Journal of Applied Science, Engineering, Technology, and Education *ISSN: 2685-0591 (online)*
Vol. 7 No. 2 (2025)
https://doi.org/10.35877/454RI.asci3897

Strategic Decision Analysis for Investment Portfolios: Computational Risk Assessment in Transportation Asset Management

Devy Sofyanty[a,*], Romadhoni[b], Handriadi[c], Istamova Shokhida Makhsudovna[d], Zakiyah Anwar[e], Zokir Mamadiyarov[a]

[a]*Universitas Bina Sarana Informatika, Indonesia*
[b]*Politeknik Negeri Bengkalis, Bathin Alam Street, Bengkalis, Riau, Indonesia*
[c]*STIT Syekh Burhanuddin Pariaman, Pariaman, Indonesia*
[d]*Department of Uzbek Language and Literature, Bukhara State Pedagogical Institute, Uzbekistan*
[e]*Department of Mathematics Education, Universitas Muhammadiyah Sorong, Sorong, 98416, Indonesia*
[f]*Department of Economics, Mamun University, Khiva, Uzbekistan*
[g]*Termez University of Economics and Service, Termez, Uzbekistan*
[h]*Alfraganus University, Tashkent, Uzbekistan*

Abstract

This study examines the risk-return characteristics of two prominent Indonesian transportation companies: PT. Adi Sarana Tbk (ASSA) and PT. Blue Bird Tbk (BIRD) and analyzes their combined portfolio performance from a managerial perspective. Using daily stock data from December 2023 to November 2024, the research employs a comprehensive methodological framework integrating traditional statistical measures with Monte Carlo simulation and Value at Risk (VaR) analysis. The findings reveal distinct risk-return profiles: BIRD demonstrates better expected returns (0.04%) but higher downside risk, while ASSA shows negative expected returns (-0.06%) with lower extreme risk. The portfolio analysis highlights significant diversification benefits, with the combined portfolio (60% ASSA, 40% BIRD) achieving positive expected returns while maintaining lower risk than either individual stock. The research provides valuable insights for investment management in the transportation sector, emphasizing the importance of strategic asset allocation, comprehensive risk assessment, and business model considerations in portfolio construction. The integration of monetary VaR estimates enhances practical applicability for managerial decision-making. This study contributes to the understanding of portfolio management in emerging markets and offers a robust methodological framework for risk-return analysis applicable across various sectors.

Keywords: Portfolio management; transportation stocks; Value at Risk; Monte Carlo simulation; risk-return analysis; investment decision-making.

Received: 12 May 2025 Revised: 17 July 2025 Published: 31 August 2025

1. Introduction

Investment management in today's volatile financial markets demands sophisticated analytical approaches that effectively integrate management science with quantitative engineering methodologies. This integration has become increasingly critical for optimizing risk-return trade-offs, particularly in emerging markets where economic fluctuations can be more pronounced. This paper examines the risk-return characteristics of stocks from two prominent transportation companies in Indonesia - PT. Adi Sarana Tbk (ASSA) and PT. Blue Bird Tbk (BIRD) - and analyzes their combined portfolio performance using an integrated framework of management strategy assessment and advanced computational methods including Monte Carlo simulation and Value at Risk (VaR) analysis.

The importance of effective portfolio management cannot be overstated in the current economic landscape. Financial markets worldwide have experienced significant volatility, particularly following global events such as the COVID-19 pandemic and ongoing geopolitical tensions. In emerging markets like Indonesia, these challenges are often amplified, making prudent investment decisions even more critical (Tu & Li, 2024). Transportation stocks, in particular, have

* Corresponding author.
E-mail address: devy.dyy@bsi.ac.id

shown notable fluctuations in recent years, reflecting broader economic trends and sector-specific challenges. As noted by Yan et al. (2024), transportation companies face unique operational risks that directly impact their financial performance and, consequently, their stock returns. These companies must navigate fuel price volatility, regulatory changes, technological disruptions, and shifting consumer preferences—all factors that contribute to their complex risk-return profiles.

The novelty of this research lies in its integrated approach to portfolio analysis, combining traditional strategic management assessment with advanced computational techniques to provide a comprehensive risk assessment framework specifically tailored to the transportation sector in Indonesia. While numerous studies have examined portfolio optimization in various contexts, few have focused specifically on the Indonesian transportation sector with such a detailed methodological framework that bridges management and engineering perspectives. The transportation industry plays a vital role in Indonesia's economic development, serving as critical infrastructure that enables commerce, facilitates supply chains, and supports urbanization. This makes the analysis particularly relevant for both academic understanding and practical investment applications.

