Sharpe vs Treynor: Strategies for evaluating stock portfolio performance on the Indonesian Stock Exchange

[1]*Thersia M M Da Silva, [2]Petrus E de Rozari, [3]Darwin Zebua, [4]Efandri Agustian

[1,2,3,4] Department of Management, Faculty of Economics and Business, University of Nusa Cendana - Indonesia

e-mail:
[1]thersiadasilva@gmail.com *(corresponding author)*
[2]petrus.rozari@staf.undana.ac.id
[3]darwin.zebua@staf.undana.ac.id
[4]efandri.agustian@staf.undana.ac.id

ABSTRACT

This study investigates whether the Sharpe Ratio and Treynor Ratio produce significantly different portfolio performance rankings in the Indonesian stock market. A quantitative research design was employed using a sample of 11 large-capitalization companies representing each IDX-IC sector listed on the Indonesia Stock Exchange during the 2020–2024 period. An optimal portfolio was constructed under a 0%–30% asset allocation constraint, and portfolio performance was assessed using the Sharpe Ratio and Treynor Ratio. Differences in portfolio rankings were examined through descriptive, comparative, and paired t-test analyses. The optimized portfolio generated an expected return of 74.60%, with a Sharpe Ratio of 5.60 and a Treynor Ratio of 0.0697. The paired t-test yielded a p-value of 0.331, indicating no statistically significant difference between the rankings produced by the two performance measures. These findings suggest that, for well-diversified portfolios in which unsystematic risk has been effectively diversified away, the Sharpe Ratio and Treynor Ratio provide comparable assessments of investment performance. This study extends the evidence on risk-adjusted portfolio evaluation in an emerging market context and provides practical implications for investors and portfolio managers in selecting appropriate performance measurement approaches.

Keywords: *Sharpe Ratio; Treynor Ratio; Portofolio Performance; Indonesian Stock Exchange*

INTRODUCTION

The significant development of the Indonesian capital market in recent years, characterized by a surge in the number of domestic investors from around 4 million at the end of 2019 to more than 10 million at the end of 2022 (Indonesia Stock Exchange, 2023), is accompanied by high volatility due to global macroeconomic factors, domestic political conditions, and issuer performance (Tandellin, 2010), as well as the behavior of beginner investors who tend to focus on absolute returns without considering risk, potentially leading to losses (Barber & Odean, 2013; Sari & Pratama, 2021), affirming the need for performance measurement tools that accommodate the risk dimension as emphasized in Modern Portfolio Theory (Markowitz, 1952). In this context, portfolio performance measurement using risk-adjusted methods such as the Sharpe Ratio and Treynor Ratio becomes crucial, although the consistency of the two in providing performance rankings remains an academic debate with varied findings (Claransia & Sugiharto, 2021; Nurlaeli & Artati, 2020; Lestari, 2017; Prasetyo & Nugroho, 2018).

Based on this research gap, this study analyzes the difference in the performance rankings of a diversified portfolio consisting of 11 leading stocks and examines whether that there is no statistically significant difference between the rankings from the two methods This research test the proposition that for a well-diversified portfolio, the two performance measurement methods can be used interchangeably because unsystematic risk has been successfully minimized, thus making total risk (measured by Sharpe) and systematic risk (measured by Treynor) aligned.

This study aims to empirically test whether the Sharpe and Treynor Ratios produce significantly different portfolio performance rankings during 2020–2024, and to validate MPT's diversification effectiveness in Indonesia—such that the two measures become interchangeable once unsystematic risk is sufficiently mitigated. Theoretically, it contributes to emerging-market literature on risk-adjusted performance measures. Practically, it provides guidance for investors and analysts in selecting appropriate metrics, while also offering regulators (OJK and IDX) insights to strengthen risk-based investor education and enhance domestic resilience against global market volatility.

LITERATURE REVIEW

Investment and Portofolio

Investment is fundamentally the commitment of funds with the expectation of future profit and is a crucial tool for wealth accumulation (Santoso et al., 2023; Rianto et al., 2023). Its main principle is the linear relationship between risk and expected return, where higher potential rewards require accepting greater uncertainty. Key instruments include stocks and bonds, and Modern Portfolio Theory (Markowitz, 1952) establishes that combining these assets into a diversified portfolio is the most effective method for mitigating risk without sacrificing returns, with the aim of achieving an "efficient" portfolio. The success of investment decisions is then evaluated using risk-adjusted performance measures such as the Sharpe, Treynor, and Jensen ratios, which provide a more complete picture by assessing returns in the context of the risks undertaken.

Modern Portfolio Theory – MPT

Modern Portfolio Theory (MPT), developed by Harry Markowitz, is a fundamental framework that introduced a quantitative approach to portfolio construction (Rianto et al., 2023). Its core principle emphasizes that investors must evaluate a portfolio based on its expected return and overall risk, measured by the variance or standard deviation of returns. The revolutionary insight of MPT lies in the critical role of diversification, which

shows that a portfolio's risk depends on the covariance or correlation between its assets; by combining assets with low or negative correlation, investors can create a portfolio with a total risk lower than the weighted average risk of its individual components, aiming to form an "efficient portfolio" that constitutes the "efficient frontier". This theory shifted the paradigm from analyzing individual securities to optimizing the portfolio as a whole, establishing that a risky asset can actually reduce the overall risk of a portfolio if its price movements are uncorrelated with other assets, embodying the principle of not putting all your eggs in one basket (Desiyanti, 2017).

