

Evaluation of Stock Returns Against Systematic Risk Using the Capital Market Line (CML) Approach: An Empirical Study on LQ45 Stocks

Ni Putu Mila Suhandi, Panji Priyanto

Universitas Jakarta Internasional
Corresponding Author: panji.priyanto@jic.ac.id

Article Information:

Received: July 30, 2025, Accepted: August 18, 2025, Published: September 06, 2025

Abstract

This study aims to evaluate the performance of LQ45 stocks against systematic risk using the Capital Market Line (CML) approach. The CML, derived from the Capital Asset Pricing Model (CAPM), represents the risk-return relationship between efficient portfolios and the market portfolio, incorporating both the risk-free rate and the total risk (standard deviation). Unlike the Security Market Line (SML), which uses beta as a measure of systematic risk, the CML emphasizes total risk in the context of portfolio efficiency. This research employs a quantitative descriptive method, analyzing secondary data of LQ45 constituents listed on the Indonesia Stock Exchange (IDX) for the period from January 2023 to December 2024. The Sharpe Ratio was calculated to assess the performance of individual stocks, followed by comparison with the CML benchmark. The findings reveal that only a limited number of stocks demonstrate efficiency by lying above CML, while the majority fall below, indicating suboptimal risk-adjusted returns. These results support the theoretical proposition that in efficient markets, only well-diversified portfolios, not individual assets, can consistently align with the CML. This study contributes to the growing literature on asset pricing by emphasizing the role of total risk in portfolio evaluation and provides practical implications for investors in constructing efficient portfolios.

Keywords: Capital Market Line, Sharpe Ratio, LQ45, Systematic Risk, Stock Performance, Portfolio Efficiency, Risk-Adjusted Return

JEL : G32, M41, L21

1. Introduction

The Indonesian capital market has undergone a significant transformation over the past few years. According to reports from the World Bank and OJK, the number of retail investors has increased dramatically—particularly through the implementation of digital trading—although the market turnover ratio is still below the average for Southeast Asian countries. ([World Bank, 2024](#)). This growth has also been driven by global uncertainty and macroeconomic policies supporting financial stability ([OJK, 2024](#)).

Published by:

From a statistical perspective, the IHSG's volatility is relatively high. The data show that this index has a monthly standard deviation of $\sim 3.03\%$ and an annual standard deviation of $\sim 10.50\%$, while its annual return is around 2.72% . This disparity indicates that investors bear relatively high risks without proportional returns. ([OJK, 2024](#)). This condition raises critical questions about the efficiency of the Indonesian capital market and the rationality of investment strategies.

In financial theory, the Capital Asset Pricing Model (CAPM), developed by ([Sharpe, 1964](#)) and ([Lintner, 1965](#)), represents a linear relationship between systematic risk (beta) and expected return, visualized by the Capital Market Line (CML). However, since the early 1970s, several empirical studies have noted the existence of beta anomalies, also known as low-volatile anomalies, where stocks with low beta outperform those with high beta, contrary to CAPM predictions ([Black et al., 1972](#)).

Modern research reinforces these findings. [Baker et al. \(2011\)](#) found that low-volatile portfolios outperform the market, a phenomenon that persists across developed countries. ([Perras et al. \(2020\)](#) confirmed the effectiveness of the low-volatility strategy in the US, European, and German markets. Meanwhile, a study by ([Li et al., 2014](#)) showed that the advantage of low-volatility stocks is often quickly corrected and declines after rebalancing, suggesting limits to arbitrage.

In the Indonesian market, and studies on LQ45/JII stocks post-COVID indicate that many individual stocks deviate significantly from the expected CAPM return. However, these studies are still aggregated and have not analyzed the relative position of each stock concerning the CML. Unfortunately, most empirical studies in Indonesia still focus on testing the CAPM against aggregate indices, such as the LQ45 or JII, without considering the relative position of each stock against the Capital Market Line. Few studies explicitly measure and classify stocks based on their deviation from the CML and analyze the factors influencing a stock's outperforming or underperforming position within the CAPM framework. ([Verkino et al., 2020](#)) constructs an optimal stock investment portfolio using the Single Index Model (SIM) from LQ45 stocks across eight sectors.