Portfolio theory has evolved significantly since Markowitz & Blay (2014) introduced the concept of mean-variance optimization. Modern approaches have incorporated more sophisticated risk measures and predictive models to enhance portfolio selection and management processes. As highlighted by Sharma and Shekhawat (2022), traditional portfolio optimization methods often fall short when applied to markets characterized by high volatility and non-normal return distributions. Their research suggests that integrating advanced computational techniques with traditional financial analysis can yield more reliable portfolio decisions, particularly in emerging markets where conventional assumptions about market efficiency may not fully apply.

The transportation sector in Indonesia presents an interesting case study for portfolio analysis due to several factors. First, transportation companies are particularly sensitive to macroeconomic conditions, including fuel prices, interest rates, and consumer spending patterns (Rajyaguru, 2023). This sensitivity creates a dynamic risk environment that requires sophisticated analysis. Second, the sector has undergone significant structural changes in recent years, including regulatory reforms, technological innovations, and the emergence of digital platforms, which have influenced market dynamics and competitive landscapes (Zhu & Yang, 2022). Third, transportation stocks often exhibit unique risk-return characteristics that may not be adequately captured by conventional analysis methods, necessitating more advanced analytical approaches.

PT. Adi Sarana Tbk (ASSA) and PT. Blue Bird Tbk (BIRD) represent two distinct business models within the transportation sector. ASSA primarily focuses on vehicle leasing and logistics services, offering fleet management solutions to corporate clients, while BIRD is predominantly known for its taxi services, providing direct transportation to individual consumers. This distinction allows for an examination of how different business models within the same sector respond to market conditions and contribute to portfolio diversification. As noted by Campbell et al. (2001), effective diversification requires not just selecting stocks from different sectors but understanding the underlying business dynamics that drive stock performance. The contrast between these two companies provides a natural experiment in how different operational approaches within the same industry sector can affect investment outcomes.

This research employs a comprehensive methodological framework that integrates strategic business analysis with quantitative risk assessment through descriptive statistics, Monte Carlo simulation, and Value at Risk (VaR) analysis. The use of Monte Carlo simulation represents a significant advancement over traditional deterministic models, as it allows for the incorporation of randomness and uncertainty into the analysis, providing a more realistic assessment of potential outcomes (Han et al., 2021). Such simulations can reveal potential tail risks and opportunities that might be missed by simpler analytical approaches. Furthermore, the application of VaR analysis enables a quantitative assessment of downside risk, which is particularly valuable for risk-averse investors (Blavatskyy, 2022). By combining these engineering-derived techniques with strategic business model assessment, this research offers a more complete picture of investment risk and return.

The financial data used in this study spans from December 2023 to November 2024, capturing a period characterized by various economic challenges and market fluctuations. This timeframe allows for a comprehensive analysis of how transportation stocks respond to different market conditions and economic scenarios. The data includes daily stock prices, which are then used to calculate returns, expected returns, standard deviations, and other relevant financial metrics (Mech, 1993). This granular approach provides insights into the day-to-day variability of these stocks, revealing patterns that might be obscured in analyses using only monthly or quarterly data.

The integration of risk management principles with portfolio optimization represents another key contribution of this research. Traditional portfolio theory often focuses on the trade-off between expected return and volatility, as measured by standard deviation. However, as pointed out by Neděla et al. (2024), this approach may not adequately capture the downside risk that is of primary concern to most investors. By incorporating VaR analysis, this research provides a more nuanced understanding of the risk profile of transportation stocks and their combined portfolio, focusing specifically on potential losses rather than general volatility.

The concept of portfolio diversification is central to modern investment theory, but its effectiveness depends on the correlation between assets and their individual risk-return characteristics. As emphasized by Schuhmacher et al. (2021), the benefits of diversification can be diminished when assets exhibit strong positive correlations, particularly during market downturns when correlations often increase. This research examines the correlation between ASSA and BIRD stocks to assess the potential diversification benefits of including both in a portfolio. The analysis also considers how different portfolio weights affect the risk-return profile, providing insights into optimal allocation strategies that balance expected returns with downside risk protection.

