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Volatility Analysis of Telecommunication Sector Stock Returns Using ARCH and GARCH Models

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Abstract. This study investigates the volatility of stock returns in the Indonesian telecommunications sector during the period January 2024 to May 2025. The research focuses on three major issuers PT Telkom Indonesia Tbk (TLKM), PT Indosat Tbk (ISAT), and PT XL Axiata Tbk (EXCL) due to their active trading and significant market capitalization. Daily closing price data were converted into log returns and tested for heteroscedasticity using normality and ARCH-LM tests. The results confirm the presence of volatility clustering, particularly in ISAT and TLKM stocks, indicating time-varying volatility. Both ARCH(1) and GARCH(1,1) models were estimated to capture the volatility dynamics, with GARCH models demonstrating better performance across all three stocks, as reflected by lower AIC values and higher log-likelihood scores. ISAT exhibited the highest return fluctuations, while EXCL appeared more stable. These findings highlight the persistence of volatility in the telecommunications sector and reinforce the importance of selecting appropriate econometric models for risk assessment. The study offers relevant insights for investors and market analysts in making data-driven decisions under uncertain market conditions.

Keywords: Stock Return Volatility, ARCH, GARCH, Heteroscedasticity

1. INTRODUCTION

In investment activities, understanding market risk and uncertainty is very important for investors. One of the main forms of risk in financial markets is the instability of the return of an investment instrument, especially stocks. The erratic movement of stock prices from time to time creates conditions where investors find it difficult to predict the profits or losses that will be obtained [1]. Therefore, it is important to understand the characteristics of stock return fluctuations, not only in terms of the direction of movement, but also the level of diversity or deviation of returns from their average value, known as volatility.

One of the most commonly observed forms of risk is stock return volatility. In the Indonesian capital market, the phenomenon of volatility clustering in financial markets is a phenomenon where the price of financial assets changes drastically in a certain period and the price does not change in other periods [2]. That is, sometimes at one time there is data that rises relatively high and at another time drops drastically, which in the next period occurs again. This situation is often also called heteroscedasticity [3]. The method used should be able to model most of the data while maintaining heteroscedasticity [4].

In this context, the ARCH/GARCH model is suitable for stock data that is time series and exhibits heteroscedasticity characteristics. In previous research, this model has been used to analyze various stocks such as PT Hanjaya Mandala Sampoerna, where the results show that ARCH or GARCH is often the best model in dealing with volatility and predicting stock prices.[2]. In addition, stock price fluctuations are also strongly influenced by external factors such as world oil prices and exchange rates. This is reinforced by the findings of [5], which stated that “the world crude oil price variable has a significant positive effect in the long term on the composite stock price index, while the exchange rate has a significant negative effect in both the short and long term.”

Previous research also shows that the ARCH/GARCH model is effective in predicting historical stock data. As stated by[6], "The GARCH (0,1) model is the most appropriate model to predict Tokai Carbon's stock price. The MAPE value shows a low percentage of 4.949972%, which indicates that the ARCH/GARCH method is very good at predicting Tokai Carbon stock prices."

Other findings also conclude that ARCH and GARCH models are able to effectively measure stock volatility in tourism sector stocks in Indonesia, where the volatility of PANR stocks is low, while SNLK is very high with a volatility value of 1.813231.[7] This finding indicates that the ARCH-GARCH model has the ability to distinguish the level of risk between stocks based on their price fluctuation characteristics.

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However, most of the previous studies are still limited to certain industrial sectors and not many have specifically highlighted the telecommunications sector in Indonesia, especially in the context of post-pandemic market dynamics and the development of 5G technology. In addition, studies that compare the performance of ARCH and GARCH models directly on the stocks of telecommunications issuers in the current period of uncertainty are still relatively rare. This suggests a research gap that needs to be filled through empirical studies that are more relevant to current market conditions.