Capital Asset Pricing Model – CAPM

The Capital Asset Pricing Model (CAPM) is an equilibrium model that links an asset's expected return to its systematic risk (beta), asserting that investors are only compensated for market risk since unsystematic risk can be diversified away (Desiyanti, 2017; Santoso et al., 2023). Beta (β) measures a security's sensitivity to market movements, where $\beta > 1$ indicates higher volatility than the market and $\beta < 1$ indicates lower volatility (Bodie et al., 2014). The model posits that required return equals the risk-free rate plus a risk premium based on beta, represented graphically by the Security Market Line (SML) (Sharpe, 1964). Despite empirical challenges to its assumptions, CAPM remains a fundamental tool in finance for determining required returns, evaluating security pricing, assessing portfolio performance, and informing capital budgeting decisions by providing a crucial framework for understanding the risk-return trade-off.

Portfolio Performance Measurement

Sharpe Ratio

The Sharpe Ratio was developed by William Sharpe in 1966 and is often referred to as the reward-to-variability ratio (Sharpe,1964). The calculation of the Sharpe Ratio is based on the concept of the Capital Market Line (CML) as a benchmark, which is done by dividing the portfolio's risk premium by its standard deviation. Therefore, the Sharpe Ratio can be used to measure the risk premium for each unit of risk in that portfolio (Bodie et al., 2014).

Treynor Ratio

The Treynor Ratio is a portfolio performance measure developed by Jack Treynor in 1965, often referred to as the reward-to-volatility ratio (Treynor, 1965). Similar to the Sharpe Ratio, the Treynor Ratio evaluates portfolio performance by linking the portfolio's return level with its risk magnitude. The difference from the Sharpe Ratio lies in its use of the Security Market Line (SML) as a benchmark, rather than the Capital Market Line used in the Sharpe Ratio (Bodie et al., 2014).

METHOD

This study employs a quantitative design with an explanatory research approach (Sugiyono, 2017). The research design is structured to analyze the comparison of stock portfolio performance using two different measurement methods, namely the Sharpe Ratio and the Treynor Ratio. The research is conducted through several systematic stages, starting from the Construction of an optimal portfolio, calculation of portfolio performance, to statistical hypothesis testing (Creswell, 2014).

The population in this study comprises all companies listed on the Indonesia Stock Exchange (IDX) during the 2020-2024 period. The study employed a purposive sampling tecnique, applying the following selection criteria (Creswell, 2014):

1. Companies actively listed on the IDX throughout the research period.
2. Possess complete financial reports for the years 2020-2024.
3. Represent the company with the largest market capitalization in each IDX-IC sector.
4. Focus on one main business sector.

Based on these criteria, 11 companies were selected as research samples, representing all IDX-IC sectors. Table 1 presents the complete list of these selected companies along with their respective market capitalizations and sector classifications.

Table 1
Research Sample

No	IDX-IC Sector	Company According to Criteria	Market Capitalization
1	Energy (IDXEnergy	PT Bayan Resources Tbk.	Rp. 610 Trillion
2	Basic Materials (IDXBasic)	PT. Chandra Asri Petrochemical Tbk.	Rp. 683.381 Trillion
3	Industrials (IDXIndust)	PT Astra Internasional Tbk.	Rp. 229.774 Trillion
4	Consumer Non-Cyclicals (IDXNoncyc)	PT Unilever Indonesia Tbk.	Rp. 67.716 Trillion
5	Consumer Cyclicals (IDXCyclic)	MD Pictures Tbk.	Rp. 52.696 Trillion
6	Healthcare (IDXHealth)	PT Kalbe Farma Tbk.	Rp. 154.018 Trillion
7	Financials (IDXFinance)	PT Bank Central Asia Tbk.	Rp. 970.568 Trillion
8	Properties & Real Estate (IDXPropert)	Metropolitan Kentjana Tbk.	Rp. 24.006 Trillion
9	Technology (IDXTechno)	PT M Cash Integrasi	Rp. 685,39 Billion
10	Infrastructures (IDXInfra)	PT Indosat Tbk.	Rp. 715.064 Trillion
11	Transportation & Logistic (IDXTrans)	PT Samudera Indoensia Tbk.	Rp. 9.306 Trillion

Source: Yahoo Finance per 17 September 2025

The data collection technique used is documentation study by gathering quantitative secondary data. This data is collected from reliable sources, namely the Indonesia Stock Exchange (www.idx.co.id), Yahoo Finance, Investing, and the Indonesian Central Securities Depository (KSEI).

The data analysis technique used in this research is conducted through several stages, namely:

1. Construction of Optimal Portfolio
   Using the Markowitz (1952) approach with three optimization scenarios:
   - Scenario 1: Equal weight allocation (9.09% per stock)

     The equal-weight approach in this scenario represents a passive investment strategy that adopts the philosophy of a market portfolio, with the main assumptions of perfect market efficiency and the absence of superior investor information. The rationale for selecting this scenario includes: the elimination of subjective bias in the stock selection process, the application of naive diversification as a simple yet comprehensive form of diversification, its function as a benchmark to measure the value added by more complex optimization strategies, and its reflection of the profile of a passive investor with moderate risk tolerance who prioritizes ease of implementation and portfolio stability.
   - Scenario 2: Allocation constraint of 5%-25%

     This scenario employs moderate diversification with 5%-25% allocation constraints, reflecting a prudent balance between risk management and optimization potential. The 25% maximum limit prevents excessive concentration in any single

asset, while the 5% minimum ensures meaningful contributions from each component without causing portfolio fragmentation. This approach represents practical risk management suitable for conservative to moderate investors seeking equilibrium between return potential and risk control in their investment strategy.