The application of Z-scores in risk assessment represents an innovative approach to quantifying the probability of extreme returns. Z-scores provide a standardized measure of how far a particular value is from the mean, expressed in terms of standard deviations. In the context of portfolio analysis, Z-scores can be used to estimate the probability of returns falling below a certain threshold, which is particularly valuable for risk management purposes (Yu et al., 2020). This research calculates Z-scores at various confidence levels (99%, 95%, and 90%) to provide a comprehensive assessment of the downside risk associated with the individual stocks and the combined portfolio, offering a more complete risk picture than simple volatility measures.

The iterative approach to VaR calculation employed in this research enhances the reliability of the risk estimates. By simulating 1,000 iterations of the VaR calculation, the analysis captures a wide range of possible scenarios, providing a more robust assessment of risk than a single-point estimate (Marcondes, 2019). This approach aligns with recent developments in risk management practices, which emphasize the importance of considering multiple scenarios and stress testing portfolio performance under various conditions. Such comprehensive risk assessment is particularly valuable in emerging markets like Indonesia, where historical data may be limited and market conditions can change rapidly.

The transportation sector in Indonesia has been subject to various regulatory changes and market disruptions, including the rise of ride-hailing services and the impact of the COVID-19 pandemic. These factors have contributed to increased volatility in transportation stocks, making risk assessment particularly important for investors in this sector. As noted by Li (2022), sectors experiencing significant structural changes often present both heightened risks and unique investment opportunities, necessitating sophisticated analytical approaches that can capture these complex dynamics. By focusing specifically on transportation stocks, this research provides targeted insights that can inform sector-specific investment strategies.

The integration of both academic rigor and practical applicability distinguishes this research from purely theoretical studies. While the methodological framework is grounded in established financial theories, the analysis is designed to provide actionable insights for investment decision-making. As emphasized by DahrulEfendi (2015), the ultimate value of portfolio analysis lies in its ability to inform practical investment strategies that balance risk and return objectives based on individual investor preferences. By translating theoretical concepts into practical applications, this research bridges the gap between academic finance and investment practice.

In summary, this introduction has highlighted the importance, novelty, and methodological framework of the research on portfolio analysis of Indonesian transportation stocks. By integrating management perspectives with engineering-based analytical techniques, this study offers a comprehensive approach to understanding the risk-return dynamics of transportation investments. The subsequent sections will delve deeper into the specific methods employed, present the empirical findings, and discuss their implications for investment management in the transportation sector.

2. Methods

2.1. Interdisciplinary Research Design

This study employs an interdisciplinary methodological framework that integrates management science principles with engineering-based analytical techniques to evaluate the risk-return characteristics of two Indonesian transportation stocks - PT. Adi Sarana Tbk (ASSA) and PT. Blue Bird Tbk (BIRD). This integration enables a comprehensive strategic portfolio analysis that bridges qualitative business model assessment with quantitative risk modeling. The management perspective addresses strategic positioning and operational characteristics of the transportation companies, while the engineering approach applies computational modeling and simulation techniques to quantify investment risk with mathematical precision.

2.2. Sampling and Data Collection

The research utilizes strategic sampling of secondary financial data obtained from financial databases covering the period from December 1, 2023, to November 29, 2024. Daily stock prices and trading volumes were collected for both transportation companies, representing different strategic approaches within the sector: ASSA's vehicle leasing and logistics services business model versus BIRD's predominantly taxi service-oriented operations. This comparative sampling framework enables analysis of how different strategic approaches within the same industry respond to market forces and contribute to portfolio diversification.

2.3. Computational Return Analysis

The computational analysis begins with stock return calculations using the standard engineering formula for discrete returns. This transforms raw market data into normalized metrics that allow for cross-company comparison despite differences in strategic orientation and operational scale. Expected returns derived from these calculations provide quantitative measures of each company's performance effectiveness, while standard deviation serves as a quantitative risk indicator that reflects the stability of their respective business models and operational execution.

2.4. Strategic Risk Modeling

The study implements advanced risk modeling techniques adapted from engineering systems analysis, including Monte Carlo simulation with 238 iterations to model uncertainty in returns. This approach transcends traditional management-based qualitative risk assessment by generating probabilistic distributions of potential outcomes based on historical performance patterns. Z-scores calculated at various confidence levels (99%, 95%, and 90%) provide standardized risk metrics that facilitate strategic comparison between the different business models represented by ASSA and BIRD.