Through this understanding, this study focuses on analyzing the volatility of stock returns of telecommunications companies that are actively traded on the Indonesia Stock Exchange, namely PT Indosat Tbk (ISAT), PT Telkom Indonesia Tbk (TLKM), and PT XL Axiata Tbk (EXCL). The three companies are major players in the national telecommunications industry known to have high stock trading activity on the Indonesia Stock Exchange. By using the ARCH and GARCH model approach, this study aims to see which model is most suitable in capturing the fluctuation pattern of telecommunication stock returns during the observation period.

This research is expected to contribute to investors and academics in understanding the characteristics of stock volatility in the telecommunications sector, as well as a basis for consideration in making more accurate and data-based investment decisions.

2. METHODOLOGY

2.1 Stock Return Volatility

Volatility is defined as fluctuations in the return of a security or portfolio within a certain period. Stock return volatility describes the rise and fall of stocks over a certain period of time [8]. In addition, stock price volatility has the potential to affect market interaction with changes in economic conditions. If Inflation and Exchange Rates experience significant fluctuations, then investors will be more careful before making transactions because it can cause sharp price movements in the stock market.[9].

2.2 Model ARCH (Autoregressive Conditional Heteroskedasticity Model)

The ARCH model was first developed by Engle (1982) to capture symptoms of heteroscedasticity in time series data, especially in financial data such as stock returns[10]. In time series data analysis, the mean is used to describe the mean or trend of the data, while the variance reflects the degree of dispersion or volatility of the data with respect to the mean. The ARCH (Autoregressive Conditional Heteroskedasticity) model is specifically designed to capture patterns of changing variance (heteroscedasticity).

$$\varepsilon_t = z_t\sqrt{\{h_t\}},\backslash quad\, z_t \sim N(0,1) \quad (1)$$

$$h_t = \alpha_0 + \alpha_1 \varepsilon^2_{\{t-1\}} \quad (2)$$

Keterangan:
ε_t = residuals (errors) at time t
z_t = standard normally distributed random error value (mean = 0, var = 1)
h_t= conditional variance at time-t
α_0 = positive constant (intersep varians)
α_1 = coefficient of influence of square of previous period's error
$\varepsilon^2_{\{t-1\}}$ = squared prior period residuals (represents historical volatility)

2.3 Model Garch (Generalized Autoregressive Conditional Heteroskedasticity)

The GARCH model or known as the Generalized Autoregressive Conditional Heteroskedasticity model is an extension model of the ARCH model developed by Bollerslev (1986). Elements of previous period residuals and residual variance are included in this modeling[10]. This model is used to see how the variance or volatility of data changes over time, especially in financial data such as stock returns.

In the GARCH model, the current variance is affected not only by the error in the previous period, but also by the variance in the past [9]. This means that the model can describe a continuous pattern of volatility. With this approach, investors can estimate the level of risk based on previous fluctuation patterns. The general formula of the GARCH(1,1) model is as follows:

$$h_t = \alpha_0 + \alpha_1 \varepsilon^2_{\{t-1\}} + \beta_1 h_{\{t-1\}} \quad (3)$$

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Description:
h_t = current conditional variance
α_0 = positive constant
α_1 = coefficient of influence of square of previous period's error
$\varepsilon^2_{\{t-1\}}$ = square of previous period's residuals
β_1 = coefficient of influence of previous period's conditional $h_{\{t-1\}}$

2.4 Heteroskedasticity(ARCH-LM)

Before the application of ARCH and GARCH models, an initial test is conducted to detect whether the daily return data contains heteroscedasticity. One of the methods used is ARCH LM (Autoregressive Conditional Heteroskedasticity - Lagrange Multiplier Test) as introduced by Engle (1982).

