of volatility; the results show sequentially the shares with the lowest expected loss (AFIN shares) to the highest loss (RAJHI shares); (-0.00024; -0.00026; -0.000132; -0.00043) < (-0.00145). The results show that BIMB shares are undervalued, and AFIN, RAJHI and KFH shares are efficient shares.

Stationarity Test

The Stationarity Test is an important initial test carried out on time series data aimed at seeing the presence of unit root content in the data, which causes the data to be unstable. The unit root test in this research is based on the Augmented Dickey Fuller (ADF) test. namely by comparing the ADF t-statistic value with the table value. If the ADF t-statistic value is greater than the critical t-value in the table with a certain level of significance. then the time series data is stationary. hypothetically stated as follows:

H0 : σ = 0 (Data contains unit root)

H_1 : σ ≠ 0 (Data does not contain a unit root)

Next, based on the results of unit root testing at the level. research data is declared stationary as shown in the following table:

Table 3. Summary of ADF Stationarity Test

Issuer	Code	ADF Statistic	MC Kinon Critical Value			Prob.	Remark
			1%	5%	10%		
Islamic Bank in Indonesia							
PT. Bank Syariah Indonesia Tbk	BRIS	-1.386	-3.466	-2.877	-2.575	0.000	Stationer
PT. Bank Panin Dubai Syariah Tbk	PNBS	-13.873	-3.466	-2.877	-2.575	0.000	Stationer
PT. Bank BTPN Syariah Tbk	BTPS	-1.349	-3.466	-2.877	-2.575	0.000	Stationer
Islamic Bank in Malaysia							
Affin Islamic Bank Berhad	AFIN	-1.263	-3.466	-2.877	-2.575	0.000	Stationer
Al-Rajhi Bank Berhad	RAJHI	-1.162	-3.4667	-2.877	-2.575	0.000	Stationer
Bank Islam Malaysia Berhad	BIMB	-1.331	-3.466	-2.877	-2.575	0.000	Stationer
Bank Islam Kuwait Berhad	KFH	-13.371	-3.466	-2.877	-2.575	0.000	Stationer

Source: Processed Data E-views 10.0

Table 3 is the result of unit root testing at the level, which was tested on the expected return of each sample by transforming it into a natural logarithm (ln) value. This was done as an effort to reduce the data points with base e numbers so that the data became normal. From this test. It results in the unit root test producing the Mc value. Kinnon is significant at all levels ($0.000 < 0.05$). With the data series being stationary at the unit level, the model that will be developed is the Autoregressive Moving Average (ARMA) model and the next test will be carried out, namely carrying out steps to forecast stock return expectations using the CAPM balance model by identifying the forecasting accuracy model.

a. Model Identification

The stage after testing data stationarity will be to identify a forecasting model that suits the characteristics of the data. begins by determining the order (pq) in the correlogram test based on the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) coefficient values approaching zero after lag p and q; Then test the significance of the model in estimating parameters; and the final stage is checking the diagnostics to ensure that the forecasting model is appropriate. A summary of the sample test results is shown in Table 4, with indicators for determining the optimum model based on the lowest AIC and HQC values.

Table 4. Summary of Test Results for Determining the Optimum Model

Issuer	Code	Ordo	AIC	HQC	Prob
Islamic Bank in Indonesia					
PT. Bank Syariah Indonesia Tbk	BRIS	AR (9.0)	-1.824484	-1.802991	0.0000
PT. Bank Panin Dubai Syariah Tbk	PNBS	AR (9.0)	-1.917785	-1.896292	0.0000
PT. Bank BTPN Syariah Tbk	BTPS	ARMA (6.6)	-4.913353	-4.884696	0.0000
Islamic Bank in Malaysia					
Affin Islamic Bank Berhad	AFIN	MA (0.6)	-3.715460	-3.693967	0.0048
Al-Rajhi Bank Berhad	RAJHI	AR (7.0)	-6.220362	-6.198869	0.0154
Bank Islam Malaysia Berhad	BIMB	AR (7.0)	-6.557782	-6.536289	0.0410
Bank Islam Kuwait Berhad	KFH	EGARCH (2.2)	-1.181873	-1.124558	0.0000

