Iqtishodia: Jurnal Ekonomi Syariah
Program Studi Hukum Ekonomi Syariah,
Universitas Al-Qolam Malang
Jalan Raya Putatlor, Putatlor, Gondanglegi, Malang, Jawa Timur 65174, Indonesia.

ISSN (Print): 2503-118X, ISSN (Online): 2580-4669
Vol. 11(2), September 2026, pp. 50-63
DOI: https://doi.org/10.35897/iqtishodia.v11i2.2737

Measuring Stock Investment Risk of PT Bank Syariah Indonesia Tbk Using Monte Carlo Value at Risk

Shinta Leyla Maghfiroh [a,1], Fitrian Aprilianto [b,2,*], Atut Frida Agustin [c,3]

[a,b,c] Department Islamic Economic, Faculty of Islamic Studies, University of Muhammadiyah Malang, Malang, Indonesia

[1] shintaleylamaghfiroh@gmail.com, [2] fitrianapril30@umm.ac.id, [3] atutfridha@gmail.com

*Corresponding Author

ARTICLE INFO:

Article History:
Received: 27 June 2026
Revised: 12 August 2026
Published: 23 September 2026

Keywords:
Value at Risk (VaR); Monte Carlo Simulation; Stock-price Volatility; Fundamental Performance; Sharia Stocks.

Kata Kunci:
Value at Risk (VaR); Simulasi Monte Carlo; Volatilitas Harga Saham; Kinerja Fundamental; Saham Syariah.

ABSTRACT

Indonesia's Islamic capital market has grown rapidly, with PT Bank Syariah Indonesia Tbk (BSI) emerging as one of its actively traded Sharia-compliant issuers. However, the growth of Islamic equity investment is accompanied by short-term stock-price volatility that exposes investors to potential downside risk. This study examines the historical return behavior of PT Bank Syariah Indonesia Tbk (BRIS) in the context of the company's fundamental performance, measured by Earnings Per Share (EPS), and estimates its one-day downside investment risk using Value at Risk (VaR). A quantitative descriptive design was applied to secondary data comprising 474 daily BRIS closing prices from November 2023 to October 2025 and quarterly EPS data for 2021–2025. Daily returns, descriptive statistics, and stock-price volatility were analyzed, while VaR was estimated using a Monte Carlo simulation with normally distributed simulated returns at 99%, 95%, and 90% confidence levels. The results show that BRIS daily returns fluctuated between -11.11% and 12.32%, indicating substantial short-term price volatility, while Annualised EPS showed an overall upward trend from 2021 to 2025, reflecting improving company-level fundamental performance. The Monte Carlo VaR estimates indicate one-day potential loss thresholds of 6.32% at the 99% confidence level, 4.42% at 95%, and 3.40% at 90%, equivalent to approximately IDR 6.32 million, IDR 4.42 million, and IDR 3.40 million, respectively, for an investment of IDR 100 million. Theoretically, the study shows that fundamental strength and downside-risk exposure are distinct dimensions; practically, investors and policymakers should complement fundamental analysis and Sharia screening with quantitative risk measures such as VaR.

ABSTRAK

Pasar modal syariah Indonesia telah berkembang pesat, dengan PT Bank Syariah Indonesia Tbk (BSI) menjadi salah satu emiten saham syariah yang aktif diperdagangkan. Namun, pertumbuhan investasi saham syariah juga disertai volatilitas harga saham jangka pendek yang menimbulkan potensi risiko kerugian bagi investor. Penelitian ini menganalisis perilaku return historis PT Bank Syariah Indonesia Tbk (BRIS) dalam konteks kinerja fundamental perusahaan yang diukur melalui Earnings Per Share (EPS), serta mengestimasi risiko kerugian investasi satu hari menggunakan Value at Risk (VaR). Penelitian menggunakan desain kuantitatif deskriptif dengan data sekunder berupa 474 observasi harga penutupan saham BRIS harian selama November 2023 hingga Oktober 2025 dan data EPS kuartalan periode 2021–2025. Analisis mencakup statistik deskriptif, perhitungan return harian, dan pengukuran volatilitas harga saham, sedangkan VaR diestimasi menggunakan simulasi Monte Carlo dengan return simulasi berdistribusi normal pada tingkat kepercayaan 99%, 95%, dan 90%. Hasil penelitian menunjukkan bahwa return harian BRIS berfluktuasi antara -11,11% hingga 12,32%,

yang menunjukkan volatilitas harga jangka pendek yang substansial, sementara EPS meningkat secara konsisten selama 2021–2025, yang mencerminkan peningkatan kinerja fundamental perusahaan. Estimasi Monte Carlo VaR menunjukkan potensi kerugian satu hari sebesar 6,32% pada tingkat kepercayaan 99%, 4,42% pada 95%, dan 3,40% pada 90%, yang setara dengan sekitar Rp6,32 juta, Rp4,42 juta, dan Rp3,40 juta untuk investasi sebesar Rp100 juta. Secara teoretis, penelitian ini menunjukkan bahwa kekuatan fundamental dan eksposur risiko kerugian merupakan dimensi yang berbeda; secara praktis, investor dan pembuat kebijakan perlu melengkapi analisis fundamental dan penyaringan syariah dengan ukuran risiko kuantitatif seperti VaR.

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

How to cite: Maghfiroh, S. L., Aprilianto, F., Agustin, A. F., (2026). Measuring Stock Investment Risk of PT Bank Syariah Indonesia Tbk Using Monte Carlo Value at Risk. *Iqtishodia: Jurnal Ekonomi Syariah*, *11*(2), 50-63. doi: https://doi.org/10.35897/iqtishodia.v11i2.2737

INTRODUCTION

Economic growth serves as a metric of a nation's advancement, defined by a rise in economic activity and national income relative to the preceding era (Acemoglu, 2012; Cypher, 2014; Hung & Thanh, 2022; Vîrjan, et al., 2023; Cárdenas-García, et al., 2024). The stability of a nation's economy is reflected in the activity and growth within the money market and capital market. The money market serves to address short-term liquidity requirements, however enhancing the long-term economy and the populace's welfare necessitates capital market investment (Li et al., 2021; Purnamasari & Ariyanti, 2023). Stocks are one of the financial tools available in the capital market. Stock prices serve as a barometer of economic growth; yet, in the context of economic globalization's uncertainties, they are influenced not only by local variables but also by external factors and economic instability (Khan et al., 2024; Syed & Kamal, 2026; Youssef et al., 2021). The decision to invest, particularly in stocks, is inherently linked to risk, as stocks are investment vehicles characterized by elevated risk compared to other assets and uncertainty over the returns generated (Bhowmik & Wang, 2020; Ramzan et al., 2024). Consequently, danger need not always be evaded, but should be effectively managed. Consequently, it is essential to adopt strategies to limit risk through effective risk management. A method to manage and foresee risk involves quantifying the anticipated severity of the risk (Anita et al., 2023). A method for assessing risk is Value at Risk (VaR). The Value at Risk (VaR) calculation procedure constitutes a component of a risk management framework applicable to both banking and non-banking entities (Pratiwi, 2024). Value at Risk (VaR) is a technique for quantifying market risk to ascertain or estimate the maximum potential loss in a portfolio, at a certain confidence level and over a defined time frame, under typical market conditions (Choudhry, 2013; Iswanto & Ramadhan, 2025). Three approaches exist for calculating Value at Risk (VaR): the Historical Simulation Method, the Variance-Covariance Method, and the Monte Carlo Simulation Method (Irsan, et al., 2022; Mala & Loku, 2024).

