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An Analysis of LQ45 Index Volatility Using the GARCH Model and Its Implications for Retail Investment Risk during the 2020-2025 Period

[1]Raisa Dea Fitrasari
[1]*Manajemen Keuangan Sektor Publik, Politeknik Istikom BCI*
*E-Mail Correspondence: raisa@istikombci.ac.id

Abstract- ***The growth of individual investors in the Indonesian capital market has resulted in greater trading activity in the stock market, particularly in the blue-chip stocks that are constituents of the LQ45 index. Although the LQ45 stocks have high liquidity and a significant market capitalization, they are still subject to market risk, which is reflected in the changing returns over time. This study examines the volatility of the LQ45 index, which is a measure of the risk of retail investment in Indonesia, using the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. For the study, the author uses secondary data of daily returns of the LQ45 index from 2021 to 2025 and uses the time series econometric method. The author undertakes the following analytical steps: tests for stationarity, tests for the presence of ARCH (conditional heteroskedasticity), and estimates the GARCH(1,1) model. The findings show that the returns on the LQ45 index are stationary and that they contain conditional heteroskedasticity and volatility clustering. Estimation from the GARCH(1,1) model shows that prior shocks, and the prior period's variance, strongly affect volatility, reflecting the model's volatility persistence. Additionally, further standardized residual diagnostics reveal that GARCH(1,1) model appropriately describes the volatility dynamics. These findings indicate that the risk related to retail investment in LQ45 stocks is both dynamic and persistent, which calls for adaptive risk management. This study theoretically advances the measurement of stock market volatility, and in Indonesia, it has practical implications for retail investors and regulators in risk management and financial education.***
Keywords: stock volatility, retail investment risk, LQ45 index, GARCH, Indonesian capital market.

I. INTRODUCTION

The development of the Indonesian capital market has exhibited a significant increase [1][2] in retail investor participation, in line with the ease of investment access facilitated by digital platforms [3]. Stocks included in the LQ45 index are often the primary choice of retail investors due to their high liquidity and large market capitalization [4]. Nevertheless, high liquidity does not necessarily guarantee low investment risk, particularly risks arising from stock price volatility [5][6].

Stock market volatility reflects the degree of return uncertainty and serves as a primary indicator of the market risk investors face. [7] For retail investors, high volatility may increase the risk of losses if it is not managed effectively. Therefore, volatility analysis is essential as a basis for rational investment decision-making and risk-oriented investment management. [8]

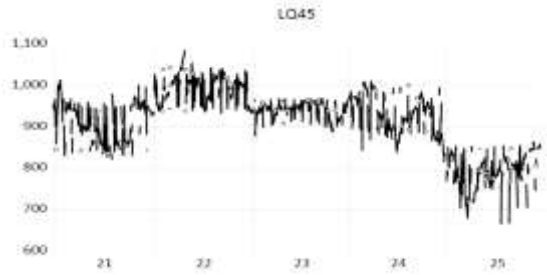

Figure 1. LQ45 Index Movement, 2021–2025
Source: EViews output (processed by the author)

Empirical studies in the field of finance indicate that stock price volatility exhibits time-varying characteristics, meaning that return variance is not constant over time. In addition, volatility exhibits volatility clustering, whereby periods of high volatility tend to be followed by subsequent periods of high volatility, and likewise for periods of low volatility [9]. This characteristic is difficult to capture accurately using conventional linear regression approaches. The Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model was developed to accommodate the time-varying nature of volatility and has been widely employed in financial market research

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to measure market risk more precisely [10].

There isn't much research on the GARCH model's application to the volatility of LQ45 stocks in the Indonesian capital markets, especially studies considering volatility to be an indicator of risk for retail investors [11]. Other studies have focused primarily on stock returns or on the performance of the firm, paying little attention to the risk of the market that retail investors face [12]. Understanding the volatility of blue chip stocks is important for the investing public's ability to manage risk, and the LQ45 index contains several of these types of stocks.

This study seeks to use the GARCH model to analyze the volatility of the LQ45 index in the Indonesian stock market to ascertain the degree of retail investment risk. By employing secondary data and an econometric approach that captures volatility dynamics more accurately, this study is expected to make theoretical contributions to the development of the capital market risk management literature, as well as practical contributions to retail investors and regulators to enhance investor protection and improve public financial literacy.

II. LITERATURE REVIEW

2.1 Investment Risk and Stock Market Volatility

Market risk is d efined as the possibility of investors losing money because of fluctuating stock prices and unpredictable returns. This leads to uncertainty regarding the returns on investments in the stock market [4]. Volatility represents the magnitude of return variation around its average value over a specific period; therefore, the higher the volatility, the greater the level of uncertainty and risk borne by investors [8].