Based on this phenomenon, this study aims to fill the literature gap by analyzing the position of stocks relative to the Capital Market Line and evaluating whether the CAPM model can effectively explain the performance of individual stocks in the Indonesian capital market. This study will also identify the characteristics of stocks that show superior or inferior performance based on the CAPM-CML approach and provide recommendations for more rational and data-driven investment decisions.

2. Literature Review

Capital Asset Pricing Model (CAPM) theory

The Capital Asset Pricing Model (CAPM) was a collaborative effort, refined by ([Lintner, 1965](#); [Sharpe, 1964](#)) from Markowitz's portfolio theory. This model aims to explain the relationship

between an asset's systematic risk and an investor's expected return. Within the CAPM framework, systematic risk is measured by beta (β), a measure of the sensitivity of stock returns to changes in market returns. The basic formula for the CAPM is as follows:

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f)$$

where $E(R_i)$ is the expected return on stock i , R_f is the risk-free rate of return, $E(R_m)$ is the expected market return, and β_i is the beta coefficient of the stock.

The CAPM produces two theoretical lines: the Capital Market Line (CML) when using an efficient portfolio (the optimal combination of risk-free assets and the market portfolio), and the Security Market Line (SML) when linking beta to the expected return of individual securities.

Systematic risk and stock returns

In modern financial theory, systematic risk refers to market risk that cannot be diversified and affects nearly all assets in the financial market simultaneously. This risk encompasses macroeconomic factors such as inflation, interest rates, GDP growth, fiscal and monetary policies, and political uncertainty ([Bodie, Kane, & Marcus, 2018](#)). Unlike unsystematic risk, systematic risk cannot be eliminated through portfolio diversification because it is inherent in overall market movements.

The Capital Asset Pricing Model (CAPM), introduced by [Sharpe \(1964\)](#), [Lintner \(1965\)](#), and [Mossin \(1966\)](#), states that the only relevant risk in determining stock returns is systematic risk, measured by beta (β). According to this model, the relationship between systematic risk and stock returns is linear and positive: the higher the beta of a stock, the higher the expected return to compensate for the higher level of risk.

Beta is a measure of systematic risk that cannot be diversified, unlike unsystematic risk, which can be eliminated through portfolio diversification. A beta greater than one indicates that the stock is more volatile than the market, while a beta less than 1 indicates lower volatility. In the CAPM, stocks with high beta should provide higher returns to compensate for the greater risk they entail.

However, some studies show that the relationship between beta and stock returns is not always consistent. [Fama & French \(1992\)](#) criticized the CAPM because beta is not strong enough to explain the variation in stock returns. Instead, they introduced a three-factor model that includes company size and book-to-market ratio.

Nevertheless, the CAPM approach remains an essential framework for understanding the relationship between systematic risk and stock returns, particularly in the context of portfolio performance evaluation. In a broader context, the Capital Market Line (CML) approach is used to describe the trade-off between total risk (in the form of standard deviation) and the return of an efficient portfolio consisting of risk-free assets and the market portfolio ([Smith et al., 1982](#)).

Several empirical studies also highlight the influence of systematic risk on stock performance.

[Kesse & Blenman \(2024\)](#) reveal that sovereign risk influences currency markets differently across advanced and emerging economies, with local political and macro risks playing a significant role in shaping FX returns. By double-sorting currencies based on these risks, the analysis shows that high political and macro risk combinations yield higher excess returns, particularly in emerging markets. These findings underscore the importance of local sovereign risk factors—rather than global systematic risks—in explaining currency carry trade performance and offer new insights supporting the risk-based explanation of the uncovered interest parity (UIP) puzzle.