- Scenario 3: Allocation constraint of 0%-30%

  This scenario employs a full optimization strategy with 0%-30% allocation limits, enabling the exclusion of underperforming stocks and concentrated positions in superior performers. Designed to approach Markowitz's efficient frontier, this approach aims for maximum risk-adjusted returns and reflects the profile of aggressive, growth-focused investors who maintain risk discipline through rational allocation constraints.

2. Portfolio Performance Calculation

   Using two main methods:

- Sharpe Ratio (Sharpe, 1966):

$$SR = \frac{R_p - R_f}{\sigma_p}$$

This formula measures the excess return per unit of total risk. A higher SR indicates better performance after adjusting for total risk.

Note:

R_p : Portfolio Return

R_f: Risk-free Rate

σ_p : Portfolio Standard Deviation

- Treynor Ratio (Treynor,1965):

$$TR = \frac{R_p - R_f}{\beta_p}$$

This formula measures the excess return per unit of systematic risk. A higher TR indicates better performance after adjusting for market risk.

Note :

R_p : Portfolio Return

R_f: Risk-free Rate

β_p : Portfolio Beta (Systematic Risk)

3. Two-Sample Difference Test

   This test is conducted in 2 ways:

- Normality Test using the Kolmogorov-Smirnov Test to ensure the data is normally distributed.
- Paired t-test to test for significant differences between the Sharpe Ratio and Treynor Ratio.

With the statistical hypotheses as follows:

- H_0: There is no significant difference between portfolio performance rankings using the Sharpe Ratio and the Treynor Ratio.
- H_1: There is a significant difference between portfolio performance rankings using the Sharpe Ratio and the Treynor Ratio.

All data analysis was conducted using Microsoft Excel, which provided significant contributions across various computational aspects. The software was utilized for scenario calculations to simulate different market conditions and potential risks, mean-variance-covariance computations as the foundation of modern portfolio analysis, and

paired T-test analysis to compare significant differences between two related samples, thereby delivering accurate and efficient statistical insights for the investment decision-making process.

RESULTS AND DISCUSSION

Optimal Portfolio Construction

Based on Markowitz's Modern Portfolio Theory, this research constructs an optimal portfolio by emphasizing risk management through diversification using imperfectly correlated assets to reduce unsystematic risk. The objective is to identify asset combinations on the efficient frontier that deliver either the highest return for a specific risk level or the lowest risk for a target expected return, resulting in a sophisticated portfolio that maximizes return compensation per risk unit undertaken.

The two main performance measurements used to evaluate the optimal portfolio are:

- Sharpe Ratio (Sharpe, 1966): Measures excess return per unit of total risk
- Treynor Ratio (Treynor, 1965): Measures excess return per unit of systematic risk.

The optimal portfolio Construction process is as follows:

a. Calculation of Individual Stock Expected Return

The expected return is calculated based on the average monthly return of each stock during the research period (2020-2024), then annualized using the formula:

$$Expected\ return\ =\ Average\ Monthly\ Return \times\ 12$$

Note:
Expected return: Calculated for each stock using monthly return data from the 2020-2024 period (60 months).

The annualized expected returns for the individual stocks, computed from the average monthly returns over the 60-month period, are summarized in Table 2, revealing a wide variation in performance across the sample.

Table 2
Expected Return

BYAN	76.25%
TPIA	43.50%
ASII	-0.40%
UNVR	-25.49%
FILM	102.04%
KLBF	0.82%
BBCA	9.81%
MKPI	21.49%
MCAS	13.08%
ISAT	31.17%
SMDR	55.89%

Source: Data Processing Results in Ms. Excel 2021, 2025

Based on the 2020-2024 expected return data, a very wide variation in performance is observed among the leading stocks. FILM recorded the highest return at 102.04%, followed by BYAN (76.25%) and SMDR (55.89%), indicating exceptionally strong performance. On the other hand, several stocks such as MCAS (13.08%) and BBCA (9.81%) showed moderate performance, while ASII (-0.40%) and particularly UNVR (-

25.49%) experienced declines. This significant return variation, ranging from -25.49% to over 100%, not only reflects different risk profiles but also creates opportunities to form a diversified portfolio to optimize returns while managing risk.

Calculation of Three Optimization Scenarios

This study employs the Markowitz mean-variance optimization model to construct efficient portfolios using Microsoft Excel Solver. To test the model's robustness, three optimization scenarios with different allocation constraints were analyzed. Solver was utilized to compute complex variance-covariance matrices to identify the optimal asset allocation that maximizes portfolio return at each specified risk level, thereby producing optimal portfolios consistent with modern portfolio theory.

1) Scenario 1: Equal Weight

The first scenario in this study applies an equal weight approach to allocating capital. In this scenario, investment funds are allocated equally to each stock in the portfolio. Assuming there are 11 stocks, the weight or allocation portion for each stock is 100% divided by 11, which is 9.09% per stock. The portfolio composition under this equal-weight scenario, with each of the 11 stocks receiving a 9.09% allocation, is presented in Table 3.