For retail investors, volatility has more significant implications than for institutional investors. [13] Retail investors generally face limitations in capital, information, and hedging instruments, making them more vulnerable to sharp price fluctuations [14]. Therefore, stock market volatility is often used as an essential indicator for measuring and managing retail investment risk.

2.2 The LQ45 Index and the Characteristics of Blue-Chip Stocks

The LQ45 index is a stock market index comprising 45 high-liquidity, large-cap stocks with relatively strong fundamentals on the Indonesia Stock Exchange. Stocks in this index are frequently used as benchmarks by investors, particularly retail investors, as they are considered more stable and easier to trade than those outside the leading index [15].

However, multiple studies show us that both greater market capitalization, as well as greater liquidity, do not guarantee more stable stock prices. The LQ45 stocks have exhibited large price fluctuations, especially during periods of economic distress, turbulence in the global markets, and changes in the sentiment of investors [12]. This condition suggests that market risk in LQ45 stocks still requires in-depth analysis, particularly from the perspective of volatility as an investment risk. [16]

2.3 Characteristics of Stock Volatility: Time-Varying Behavior and Volatility Clustering

Empirical studies in the field of finance indicate that stock price volatility exhibits time-varying characteristics, meaning that return variance is not constant over time. In addition, volatility demonstrates the phenomenon of volatility clustering, whereby periods of high volatility tend to be followed by subsequent periods of high volatility, and likewise for periods of low volatility [9].

This phenomenon is illustrative of the fact that market risk does not appear as a random variable, but rather consistent and organized. In reality, structural situations have the potential to accumulate risk over time and exacerbate investor losses if not addressed in a way that can prepare for them through risk management processes. These characteristics are among the main reasons why simple statistical approaches are often inadequate for analyzing stock market volatility [11].

2.4 Limitations of Conventional Linear Regression in Volatility Analysis

Conventional linear regression approaches, particularly Ordinary Least Squares (OLS), assume that the error variance is constant (homoskedasticity). Nevertheless, relational independence is often not satisfied by financial time series such as stock returns, which behave conditionally heteroscedastic and have volatility that changes through time. Hence the application of conventional linear regression in volatility analysis may yield to an inefficient estimator and less precise risk measurement [17]. This has inspired the building of econometric models that were specifically built for capturing the dynamics of volatility in stock markets [18].

2.5 GARCH Model of Measuring Market Risk

The GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model was developed to deal with the time dependent behaviour of volatility and clustering of volatilities. This model allows the conditional variance of returns to be influenced by

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past shocks and previous-period fluctuations, thereby providing a more realistic representation of market risk dynamics [18].

In the financial market literature, the GARCH model has been widely applied to measure the volatility of individual stocks and market indices, and to serve as a basis for calculating risk measures such as Value at Risk (VaR). The primary advantage of the GARCH model lies in its ability to capture volatility persistence, which conventional linear approaches cannot adequately explain [19].

2.6 Literature Review on LQ45 Volatility in Indonesia

In Indonesian stock markets, there are few studies about the volatility of both stock and market index along with Indonesia LQ45 index. Appropriate research Most of these studies focus mainly on stock return, firm performance, fundamental factors or the effect of macroeconomic variables upon stock price.

Research that explicitly employs the GARCH model to analyze the volatility of LQ45 stocks remains relatively limited, particularly studies that position volatility as an indicator of retail investment risk [11]. Moreover, few studies have linked volatility analysis results to practical implications for retail investors in managing investment risk. This condition highlights a relevant research gap that warrants further investigation.

III. RESEARCH METHODS

Based on the literature review, the volatility of LQ45 stocks is widely regarded as an important proxy for retail investment risk. The time-varying and persistent characteristics of volatility necessitate the use of an appropriate econometric model, namely the GARCH model [18]. Accordingly, this study employs secondary data consisting of daily closing prices of the LQ45 index obtained from Yahoo Finance for the period 2020–2025. The data were collected through documentation techniques and analyzed using volatility modeling by estimating the ARCH/GARCH model with EViews software to capture the time-varying volatility characteristics of the LQ45 index, thereby providing a more realistic depiction of market risk experienced by retail investors in Indonesia.

This research is intended to examine stock market volatility of LQ45 index and its impact toward retail investment risk in Indonesia. The study's conceptual framework is based on investment risk theory, characteristics of stock market volatility, and econometric approaches to market risk measurement [20].

The stock return of LQ45 index is analyzed in this research. Theoretical, as well as empirical evidence support the finding that stock returns have conditional heteroskedasticity, time varying volatility and volatility clustering. These properties make it inappropriate to use traditional linear regression methods for stock market risk estimation [21]. These volatility dynamics are captured using the GARCH model in this study. The conditional variance of stock returns with a GARCH model is allowed to be affected by previous shocks rather than on the current volatility, which can lead to a better description of persistence in volatility [19].