Stock efficiency against the capital market line

The efficiency of stocks relative to the capital market line (CML) is an essential concept in modern portfolio theory and investment performance analysis. The CML, representing the relationship between expected return and total risk (standard deviation), describes the set of optimal portfolios that combine risk-free assets and market portfolios. A stock is considered efficient if it lies on or above the CML because it reflects a commensurate return compensation for the risk taken ([Sharpe, 1964](#)).

The concept of efficiency originates from the fundamental assumptions of [Markowitz \(1952\)](#), which William F. Sharpe further developed in the Capital Asset Pricing Model (CAPM). Within the CAPM framework, only systematic risk is relevant in explaining asset returns. The CML, on the other hand, compares the total risk of the portfolio with the expected return, thereby serving as a benchmark for the efficiency of an optimally diversified portfolio. Individual stocks that fall below the CML reflect inefficient conditions because they do not provide expected returns commensurate with the total risk borne by investors. In practice, stock efficiency analysis against the CML can be used as a tool for investment.

Based on the above theory and empirical findings, this study aims to test the efficiency of stocks relative to the CML in the Indonesian capital market using the CAPM approach. The hypothesis development is formulated as follows:

Hypothesis 1 (H1): There is a significant positive relationship between stock beta and LQ45 stock returns in the Indonesian capital market.

Hypothesis 2 (H2): Most LQ45 stocks on the Indonesia Stock Exchange are below the Capital Market Line, indicating market inefficiency.

Hypothesis 3 (H3): LQ45 stocks with low beta but high returns indicate a deviation from CAPM predictions (market anomaly).

These hypotheses are tested empirically through a quantitative approach by analyzing individual stock data, beta, historical returns, and the relative position of each stock to the CML over a specific period.

3. Research Method

This research employs a quantitative approach, incorporating descriptive and explanatory

methods. This approach is used to analyze the relationship between systematic risk (beta) and stock performance (measured by the Sharpe ratio, Treynor ratio, and Jensen's Alpha) within the CML and the CAPM frameworks. This study also evaluates the deviation between the actual position of LQ45 stocks and the CML as an indicator of risk-return mismatch.

The population in this study consisted of all stocks included in the LQ45 index, listed on the Indonesia Stock Exchange (IDX), during the observation period. A purposive sampling technique was used to select LQ45 stocks that met the following criteria: consistently listed in LQ45 during the period January 2023 to December 2024; not experiencing a suspension of more than 30 days in one year; have complete data regarding monthly closing prices and dividends (if any); have historical beta available from secondary sources.

The data used is secondary data obtained from monthly closing prices of shares and the IHSG: accessed via Yahoo Finance, IDX, or Bloomberg; risk-free interest rate uses the average monthly yield of 1-year government bonds from Bank Indonesia; stock beta: calculated based on historical regression against market returns (JKSE) LQ45 Index: from the IDX report.

Data was collected through documentation and literature studies from annual and quarterly financial reports; Indonesia Stock Exchange Website (www.idx.co.id); Financial databases such as Investing.com, Refinitiv Eikon, or Bloomberg; Journals and scientific articles related to CAPM, beta, and stock performance measurement.

This study uses several data analysis techniques as follows:

$$R_i = \frac{P_t - P_{t-1} + D_t}{P_{t-1}}$$

where:

P_t : closing price in month t

P_{t-1} : closing price in the previous month

D_t : dividends paid in month t

Beta is calculated from r:

$$R_i = \alpha + \beta R_m + \varepsilon$$

where:

R_i : closing price in month t

R_m : closing price in the previous month

β : dividends paid in month t

Stock performance measurement:

Sharpe ratio:

$$SR = \frac{R_i - R_f}{\sigma_i}$$

Treynor:

$$TR = \frac{R_i - R_f}{\beta_i}$$

Je:

$$\alpha_i = R_i - [R_f + \beta_i(R_m - R_f)]$$

4. Findings and Discussions

Based on Table 1, it is evident that the Composite Stock Price Index (IHSG), serving as a market proxy, recorded an annual return of 2.72% with an annual standard deviation of 10.50%. This figure indicates that market risk is relatively high, but relatively low returns offset it. This reflects a volatile market environment during the observation period, driven by global economic uncertainty, fluctuations in commodity prices, and changes in investor behavior following the pandemic.