The Monte Carlo simulation method quantifies diverse risks and exposures (stocks), encompassing price risk, volatility risk, non-linear price risk, and more intricate risks through repeated simulations. This study used the Monte Carlo simulation method because to its relatively straightforward methods and its ability to yield more accurate and adaptable computational outcomes (Hidayati, 2020; Lahi et al., 2023; Zhou et al., 2016). The efficacy of results improves with an increased number of simulations conducted using this strategy (Ningsih & Arsal, 2022).

Table 1. Performance of PT. Bank Syariah Indonesia Tbk (BRIS) Shares

	Earning Per Share (EPS)				
Period	**2025**	**2024**	**2023**	**2022**	**2021**
Q1	40.73	37.01	31.61	21.41	16.08
Q2	40.37	36.58	29.57	24.79	16.02
Q3	-	37.13	29.87	23.28	16.84
Q4	-	41.16	32.59	22.87	16.71
Annualised	162.21	151.88	123.65	92.35	65.65
TTM (Q2)	159.39	151.88	123.65	92.35	65.65

Source: Stockbit 2025

Table 1 above shows that BRIS's annualized EPS followed an overall upward trajectory, increasing from 65.65 in 2021 to 162.21 in 2025. This pattern indicates strengthening earnings performance over the period and provides a favorable company-level fundamental signal. This indicates a favorable signal, demonstrating that PT. Bank Syariah Indonesia Tbk is expanding and effectively generating profits, which implies strong fundamental performance. The EPS value, which generally rises annually, such earnings improvement may provide a positive signal for investors when assessing the company's fundamental performance interested in the company's stock. Investor demand might affect the rise in the company's market share price. Furthermore, the Earnings per Share metric serves as an indicator of a company's performance. A high EPS value generated by a corporation might lead to an increase in its share price.



Figure 1. Historical BRIS Stock Price, 2021–2025
Source: Stockbit 2025

Figure 1 above illustrates the volatility of BRIS stock prices from 2021 to the present, determined by the dynamics of supply and demand in the capital market. The nadir was documented at Rp. 1,085 in December 2022, caused by a plethora of proposals from investors in the stock market. Price variations are deemed natural if they transpire gradually and within an acceptable duration. It is essential to observe instances of dramatic market movements characterized by abrupt and significant price fluctuations, as well as prolonged periods of persistent price drops.

The Monte Carlo simulation method for Value at Risk has previously been applied in the Indonesian capital market literature. Lahi et al (2023) applied single-asset Monte Carlo VaR to two large-cap manufacturing and consumer-goods issuers, PT Indofood CBP Sukses Makmur Tbk and PT Astra International Tbk, confirming the method's applicability to non-financial blue-chip stocks. Rahman (2024) extended the approach to ten major Indonesian banking stocks and found that PT Bank Syariah Indonesia Tbk (BRIS) exhibited the highest return and volatility among them, though the analysis combined multiple banks into a diversified portfolio rather than examining BRIS's own standalone risk profile. The underlying simulation technique itself draws on methodological developments in adaptive sequential Monte Carlo estimation (Zhou et al., 2016). Collectively, these studies have generally examined well-established banking or manufacturing issuers over relatively short or pre-consolidation periods (Lahi et al., 2023; Rahman, 2024; Zhou et al., 2016), leaving the risk profile of Indonesia's largest Sharia-compliant bank underexplored in the post-merger period. This study addresses that gap by focusing on PT Bank Syariah Indonesia Tbk (BRIS) using daily price data from November 2023 to October 2025, a period that reflects the bank's performance well after its 2021 merger consolidation, and by jointly evaluating stock-price volatility, the company's fundamental performance (EPS), and Monte Carlo-based VaR within a single analytical framework, rather than treating these dimensions separately in the studies reviewed in this article.

Accordingly, this study addresses two questions: (1) How does the historical return behavior of BRIS reflect its short-term market risk, particularly when considered alongside the company's EPS development? and (2) What is the estimated one-day downside risk of BRIS shares at the 90%, 95%, and 99% confidence levels using Monte Carlo VaR?. This study aims to examine BRIS's historical return behavior in the context of its fundamental performance (EPS) and to estimate the stock's one-day downside risk using Monte Carlo Value at Risk. This study focuses on PT. Bank Syariah Indonesia. Despite being relatively new, BSI has demonstrated remarkable performance in the capital market, with a share price of Rp. 3,020 in February 2025 and a year-to-date growth of

10.62% – the most among banking issuers (BSI 2025). The earnings per share (EPS) numbers produced by Bank BSI serve as a metric for assessing the company's performance quality:

LITERATURE REVIEW

Risk and Risk Management

Risk constitutes a manifestation of uncertainty regarding future events, contingent upon present decisions and considerations (Bui & De Villiers, 2017; Park & Shapira, 2017; Sharma et al., 2020). A risk pertains to the potential occurrence of adverse events, including unforeseen losses that may arise in the future. Bali & Zhou (2016; Maneemaroj et al (2021); Van Dinh (2023) define investment risk as the degree of divergence between anticipated returns and actual returns. Return and risk are theoretically interconnected; an increase in risk corresponds to a potential increase in return (Fifield et al., 2020; Gleißner et al., 2022; Schoenmaker & Schramade, 2023). Conversely, if investors seek to minimize risk, they must also be willing to accept a lesser return on their investment than anticipated (Cornell, 2021; O'Donoghue & Somerville, 2018).Investment risks in equities are categorized into two types: systematic risk, a component of market risk that is outside the company's control, including factors such as recession, inflation, interest rates, and currency rates (Purwanti & Nurastuti, 2020). Additionally, unsystematic risk, a component of securities risk, can be mitigated through portfolio diversification (Effendi, 2017; Sunchalin et al., 2019; Zaimovic et al., 2021).

Furthermore, in the context of investment decisions, investors can be categorized into two groups based on their risk tolerance: risk takers and risk averse investors (Puspitaningtyas, 2015). Risk takers often perceive uncertainty as a formidable opportunity. This perspective is founded on the notion of "high risk, high return; low risk, low return," asserting that the possibility for substantial earnings is invariably proportional to the level of risk encountered. Conversely, risk-averse investors tend to eschew risk and emphasize investment security, despite the comparatively lower profits achieved (Aren & Nayman Hamamci, 2020; Gershkov et al., 2025).

Concept of Value at Risk (VaR)

A technique for quantifying and controlling investment risk is Value at Risk (VaR). Value at Risk (VaR) is a technique for quantifying market risk by assessing the largest potential loss that may arise within a certain confidence interval, during a defined time frame, and under typical market conditions (Conlon et al., 2020; Guégan & Hassani, 2019; Iswanto & Ramadhan, 2025). Value at Risk (VaR) quantifies the maximum potential loss during a designated timeframe, while recognizing the marginal probability that actual losses may surpass the projected VaR value (Boo et al., 2017; Maphalla et al., 2023). VaR is a statistical risk metric that incorporates historical volatility of risk components along with the correlations across these indicators (Anam et al., 2020).