The purpose of the ARCH LM test is to identify the presence of autocorrelation in the residual variance, which is commonly called volatility clustering. If the probability value (p value) of the test is lower than the significance level (e.g. 5%), it is concluded that heteroscedasticity is present - thus the ARCH or GARCH model should be applied next. This test was conducted on the daily returns of ISAT, TLKM, and EXCL stocks as a basis for selecting the appropriate volatility model[11]

2.5 Research Stages

This research uses a quantitative approach with descriptive and time series research types. This approach was chosen because it is suitable for analyzing stock return data that is quantitative and changes over time. Quantitative research is based on the measurement of quantity or number. It applies to phenomena that can be expressed in terms of quantity [12]. This is in line with the opinion of [13]. which states that economic time series data tend to have unstable or changing variances (heteroscedasticity), so ARCH and GARCH models are suitable for analyzing volatility in financial and commodity data. Therefore, this study uses ARCH and GARCH models to measure and model the volatility of stock returns in the telecommunications sector in Indonesia.

The location of this research is not limited by a particular region because the data used is sourced from the internet. Data was taken from the official website of the Indonesia Stock Exchange (IDX) and the Investing.com platform. The time span for data collection starts from January 2024 to May 2025. This period covers an important phase in the national economic recovery, the expansion of 5G technology, and the increasing digitization of the telecommunications sector, which allows researchers to observe stock volatility patterns in market conditions that are undergoing a process of economic adjustment and strengthening.

The object of this study is the daily stock returns of three telecommunications sector issuers that are actively traded on the Indonesia Stock Exchange, namely PT Indosat Tbk (ISAT), PT Telkom Indonesia Tbk (TLKM), and PT XL Axiata Tbk (EXCL). The three were chosen because they are the main players in the national telecommunications industry and have a high level of liquidity based on trading time series data during the period mentioned. The selection of these three issuers is also supported by the findings of[14] which show that TLKM and EXCL have volatility levels that tend to be stable, while ISAT experiences more dynamic volatility due to aggressive merger and expansion policies.

The data collection technique is carried out by downloading historical data on daily stock closing prices from the official websites and platforms that have been mentioned. The stock price data is then processed to calculate the daily stock return using the log return formula.

Log Return Formula:

$$Return = ln(Pt/Pt-1) \quad (4)$$

Data processing is done using the EViews 12 application, which serves to calculate log returns, perform heteroscedasticity tests (ARCH-LM), and estimate ARCH(1) and GARCH(1,1) models. EViews was chosen due to its ability to handle time series data and provide comprehensive and accurate econometric analysis features.

3. RESULT AND DISCUSSION

3.1 Results

Data processing is done by calculating daily stock returns based on closing prices using the log return formula. After data processing using daily closing prices of shares from PT Indosat Tbk (ISAT), PT Telkom Indonesia Tbk (TLKM), and PT XL Axiata Tbk (EXCL), daily return data is obtained using the log return formula

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The results of log return calculations show different fluctuations between issuers. Before modeling, heteroscedasticity test (ARCH-LM test) is conducted on each return data to ensure the presence of volatility clustering symptoms. The observation period in this study covers approximately 350 trading days, starting from January 2024 to May 2025. This time span was chosen to reflect the recovery and restructuring phase of the national economy, as well as the increasing dynamics of competition in the Indonesian telecommunications sector. Based on the analyzed daily return data, the three main stocks of this sector-ISAT, TLKM, and EXCL-show different volatility patterns, with a strong indication of volatility clustering.

ISAT stock showed sharp return fluctuations throughout the period. One significant example occurred at the end of May 2025, when the daily return was recorded at +2.83% on May 27, then reversed downward by 2.83% on May 28. This pattern reflects symptoms of volatility clustering, which is when large return movements-both positive and negative-occur sequentially in close proximity.

TLKM stock, although known to be more stable, also shows high volatility at certain moments. For example, there was a sharp drop of -4.01% on May 23, 2025, followed by a spike of +4.00% on May 26, 2025. These fluctuations generally coincide with the announcement period of the company's financial information, indicating that volatility in TLKM stock is still very responsive to market sentiment and public information.