Table 1 Standard deviation and annual returns of LQ45 stocks

Stock code	Annual Standard Deviation	Annual Return
JKSE	0.105027653	2.72%
ACES	0.435387335	9.72%
ADMR	0.302053979	-11.76%
ADRO	0.535371676	2.10%
AKRA	0.229441241	-24.07%
AMMN	0.399660535	29.39%
AMRT	0.248716299	-2.73%
ANTM	0.30707567	-10.56%
ARTO	0.370532503	-16.21%
ASII	0.231623223	-13.27%
BBCA	0.123173048	2.93%
BBNI	0.287441728	-19.07%
BBRI	0.292709325	-28.73%
BBTN	0.288289341	-8.80%
BMRI	0.271117727	-5.79%
BRIS	0.45785312	56.90%
BRPT	0.33297932	-30.72%
BUKA	0.29998613	-42.13%
CPIN	0.265999649	-5.27%

ESSA	0.417318287	52.83%
EXCL	0.22495361	12.50%
GOTO	0.441785972	-18.60%
ICBP	0.221876547	7.57%
INCO	0.312707054	-16.01%
INDF	0.170486021	19.38%
INKP	0.241830018	-18.32%
INTP	0.273927463	-21.28%
ISAT	0.265342144	5.81%
ITMG	0.174511172	4.09%
JSMR	0.237708157	-11.09%
KLBF	0.170440388	-15.53%
MAPI	0.397851031	-21.23%
MBMA	0.431575133	-18.21%
MDKA	0.41898395	-40.19%
MEDC	0.228632034	-4.76%
MTEL	0.184374675	-8.51%
PGAS	0.305520896	40.71%
PGEO	0.25822894	-20.09%
PTBA	0.323770129	12.70%
SIDO	0.337868745	12.38%
SMGR	0.346653886	-48.59%
SMRA	0.319090491	-14.78%
TLKM	0.219432152	-31.39%
TOWR	0.267997678	-33.84%
UNTR	0.221435965	18.34%
UNVR	0.328009426	-46.60%

Stocks in the LQ45 index exhibit significant variation in terms of returns and risk. Some stocks demonstrate exceptional performance, such as: BRIS with the highest annual return of 56.90% and a standard deviation of 0.4579. ESSA with a return of 52.83% and a risk of 0.4173. PGAS with a return of 40.71% and a risk of 0.3055. AMMN with a return of 29.39% and a risk of 0.3997. INDF also showed positive performance with a return of 19.38% and relatively low risk of 0.1705. These stocks are far above the IHSG, both in terms of return and volatility, indicating their potential as outperforming stocks when compared to the Capital Market Line (CML).

On the other hand, there are stocks with significant negative performance, including: SMGR: return of -48.59% with a standard deviation of 0.3467. UNVR: return of -46.60% with a risk of

0.3280. MDKA: return of -40.19%, risk of 0.4189. BUKA: return of -42.13%, risk of 0.2999. TOWR and TLKM also recorded negative returns above 30% despite being classified as blue-chip stocks with large market capitalization. The significant difference between returns and risk indicates an anomaly in the CAPM, where the linear relationship between risk and return is not fully reflected in the Indonesian capital market, particularly in LQ45 stocks.

Visualizing the distribution of stocks against the Capital Market Line (CML) indicates that not all high-risk stocks provide comparable returns. Some stocks with low standard deviations tend to generate higher returns than those with high risk. For example, INDF stock, with a standard deviation of only 0.1705, delivered a positive return of 19.38%, while ADRO, with a high risk of 0.5354, only returned 2.10%. This reinforces the suspicion that the market is not yet fully efficient in compensating for risk through returns, or that there are other factors outside the CAPM model that influence stock returns, such as momentum, investor sentiment, and the fundamental conditions of each issuer.