Value at Risk (VaR) is defined as the maximum potential loss on an investment over a specified time frame. In essence, VaR quantifies the anticipated loss over a specified time frame (one day, one week, one month) (Banihashemi & Navidi, 2017). Value at Risk (VaR) offers a comprehensive assessment of potential losses from invested funds or assets, VaR represents a loss threshold associated with a specified confidence level and holding period, while losses beyond that threshold remain possible (Rahman, 2024).

The distributional assumption depends on the VaR approach employed. In this study, the Monte Carlo procedure generates simulated returns under a normal-distribution assumption. This measurement method is applicable to all traded financial goods (Prihatiningsih et al., 2020). A further benefit of VaR is its capacity to assess the likelihood that losses will surpass the established loss threshold. Furthermore, VaR considers the impact of price fluctuations of individual assets on other assets. This characteristic is absent in alternative risk assessment methodologies (Iswanto & Ramadhan, 2025).

J.P. Morgan identifies three approaches for calculating Value at Risk (VaR) (Tobias & Brunnermeier, 2016; Zhang & Nadarajah, 2018): *first,* the Variance-Covariance approach is advantageous due to its simplicity in computation and implementation; yet, it is less precise compared to alternative methods. This technique is applicable solely to data with a normal distribution. Due to the non-normal distribution of stock prices, this strategy exhibits deficiencies in accuracy. *Second,* the historical simulation method is the most straightforward measurement technique utilizing historical data. It exhibits the highest level of transparency in its computations and does not encounter model risk issues. This method's drawback is its failure to utilize a normal distribution for asset returns. *Third,* the Monte Carlo Simulation Method is a technique developed to assess uncertainty. The Monte Carlo approach provides flexibility because the analyst can specify an appropriate return-generating process and repeatedly simulate possible outcomes. This method for quantifying value at risk due to its flexibility in addressing diverse risk exposures, including non-linear price risk, volatility risk, and fixed model risk issues.

Stock, Sharia Stock and Portofolios

Shares are securities that represent ownership in a firm, signifying that shareholder are also proprietors of the company. An investor's influence and power in a corporation increase with the number of shares they possess, while income for investors is derived from dividends (Jahfer & Mulafara, 2016; Priya & Mohanasundari, 2016; Tayachi et al., 2023). Shares are certificates that attest to ownership of a corporation, granting shareholders the ability to claim the company's revenue and assets (Sapiri et al., 2023). Similar to the general definition of shares, sharia shares are certificates of ownership in a company issued by the issuer. The operational system and management are conducted in accordance with Sharia principles. Moreover, the principle of sharia stock ownership is not achieved by differentiating between sharia and non-sharia stocks, but rather through stock indices that adhere to Islamic principles, such as the Jakarta Islamic Index (JII) issued by the Indonesia Stock Exchange (IDX), which acts as a benchmark for evaluating the performance of sharia stock investments (Alamsyahbana et al., 2024; Imam et al., 2022).

Issuer's issue two types of shares: common stock and preferred stock. Common stock confers the authority to elect the company's directors and to vote on corporate decisions. Preferred stock is often referred to as hybrid stock due to its dual qualities of equity and debt (Sapiri et al., 2023). Preferred investors lack voting rights at the General Meeting of Shareholders (GMS) but receive precedence in dividend distribution, which is guaranteed and assured (fixed income) in contrast to common stock (Widjanarko, 2020). A method to mitigate risk is by constructing a portfolio. An investment portfolio comprises a diverse array of financial assets, including stocks, bonds, and mutual funds, held by individuals or organizations. The objective is to attain maximal returns in the future, contingent upon three principal factors: capital, investment goals, and risk tolerance (Alamsyahbana et al., 2024). A stock investment portfolio comprises many types of equities held by both individual and institutional investors (Santoso et al., 2023). The decision to establish a portfolio for investment is prudent, as it mitigates risk via diversity without adversely affecting the anticipated return. This method seeks to avert complete losses in the event of asset failure (Sapiri et al., 2023).

Capital Market and Sharia Capital Market

The capital market is an institution engaged in financial sector operations through the trading of securities by pertinent entities (Melicher & Norton, 2019; Pilbeam, 2018; Yuliani et al., 2020). The capital market is defined as a venue for capital owners or investors to engage with corporations or institutions that trade stocks, bonds, and other securities through the services of securities traders (Fabozzi, 2025; Saunders et al., 2021; Strumeyer, 2017). Capital Market Law No. 8 of 1995 defines capital markets as "activities pertaining to public offerings and trading of securities, public companies associated with the securities they issue, along with institutions and professions related to securities"(Undang-Undang Republik Indonesia Nomor 8 Tahun 1995 Tentang Pasar Modal, 1995). The capital market is defined as a mechanism for individuals and companies to augment their assets by offering capital to public investors interested in long-term investments in stocks, bonds, and securities (Kemala et al., 2024).

The categories of Islamic financial markets or Sharia-compliant capital markets. Sharia capital markets refer to capital market activities that adhere to Islamic norms. To comprehend sharia capital markets, one must grasp the concept of capital markets governed by the Islamic principles that underpin sharia capital market operations (Abdullah, 2018). The Islamic capital market refers to capital market activities governed by Capital Market Law No. 8 of 2025, which adhere to Islamic principles and are overseen by the Capital Market and Financial Institution Supervisory Agency (Bapepam-LK). The fundamental structure of the Islamic capital market closely resembles that of the conventional capital market. Nevertheless, the Islamic capital market possesses distinct characteristics, including products and transaction processes that align with Islamic values and are derived from the Qur'an and Hadith (Aman, 2020; Faisal, 2026; Syahriani et al., 2023).

The capital market is crucial for a nation as it serves as a benchmark for economic advancement, facilitates development, and provides a mechanism for enterprises to secure funding from investors for business expansion, additional working capital, and other requirements. To facilitate public investment by offering diverse financial instruments, including stocks, bonds, rights issues, warrants, and options (Pitoy et al., 2022). According to Law No. 8/1995, the instruments exchanged in the capital market include debt acknowledgment letters, commercial papers, stocks, bonds, credit securities, debt certificates, rights, warrants, and any other entities classified as securities (Wardoyo, 2012). The Islamic capital market encompasses traded assets such as Islamic equities, sukuk, Islamic mutual funds, Islamic Collective Investment Contracts (KIK EBA), Islamic Preemptive Rights (HEMTD), and Islamic warrants (Alamsyahbana et al., 2024).

RESEARCH METHOD

Research Design

This study employs a quantitative descriptive research design. A quantitative approach was adopted because the research objective is to measure the maximum potential loss of investing in PT Bank Syariah Indonesia Tbk (BRIS) shares in numerical, comparable, and verifiable terms. The descriptive approach was chosen because the study does not test causal relationships between variables, but instead systematically describes the risk condition reflected in BRIS's return movement, volatility, and the resulting Value at Risk (VaR) estimates based on historical data.