Table 3
Scenario 1: Equal Weight

Var/Cov Matriks	Weights	BYAN	TPIA	ASII	UNVR	FILM	KLBF	BBCA	MKPI	MCAS	ISAT	SMDR
		9.09%	9.09%	9.09%	9.09%	9.09%	9.09%	9.09%	9.09%	9.09%	9.09%	9.09%
BYAN	9.09%	0.054830	-0.000002	-0.000002	-0.000005	-0.000001	-0.000004	-0.000002	-0.000005	0.000000	0.000001	-0.000003
TPIA	9.09%	-0.000002	0.032164	0.000001	-0.000003	-0.000002	-0.000011	0.000001	0.000003	-0.000003	0.000001	0.000002
ASII	9.09%	-0.000002	0.000001	0.007961	0.000001	0.000000	0.000001	0.000001	0.000002	0.000000	0.000004	0.000001
UNVR	9.09%	-0.000005	-0.000003	0.000001	0.005727	-0.000006	0.000131	0.000000	0.000003	-0.000015	0.000003	-0.000005
FILM	9.09%	-0.000001	-0.000002	0.000000	-0.000006	0.076261	0.000002	0.000000	0.000000	0.000003	0.000000	0.000001
KLBF	9.09%	-0.000004	-0.000011	0.000001	0.000131	0.000002	0.003121	0.000000	0.000001	0.000001	-0.000002	0.000003
BBCA	9.09%	-0.000002	0.000001	0.000001	0.000000	0.000000	0.000000	0.002693	0.000001	0.000000	0.000002	0.000002
MKPI	9.09%	-0.000005	0.000003	0.000002	0.000003	0.000000	0.000001	0.000001	0.018383	-0.000001	0.000003	0.000002
MCAS	9.09%	0.000000	-0.000003	0.000000	-0.000015	0.000003	0.000001	0.000000	-0.000001	0.046965	0.000000	0.000000
ISAT	9.09%	0.000001	0.000001	0.000004	0.000003	0.000000	-0.000002	0.000002	0.000003	0.000000	0.050873	0.000002
SMDR	9.09%	-0.000003	0.000002	0.000001	-0.000005	0.000001	0.000003	0.000002	0.000002	0.000000	0.000002	0.036115
Contribution to Var		0.000453	0.000266	0.000066	0.000048	0.000630	0.000027	0.000022	0.000152	0.000388	0.000421	0.000299

Source: Data Processing Results in Ms. Excel 2021, 2025

Scenario 1 (Equal Weight) serves as a baseline portfolio with equal allocation across all stocks to avoid subjective bias, reflecting passive investors who prioritize diversification, cost efficiency, and ease of management. Its main advantage is minimizing asset selection error risk. In this study, its performance will benchmark whether more complex optimization strategies provide significant added value compared to this simple passive approach.

2) Scenario 2: Allocation Constraint (5%-25%)

The second scenario applies strict allocation constraints to create a well-diversified and controlled-risk portfolio. In this scenario, each stock in the portfolio is constrained with a minimum allocation of 5% and a maximum allocation of 25%. Following the optimization process with the 5%–25% boundaries, Table 4 reports the final asset allocation across the portfolio.

Table 4
Scenario 2: Allocation Constraint (5%-25%)

Var/Cov Matriks	Weights	BYAN	TPIA	ASII	UNVR	FILM	KLBF	BBCA	MKPI	MCAS	ISAT	SMDR
		25.00%	5.00%	5.00%	5.00%	25.00%	5.00%	5.00%	5.00%	5.00%	5.00%	10.00%
BYAN	25.00%	0.054830	-0.000002	-0.000002	-0.000005	-0.000001	-0.000004	-0.000002	-0.000005	0.000000	0.000001	-0.000003
TPIA	5.00%	-0.000002	0.032164	0.000001	-0.000003	-0.000002	-0.000011	0.000001	0.000003	-0.000003	0.000001	0.000002
ASII	5.00%	-0.000002	0.000001	0.007961	0.000001	0.000000	0.000001	0.000001	0.000002	0.000000	0.000004	0.000001
UNVR	5.00%	-0.000005	-0.000003	0.000001	0.005727	-0.000006	0.000131	0.000000	0.000003	-0.000015	0.000003	-0.000005
FILM	25.00%	-0.000001	-0.000002	0.000000	-0.000006	0.076261	0.000002	0.000000	0.000000	0.000003	0.000000	0.000001
KLBF	5.00%	-0.000004	-0.000011	0.000001	0.000131	0.000002	0.003121	0.000000	0.000001	0.000001	-0.000002	0.000003
BBCA	5.00%	-0.000002	0.000001	0.000001	0.000000	0.000000	0.000000	0.002693	0.000001	0.000000	0.000002	0.000002
MKPI	5.00%	-0.000005	0.000003	0.000002	0.000003	0.000000	0.000001	0.000001	0.018383	-0.000001	0.000003	0.000002
MCAS	5.00%	0.000000	-0.000003	0.000000	-0.000015	0.000003	0.000001	0.000000	-0.000001	0.046965	0.000000	0.000000
ISAT	5.00%	0.000001	0.000001	0.000004	0.000003	0.000000	-0.000002	0.000002	0.000003	0.000000	0.050873	0.000002
SMDR	10.00%	-0.000003	0.000002	0.000001	-0.000005	0.000001	0.000003	0.000002	0.000002	0.000000	0.000002	0.036115
Contribution to Var		0.003427	0.000080	0.000020	0.000014	0.004766	0.000008	0.000007	0.000046	0.000117	0.000127	0.000361

Source: Data Processing Results in Ms. Excel 2021, 2025

Scenario 2 forms a portfolio with 5%-25% allocation constraints per stock to balance return potential and risk control, suitable for conservative to moderate investors. The 5% minimum ensures meaningful asset contribution without excessive fragmentation, while the 25% maximum prevents risk concentration. Optimization results show three stocks (BYAN, FILM, SMDR) received above-minimum allocations, creating dynamic diversification that reflects prudent principles and long-term investment discipline.