Figure 1 shows the distribution of LQ45 stocks against the Capital Market Line (CML) based on annual return and annual standard deviation data. The CML line in this graph represents the efficient combination of risk and market return, assuming that investors can invest in risk-free and market portfolios. However, the graph shows that most stocks are distributed below the CML, indicating that the returns obtained are not commensurate with the risks incurred. Theoretically, in the CAPM model, stocks above the CML are categorized as outperforming or efficient, while those below the CML are considered underperforming or inefficient in terms of risk-return.

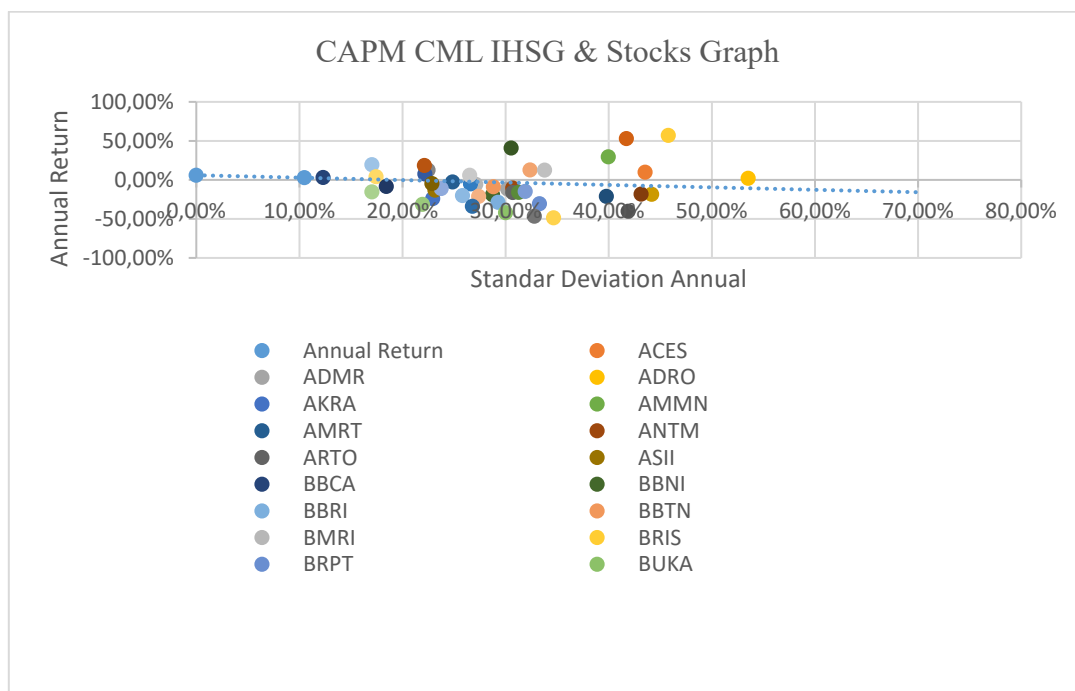


Figure 1 distribution of LQ45 stocks against the Capital Market Line (CML)

Source: Author's Calculation

Some stocks stand out due to their positions far above the CML line: BRIS (Bank Syariah Indonesia) with a return of 56.90% and a standard deviation of 0.4579, far exceeding the market return. ESSA and PGAS recorded returns of 52.83% and 40.71%, respectively, with risk still within the medium range. AMMN and IND also fall into this category, as they generate high returns with relatively measurable risk. These stocks demonstrate high efficiency in generating returns that exceed the markets with an acceptable level of risk.