Source: Processed Data E-views 10.0

Model Verification

a) Residual Independence Test

The requirements for testing the ARMA model require that the data be white noise , that is, it does not tolerate a relationship between the residual and the mean. The test applied is the ARCH-LM test to ensure the presence/absence of ARCH/GARCH elements in the Box-Jenkins test. with the following testing hypothesis:

Hypothesis formulation:

H0 : $\alpha = 0$ (There are ARCH elements)

H_1 : $\alpha \neq 0$ (No ARCH elements)

Furthermore, the following table will display the results of heteroscedasticity testing for each research sample. namely as follows:

Table 5. Summary of Heterochasticity Test Results

Code	Ordo	Obs*R-Squared	Prob. Chi-Square	Remark
BRIS	ARMA (9.0)	4.458294	0.8787	Homoscedastic
PNBS	ARMA (9.0)	4.123148	0.9031	Homoscedastic
BTPS	ARMA (6.6)	52.46394	0.0000*)	Heteroscedastic
AFIN	ARMA (0.6)	6.029541	0.4199	Homoscedastic
RAJHI	ARMA (7.0)	20.76137	0.0041*)	Heteroscedastic
BIMB	ARMA (7.0)	25.90847	0.0005*)	Heteroscedastic
KFH	EGARCH (2.2)	0.076389	0.7823	Homoscedastic

Source: Processed Data E-views 10.0 (*) sig @ α=5% (reject H_1)

In the residual independence test in the ARMA model, not all samples meet the homoscedasticity assumption. Next, an alternative ARCH/GARCH residual model will be developed for BTPS, RAJHI and BIMB shares.

b) Normality Test

The normality test is another assumption that must be met in testing residual variations. Table 6 below summarizes the Jarque-Bera test as a requirement for determining a prediction model.

Table 6. Summary of Normality Test Results

Code	Model/Ordo	Jarque Bera	Prob.	Normality
BRIS	ARMA (9.0)	4025.754	0.0000	No
PNBS	ARMA (9.0)	4267.633	0.0000	No
BTPS	ARMA (6.6)	536.8197	0.0000	No
AFIN	ARMA (0.6)	60.82603	0.0000	No
RAJHI	ARMA (7.0)	13.01318	0.0040	No
BIMB	ARMA (7.0)	38.39207	0.0000	No
KFH	EGARCH (2.2)	174775.2	0.0000	No

Source: Processed Data E-views 10.0

The results of the residual data normality test are shown in the table above. The Jarque fallout value obtained > $\chi^2_{(6;\ 0.05)} =$ 12.5916 or Probability value < 0.05. This indicates that the Box-Jenkins model experiment cannot be applied. Thus, it can be said that the stock market index variable alone is not sufficient to be used in predicting expected returns on shares of Sharia banks in Indonesia and Malaysia, so there is a need to develop more accurate model techniques in predicting volatility to predict returns on shares of Sharia banks. In the context of this objective, the ARMA-GARCH model selection procedure will be applied next.

Analysis of the Conditional-CAPM

Model Selection

Testing the ARMA model on Atabek showed its independence and the normality of the data. So, it cannot be relied on as a model for estimating expected stock returns. Therefore. So, it was decided to establish a prediction model using the ARMA-GARCH combination model to overcome the residual problem of the ARMA model by exploring the residual variance known as the conditional-heteroscedasticity method, which includes various types, namely: ARCH-GARCH-EGARCH-IGARCH model. And then this research will model the expected return as shown in each of the following output tables:

Table 7. Summary of ARMA-GARCH Model Output

BRIS	**ARMA (9.0)-GARCH (1.0)** Parameter estimates: $Z_t = 0.385735 - 0.295215\ Z_{t-1}$ Varian residual: $\sigma_t^2 = 0.009531 - 0.020764\ \alpha^2_{t-1}$
PNBS	**ARMA (9.0)-GARCH (1.0)** Parameter estimates: $Z_t = 0.361751 - 0.282453 Z_{t-1}$ Varian residual: $\sigma_t^2 = 0.008775 - 0.020606\ \alpha^2_{t-1}$
BTPS	**ARMA (6.6)-GARCH (1.0)** Parameter estimates: $Z_t = 0.068823 + 0.366124\ Z_{t-1} - 0.699688\ Z_{t-2}$ Varian residual: $\sigma_t^2 = 0.000244 - 0.168464\alpha^2_{t-1}$
AFIN	**ARMA (6.0)-GARCH (1.1)** Parameter estimates: $Z_t = 0.155446 - -0.232216 Z_{t-1}$ Varian residual: $\sigma_t^2 = 0.00000401 - 0.043\ e^2_{t-1} + 1.040\alpha^2_{t-1}$
RAJHI	**ARMA (7) - IGARCH (1.1)** Parameter estimates: $Z_t = 0.036405 + 0.107639 Z_{t-1}$ Varian residual: $\sigma_t^2 = 0.095959\alpha^2_{t-1} + 0.904041\alpha^2_{t-1}$
BIMB	**ARMA (7.0) - GARCH (1.0)** Parameter estimates: $Z_t = 0.024196 + 0.240015 Z_{t-1}$ Varian residual: $\sigma_t^2 = 8.51E\text{-}05 - 0.052645\alpha^2_{t-1}$

	IGARCH (1.3)
KFH	Estimates: $\boldsymbol{\sigma_t^2 = 0.044430+0.016671\alpha^2_t + 1.577720\alpha^2_{t-1} + 0.155636\, \alpha^2_{t-2} - 0.750028\, \alpha^2_{t-3}}$

Source: Processed Data E-views 10.0

Diagnostic Models

The diagnostic stage is carried out as a consequence of developing the residual variance model to ensure that the assumptions of heteroscedasticity and residual data volatility are met. Figure 1 displays the data trends shown by histogram graphs and Jarque-Bera values, as well as forecasting results for the smallest Mean Absolute Error (MAE) values.