In contrast to ISAT and TLKM, EXCL stock shows relatively calm movements during the observation period. EXCL's daily return tended to be close to zero for several consecutive days, and only recorded limited gains such as +0.92% on May 28, 2025. This shows that EXCL stock is in a low volatility condition and tends to be stable compared to the other two stocks.

The statistical test results show that all stocks have elements of heteroscedasticity, which is shown through the ARCH-LM test. Thus, the use of ARCH(1) and GARCH(1,1) models is considered appropriate to model the behavior of stock return volatility during the period.

3.2 Discussion

This analysis aims to evaluate the volatility characteristics of stock returns of three major telecommunications issuers on the Indonesia Stock Exchange, namely PT Indosat Tbk (ISAT), PT Telkom Indonesia Tbk (TLKM), and PT XL Axiata Tbk (EXCL) for 90 trading days in the period January to May 2025. The data processing process begins with calculating daily returns using the log return formula, which produces time series data describing changes in stock prices in daily time units.

3.2.1 Descriptive Statistics of Log Return

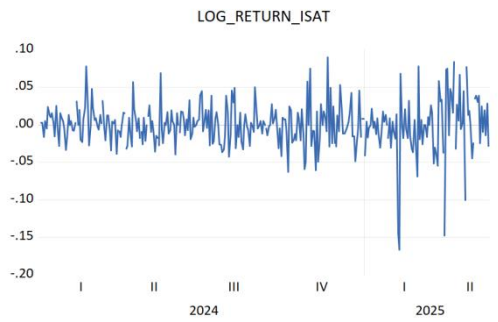

Figure 1. ISAT Log Stock Return
Source: EViews output, processed by the author (2025)

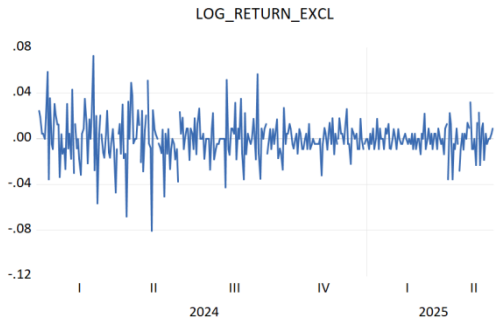

Figure 2. EXCL Log Stock Return
Source: EViews output, processed by the author (2025)

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Figure 3. TLKM Log Stock Return
Source: EViews output, processed by the author (2025)

Based on the daily log return graphs of ISAT, EXCL, and TLKM stocks shown in Figures 1, 2, and 3, it can be seen that the log return calculation results show significant differences in average return and volatility between the three stocks. ISAT stock shows the highest level of volatility, characterized by large return fluctuations and frequent extreme spikes, both positive and negative. This pattern is in line with the results of the descriptive statistics that show high standard deviation and kurtosis, as well as negative skewness values that reflect the unsymmetrical and left-heavy distribution of the data.

The difference in volatility level is not only caused by external market factors, but can also be attributed to the fundamental characteristics of the company. Research by [15] shows that profitability, non-debt tax shield (NDTS), and uniqueness have a negative and significant effect on the company's capital structure, while tangibility has a positive and significant effect. These findings indicate that the company's internal conditions play a role in shaping the funding structure that ultimately affects investors' risk perception of the stock, and has an impact on the level of stock price volatility in the market. As stated by [16], the stable financial performance of PT Summarecon Agung Tbk, which is indicated by strong liquidity and solvency, reflects the company's fundamental strength in maintaining the stability of stock returns and the level of volatility in the market.

EXCL stock tends to be more stable, with narrower return movements and not too many extreme spikes. This corresponds to the lowest standard deviation value and skewness close to zero, signaling an almost symmetrical distribution. Nonetheless, the high kurtosis indicates that extreme events are still possible, although not as frequent as for ISAT stock.Sementara itu, saham TLKM menunjukkan pola yang berada di antara ISAT and EXCL. The daily returns of these stocks fluctuate moderately, not too extreme but also not completely stable. The kurtosis and skewness values are close to normal distribution, but the Jarque-Bera test still shows a deviation from statistical normality.