The GARCH model's output, the estimated volatility of LQ45 index stocks, is treated as a proxy for retail investment risk. [21] The resulting fluctuations reflect the degree of return uncertainty faced by retail investors when investing in LQ45 stocks. In addition, the results of this study should provide some implications for both retail investors to control investment risk and capital market regulators to strengthen investor protection and increase public financial literacy.

IV. RESULT AND DISCUSSION

Result

This paper attempts to provide a full T.V. set of models for modelling every aspect of stock market volatility using time series econometric techniques. By using stock returns of LQ45 index as the subject of study it can be seen that risk measurement is the market risk that is relevant to individual investors because the stocks are high-liquiditied, large cap in Indonesia Stock Exchange.

We use the GARCH model due to its capability to capture time varying and volatility clustering phenomena, which typical linear regression cannot account for appropriately. I anticipate that this research approach will yield more precise and realistic estimates of volatility as a proxy for retail investment risk.

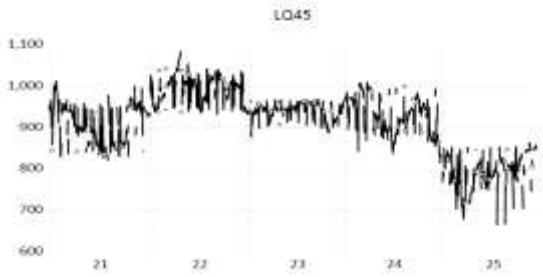

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Figure 2. LQ45 Index Movement, 2021–2025
Source: EViews output (processed by the author)

The LQ45 index volatility graph for the 2021-2025 period is presented unsteadily and displays no constancy of form. Variance increases in certain periods and lasts for a while, that we call volatility clustering. This is an issue of the high risks to which small retail investors can be exposed, particularly in times of financial crisis, and highlights the importance of risk in investment decisions.

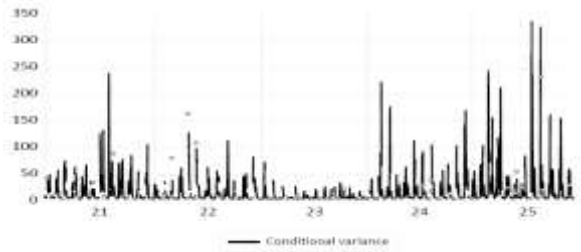

Figure 3. Conditional Volatility of the LQ45Index Based on the GARCH(1,1) Model
Source: EViews output (processed by the author)

The conditional variance graph derived from the GARCH(1,1) model estimation indicates that the volatility of LQ45 index returns is non-constant and tends to cluster over time. Sharp spikes in volatility during specific periods signal heightened market uncertainty, which directly affects retail investment risk. These findings reinforce the ARCH test and GARCH estimation results, confirming that stock market volatility is persistent and reacts to shocks, underscoring the importance of risk management for retail investors.

Table 1. Descriptive Statistics of the LQ45 Index

	LQ45
Mean	915.4239
Median	938.9550
Maximum	1085.440
Minimum	667.7700
Std. Dev.	76.18621
Skewness	-0.667096
Kurtosis	2.878048
Jarque-Bera	90.34544
Probability	0.000000
Sum	1105832.
Sum Sq. Dev.	7005837.
Observations	1208

Source: EViews output (processed by the author)

The descriptive statistics indicate that the LQ45 index exhibits relatively high volatility and an asymmetric, non-normal distribution. This condition suggests significant market risk, particularly downside risk, thereby making further volatility analysis using ARCH/GARCH models relevant.

Table 2. Results of the Stationarity Test of LQ45 Index Returns (Augmented Dickey–Fuller)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-20.49801	0.0000
Test critical values:	1% level	-3.435581	
	5% level	-2.863738	
	10% level	-2.567990	

*MacKinnon (1996) one-sided p-values.

Source: EViews output (processed by the author)

The Augmented Dickey–Fuller (ADF) test results indicate that LQ45 index returns are stationary at the level, as shown by an ADF statistic of −20.49801 with a probability value of 0.0000. This statistic is smaller than the critical values at the 1%, 5%, and 10% significance levels. Therefore, the return data are suitable for use in volatility analysis employing ARCH/GARCH models.

Table 3. Results of the Conditional Heteroskedasticity Test (ARCH–LM Test) on LQ45 Index Returns

Heteroskedasticity Test: ARCH

F-statistic	40.62017	Prob. F(1,1204)	0.0000
Obs*R-squared	39.35974	Prob. Chi-Square(1)	0.0000

Source: EViews output (processed by the author)

The ARCH test results show that the probability values for both the F- and Chi-square statistics are 0.0000. This indicates that the variance of the LQ45 index returns is heteroskedastic and influenced by variance from previous periods. Accordingly, stock market volatility is dynamic and exhibits volatility clustering, making ARCH/GARCH models relevant for measuring retail investment risk.