The data used are secondary, numerical, time-series data comprising BRIS's daily stock closing prices, the daily returns derived from those prices, and the resulting price volatility. The population of this study is the entire historical daily closing-price series of BRIS shares since its listing on the Indonesia Stock Exchange (IDX). The sample consists of 474 daily trading observations covering 1 November 2023 to 31 October 2025 (approximately two years of trading), selected through purposive sampling on the basis that the period represents a post-merger observation window after the 2021 consolidation of BSI and provides a complete, uninterrupted daily price series suitable for return and VaR calculation. Data were obtained from Stockbit and Investing.com, which provided the daily closing-price series used for the analysis. EPS data were also obtained from Stockbit. Further the data analysis proceeded in four stages. *First,* descriptive statistical analysis characterized the sample through the mean, standard deviation, variance, minimum, and maximum values of the price series. *Second,* daily stock returns were calculated as:

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

Where Rt is the daily return, Pt is the closing price on day t, and Pt-1 is the closing price on the previous trading day. The return calculation uses price returns and does not incorporate dividend payments.

Third, wolatility was measured as the standard deviation of the daily return series obtained in the seccond stage. *Fourth,* value at Risk (VaR) was estimated using Monte Carlo simulation in Microsoft Excel, following this procedure: *Step 1 – Parameter estimation.* The mean and standard deviation of BRIS's historical daily returns were calculated as inputs for the simulation. *Step 2 – Random return generation.* Simulated daily returns were generated using =NORM.INV (RAND(), mean, standard_dev), combining Excel's RAND() function — which produces a random number between 0 and 1 — with the NORM.INV inverse-normal function. This step assumes returns are normally distributed and constitutes the Monte Carlo simulation component of the procedure. *Step 3 – Simulated distribution parameters.* The mean (μ_{PL}) and standard deviation (σ_{PL}) were recalculated from the simulated return distribution generated in Step 2. *Step 4 – Z-score calculation.* The Z-score for each confidence level was obtained using =NORM.S.INV(1−α), where α = 1%, 5%, and 10%, corresponding to confidence levels of 99%, 95%, and 90%. *Step 5 – VaR calculation.* VaR at each confidence level was calculated as:

$$VaR_{1-\alpha} = \mu_{PL} - Z_{1-\alpha} \cdot \sigma_{PL}$$

Applied to the simulated mean and standard deviation from Step 3, rather than to the raw historical mean and standard deviation directly — The Monte Carlo procedure extends the parametric VaR framework by repeatedly generating random returns from the estimated return distribution and recalculating the VaR measure.

Step 6 – Iteration and stabilization. Because Excel's RAND() function is volatile and regenerates a new value with every recalculation, Steps 2–5 were repeated for 1,000 iterations per observation, and this full procedure was applied across all 474 daily observations. The VaR reported for each confidence level is the average across these 1,000 iterations. This nested structure — 474 historical observations, each subjected to 1,000 random simulation runs, subsequently averaged — was designed to stabilize the VaR estimate by reducing the variation introduced by the volatile random-number generation.

Further, the VaR estimate reflects a 1-day holding period, consistent with the daily return data used and BRIS's status as an actively traded stock, for which short-term risk is most relevant to monitor. On the other hand,

Loss quantification. VaR is expressed both as a percentage and in nominal terms, assuming an initial investment of IDR 100,000,000. Descriptive statistical analysis (stage 1) was processed using Eviews 13, while daily return calculation and the Monte Carlo VaR simulation (stages 2–4) were processed using Microsoft Excel.

Table 2. The Measurement of Variables

Variable	Definition	Measurement
Daily Stock Return	Percentage change in BRIS's closing price relative to the previous trading day	$R_t = \left(\frac{P_t}{P_{t-1}} - 1\right) \times 100\%$
Volatility	Dispersion of daily returns around their mean	Standard deviation of the daily return series
Value at Risk (VaR)	VaR represents the estimated loss threshold over a one-day horizon at a specified confidence level	VaR1-α = μPL − Z1-α · σPL, estimated via 1,000-iteration Monte Carlo simulation of the return distribution across 474 daily observations, averaged to obtain a stable estimate

RESULT AND DISCUSSION

Descriptive Statistics and Daily Return Behavior

Descriptive statistical tests are employed to summarize or characterize data through the mean, standard deviation, variance, maximum, and minimum values (Sugiyono, 2024). The purpose of these tests is to ascertain the attributes of the research sample data. The descriptive statistical analysis yielded the following results below,

Table 3. Descriptive statistics results (November 2023–October 2025)

Descriptions	Opening Point	Value Change	Latest Point	Lowest Point	Highest Point
Mean	2.555306	0.001465	2.551160	2.510696	2.597004
Median	2.620000	0.000000	2.620000	2.590000	2.660000
Maximum	3.190000	0.123200	3.160000	3.130000	3.350000
Minimum	1.465000	-0.111100	1.460000	1.455000	1.475000
Std. Deviation	0.386744	0.026318	0.381516	0.378742	0.388409

Source: Data was processed by researchers using Eviews 13

Table 3 shows that across 474 trading days from 1 November 2023 to 31 October 2025, BRIS's closing price ranged from IDR 1,460 to IDR 3,160, with an average price of approximately IDR 2,551. Daily returns fluctuated between -11.11% and 12.32%, indicating substantial short-term variation in the stock's market performance. The magnitude of these daily movements shows that BRIS was exposed to meaningful short-term price risk during the observation period rather than displaying a stable return pattern.

This finding is consistent with (Rahman, 2024), who reported that BSI exhibited relatively high return and volatility compared with several major Indonesian banking stocks included in the study. The present evidence therefore reinforces the view that the return potential of BRIS should be considered together with its associated price volatility. This interpretation is also consistent with the general risk-return relationship in capital market theory, which treats uncertainty as an inherent characteristic of equity investment (Hadinata, 2018). For investors, the implication is that BRIS's return performance cannot be evaluated solely from the direction of price changes; the magnitude of potential downside must also be incorporated into investment decisions. The subsequent VaR estimation provides a quantitative measure of this downside exposure.

EPS Development and Fundamental Performance

Figure 2 presents the development of BRIS's Earnings Per Share (EPS) during 2021–2025 as an indicator of company-level fundamental performance. This is depicted in the graph below:

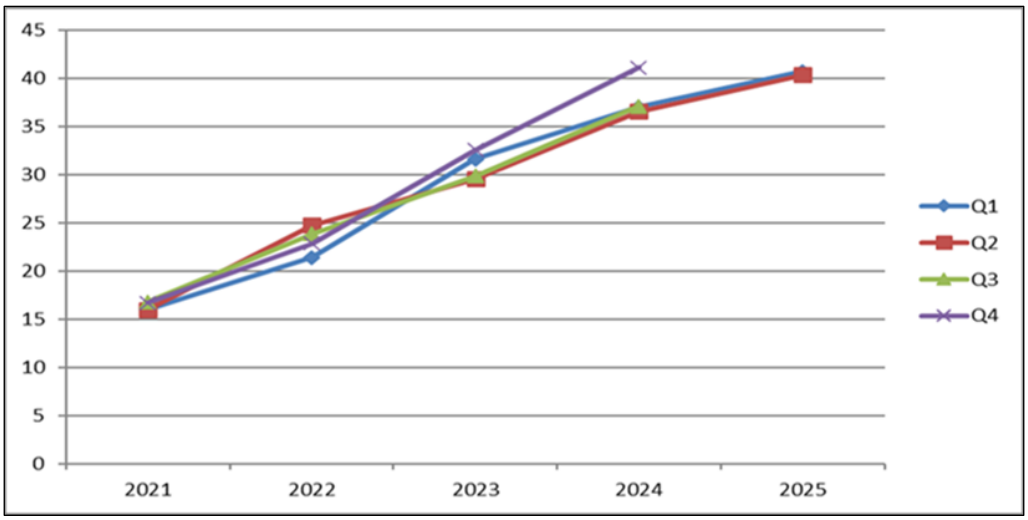


Figure 2. the Value BRIS EPS Development, 2021–2025

Source: Stockbit 2025

Figure 2 shows a sustained increase in BRIS's earnings per share (EPS) over the 2021-2025 fundamental period. The upward pattern indicates an improvement in the company's earnings performance. When considered alongside the relatively wide fluctuation in daily stock returns, this finding shows that stronger corporate earnings did not coincide with the elimination of short-term market risk. This distinction is important because EPS and market-price volatility represent different dimensions of investment evaluation. EPS reflects the company's earnings performance, whereas fluctuations in daily stock returns capture changes in market valuation and short-term price risk. The simultaneous presence of improving EPS and substantial return volatility therefore indicates that favorable company fundamentals should not be interpreted as evidence of low market risk.