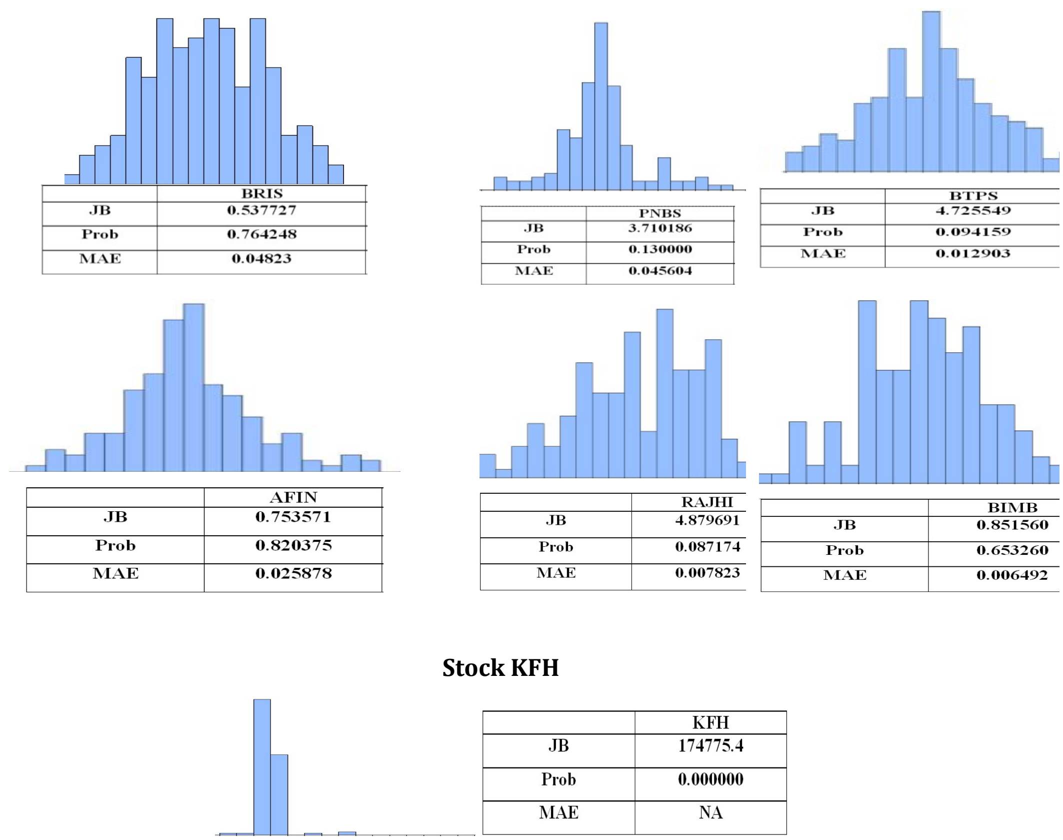

Figure 1. Normality Test and Forecasting

Figure 1 shows the residual data with a normal distribution as indicated by the Jarque fallout value > $\chi^2_{(6;0.05)} = 12.5916$ or Probability < 0.05; except for KFH shares which show that the data is not normally distributed, thus the verification stage above is confirmation that the application of the ARMA-GARCH combination model is a fit and efficient model in predicting the expected return of Sharia commercial bank shares with a Mean Absolute Error (MAE) value below 10 % .

Return Performance of Indonesian-Malaysian Sharia Banking Shares

The results of the analysis above produce a modelling equation for predicting the expected return of Islamic bank shares on the Indonesian and Malaysian stock exchanges. Although the CAPM modelling stage is carried out through a series of testing procedures. which is caused by symptoms of classical assumptions that do not meet the requirements to be continued as a forecasting model. Among them are the problems of normality and heteroscedasticity. So, modelling must be applied with the ARMA–GARCH model. This modelling is a solution for residual data from periods (time series) that experience heteroscedasticity problems, except for KFH shares, which do not meet the Jarque-Bera test. Each expected return prediction was tested using several ARMA-GARCH techniques. until an estimated expected return is obtained as below:

Table 8. Comparison of Share Returns of Indonesian and Malaysian Sharia Banks June-July 2023

Code	Model	Return Predict	Actual Return Predict	Exp. Return Predict	Remark
			Indonesia		
BRIS	ARMA (9.0) GARCH (1.0)	0.378	0.3767679	-0.0009679	Efficient
PNBS	ARMA (9.0) GARCH (1.0)	0.354	0.3548475	-0.0008475	Efficient
BTPS	ARMA (6.6) GARCH (1.0)	0.056	0.0573789	-0.0013789	Efficient
			Malaysia		
AFFIN	ARMA (6.0)- IGARCH (1.1)	0.141	0.135697	0.005302965	Efficient
RAJHI	ARMA (7.0)-	0.021	0.0167277	0.004272223	Efficient

	IGARCH (1.1)				
BIMB	ARMA (7.0)-GARCH (1.0)	0.014	0.0097410	0.00425895	Efficient

Source: Processed Data E-views 10.0

After carrying out modelling tests. Furthermore, this mathematical model can be used as a prediction model for expected returns for the next period. Based on the decision-making criteria, it is stated that Sharia Commercial Bank shares in the coming period will be efficient shares. This means that these shares are worth buying or holding and not selling for investors who already own them.

If we observe it based on the CAPM formula calculation, it can be seen that the returns on Indonesian shares are higher than the returns on shares of Sharia banks in Malaysia, namely around 0.107, but this difference is not statistically significant, as shown in the following output table:

Table 9. Expected Return Comparison Test Output

Indonesia and Malaysia

Comparison of Expected Return (Unconditional-CAPM)				
Method	Mean Diff.	Df	Value	Probability
t-test	0.2010	1084	25.94813	0.0000
Anova F-test		(1. 1084)	673.3054	0.0000
Welch F-test*		(1. 686.573)	673.3054	0.0000
Comparison of Expected Return (Conditional Heteroscedasticity-CAPM)				
Method	Mean Diff.	Df	Value	Probability
t-test	0.107	1084	-0.331128	0.7406
Anova F-test		(1. 1084)	0.109646	0.7406
Welch F-test*		(1. 575.749)	0.109646	0.7407