Overall, the log return graph provides a visual picture that reinforces the findings of the descriptive statistics, where ISAT is the stock with the highest risk, EXCL is the most stable, and TLKM is in the middle position in terms of return volatility and distribution. To provide a clearer picture of the characteristics of the distribution and volatility of the three stocks' returns, the following descriptive statistics are summarized:

Table 1. Summary of Descriptive Statistics of Daily Return of ISAT, TLKM, and EXCL Shares

Stock	Mean	Std. Deviation	Skewness	Kurtosis	Jarque-Bera	Probabilitas
ISAT	-0.000351	0.030870	-0.760737	8.277615	411.0404	0.000000
EXCL	0.000291	0.017915	-0.097682	6.113485	132.5979	0.000000
TLKM	-0.001061	0.020461	-0.030142	4.005919	13.83627	0.000990

After descriptive statistical analysis of the log returns of ISAT, EXCL, and TLKM stocks, it is found that the three stocks show distribution characteristics that deviate from normality and have high kurtosis, which indicates the potential for heteroscedasticity in the return data. To further test whether there are symptoms of heteroscedasticity, especially autocorrelation in variance (volatility), the next step is to conduct the ARCH-LM (Autoregressive Conditional Heteroskedasticity - Lagrange Multiplier) Test. This test aims to determine whether the residual variance of the time series model contains the ARCH effect, which is the basis for choosing a volatility forecasting model such as ARCH or GARCH.

3.2.2 Heteroscedasticity Test (ARCH-LM)

To test the presence of heteroscedasticity in the daily return data, the ARCH-LM (Autoregressive Conditional Heteroskedasticity - Lagrange Multiplier) test was conducted on the three stocks, namely ISAT,

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EXCL, and TLKM. This test aims to determine whether the residual variance of the return data shows symptoms of volatility clustering, which is a condition where volatility is not constant, but changes over time. Visualization of the ARCH-LM test results for each stock is shown in Figure 4 (ISAT), Figure 5 (EXCL), and Figure 6 (TLKM) respectively.

Table 2. ARCH-LM Test Results on Daily Returns of ISAT, EXCL, and TLKM Stocks

Stocks	F-Statistic	Probability	Description
ISAT	60.73318	0.000000	Heteroscedasticity is present
EXCL	3.503995	0.062122	No heteroscedasticity
TLKM	4.991737	0.026150	Heteroscedasticity is present

The ARCH-LM test results provide important information about the presence of heteroscedasticity in the stock return data. For ISAT stock, the F-statistic value of 60.73318 and probability of 0.000000 indicate that there is highly significant heteroscedasticity in the stock return data. This indicates a pattern of volatility clustering, which is a condition where the residual variance changes over time and is not constant. Thus, the use of ARCH or GARCH models is considered appropriate to model the volatility of ISAT stock returns.

Meanwhile, TLKM stock also shows symptoms of heteroscedasticity, with an F-statistic value of 4.991737 and a probability of 0.026150. Although not as large as ISAT, the probability that is still below the 5% significance level indicates that the residual variance of TLKM returns is also not constant, so modeling using ARCH or GARCH remains relevant.

In contrast, the test results on EXCL stock show an F-statistic of 3.503995 and a probability of 0.062122. Since this probability value is above the 5% threshold, there is not enough evidence to conclude that there is heteroscedasticity in EXCL stock returns. In other words, the variance fluctuations of EXCL are relatively stable throughout the observation period, so ARCH or GARCH models may not be appropriate to model this stock directly. These results reinforce the findings from the previous descriptive statistics, where ISAT and TLKM show higher return fluctuations and distribution patterns that deviate from normality. The ARCH-LM test is an important basis in choosing the appropriate volatility estimation model for each stock.