This finding is broadly consistent with (Bhowmik & Wang, 2020; Indarningsih, 2022; Zaimovic et al., 2021), who emphasize that stock-price movements may remain sensitive to market conditions even when company-level fundamentals are considered. However, because the present study does not statistically test the relationship between EPS and stock-price volatility, the EPS evidence should be interpreted as contextual rather than causal. For investors, positive earnings development can complement, but cannot substitute for, an explicit assessment of downside market risk. The VaR estimation in the following section provides such a risk measure.

Monte Carlo Value at Risk Estimation

Value at Risk (VaR) computations are conducted to furnish investors with an assessment of risk exposure. VaR estimation provides investors with a quantitative measure of potential one-day downside risk. The outcomes of Value at Risk (VaR) assessments utilizing Monte Carlo simulations yielded the subsequent results below,

Table 4. Results of Value at Risk calculations for PT. Bank Syariah Indonesia (BRIS) Shares

Opening Point	Value Change	Latest Point
Confidence Level	**VaR (%)**	**VaR for IDR 100 Million**
99%	6.32%	IDR 6,317,543.69
95%	4.42%	IDR 4,417,017.48
90%	3.40%	IDR 3,403,854.00

Source: Data was processed using Microsoft Excel.
**VaR is reported as the magnitude of potential loss; the corresponding lower-tail return is negative*

At the 99% confidence level, the Monte Carlo estimation produces a one-day VaR of approximately 6.32%. For an initial investment of IDR 100 million, this corresponds to a monetary VaR of approximately IDR 6.32 million. Under the assumptions of the model, this indicates that the estimated one-day loss threshold is approximately 6.32% at the 99% confidence level. The result highlights the substantial short-term downside exposure associated with holding BRIS as a single-stock position.

The magnitude of the estimated risk is broadly consistent with previous evidence that BRIS exhibits relatively high volatility among Indonesian banking stocks. Rahman (2024) for example, demonstrates that combining banking stocks within a portfolio can produce a lower overall VaR than the risk associated with a concentrated position. Although the numerical values cannot be compared directly without accounting for differences in sample period, portfolio composition, and estimation procedure, the direction of the evidence is consistent with the diversification principle: concentration in a single asset leaves investors more exposed to asset-specific price fluctuations. This point is particularly relevant in the context of Islamic investment. Sharia compliance determines the permissibility and contractual characteristics of the investment, but it does not eliminate exposure to market-price risk. Consequently, investors in Sharia-compliant equities still require quantitative risk-management tools to evaluate potential downside. The present single-asset VaR estimate therefore complements Sharia screening by providing information about the magnitude of financial risk that compliance criteria alone do not measure.

At the 95% confidence level, the estimated one-day VaR decreases to approximately 4.42%, corresponding to a potential loss threshold of approximately IDR 4.42 million for an IDR 100 million investment. At the 90% confidence level, the VaR further declines to approximately -3.40% based on the mean VaR reported in Table 4, corresponding to approximately IDR 3.40 million. The increase in VaR as the confidence level rises from 90% to 99% reflects the increasingly conservative loss threshold required to capture more extreme simulated outcomes. This monotonic pattern is consistent with the normal-distribution framework used in the Monte Carlo procedure.

Importantly, the simulation generates returns using distributional parameters derived from historical returns and a normal random-return generator. The study therefore assumes normality for simulation purposes but does not test whether the historical return series strictly satisfies this distributional assumption. Consequently, the reported VaR estimates should be interpreted as model-based risk estimates rather than evidence that BRIS returns are normally distributed. Equity returns may display skewness, volatility clustering, or excess kurtosis that a normal distribution does not fully capture. Accordingly, the present VaR estimates provide a transparent benchmark of short-term downside risk, while alternative approaches such as GARCH-based VaR or Conditional Value at Risk could be used in future research to examine more extreme tail behavior.

Integrated Discussion: Volatility, Fundamentals, and Downside Risk

Taken together, the findings provide an integrated interpretation of three distinct dimensions of BRIS investment performance. First, the stock exhibited substantial short-term return fluctuations during the observation period. Second, the company's EPS showed an upward trend, indicating strengthening earnings performance despite continued market-price volatility. Third, the Monte Carlo VaR estimates demonstrate that a single-stock position in BRIS remains exposed to meaningful one-day downside risk, particularly at higher confidence levels.

These findings extend previous studies by placing stock-price volatility, fundamental performance, and quantitative downside-risk measurement within the same analytical discussion of BRIS during the recent post-merger period. Compared with the studies cited in this article, the present study contextualizes Monte Carlo VaR estimates with both observed stock-return behavior and the company's EPS development during the post-merger period. The contribution is therefore not to establish a causal relationship between EPS and volatility, but to demonstrate that improving corporate fundamentals and Sharia-compliant status should not be interpreted as substitutes for explicit market-risk assessment. For investors in the Islamic capital market, this distinction has practical significance. Fundamental analysis provides information on company performance, Sharia screening provides information on investment compliance, while VaR provides a separate measure of potential financial loss. Combining these perspectives at the investment-decision level enables a more comprehensive assessment of BRIS than reliance on any single indicator alone.

Theoretically, this study contributes to the Value-at-Risk literature by jointly contextualizing Monte Carlo-based downside-risk estimation with a stock's fundamental performance (EPS) within a single post-merger-period case study, extending prior work that examined volatility, fundamentals, or VaR as separate strands (Lahi et al., 2023; Rahman, 2024; Purwanti & Nurastuti, 2020). It further demonstrates, within a Sharia-compliant equity setting, that favorable fundamental performance and favorable downside-risk exposure are conceptually and empirically distinct outcomes that should not be inferred from one another. Practically, the estimated one-day VaR thresholds (approximately 6.32%, 4.42%, and 3.40% at the 99%, 95%, and 90% confidence levels, respectively) offer investors and portfolio managers a concrete, quantitative benchmark for setting position limits or risk tolerances on BRIS shares, rather than relying on qualitative or fundamentals-only screening. For regulators and Islamic capital-market policymakers, the findings suggest that Sharia-compliance screening criteria, which govern permissibility rather than market-price risk, could usefully be complemented by investor disclosure or education initiatives around quantitative risk measures such as VaR for Sharia-compliant equities.