3) Scenario 3: Allocation Constraint (0%-30%)

The third scenario is designed to provide maximum flexibility to the optimization model in forming the portfolio. Unlike the previous scenarios, this scenario applies a minimum allocation of 0% and a maximum allocation of 30% for each stock. This can be seen in Table 5.

Tabel 5.
Scenario 3: Allocation Constraint (0%-30%)

Var/Cov Matriks	Weights	BYAN	TPIA	ASII	UNVR	FILM	KLBF	BBCA	MKPI	MCAS	ISAT	SMDR
		30.00%	10.00%	0.00%	0.00%	30.00%	0.00%	0.00%	0.00%	0.00%	0.00%	30.00%
BYAN	30.00%	0.054830	-0.000002	-0.000002	-0.000005	-0.000001	-0.000004	-0.000002	-0.000005	0.000000	0.000001	-0.000003
TPIA	10.00%	-0.000002	0.032164	0.000001	-0.000003	-0.000002	-0.000011	0.000001	0.000003	-0.000003	0.000001	0.000002
ASII	0.00%	-0.000002	0.000001	0.007961	0.000001	0.000000	0.000001	0.000001	0.000002	0.000000	0.000004	0.000001
UNVR	0.00%	-0.000005	-0.000003	0.000001	0.005727	-0.000006	0.000131	0.000000	0.000003	-0.000015	0.000003	-0.000005
FILM	30.00%	-0.000001	-0.000002	0.000000	-0.000006	0.076261	0.000002	0.000000	0.000000	0.000003	0.000000	0.000001
KLBF	0.00%	-0.000004	-0.000011	0.000001	0.000131	0.000002	0.003121	0.000000	0.000001	0.000001	-0.000002	0.000003
BBCA	0.00%	-0.000002	0.000001	0.000001	0.000000	0.000000	0.000000	0.002693	0.000001	0.000000	0.000002	0.000002
MKPI	0.00%	-0.000005	0.000003	0.000002	0.000003	0.000000	0.000001	0.000001	0.018383	-0.000001	0.000003	0.000002
MCAS	0.00%	0.000000	-0.000003	0.000000	-0.000015	0.000003	0.000001	0.000000	-0.000001	0.046965	0.000000	0.000000
ISAT	0.00%	0.000001	0.000001	0.000004	0.000003	0.000000	-0.000002	0.000002	0.000003	0.000000	0.050873	0.000002
SMDR	30.00%	-0.000003	0.000002	0.000001	-0.000005	0.000001	0.000003	0.000002	0.000002	0.000000	0.000002	0.036115
Contribution to Var		0.004934	0.000322	0.000000	0.000000	0.006863	0.000000	0.000000	0.000000	0.000000	0.000000	0.003250

Source: Data Processing Results in Ms. Excel 2021, 2025

Scenario 3 forms a highly selective portfolio with 0%-30% allocation constraints, reflecting aggressive investor characteristics. The optimization model allocates all capital to only four "winning stocks": BYAN, FILM, and SMDR each receive the maximum 30% allocation, and TPIA gets 10%, while the other seven stocks are eliminated with 0% allocation. This decision is purely based on mathematical calculations to maximize the portfolio's expected return. This scenario embodies a strategy of high concentration on the best assets and prioritizes full capital efficiency, making it suitable for investors who strongly believe in the optimization model, prioritize maximum growth, and are willing to accept higher risk with a minimally diversified portfolio.

Portfolio Risk Calculation

Risk measurement in portfolio optimization depends on how stocks move together, not just individual volatility. The Variance-Covariance Matrix serves as the quantitative foundation measuring two aspects: variance (individual risk) and covariance (inter-stock movement correlation). Low or negative covariance creates diversification benefits, reducing portfolio risk below the average risk of individual assets. Thus, this matrix helps identify the optimal asset combination where risk is minimized for each expected return level. Table 6 presents the variance-covariance matrix for the 11 selected stocks, comprising both individual variances and inter-stock covariances.

Table 6
Variance-Covariance Matrix

Var/Cov Matriks	BYAN	TPIA	ASII	UNVR	FILM	KLBF	BBCA	MKPI	MCAS	ISAT	SMDR
BYAN	0.054830	-0.000002	-0.000002	-0.000005	-0.000001	-0.000004	-0.000002	-0.000005	0.000000	0.000001	-0.000003
TPIA	-0.000002	0.032164	0.000001	-0.000003	-0.000002	-0.000011	0.000001	0.000003	-0.000003	0.000001	0.000002
ASII	-0.000002	0.000001	0.007961	0.000001	0.000000	0.000001	0.000001	0.000002	0.000000	0.000004	0.000001
UNVR	-0.000005	-0.000003	0.000001	0.005727	-0.000006	0.000131	0.000000	0.000003	-0.000015	0.000003	-0.000005
FILM	-0.000001	-0.000002	0.000000	-0.000006	0.076261	0.000002	0.000000	0.000000	0.000003	0.000000	0.000001
KLBF	-0.000004	-0.000011	0.000001	0.000131	0.000002	0.003121	0.000000	0.000001	0.000001	-0.000002	0.000003
BBCA	-0.000002	0.000001	0.000001	0.000000	0.000000	0.000000	0.002693	0.000001	0.000000	0.000002	0.000002
MKPI	-0.000005	0.000003	0.000002	0.000003	0.000000	0.000001	0.000001	0.018383	-0.000001	0.000003	0.000002
MCAS	0.000000	-0.000003	0.000000	-0.000015	0.000003	0.000001	0.000000	-0.000001	0.046965	0.000000	0.000000
ISAT	0.000001	0.000001	0.000004	0.000003	0.000000	-0.000002	0.000002	0.000003	0.000000	0.050873	0.000002
SMDR	-0.000003	0.000002	0.000001	-0.000005	0.000001	0.000003	0.000002	0.000002	0.000000	0.000002	0.036115