3.2.3 Model ARCH-GARCH Estimation

After conducting a heteroscedasticity test using ARCH-LM, it was found that two of the three stocks, ISAT and TLKM, showed significant heteroscedasticity symptoms, while EXCL did not. However, to maintain the consistency of the analysis and to provide a comprehensive comparison between the three stocks, the ARCH(1) model is still applied to the EXCL stock return data. This application is intended to evaluate the extent to which the ARCH(1) model is able to capture volatility dynamics even though there is no strong indication of heteroscedasticity symptoms in the EXCL data.

The ARCH (1) model estimation in analyzing the volatility of daily stock returns of ISAT, TLKM, EXCL is presented in Table 3 below:

Table 3. ARCH (1) Model Estimation Results ISAT, TLKM, EXCL

Stock	Parameter	Koefisien	*p*-Value	AIC	Log Likelihood	Keterangan
ISAT	ω	0,000649	0,0000	-4,234,252	6,953,002	Volatilitas dipengaruhi oleh residual kuadrat sebelumnya secara signifikan
	α_1	0,297867	0,0000			
TLKM	ω	0,000367	0,0000	-4,941,853	8,109,900	Koefisien α_1 tidak signifikan efek volatilitas jangka pendek lemah
	α_1	0,120775	0,0737			

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EXCL	ω	0,000248	0,0000	-5,222,467	8,568,733	Model mampu menangkap volatilitas meskipun data kurang heteroskedastik
	α_1	0,277878	0,0016			

The ARCH(1) model is used to measure the volatility of stock returns by assuming that the current variance is affected by the previous period's squared residuals. The general form of the ARCH(1) model corresponds to the following equation:

$$\sigma_t^2 = \omega + \alpha_1 \varepsilon_{\{t-1\}}^2 \quad (5)$$

Based on the estimation results in Table 3, ISAT stock shows that the parameters ω of 0.000649 and α_1 of 0.297867, both significant at the 1% level (p-value = 0.0000). This indicates that the volatility of ISAT stock returns is strongly influenced by extreme fluctuations in the previous period, reflecting the volatility clustering symptom. For TLKM stock, the α_1 value of 0.120775 is not significant (p-value = 0.0737), although ω remains significant. This indicates that although there is a slight influence of the squared residual variable on the current variance, its strength is not large enough to form a persistent volatility pattern.

As for EXCL stock, both parameters are significant, namely ω of 0.000248 and α_1 of 0.277878 (p-value = 0.0016), so the ARCH(1) model is considered quite capable of describing the dynamics of EXCL volatility, although the previous ARCH-LM test results show no indication of strong heteroscedasticity. In general, the ARCH(1) model provides an initial picture of the effect of return surprises or sharp price movements in the past on current volatility, but is not effective enough in capturing the effects of volatility that is sustained in the long run.

After the ARCH(1) estimation, the GARCH(1,1) model is used to capture volatility that is more persistent, by considering the effect of residuals and variance of the previous period. The estimation of this model is applied to ISAT, TLKM, and EXCL stocks, and the results are presented in Table 4 below.

Table 4. GARCH (1,1) Model Estimation Results ISAT, TLKM, EXCL

Saham	**Parameter**	**Koefisien**	***p*-Value**	**AIC**	**Log Likelihood**	**Keterangan**
ISAT	ω	0,0000943	0,0002	-4,252,644	6,993,073	Volatilitas jangka panjang signifikan, β_1 mendekati 1 clustering kuat
	α_1	0,123324	0,0000			
	β_1	0,777935	0,0000			
TLKM	ω	0,0000066	0,0300	-4,989,763	8,198,300	β_1 sangat tinggi (0,9661) volatilitas sangat persisten
	α_1	0,021234	0,0809			Efek inovasi lemah namun tetap relevan
	β_1	0,966120	0,0000			
EXCL	ω	0,0000019	0,0396	-5,386,411	8,846,781	Model terbaik secara AIC; β_1 mendekati 1. meski stabil, tetap persisten
	α_1	0,050175	0,0001			
	β_1	0,940641	0,0000			