CONCLUSION

This study shows that BRIS experienced substantial short-term return variability during the November 2023–October 2025 observation period, with daily returns ranging from −11.11% to 12.32%, while the company's EPS showed an upward trajectory over 2021–2025. The Monte Carlo VaR estimation indicates one-day potential loss thresholds of approximately 6.32%, 4.42%, and 3.40% at the 99%, 95%, and 90% confidence levels, respectively. These findings indicate that improving company-level fundamental performance does not eliminate short-term market risk, highlighting the importance of combining fundamental assessment with quantitative downside-risk measurement in evaluating Sharia-compliant equity investments. Theoretically, the study shows that fundamental performance and downside-risk exposure are distinct dimensions of a Sharia-compliant stock's investment profile. Practically, investors and portfolio managers can use the estimated VaR thresholds as quantitative benchmarks for position limits, while regulators and Islamic capital-market policymakers could complement Sharia screening with investor education on quantitative risk measures such as VaR.

However, this study has several limitations. It focuses on a single Sharia-compliant banking stock over a relatively limited observation period and estimates VaR using price returns under a normal-distribution assumption; dividend distributions and extreme tail behavior are therefore not fully incorporated. Future studies may compare several Islamic banking stocks, employ total returns that include dividend distributions, and incorporate macroeconomic variables such as inflation and benchmark interest rates. Alternative approaches such as Conditional Value at Risk (CVaR) and GARCH-based VaR may also be employed to capture tail risk and time-varying volatility more comprehensively.

Author's Contributions

Shinta Leyla Maghfiroh: Conceptualization, Methodology, Investigation,
Fitrian Aprilianto: Data curation, Formal analysis, Writing original draft, review & editing.
Atut Frida Agustin: Research method, validation, review & editing.
All authors have read and approved the final version of the manuscript

Acknowledgements

The author acknowledges the support and cooperation of all participants who contributed to this study. Constructive feedback from academic colleagues is also appreciated. This research was conducted for academic purposes and did not receive any specific funding from public, commercial, or not-for-profit organizations.

Declarations of Ethical Considerations

Participation in the study was voluntary, and informed consent was obtained from all participants prior to the interviews. Participants' identities were anonymized using respondent codes to ensure confidentiality.

Use of artificial intelligence (AI)

The authors declare that no generative artificial intelligence (AI) tools were used in the preparation, analysis, or writing of this manuscript.

Conflict of Interest

The authors declare no conflicts of interest.

Funding

This research did not receive any financial support.

REFERENCES

Abdullah, I. (2018). *Pasar Modal Syariah*. Jogjakarta: PT Elex Media Komputindo.

Acemoglu, D. (2012). Introduction to economic growth. *Journal of Economic Theory*, *147*(2), 545–550. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0022053112000245

Alamsyahbana, M. I. (2024). Pasar Modal. In *Media Saind Indonesia*. Surabaya: CV. Media Sains Indonesia.

Aman, A. (2020). Islamic marketing ethics for Islamic financial institutions. *International Journal of Ethics and Systems*, *36*(1), 1–11. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0022053112000245

Anam, K., Maruddani, D. A. I., & Kartikasari, P. (2020). Pengukuran Value at Risk pada Portofolio Obligasi dengan Metode Varian Kovarian. *Jurnal Gaussian*, *9*, 434–443. https://doi.org/10.14710/j.gauss.v9i4.29012

Anita, S. Y., Kustina, K. T., Wiratikusuma, Y., Sudirjo, F., Sari, D., Nurchayati, Rupiwardani, I., Ruswaji, Nugroho, L., Rukhmawati, I., Harahap, A. K., Anwar, S., Apriani, E., & Sucandrawati, N. L. K. A. S. (2023). Manajemen Risiko. Bogor: PT. Global Eksekutif Teknologi.

Aren, S., & Nayman Hamamci, H. (2020). Relationship between risk a version, risky investment intention, investment choices: Impact of personality traits and emotion. *Kybernetes*, *49*(11), 2651–2682. Retrieved from https://www.researchgate.net/publication/338872471_Relationship_between_risk_aversion_risky_investment_intention_investment_choices_Impact_of_personality_traits_and_emotion

Bali, T. G., & Zhou, H. (2016). Risk, uncertainty, and expected returns. *Journal of Financial and Quantitative Analysis*, *51*(3), 707–735. https://doi.org/1 0.1017/S0022109016000417

Banihashemi, S., & Navidi, S. (2017). Portfolio performance evaluation in Mean-CVaR framework: A comparison with non-parametric methods value at risk in Mean-VaR analysis. *Operations Research Perspectives*, *4*, 21–28. https://doi.org/10.1016/j.orp.2017.02.001

Bhowmik, R., & Wang, S. (2020). Stock market volatility and return analysis: A systematic literature review. *Entropy*, *22*(5), 522. https://doi.org/10.3390/e22050522

Boo, Y. L., Ee, M. S., Li, B., & Rashid, M. (2017). Islamic or conventional mutual funds: Who has the upper hand? Evidence from Malaysia. *Pacific-Basin Finance Journal*, *42*, 183–192. Retrieved from https://www.researchgate.net/publication/291555632_Islamic_or_conventional_mutual_funds_Who_has_the_upper_hand_Evidence_from_Malaysia

Bui, B., & De Villiers, C. (2017). Business strategies and management accounting in response to climate change risk exposure and regulatory uncertainty. *The British Accounting Review*, *49*(1), 4–24. https://doi.org/10.1016/j.bar.2016.10.006

Cárdenas-García, P. J., Brida, J. G., & Segarra, V. (2024). Modeling the link between tourism and economic development: Evidence from homogeneous panels of countries. *Humanities and social sciences communications*, *11*(1), 308. Retrieved from https://www.nature.com/articles/s41599-024-02826-8

Choudhry, M. (2013). *An introduction to value-at-risk*. London: John Wiley & Sons.

Conlon, T., Corbet, S., & McGee, R. J. (2020). Are cryptocurrencies a safe haven for equity markets? An international perspective from the COVID-19 pandemic. *Research in International Business and Finance*, *54*, 101248. https://doi.org/10.1016/j.ribaf.2020.101248

Cornell, B. (2021). ESG preferences, risk and return. *European Financial Management*, *27*(1), 12–19. https://doi.org/10.1111/eufm.12295?af=R

Cypher, J. M. (2014). *The process of economic development*. London: Routledge.

Effendi, M. (2017). Analisis Risiko Sistematis dan Risiko Tidak Sistematis Terhadap Expected Return Saham dalam Pembentukan Portofolio Optimal Indeks Saham LQ45. *Jurnal Manajerial Bisnis*, *1*(2), 178–193. https://doi.org/10.1111/eufm.12295

Fabozzi, F. J. (2025). *Capital markets: institutions, instruments, and risk management*. USA: MIT Press.