2.5. Value-at-Risk Framework for Strategic Decision Support

Value at Risk (VaR) analysis employs the parametric approach with the delta-normal method, enhanced through 1,000 computational iterations to ensure statistical reliability. This engineering-based risk quantification is then translated into monetary terms (Indonesian Rupiah) to provide tangible decision support metrics for management applications. The integration of technical precision with practical financial implications exemplifies the bridging of engineering analytics with management decision-making that is central to this research.

2.6. Strategic Portfolio Engineering

The portfolio construction methodology applies strategic weighting based on both quantitative and qualitative factors: PT. Adi Sarana Tbk (ASSA): 60% and PT. Blue Bird Tbk (BIRD): 40%. These allocations reflect a strategic integration of market capitalization considerations, business model evaluation, and sector-specific expertise. The portfolio risk assessment methodology incorporates mathematical modeling of asset interactions through variance-covariance analysis, demonstrating how engineering principles can enhance strategic asset allocation decisions.

2.7. Managerial Implications Framework

The methodology establishes a structured framework for deriving managerial implications from the technical analysis. This framework systematically links computational risk-return findings to strategic decision contexts in transportation investment management. It examines how quantitative diversification benefits translate to strategic advantage, how risk-return trade-offs inform strategic positioning decisions, and how different business models within the transportation sector respond to market conditions from both technical and managerial perspectives. This bidirectional translation

between engineering metrics and management applications represents the core methodological innovation of the research.

3. Results

This section presents the empirical findings of the integrated management-engineering analysis conducted on PT. Adi Sarana Tbk (ASSA) and PT. Blue Bird Tbk (BIRD) stocks, along with their combined portfolio.

3.1. Return Analysis

3.1.1. Individual Stock Returns

The analysis of daily returns for both transportation companies reveals distinctive patterns reflective of their different business models. Table 1 presents selected daily returns for both stocks over the study period.

Table 1. Selected Daily Returns of ASSA and BIRD Stocks (December 2023 - November 2024)

Date	PT. Adi Sarana Tbk	PT. Blue Bird Tbk
01/12/2023	0.00000	0.00000
04/12/2023	0.01579	-0.03636
05/12/2023	-0.02073	0.01887
...	...	...
26/11/2024	-0.00699	-0.00990
28/11/2024	-0.00704	-0.02000
29/11/2024	0.02128	-0.03316

The return patterns demonstrate notable volatility in both stocks, with ASSA showing more pronounced fluctuations compared to BIRD. This aligns with Felder and Mayer's (2022) findings that companies with diverse business models within the same sector often exhibit different return characteristics. ASSA's vehicle leasing and logistics services business model appears to generate more variable returns than BIRD's predominantly taxi service-oriented business.

3.1.2. Expected Returns

The expected returns calculated for both stocks provide crucial insights into their relative performance prospects. As shown in Table 2, the expected returns differ significantly between the two companies.

Table 2. Expected Returns of Individual Stocks

Company	Expected Return
PT. Adi Sarana Tbk	-0.06%
PT. Blue Bird Tbk	0.04%

These findings reveal that BIRD demonstrates a positive expected return of 0.04%, suggesting better average performance compared to ASSA, which shows a negative expected return of -0.06%. According to Tu and Li (2024), such divergence within the same sector often reflects company-specific factors such as operational efficiency, market positioning, and strategic orientation. The negative expected return for ASSA suggests potential management challenges or structural issues affecting its financial performance.

3.2. Risk Analysis

3.2.1. Standard Deviation

Standard deviation serves as a primary measure of investment risk, quantifying the volatility or dispersion of returns. Table 3 presents the standard deviation results for both stocks.

Table 3. Standard Deviation of Individual Stocks

Company	Standard Deviation
PT. Adi Sarana Tbk	2.53%

Company	Standard Deviation
PT. Blue Bird Tbk	1.87%

The results indicate that ASSA exhibits higher volatility (2.53%) compared to BIRD (1.87%), suggesting greater risk associated with ASSA investments. This aligns with Rajyaguru's (2023) observation that within the transportation sector, companies with more diversified service offerings (like ASSA) often face higher operational complexities and market uncertainties, leading to greater return volatility.

3.2.2. Monte Carlo Simulation Results

To comprehensively assess potential future scenarios, Monte Carlo simulations were conducted using the historical return characteristics. Table 4 presents a snapshot of the simulation results.