To capture the more persistent nature of volatility, the GARCH(1,1) model is used, which incorporates the previous period variance variable into the model. Mathematically, the GARCH(1,1) model is formulated as:

$$\sigma_t^2 = \omega + \alpha_1 \varepsilon_{\{t-1\}}^2 + \beta_1 \sigma_{\{t-1\}}^2 \quad (6)$$

The estimation results in Table 3 show that all stocks have high and significant β_1 coefficients, indicating the persistence of volatility in telecommunication sector stock returns. For ISAT, the parameters α_1 is 0.123324 and β_1 is 0.777935, both significant at the 1% level, with an AIC of -4.252644. This indicates that ISAT's volatility is not only affected by the previous shock but also by past variance, so the GARCH(1,1) model is more appropriate than ARCH(1).

In TLKM stock, the coefficient β_1 of 0.966120 is very high and significant, indicating that the volatility of TLKM returns is very persistent over time. Although α_1 (0.021234) is not significant, the effect of past variance still dominates. The model also produces a lower AIC value (-4.989763) than ARCH(1), which reinforces the conclusion that GARCH is more appropriate.

For EXCL stock, the parameters β_1 of 0.940641 and α_1 of 0.050175 are both significant, and the AIC value is the lowest at -5.386411. This indicates that EXCL has a stable volatility structure but still experiences the long-run effect of past variance. Thus, GARCH(1,1) is proven to be the model that is best able to capture the volatility pattern of telecommunication stock returns during the observation period.

4. CONCLUSION

Based on the results of processing daily stock return data in the telecommunications sector during the period january to may 2025, it was found that there were differences in volatility patterns between each issuer. PT Indosat Tbk (ISAT) shares show a high level of fluctuation accompanied by indications of strong volatility clustering, indicating that large return movements tend to be close together in time. Shares of PT Telkom Indonesia Tbk (TLKM) reflect a moderate level of volatility, with fluctuations occurring in less extreme intensity. Meanwhile, PT XL Axiata Tbk (EXCL) stock tends to be more stable, with daily returns moving relatively calmly during the observation period.

ARCH-LM test results confirm the presence of heteroscedasticity symptoms in ISAT and TLKM stocks, so modeling using ARCH and GARCH is relevant for both stocks. Although the test results on EXCL stock show no significant heteroscedasticity, ARCH and GARCH models are still applied for the purpose of comparison and consistency of analysis.

From the model estimation results, it is known that GARCH(1,1) consistently provides better results than ARCH(1) for all stocks analyzed. This is indicated by the higher log-likelihood value and lower Akaike Information Criterion (AIC) in the GARCH model. In addition, the high GARCH coefficients, especially in ISAT and EXCL stocks, indicate that the market volatility of telecommunication sector stocks is persistent and has a long-term effect.

Overall, the findings in this study confirm the importance of selecting an appropriate model in measuring and predicting stock volatility. The GARCH model proved to be more accurate in describing the behavior of stock return volatility in the telecommunications sector. The results of this study are expected to contribute to investors, analysts, and policy makers in understanding market risk and developing more appropriate and data-based investment strategies.

References

[1] I. A. Sah, " STOCK MARKET VOLATILITY AND MACROECONOMIC INDICATORS: FINANCIAL SECTOR ANALYSIS AMID ECONOMIC GROWTH OPTIMISM," vol. 5, no. 2, 2025, doi: 10.17977/um066.v5.i2.2025.1.

[2] R. Wulandari, V. Sari, and T. Laksita, "Application of ARIMA-ARCH / GARCH Method to Forecast Stock Price of Hanjaya Mandala Sampoerna Tbk," vol. 03, no. 01, 2022.

[3] A. P. Desvina and N. Rahmah, "Application of ARCH/GARCH Method," vol. 2, no. I, 2020.

[4] F. Fitriyani, S. F. A, M. I. R, T. A. T, and Statistics, "Forecasting the Stock Price Index of PT Verena Multi Finance Tbk with ARIMA and ARCH-GARCH Modeling Methods,"vol. 14, no. 1, pp. 11–23, 2021.