On the other hand, many stocks are far below the CML. Examples include: UNVR, SMGR, and MDKA experienced sharp declines in returns of -46.60%, -48.59%, and -40.19%, respectively. TLKM, TOWR, and BBRI also showed significant negative returns despite having moderate risk. The positions of these stocks reflect inefficiency in converting risk into returns. This could be due to various external factors such as macroeconomic pressures, declining fundamental performance of companies, or negative market sentiment. The data distribution that does not follow the theoretical CAPM pattern reinforces the indication that the CAPM model does not fully explain the behavior of the Indonesian capital market. The expected linear relationship between risk and return through the CML is not well reflected, and the regression line in this graph tends to decline, contrary to CAPM expectations.

The results of this study indicate that most stocks in the LQ45 index during the observation period were not on the CML, which theoretically represents an efficient portfolio combining risk-free assets and the market portfolio. This suggests that most stocks do not generate excess returns commensurate with the total risk (standard deviation) they entail. This finding strengthens the argument that not all stocks in leading indices, such as the LQ45, promise efficient performance from the perspective of rational investors, as referenced in Markowitz (1952) portfolio theory and the CML version of the CAPM developed by (Sharpe, 1964).

Theoretically, the Capital Market Line (CML) approach assesses investment performance based on a linear relationship between expected return and total risk. The CML differs from the Security Market Line (SML), which uses beta (systematic risk) as the basis for evaluation. Therefore, stocks that fall outside the CML are considered underperforming because they do not provide adequate returns relative to their total risk. This finding aligns with the theory that an efficient portfolio should lie along the CML, where investors receive optimal compensation for risk ([D. J. Smith, 2008](#)).

Several stocks, such as TLKM, UNVR, and BBRI, are positioned close to or even above the CML line, reflecting efficient performance. These stocks are capable of generating relatively high returns with relatively controlled volatility (σ), in line with rational investor preferences within the mean-variance framework. This is consistent with previous research by [Verkino et al. \(2020\)](#), which showed that non-cyclical infrastructure and consumer stocks in the LQ45 tend to provide more stable returns with controlled risk. Additionally, performance evaluation using Sharpe, Treynor, and Jensen's ratios indicates the portfolio provides superior risk-adjusted returns relative to the market, demonstrating its effectiveness for investors seeking optimal returns.

Conversely, stocks far from the CML, such as BRPT, INDY, and EMTK, exhibit inefficiency, meaning their returns are lower than the total risk borne by investors. These results support the findings of [Septiani & Supadmi \(2014\)](#), who revealed that stocks with high volatility in the energy and technology sectors tend to be undervalued when assessed from a total risk perspective, but can be overvalued when only using systematic risk (beta) as in the SML.

Furthermore, these results vindicate criticism of classical CAPM, which considers beta as the sole measure of risk. Contemporary literature, such as [Fama & French \(1996\)](#) and Lintner (2005), emphasizes the importance of considering factors beyond beta, including total risk, firm size, and book-to-market value. Therefore, the use of CML in this study is relevant because it integrates total risk, which includes both systematic and unsystematic risk.

Empirically, this approach provides a more comprehensive picture of stock performance, especially in markets that are not yet fully efficient, such as Indonesia. Consistent with a study by [Ibrahim et al. \(2017\)](#), the CML approach is better able to distinguish between efficient and inefficient stocks in the LQ45 index than the SML approach, as it considers the overall actual risks faced by investors.

5. Conclusion

This study aims to evaluate the efficiency of LQ45 stocks on the Indonesia Stock Exchange based on the Capital Market Line (CML) approach, which considers total risk (standard deviation) in the context of efficient portfolios. Using the Sharpe ratio as the primary indicator to measure risk-adjusted performance, the results show that only a small portion of LQ45 stocks have a Sharpe Ratio exceeding the Capital Market Line (CML), thereby qualifying as efficient stocks. The majority of other stocks are below CML, indicating that their performance is not yet optimal in terms of risk-adjusted return.