Table 4. Estimation Results of the GARCH(1,1) Model on LQ45 Index Returns

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.097560	0.045041	-2.166044	0.0303
Variance Equation				

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C	3.466238	0.155333	22.31493	0.0000
RESID(-1)^2	0.769606	0.050767	15.15970	0.0000
GARCH(-1)	0.276324	0.022293	12.39533	0.0000

R-squared	-0.000627	Mean dependent var	-0.008156
Adjusted R-squared	-0.000627	S.D. dependent var	3.573236
S.E. of regression	3.574355	Akaike info criterion	5.222282
Sum squared resid	15407.87	Schwarz criterion	5.239170
Log likelihood	-3147.647	Hannan-Quinn criter.	5.228641
Durbin-Watson stat	2.521667		

Source: EViews output (processed by the author)

The GARCH(1,1) estimation results indicate that past shocks and previous-period variance significantly influence the volatility of LQ45 index returns. The significant ARCH and GARCH coefficients, with the sum of α and β exceeding 1, suggest that stock market volatility is highly persistent and tends to persist for an extended period following a shock. This highlights the particular danger for retail investors during times of uncertainty and the need for more sophisticated risk management techniques.

Table 5. Results of the ARCH Heteroskedasticity Test on Residuals of LQ45 Index Returns

Heteroskedasticity Test: ARCH			
F-statistic	1.176610	Prob. F(1,1204)	0.2783
Obs*R-squared	1.177414	Prob. Chi-Square(1)	0.2779

Source: EViews output (processed by the author)

The ARCH test on the standardized residuals yields a probability value of 0.2783. This result indicates that the estimated GARCH(1,1) model has adequately captured the conditional heteroskedasticity in LQ45 index returns. Therefore, the model used for volatility is legitimate and adequate for its application in the analysis ofinvestment risk of retail investors.

Discussion

The findings of this study confirm that the volatility of the LQ45 index is time-varying and exhibits strong persistence, as indicated by the significant ARCH and GARCH coefficients and the presence of volatility clustering. These results are consistent with empirical studies in the financial literature, which suggest that stock market volatility tends to react to shocks and remains elevated for prolonged periods, particularly during times of market uncertainty [22].

From the perspective of retail investors, the persistent nature of volatility implies that market risk in the Indonesian stock market cannot be considered transitory. Instead, periods of heightened volatility may expose retail investors to sustained risk, especially during economic downturns or financial crises [23]. This finding highlights the importance of incorporating volatility dynamics into investment decision-making rather than relying solely on average returns or static risk measures.

Furthermore, the adequacy of the GARCH(1,1) model in capturing conditional heteroskedasticity, as evidenced by the ARCH test on standardized residuals, indicates that volatility modeling provides a more realistic assessment of market risk compared to conventional linear models. This supports the relevance of GARCH-based approaches for risk measurement in emerging markets such as Indonesia, where market fluctuations tend to be more pronounced [24].

Overall, the results underscore the critical role of volatility analysis in understanding retail investment risk in the LQ45 index. Policymakers, financial educators, and individual investors may benefit from increased awareness of volatility persistence when formulating risk management strategies and investment policies.

V. CONCLUSION AND SUGGESTION

The aim of this research is measuring the vulnerability of stock market in LQ45 index as a proxy measurement for retail investment risk in Indonesia by employing the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. In light of the empirical evidence, a number of main insights are as follow. First, LQ45 index returns are stationary and they have conditional heteroskedasticity and volatility clustering. This suggests that stock market volatility is not constant over time but clustered, also suggesting that market risk of retail investors is dynamic and permanent.

Second, the estimation results of GARCH(1,1) show that past shocks and previous period variance significantly influence on the volatility of LQ45 index returns. The importance of the ARCH and GARCH coefficient implies that stock market volatility is time-dependent and it responds quickly to market disturbances. These results highlight the shortcomings

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of standard linear regression methods to evaluate stock market risk. Third, there is no evidence of ARCH effects in the standardized residuals left after using below equations, suggesting that GARCH(1, 1) model has captured well the volatility process: Therefore the estimated volatility may approximate a reasonable proxy will likely be a good enough approximation for retail investor risk in LQ45 index.

Overall, the results demonstrate that although LQ45 stocks are characterized by high liquidity and large market capitalization, market risk, as reflected by volatility, remains significant and must be carefully managed by retail investors. For retail investors, this study's results highlight the importance of understanding volatility dynamics as an integral part of investment risk management. Retail investors are advised not to focus solely on potential returns or a stock's blue-chip status, but also to consider market volatility.

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