Faisal, Y. A. (2026). Rethinking Islamic Finance: Toward A Hybrid Model. *Journal of Islamic Thought and Civilization*, *16*(1), 212–233. https://doi.org/10.24252/JITC.vi.64620

Fifield, S. G. M., McMillan, D. G., & McMillan, F. J. (2020). Is there a risk and return relation? *The European Journal of Finance*, *26*(11), 1075–1101. Retrieved from https://discovery.dundee.ac.uk/en/publications/is-there-a-risk-and-return-relation/

Gershkov, A., Moldovanu, B., Strack, P., & Zhang, M. (2025). Optimal security design for risk-averse investors. *American Economic Review*, *115*(6), 2050–2092. Retrieved from https://www.aeaweb.org/articles?id=10.1257/aer.20231597

Gleißner, W., Günther, T., & Walkshäusl, C. (2022). Financial sustainability: measurement and empirical evidence. *Journal of Business Economics*, *92*(3), 467–516. https://doi.org/10.1007/s11573-022-01081-0

Guégan, D., & Hassani, B. K. (2019). *Risk measurement*. London: Springer.

Hidayati, L. N. (2020). Mengukur Risiko Perbankan Dengan Var (Value At Risk) Oleh: Lina Nur Hidayati. *Jurnal Ilmu Manajemen Universitas Brawijaya*, *V*(3), 156–172. Retrieved from https://www.academia.edu/download/53430862/Artikel_MENGUKUR_RISIKO_DENGAN_VAR_Jurnal_Ilmu_Manajemen.pdf

Hung, N. T., & Thanh, S. D. (2022). Fiscal decentralization, economic growth, and human development: Empirical evidence. *Cogent Economics & Finance*, *10*(1), 2109279. https://doi.org/10.1080/23322039.2022.2109279

Imam, A., Muslikhati, M., & Aprilianto, F. (2022). Pengaruh Saham Syariah, Sukuk, dan Reksadana Syariah Terhadap Pertumbuhan Ekonomi Indonesia Tahun 2011-2020. *Journal of Islamic Economics Development and Innovation (JIEDI)*, *2*(1), 063-073. Retrieved from https://ejournal.umm.ac.id/index.php/ijiedi/issue/view/1079

Indarningsih, N. A. (2022). Analisis Perbandingan Risiko Volatilitas Indeks Harga Saham Syariah dan Konvensional (Jakarta Islamic Indeks dan Indeks LQ45). *Jurnal Ekonomi Syariah Teori Dan Terapan*, *9*(5), 694. https://doi.org/10.20473/vol9iss20225pp694-709

Irsan, M. Y. T., Priscilla, E., & Siswanto, S. (2022). Comparison of variance covariance and historical simulation methods to calculate value at risk on banking stock portfolio. *Jurnal Matematika, Statistika dan Komputasi*, *19*(1), 241-250. https://doi.org/10.20956/j.v19i1.21436

Iswanto, P., & Ramadhan, A. R. (2025). Pengukran Tingkat Risiko dan Keuntungan Saham Individual dengan Menggunakan Pendekatan Historis pada metode Value at Risk (VaR) (Studi Kasus Top 5 Saham Tambang Terbaik 2025). *Jurnal Akuntansi Dan Manajemen Bisnis*, *5*(1), 49–55. https://doi.org/10.56127/jaman.v5i1.2140

Jahfer, A., & Mulafara, A. H. (2016). Dividend policy and share price volatility: Evidence from Colombo stock market. *International Journal of Managerial and Financial Accounting*, *8*(2), 97-108. https://doi.org/10.1504/IJMFA.2016.077947

Kemala, P., Lubis, D., Hotmian, H., Silalahi, B., & Sinaga, A. F. (2024). *Pasar Modal Dan Pengaruhnya Terhadap Perekonomian Di Indonesia*. *5*(1), 196–214. Retrieved from https://publikasi.dinus.ac.id/index.php/jaka/article/view/10755

Khan, M. A., Ali, H., Shabbir, H., Noor, F., & Majid, M. D. (2024). Impact of macroeconomic indicators on stock market predictions: A cross country analysis. *Journal of Computing & Biomedical Informatics*, *8*(01), 30-67. Retrieved from https://www.jcbi.org/index.php/Main/article/view/740

Lahi, R., Atti, A., Kleden, M. A., & Guntur, R. D. (2023). Perhitungan Risiko Value at Risk (VaR) Aset Tunggal Menggunakan Pendekatan Metode Simulasi Monte Carlo (Studi Kasus: PT. Indofood CBP Sukses Makmur Tbk Dan PT. Astra International Tbk). *Jurnal Cakrawala Ilmiah*, *2*(8), 3297–3310.

Li, L., Li, Y., Macchiavelli, M., & Zhou, X. (2021). Liquidity restrictions, runs, and central bank interventions: Evidence from money market funds. *The Review of Financial Studies*, *34*(11), 5402–5437.

Mala, I., & Loku, N. (2024). Comprehensive Risk Assessment in Insurance Companies Using Value at Risk (VaR) Methodologies: Comparative Analysis and Practical Applications. *Pakistan Journal of Life & Social Sciences*, *22*(2), 1394. Retrieved from https://www.pjlss.edu.pk/pdf_files/2024_2/1394-1405.pdf

Maneemaroj, P., Lonkani, R., & Chingchayanurak, C. (2021). Appropriate expected return and the relationship with risk. *Global Business Review*, *22*(4), 865–878. https://doi.org/10.1177/0972150919830879

Maphalla, R., Mokhoabane, M., & Ndou, M. (2023). Quantifying Risk Using Loss. *Applied Probability Theory: New Perspectives, Recent Advances and Trends*, 139.

Melicher, R. W., & Norton, E. A. (2019). *Introduction to finance: Markets, investments, and financial management*. London: John Wiley & Sons.

Ningsih, S., & Arsal, A. (2022). Penerapan Simulasi Monte Carlo untuk Pengukuran Value at Risk (VaR). *Research in the Mathematical and Natural Sciences*, *1*(2), 8–16. https://doi.org/10.55657/rmns.v1i2.62

O'Donoghue, T., & Somerville, J. (2018). Modeling risk aversion in economics. *Journal of Economic Perspectives*, *32*(2), 91–114. https://doi.org/10.1257/jep.32.2.91

Park, K. F., & Shapira, Z. (2017). Risk and uncertainty. In *The Palgrave encyclopedia of strategic management* (pp. 1–7). London: Springer.

Pilbeam, K. (2018). *Finance and financial markets*. London: Bloomsbury Publishing.

Pitoy, R. R., Saerang, I. S., & Tulung, J. E. (2022). Reaksi Pasar Modal Terhadap Disahkannya RUU Cipta Kerja Menjadi Undang-Undang Pada Emiten Perbankan. *JMBI UNSRAT (Jurnal Ilmiah Manajemen Bisnis Dan Inovasi Universitas Sam Ratulangi).*, *9*(1), 82–92. https://doi.org/10.35794/jmbi.v9i1.40783

Pratiwi, R. G. (2024). Analysis of Value at Risk Measurement Using the Variance-Covariance Method in The Securities Portfolio. *Jurnal Indonesia Sosial Teknologi*, *5*(01), 198–206. https://doi.org/10.59141/jist.v5i01.868

Prihatiningsih, D. R., Maruddani, D. A. I., & Rahmawati, R. (2020). Value at Risk (VaR) dan Conditional Value at Risk (CVaR) dalam Pembentukan Portofolio Bivariat Menggungakan Copula Gumbel. *Jurnal Gaussian*, *9*(3), 326–335. https://doi.org/10.14710/j.gauss.v9i3.28913

Priya, P. V., & Mohanasundari, M. (2016). Dividend policy and its impact on firm value: A review of theories and empirical evidence. *Journal of Management Sciences and Technology*, *3*(3), 59–69. Retrieved from

https://www.academia.edu/8447440/Dividend_policy_and_its_impact_on_firm_value_A_Review_of_Theories_and_Empirical_Evidence

Purnamasari, K., & Ariyanti, S. (2023). Pengaruh sentimen pasar dan faktor makroekonomi terhadap volatilitas harga saham di Indonesia. *Jurnal Keuangan Dan Perbankan*, *27*(1), 45–62. https://doi.org/10.26905/jkdp.v27i1.8912

Purwanti, Y. D., & Nurastuti, P. (2020). Pengaruh Analisis Fundamental Dan Risiko Sistematik Terhadap Harga Saham Pada Pasar Modal Syariah. *Ekomabis: Jurnal Ekonomi Manajemen Bisnis*, *1*(01), 103–116. https://doi.org/10.37366/ekomabis.v1i01.12

Puspitaningtyas, Z. (2015). *Prediksi Risiko Investasi Saham*. Surabaya: Pandiva Buku.