Source: Processed Data E-views 10.0

The results of the Welch test in table 9 answer the following hypothesis:

H_0 : There is no difference between the expected return on shares of Islamic commercial banks in Indonesia and Malaysia

H_1 : There is a difference between the expected return on shares of Islamic commercial banks in Indonesia and Malaysia

The average difference test output in table (9) presents two conditions. The first test stated that there was a significant difference (0.00 < 0.05) between the expected return of Malaysian Sharia Bank shares and the return of Indonesian shares (Reject H_0). The difference is around 20.10% namely, the performance of Islamic bank shares in Malaysia is higher than the performance of Islamic bank shares in Indonesia. Next, the author compares the expected return forecasting between the performance of BUS shares in Indonesia and Malaysia and it was declared to have received H_0, the meaning of which could be interpreted to mean that the performance of Indonesian sharia shares increased to match that of Malaysian shares.

Exploration of Economic and Strategic Implications

Return Differences

Although the Welch F test results show no statistically significant difference in expected returns between Islamic bank stocks in Indonesia and Malaysia (in the C-CAPM framework), economically absolute differences still appear (Ind: 0.107 vs. My: 0.000). This has strategic implications: (1) Investors: Can allocate cross-country portfolios to diversify risk. Indonesian stocks offer higher growth potential, while Malaysian stocks tend to be defensive with more stable returns; (2) Islamic Investment Managers: Can adjust strategies between growth-oriented (Indonesia) and stability-oriented (Malaysia); (3) Capital market regulators: Must formulate policies to harmonize Islamic reporting and disclosure standards so that cross-country competitiveness is equal.

Volatility Patterns

The GARCH model shows that stocks in Indonesia tend to have higher volatility, reflected in the larger residual variance values. This is caused by: Instability of macroeconomic policies (inflation, exchange rates) and domestic market sentiment. The graphs illustrating volatility clustering or return dynamics, Lack of liquidity, and depth of Indonesia's Islamic capital market compared to Malaysia.

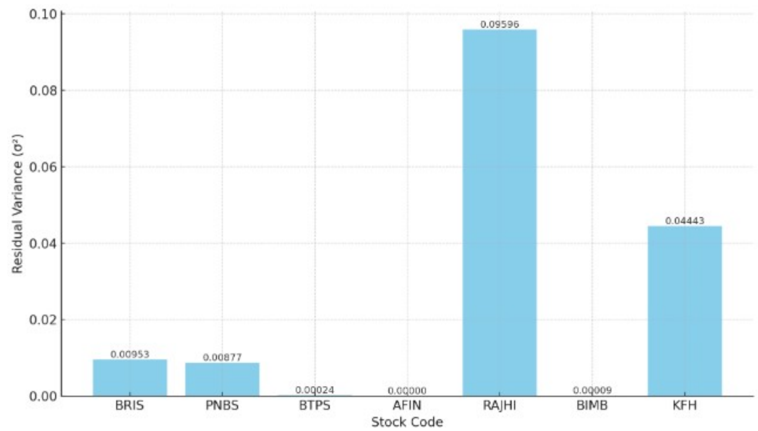

Figure2. Comparison of Stock Volatility (Residual Variance)

Figure 2 is a comparative graph of the volatility of Islamic stocks based on the residual variance (σ^2) of the GARCH model. Brief interpretation: (1) RAJHI (Malaysia) shares show the highest volatility, possibly reflecting return instability or sensitivity to external factors; (2) BRIS and PNBS (Indonesia) also have relatively high volatility; (3) Shares such as AFIN and BIMB show very low volatility, indicating a defensive and stable character. Implications: Foreign investors may tend to choose the Malaysian market because of the more manageable risks. Indonesian policymakers should improve market information transparency and encourage more Islamic companies to go public in order to increase liquidity and investor confidence.