Source: Data Processing Results in Ms. Excel 2021, 2025

Portfolio risk calculation utilizes a variance-covariance matrix implementing modern portfolio theory. This matrix contains variance values on the main diagonal (measuring individual stock return dispersion, such as FILM's 0.076261 variance indicating high individual risk) and covariance values off the diagonal (measuring inter-stock co-movement relationships). Negative covariance (like between BYAN and UNVR at -0.000005) is highly beneficial as it indicates the two stocks tend to move in opposite directions, creating a diversification effect that reduces total portfolio risk. By analyzing both components, investors can optimize the portfolio to minimize volatility without sacrificing expected return.

Portfolio Performance Evaluation Using Sharpe Ratio & Treynor Ratio Methods

The optimal portfolio construction was evaluated using Sharpe Ratio (measuring excess return per unit of total risk) for less diversified portfolios, and Treynor Ratio (measuring excess return per unit of systematic risk) for well-diversified portfolios. These two ratios provide complementary perspectives in assessing the risk-return efficiency of various portfolio configurations.

1) Comparison of Scenario 1 Calculation Results for Sharpe Ratio & Treynor Ratio

Scenario 1 evaluation as a baseline portfolio with equal-weight approach was conducted using Sharpe Ratio (excess return per unit of total risk) and Treynor Ratio (excess return per unit of systematic risk). Here are the calculation results and comparative analysis performed:

Table 7
Scenario 1 Equal Weight Sharpe Ratio

Portfolio Statistics	
Sum of Weights	100%
Portofolio Expected Return	29.83%
Std Dev of Portofolio	5.26%
Sharpe Ratio	4.69

Source: Data Processing Results in Ms. Excel 2021, 2025

Table 8
Scenario 1 Equal Weight Treynor Ratio

Portfolio Statistics	
Sum of Weights	100%
Portofolio Expected Return	29.83 %
Beta Portofolio	1097%
Treynor Ratio	0.0225

Source: Data Processing Results in Ms. Excel 2021, 2025

Scenario 1 results show a striking contrast between Sharpe Ratio (4.69) and Treynor Ratio (0.0225). The high Sharpe Ratio indicates excellent excess return relative to total risk (standard deviation 5.26%), while the low Treynor Ratio reveals poor performance against systematic risk with a portfolio beta of 1097% showing extreme sensitivity to market movements. This contradiction means the equal-weight strategy successfully diversifies unsystematic risk but creates exposure to very high market risk.

2) Comparison of Scenario 2 Calculation Results for Sharpe Ratio & Treynor Ratio

Scenario 2 evaluation was conducted by calculating Sharpe Ratio and Treynor Ratio to assess the optimal portfolio's performance from two different risk perspectives. Here are the calculation results and comparative analysis:

Table 9
Scenario 2 Allocation Constraint Sharpe Ratio (5% - 25%)

Portofolio Statistik	
Sum of Weights	100%
Portofolio Expected Return	54.86%
Std Dev of Portofolio	9.47%
Sharpe Ratio	5.25

Source: Data Processing Results in Ms. Excel 2021, 2025

Table 10
Scenario 2 Allocation Constraint Sharpe Ratio (5% - 25%)

Portofolio Statistik	
Sum of Weights	100%
Portofolio Expected Return	54.86%
Beta Portofolio	1097%
Treynor Ratio	0.0453

Source: Data Processing Results in Ms. Excel 2021, 2025

Scenario 2 shows contrasting performance: strong Sharpe Ratio (5.25) but low Treynor Ratio (0.0453). The high Sharpe Ratio reflects excellent excess return generation relative to total risk (standard deviation 9.47%), while the low Treynor Ratio results from a very high portfolio beta (1097%) indicating extreme market sensitivity. This suggests that although the portfolio has an impressive 54.86% expected return, part of this performance comes from aggressive market risk exposure and likely still contains undiversified specific risk.

3) Comparison of Scenario 3 Calculation Results for Sharpe Ratio & Treynor Ratio

Scenario 3 evaluation was conducted by analyzing the optimal portfolio composition using Sharpe Ratio and Treynor Ratio. Here are the calculation results and comparative analysis:

Table 11
Scenario 3 Allocation Constraint Sharpe Ratio (0% - 30%)

Portfolio Statistics	
Sum of Weights	100%
Portofolio Expected Return	74.60%
Std Dev of Portofolio	12.40%
Sharpe Ratio	5.60

Source: Data Processing Results in Ms. Excel 2021, 2025

Tabel 12
Scenario 3 Allocation Constraint Treynor Ratio (0% - 30%)

Portfolio Statistics	
Sum of Weights	100%
Portofolio Expected Return	74.60%
Beta Portofolio	997%
Treynor Ratio	0.0697

Source: Data Processing Results in Ms. Excel 2021, 2025

Scenario 3 shows a very high Sharpe Ratio (5.60) reflecting large excess return relative to low total risk (standard deviation 12.40%), but a lower Treynor Ratio (0.0697) due to a portfolio beta of 997%. This disparity reveals that although the portfolio successfully minimizes unsystematic risk, its performance remains highly dependent on market movements due to exposure to high systematic risk.