Rahman, W. K. (2024). Analisis value at risk (VaR) pada saham sektor perbankan indonesia dengan metode simulasi Monte Carlo. *JATI (Jurnal Mahasiswa Teknik Informatika)*, *8*(4), 5895–5899. https://doi.org/10.36040/jati.v8i4.10062

Ramzan, M., Hossain, M. R., Abbasi, K. R., Adebayo, T. S., & Alvarado, R. (2024). Unveiling time-varying asymmetries in the stock market returns through energy prices, green innovation, and market risk factors: wavelet-based evidence from China. *Economic Change and Restructuring*, *57*(3), 103. Retrieved from https://ideas.repec.org/a/kap/ecopln/v57y2024i3d10.1007_s10644-024-09684-z.html

Santoso, A., Syahputri, A., Puspita, G., Nurhikmat, M., & Dewi, S. (2023). Manajemen Investasi Dan Teori Portofolio. Purbalingga: CV Eureka Media Aksara. Retrieved from https://repository.latansamashiro.ac.id/283/1/23-02-20-EBOOK-Manajemen%20Investasi%20dan%20Portofolio.pdf

Sapiri, M., Suaib, F., Faridah, & Rahmawati. (2023). *Teori Portofolio dan Analisis Investasi*. Bogor: PT. Nas Media Indonesia.

Saunders, A., Cornett, M. M., & Jain, A. (2021). *Financial markets and institutions* (7th ed.). London: McGraw-Hill Education.

Schoenmaker, D., & Schramade, W. (2023). Risk-return analysis. In *Corporate Finance for Long-Term Value* (pp. 325–366). London: Springer.

Sharma, P., Leung, T. Y., Kingshott, R. P. J., Davcik, N. S., & Cardinali, S. (2020). Managing uncertainty during a global pandemic: An international business perspective. *Journal of Business Research*, *116*, 188–192. https://doi.org/10.1016/j.jbusres.2020.05.026

Strumeyer, G. (2017). *The capital markets: evolution of the financial ecosystem*. London: John Wiley & Sons.

Sugiyono. (2024). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bogor: Alfabeta.

Sunchalin, A. M., Kochkarov, R. A., Levchenko, K. G., KOCHKAROV, A. A., & Ivanyuk, V. A. (2019). Methods of risk management in portfolio theory. *Revista Espacios*, *40*(16), 25. Retrieved from https://www.revistaespacios.com/a19v40n16/19401625.html

Syahriani, F., Mulyani, F. F., Fismanelly, F., Afifah, S., & Medani, A. (2023). Application of maqasid al-shariah in Islamic economics and finance as the development of products of Islamic value. *Hakamain: Journal of Sharia and Law Studies*, *2*(1), 150–162. https://doi.org/10.57255/hakamain.v2i1.322

Syed, A. A., & Kamal, M. A. (2026). Does the economic policy uncertainty in the USA and China affect Indian stock markets symmetrically and asymmetrically? An empirical analysis of pre-and post-coronavirus Disease 2019 timelines. *Global Business Review*, *27*(2), 275–294. https://doi.org/10.1177/09721509221119708

Tayachi, T., Hunjra, A. I., Jones, K., Mehmood, R., & Al-Faryan, M. A. S. (2023). How does ownership structure affect the financing and dividend decisions of firm? *Journal of Financial Reporting and Accounting*, *21*(3), 729–746. https://doi.org/10.1108/JFRA-09-2021-0291

Tobias, A., & Brunnermeier, M. K. (2016). CoVaR. *The American Economic Review*, *106*(7), 1705. Retrieved from https://www.aeaweb.org/articles?id=10.1257/aer.20120555

Undang-Undang Republik Indonesia Nomor 8 Tahun 1995 Tentang Pasar Modal, Lembaran Negara Republik Indonesia Tahun 1995 Nomor 64 (1995). Retrieved from https://www.ojk.go.id/id/kanal/pasar-modal/regulasi/undang-undang/Documents/Pages/undang-undang-nomor-8-tahun-1995-tentang-pasar-modal/UU%20Nomor%208%20Tahun%201995%20(official).pdf

Van Dinh, D. (2023). Analyzed relationship between risks and expected returns. *Journal of Economic and Administrative Sciences*, *39*(4), 749–759. https://doi.org/10.1108/JEAS-05-2021-0088

Vîrjan, D., Manole, A. M., Stanef-Puică, M. R., Chenic, A. S., Papuc, C. M., Huru, D., & Bănacu, C. S. (2023). Competitiveness—the engine that boosts economic growth and revives the economy. *Frontiers in Environmental Science*, *11*, 1130173. https://doi.org/10.3389/fenvs.2023.1130173/full

Wardoyo, P. (2012). Pasar Modal. Semarang: Semarang University Press.

Widjanarko, H., & Wibawa, T. (2020). Investasi Saham. Yogyakarta: LPPM UPN Veteran.

Youssef, M., Mokni, K., & Ajmi, A. N. (2021). Dynamic connectedness between stock markets in the presence of the COVID-19 pandemic: does economic policy uncertainty matter? *Financial Innovation*, *7*(1), 1-13. https://doi.org/10.1186/s40854-021-00227-3

Yuliani, W., Usman, S., & Sudarwadi, D. (2020). Analisa Minat Investasi Pasar Modal Pada Mahasiswa FEB di Universitas Papua. *Nominal: Barometer Riset Akuntansi Dan Manajemen*, *9*(2), 150–167. https://doi.org/10.21831/nominal.v9i2.30033

Zaimovic, A., Omanovic, A., & Arnaut-Berilo, A. (2021). How many stocks are sufficient for equity portfolio diversification? A review of the literature. *Journal of Risk and Financial Management*, *14*(11), 551. https://doi.org/10.3390/jrfm14110551

Zhang, Y., & Nadarajah, S. (2018). A review of backtesting for value at risk. *Communications in Statistics-Theory and Methods*, *47*(15), 3616–3639. https://doi.org/10.1080/03610926.2017.1361984

Zhou, Y., Johansen, A. M., & Aston, J. A. D. (2016). Toward automatic model comparison: an adaptive sequential Monte Carlo approach. *Journal of Computational and Graphical Statistics*, *25*(3), 701–726. https://doi.org/10.1080/10618600.2015.1060885