Market Efficiency

This study concludes that Islamic stocks in both countries are efficient, meaning that prices reflect available information. However, this efficiency is static (based on actual and predicted returns), not touching on dynamic or informational efficiency that can shift due to: Changes in Islamic regulatory policies; Regional/global economic crises, and the level of adoption of Islamic fintech and digitalization of Islamic finance.

Consideration of external factors influencing Islamic stock returns

Based on the research results, this research identifies several factors that can influence the Sharia stock index in Indonesia and Malaysia.

Table 10. External Factors Affecting Islamic Stock Returns

External Factors	Impact	Notes
Monetary Policy	Direct impact on the cost of capital and investment interest	A decrease in interest rates can increase returns
Inflation	Increasing market uncertainty	Indonesia is more sensitive to annual inflation
IDR/MYR exchange rate against USD	Influencing purchasing power and foreign investor sentiment	Malaysia tends to be more stable
ESG Issues and Sustainable Finance	Increase interest in Sharia shares	Both countries are pioneering green sukuk and ESG index

E. CONCLUSION

This study examines the efficiency of Islamic banking stocks in Indonesia and Malaysia through the Conditional Capital Asset Pricing Model (C-CAPM) approach integrated with the multivariate GARCH model (GARCH, EGARCH, IGARCH). The results of the study indicate that, in general, Islamic banking stocks from both countries show market efficiency, as indicated by actual return values that are close to the predicted results. This finding is supported by the Welch F test, which states that there is no significant difference in expected returns between Indonesian and Malaysian Islamic stocks.

The application of multivariate GARCH has proven effective in dealing with heteroscedasticity and non-normality issues that often arise in financial time series data, especially in markets that are not yet fully mature, such as Islamic stocks. Thus, this approach offers increased accuracy in estimating risk and investment returns. Although this study makes significant contributions to the Islamic finance literature and stock return prediction methodology, there are several limitations that need to be explicitly noted: (1) Limited Sample Size: This study only covers seven stocks from two countries, which limits the generalizability of the results to the global Islamic market; (2) Relatively Short Observation Period: Focusing on data between 2020 and 2023 limits the ability to capture long-term economic cycle dynamics or the effects of previous financial crises; (3) GARCH and CAPM Model Assumptions: GARCH still relies on the normal distribution of residuals, and CAPM assumes efficient markets and rational investors, which may not be entirely appropriate in the unique context of the Islamic market; (4) Limited Variables: The analysis has not included external macroeconomic factors such as interest rates, inflation, or exchange rates, which could theoretically affect stock volatility and returns.

The future research directions to enrich the understanding and expand the impact of the study, some suggested research directions are: (1) Integration of Macroeconomic Variables: Incorporating factors such as inflation, Islamic interest rates, exchange rates, and GDP to develop a dynamic macro-financial model; (2) Expansion to Other Islamic Financial Instruments: Including sukuk, Islamic mutual funds, or global Islamic stock indices (e.g., Dow Jones Islamic Market Index) for a cross-instrument portfolio approach; (3) Application of Machine Learning or Nonlinear Models: To capture complex return and volatility patterns, especially in extreme market conditions or crises; (4) Cross-Country Panel Data Study: Include more countries with active Islamic financial systems such as Saudi Arabia, Pakistan, or the United Arab Emirates to assess the global validity of the GARCH-based C-CAPM model; (5) Informational Efficiency and Muslim Investor Sentiment: Analyze the role of psychology, religiosity, and Islamic financial literacy in influencing market efficiency.

The findings on the efficiency of Islamic stocks suggest the need for greater support to expand the Islamic investor base through education and tax incentives, as well as harmonization of Islamic standards across countries. For Islamic Investment Managers and Financial Institutions: The GARCH-based C-CAPM model can be used to build a more accurate risk management system based on actual volatility data, not just historical assumptions. For Retail and Institutional Investors: This study provides a basis for cross-country diversification based on stock volatility profiles, not just nominal returns.

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