This finding reinforces the Capital Asset Pricing Model (CAPM) theory and Markowitz's portfolio principle, which states that only optimally diversified portfolios can be on or above the CML. Therefore, investors are advised to focus more on forming efficient portfolios rather than relying solely on individual stock selection. This study also emphasizes that total risk, not just systematic risk (beta), plays a crucial role in determining stock efficiency within the CML framework.

References

- Baker, M., Bradley, B., & Wurgler, J. (2011). Benchmarks as limits to arbitrage: Understanding the low-volatility anomaly. *Financial Analysts Journal*, 67(1). <https://doi.org/10.2469/faj.v67.n1.4>

- Black, F., Jensen, M. C., & Scholes, M. (1972). The Capital Asset Pricing Model: Some Empirical Tests. *Studies in the Theory of Capital Markets*, 81. <https://doi.org/10.2139/ssrn.908569>
- Bodie, Z., Kane, A., & Marcus, A. J. (2018). *Investments*. McGraw-Hill Education.
- Fama, E. F., & French, K. R. (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance*, 47(2). <https://doi.org/10.2307/2329112>
- Ibrahim, M. I., Titaley, J., & Manurung, T. (2017). Analisis Keakuratan Capital Asset Pricing Model (CAPM) dan Arbitrage Pricing Theory (APT) dalam Memprediksi Expected Saham pada LQ45. *D'CARTESIAN*, 6(1). <https://doi.org/10.35799/dc.6.1.2017.15837>
- Kesse, K., & Blenman, L. P. (2024). Political risks, excess and carry trade returns in global markets. *International Review of Financial Analysis*, 91. <https://doi.org/10.1016/j.irfa.2023.102906>
- Li, X., Sullivan, R. N., & Garcia-Feijóo, L. (2014). The limits to arbitrage and the low-volatility anomaly. *Financial Analysts Journal*, 70(1). <https://doi.org/10.2469/faj.v70.n1.3>
- Lintner, J. (1965). The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. *The Review of Economics and Statistics*, 47(1). <https://doi.org/10.2307/1924119>
- Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance*, 7(1), 77. <https://doi.org/10.2307/2975974>
- Mossin, J. (1966). Equilibrium in a Capital Asset Market. *Econometrica*, 34(4). <https://doi.org/10.2307/1910098>
- OJK. (2024). *Indonesia Financial Sector Development Q3 2024 Report*. <https://ojk.go.id/IRU>
- Perras, P. J., Reberger, A., & Wagner, N. F. (2020). The low-volatility anomaly revisited. *Credit and Capital Markets*, 53(2). <https://doi.org/10.3790/ccm.53.2.221>
- Septiani, N. N. D., & Supadmi, N. L. (2014). Analisis pengaruh beta terhadap return saham periode sebelum dan saat krisis global (studi pada perusahaan perbankan di BEI). *E-Jurnal Akuntansi Universitas Udayana*, 7(1).
- Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *The Journal of Finance*, 19(3). <https://doi.org/10.2307/2977928>
- Smith, D. J. (2008). Moving from an Efficient to a Behavioral Market Hypothesis. *Journal of Behavioral Finance*, 9(2). <https://doi.org/10.1080/15427560802093589>
- Smith, K. V., Elton, E. J., & Gruber, M. J. (1982). Modern Portfolio Theory and Investment Analysis. *The Journal of Finance*, 37(5). <https://doi.org/10.2307/2327857>
- Verkino, B., Sinaga, B. M., & Andati, T. (2020). Portofolio Optimal Investasi Saham dari 6 Sektor pada Indeks LQ45 Periode 2015-2018. *Jurnal Aplikasi Bisnis Dan Manajemen*. <https://doi.org/10.17358/jabm.6.2.389>
- World Bank. (2024). *The World Bank Group Indonesia Financial Sector Assessment Program Technical Note Long Term Finance and Capital Markets Development*. Prepared By. www.worldbank.org/fsap.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>)