[5] M. Rizki Nasution and A. Albar Tanjung, "Analysis of The Effect of World Crude Oil Prices, Exchange Rates, Inflation, Dow Jones Industrial Average, and The Nikkei 225 Index on The Composite Stock Price Index," *Quant. Econ. Manag. Stud.*, vol. 4, no. 4, pp. 764–772, 2023, [Online]. Available: https://doi.org/10.35877/454RI.qems1825

[6] M. I. Rizki, T. A. Taqiyyuddin, P. F. Rahmah, and A. E. Hasana, "Application of ARCH/GARCH Model to Predict Stock Price of Tokai Carbon Company," *J. Science Mat. and Stat.*, vol. 7, no. 2, 2021, doi: 10.24014/jsms.v7i2.13138.

[7] A. A. Tanjung, Muliyani, and D. P. Sari, "Volatility Analysis of Tourism Industry Sector Stocks in Indonesia," *Senashtek, pp*. 492-499, 2024, [Online]. Available: https://finance.yahoo.com/.

[8] A. A. I. Pratama and A. Susetyo, "The Effect of Closing Price, Trading Volume Activity, and Stock Return Volatility on Bid-Ask Spread in LQ45 Companies in 2017," *J. Ilm. Mhs. Management, Business and Accounting*, vol. 2, no. 1, pp. 81-88, 2020, doi: 10.32639/jimmba.v2i1.446.

[9] K. J. Muntu, "The Effect of Inflation, Bank Indonesia Interest Rate, IDR/USD Exchange Rate, and Money Supply on Stock Prices," *J. Business Manaj. Econ*., vol. 18, no. 2, pp. 279-293, 2020.

[10] F. Emmanuel, D. Parulian, A. Ikhlasul, and S. N. Asrizal, "Analysis of Construction Stock Price Forecasting against Indonesian Sovereign Wealth Funds (SWF) Sentiment with ARCH/GARCH Model Approach," vol. 3, no. 1, pp. 308-324, 2024.

[11] Z. R. Dien, "Application of Autoregressive Conditional Heteroskedastic-Generalized Auto Autoregressive Conditional Heteroskedastic Model on Indonesian Islamic Bank Stock Return Data," Estimation J. Stat. Its Appl., vol. 4, no. 1, pp. 2721-379, 2023, doi: 10.20956/ejsa.vi.24799.

[12] M. Ahmad Albar Tanjung, *RESEARCH METHODOLOGY IS SIMPLE, CONCISE, CONCISE AND EASY TO UNDERSTAND. Scopindo Media Pustaka, 2021.*

[13] P. Puspitasari, D. Kurniasih, and A. M. Kiloes, "Application of ARCH-GARCH Model in Analyzing the Volatility of Shallot Price," *Inform. Pertan.*, vol. 28, no. 1, p. 21, 2019, doi: 10.21082/ip.v28n1.2019.p21-30.

[14] P. I. Akami, "IN FACING THE OPTIMISM OF INDONESIA'S ECONOMIC GROWTH OF 8% IN THE VUCA ERA," vol. 5, no. 2, 2025, doi: 10.17977/um066.v5.i2.2025.4.

[15] U. R. Siregar, A. A. Tanjung, and S. Sukardi, "Analysis of Determinants of Capital Structure of Miscellaneous Industrial Sector Manufacturing Companies Listed on the Indonesia Stock Exchange (IDX) 2016-2022," Ekon. J. Econ. Bus., vol. 8, no. 1, p. 82, 2024, doi: 10.33087/ekonomis.v8i1.1216.

[16] M. Muliyani, V. S. Putri, and A. A. Tanjung, "Fundamental Analysis of Financial Performance on the Growth of Companies Listed on the IDX," J. Manag. Econ. Res., vol. 3, no. 1, pp. 20-25, 2024, doi: 10.62866/jomer.v3i1.187.