The choice between Sharpe and Treynor ratios depends on portfolio context and investor profile. Treynor Ratio is more suitable for well-diversified portfolios as it measures performance per unit of systematic risk (beta). Conversely, Sharpe Ratio is better for less diversified portfolios since it considers total risk (standard deviation), making it more representative of retail investors' actual conditions. Within modern portfolio theory assuming optimal diversification, Treynor may be more relevant; however, for investors with concentrated portfolios, Sharpe Ratio provides a more comprehensive performance measure by accounting for all undertaken risks.

Comparative Analysis of Portfolio Performance

This comparative analysis tests the significance of differences in portfolio performance rankings between Sharpe Ratio (measuring excess return per unit of total risk) and Treynor Ratio (measuring excess return per unit of systematic risk). Theoretically, this difference in risk approaches could yield different performance rankings, particularly for sub-optimally diversified portfolios.

a. Paired t-test

Before conducting the paired t-test, the researcher performed a normality test using the Kolmogorov-Smirnov method to verify data distribution. Here are the results:

Table 13
Kolmogorov-Smirnov Normality Test (Sharpe Ratio)

Statistics	Sharpe Ratio
n	11
x	-0.164
s	0.131
D	0.054
KS Table	0.391

Source: Data Processing Results in Ms. Excel 2021, 2025

Table14
Kolmogorov-Smirnov Normality Test (Treynor Ratio)

Statistics	Treynor Ratio
n	11
x	-1.613
s	4.783
D	0.051
KS Table	0.391

Source: Data Processing Results in Ms. Excel 2021, 2025

Based on the results of the Kolmogorov-Smirnov Normality Test presented in the tables 13 and Table 14, it can be concluded that the Sharpe Ratio and Treynor Ratio data are normally distributed. This is evidenced by:

- Sharpe Ratio: statistical D value = 0.054 < critical KS Table value = 0.391
- Treynor Ratio: statistical D value = 0.051 < critical KS Table value = 0.391
  Karena nilai statistik D untuk kedua variabel lebih kecil dari nilai kritis KS

Since the D value for both variables is smaller than the critical KS Table value at α = 0.05 significance level, the null hypothesis (H_0) is accepted, meaning both ratios' data are normally distributed. This normality fulfillment guarantees that using the paired t-test is an appropriate statistical method, making the comparative analysis results between Sharpe Ratio and Treynor Ratio scientifically reliable.

Table15
t-Test: Paired Two Sample for Means

	Sharpe	Treynor
Mean	-0.164	-1.613
Variance	0.017	22.872
Observations	11.00	11.00
Pearson Correlation	0.635	
Hypothesized Mean Difference	0.000	
df	10.00	
t Stat	1.023	
P(T<=t) one-tail	0.165	
t Critical one-tail	1.812	
P(T<=t) two-tail	0.331	
t Critical two-tail	2.228	

Source: Data Processing Results in Ms. Excel 2021, 2025

Criteria:
P Value < 0.05 = Significant Difference Exists
P Value > 0.05 = No Significant Difference Exists

The paired t-test results conclude no statistically significant difference between Sharpe and Treynor Ratios, supported by P-value (0.331) > α=0.05 and t-statistic (1.023) < t-critical (2.228). This finding implies both ratios provide consistent performance evaluations and are interchangeable, indicating the portfolio is sufficiently well-diversified to minimize unsystematic risk.

b. Wilcoxon Signed-Rank Test

Sharpe and Treynor Ratio data are normally distributed with D values (0.054 and 0.051) smaller than the critical KS Table value (0.391). Thus, using the Paired t-test is appropriate without needing the Wilcoxon test. With the normality assumption met, this study's results are statistically accountable.

Analysis of Individual Stock Risk & Return

The risk and return analysis reveals two complementary dimensions that often provide different signals. Total risk, measured by standard deviation, shows significant variation, from highly volatile stocks like FILM (27.85%) to stable stocks like BBCA (5.23%), proving the risk-return trade-off principle where high-risk stocks tend to offer high expected returns. Meanwhile, systematic risk measured by beta shows more extreme variation, from MCAS (1.99) to negative betas for BYAN (-0.08) and UNVR (-0.24). This diversity in risk profiles is what causes the inconsistency between the Sharpe Ratio

(which penalizes total risk) and the Treynor Ratio (which penalizes systematic risk) in evaluating individual stock performance.

Construction of Optimal Portfolio

Based on the research results, the portfolio with a 0%-30% allocation constraint proved to be the most optimal, producing the highest Sharpe Ratio (5.60) and Treynor Ratio (0.0697), demonstrating the effectiveness of Markowitz's modern portfolio theory in the context of the Indonesian market. The advantage of this scenario lies in its flexibility in reaching the efficient frontier through two key mechanisms: the ability to eliminate poorly performing stocks (0% allocation) and the opportunity to maximize leading stocks (allocation up to 30%). This finding aligns with research by Atmaca (2022) which states that overly strict constraints can produce sub-optimal solutions, while a 0%-30% range provides the necessary elasticity for the optimization algorithm to find the highest efficiency point.

Portfolio Performance Comparison: Sharpe vs. Treynor

In portfolio performance evaluation, there are two main conceptual approaches: Return to Volatility (RVOL) and Return to Value (RVAL). The Sharpe Ratio falls into the RVAL category as it measures excess return per unit of total risk (standard deviation), which includes all portfolio volatility. Conversely, the Treynor Ratio is classified as RVOL because its focus is on excess return per unit of systematic risk (beta), making it more relevant for well-diversified portfolios where non-systematic risk is considered minimal. This study found no statistically significant difference in performance rankings between the Sharpe Ratio and the Treynor Ratio. This finding actually indicates an ideal condition: namely, the portfolio consisting of these 11 leading stocks across sectors has successfully minimized unsystematic risk through effective diversification. Consequently, total risk (σ) and systematic risk (β) become aligned, making the fundamental difference between the RVAL and RVOL approaches insignificant, so both measurements result in consistent and interchangeable performance assessments.

This finding is consistent with and strengthens the findings of the majority of previous studies. As found by Manurung (2019), Prayogo (2017), and Muslim et al. (2020), who stated that portfolio performance evaluation using both ratios tends to yield consistent and non-significantly different rankings, indicating that in many contexts of the Indonesian market, the analyzed portfolios were sufficiently diversified. Further support comes from Nurlaeli & Artati (2020) who directly concluded no significant difference between Sharpe, Treynor, and Jensen, a finding that aligns with the statistical test results in this study.

Furthermore, this research is also consistent with the study by Claransia & Sugiharto (2021), which provided an important nuance by stating that the Treynor Ratio is considered the most consistent for diversified portfolios, an argument that aligns with the characteristics of the sample in this study, which consists of leading stocks across sectors, thus explaining why the two ratios become aligned. More broadly, research by Hoang (2022) on the benefits of diversification in emerging markets and Atmaca (2022), which showed that both ratios can be used complementarily for optimization, provides an empirical basis that in the context of a diversified market, the difference between Sharpe and Treynor can indeed be minimized.

However, some previous studies have also revealed differences that enrich the analysis. For instance, findings by Sa'diyah et al. (2023) showed the Sharpe Ratio provided the highest performance value, and Verma & Hirpara (2016) reported the

superiority of the Treynor Ratio during bearish market conditions in India, stand outside the majority consensus. These differences are not contradictions but reflect the sensitivity of research results to specific contexts. Variables such as sample composition, the research time period covering specific market conditions, and market characteristics have proven to be determining factors that can influence the superiority of one ratio over the other (Akbar et al., 2017).

Thus, the finding of non-significant difference in this study is not only supported by previous research but also has contextual limitations. This result holds strongly for portfolios of leading stocks across sectors on the IDX during the 2020-2024 period, but may not be applicable to more specific samples, recession periods, or capital markets with different characteristics, as illustrated by studies with differing findings.

CONCLUSION AND SUGGESTIONS

Based on the research results and discussion regarding the evaluation of stock portfolio performance using the Sharpe Ratio and Treynor Ratio on 11 leading stocks from each IDX-IC sector on the Indonesia Stock Exchange for the 2020-2024 period, no statistically significant difference was found in the portfolio performance ranking between the two methods.

This finding indicates that for a well-diversified portfolio like the one in this study, both performance measurement methods can be used interchangeably as they provide consistent evaluation results. The insignificance of this difference is because the formed portfolio has successfully minimized unsystematic risk, making the total risk (measured by the Sharpe Ratio) and systematic risk (measured by the Treynor Ratio) aligned.

Based on the research findings, the diversification strategy across IDX-IC sectors proved effective in forming an optimal portfolio under the 0%–30% allocation constraint, consisting of four stocks: BYAN, FILM, SMDR (30% each), and TPIA (10%). This portfolio generated the highest expected return of 74.60%, with a Sharpe Ratio of 5.60 and a Treynor Ratio of 0.0697, confirming the effectiveness of modern portfolio optimization in the Indonesian capital market. The consistency between both performance measures indicates that the portfolio has successfully minimized unsystematic risk, aligning total risk (σ) with systematic risk (β), and rendering the conceptual difference between the two ratios insignificant for well-diversified cross-sector portfolios. The considerable variation in individual stock performance—with returns ranging from -25.49% (UNVR) to 102.04% (FILM) and betas from -1.75% (BYAN) to 202.84% (MCAS) underscores the importance of both careful stock selection and effective diversification in portfolio construction.

Based on the findings, investors should focus on building well-diversified cross-sector portfolios, as Sharpe and Treynor Ratios produce consistent rankings once unsystematic risk is minimized. For high-risk-tolerance investors, the 0%–30% optimization strategy proved most effective, yielding a 74.60% annual return with a Sharpe Ratio of 5.60 and a Treynor Ratio of 0.0697, though this requires rigorous stock selection and regular rebalancing. Regulators (OJK and IDX) are encouraged to develop risk-literacy education programs to help novice investors adopt more comprehensive risk-based decision-making.

For future research, studies should expand samples beyond large-cap stocks to include mid- and small-cap companies, extend observation periods across different market conditions, and compare Sharpe and Treynor with alternative measures such as Jensen's Alpha, Sortino Ratio, and M-squared. Additionally, future studies could explore the sensitivity of optimization outcomes to varying allocation limits, test alternative

models like Black-Litterman or Bayesian approaches, and conduct out-of-sample testing to validate portfolio robustness. These efforts would enrich emerging market literature and provide more practical guidance for Indonesian capital market participants.

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