Table 4. Selected Monte Carlo Simulation Results

Simulation	PT. Adi Sarana Tbk	PT. Blue Bird Tbk
1	-4.03%	2.46%
2	2.11%	-0.72%
3	0.70%	-0.56%
...	...	...
236	-2.55%	-0.18%
237	0.11%	0.24%
238	-1.07%	1.29%

The simulation results demonstrate the wide range of potential returns for both stocks. As noted by Yan et al. (2024), Monte Carlo simulations provide valuable insights for managerial decision-making by illustrating the full spectrum of potential outcomes beyond simple point estimates.

3.2.3. Expected Returns from Monte Carlo Simulation

Table 5. Expected Returns from Monte Carlo Simulation

Company	Historical Expected Return	Simulation Expected Return
PT. Adi Sarana Tbk	-0.06%	-0.11%
PT. Blue Bird Tbk	0.04%	0.09%

The simulation-based expected returns reinforce the patterns observed in the historical data, with BIRD maintaining a positive outlook (0.09%) while ASSA shows a negative expected return (-0.11%). As observed by Chen et al. (2014), such consistency between historical and simulation-based returns often indicates structural factors influencing company performance rather than temporary market fluctuations.

3.2.4. Standard Deviation from Monte Carlo Simulation

Table 6. Standard Deviation from Monte Carlo Simulation

Company	Historical Standard Deviation	Simulation Standard Deviation
PT. Adi Sarana Tbk	2.53%	1.05%
PT. Blue Bird Tbk	1.87%	1.30%

Interestingly, the simulation results suggest lower volatility for both stocks compared to historical data, particularly for ASSA, which shows a substantial reduction from 2.53% to 1.05%. This aligns with Li (2022) observation that Monte Carlo simulations often smooth extreme values when based on normal distribution assumptions, potentially underestimating tail risks in volatile markets.

3.3. Value at Risk (VaR) Analysis

3.3.1. Z-scores for VaR Calculation

Z-scores at different confidence levels were calculated to standardize the risk assessment process. Table 7 presents these Z-scores.

Table 7. Z-scores at Different Confidence Levels

Confidence Level	Z-score
99% (Z0.01)	2.326348
95% (Z0.05)	1.644854
90% (Z0.1)	1.281552

These Z-scores serve as critical inputs for the VaR calculations, determining the cutoff points for risk assessment at various confidence levels. As Schuhmacher et al. (2021) note, the selection of appropriate confidence levels is crucial for aligning risk assessments with organizational risk tolerance and regulatory requirements.

3.3.2. VaR Results for Individual Stocks

Table 8. VaR Results at Different Confidence Levels

Confidence Level	PT. Adi Sarana Tbk	PT. Blue Bird Tbk
99% (1%)	-2.55%	-2.93%
95% (5%)	-1.83%	-2.04%
90% (10%)	-1.45%	-1.57%

The results reveal that despite BIRD's better expected return, it demonstrates higher potential losses at all confidence levels compared to ASSA. At the 99% confidence level, BIRD shows a potential maximum daily loss of 2.93%, while ASSA shows 2.55%. This apparent contradiction aligns with Blavatskyy's (2022) observation that expected returns and extreme risks don't always exhibit a linear relationship, particularly in markets with complex risk factors.

3.3.3. Mean VaR Results

After 1,000 iterations, the mean VaR results were calculated to provide a more robust assessment of downside risk. Table 9 presents these results.

Table 9. Mean VaR Results at Different Confidence Levels

Confidence Level	PT. Adi Sarana Tbk	PT. Blue Bird Tbk
99% (1%)	-2.46%	-2.92%
95% (5%)	-1.77%	-2.04%
90% (10%)	-1.40%	-1.58%

The mean VaR results confirm the pattern observed in the initial VaR calculations, with BIRD consistently showing higher downside risk compared to ASSA across all confidence levels. According to Miao et al. (2023), such consistent risk differentials often reflect fundamental business model distinctions rather than temporary market fluctuations.

3.3.4. VaR in Monetary Terms

Table 10. VaR in Monetary Terms (IDR) based on 100,000,000 IDR investment

Confidence Level	PT. Adi Sarana Tbk	PT. Blue Bird Tbk
99% (1%)	-Rp 2,464,712	-Rp 2,924,205
95% (5%)	-Rp 1,770,190	-Rp 2,044,944
90% (10%)	-Rp 1,399,942	-Rp 1,576,214

The monetary VaR results provide practical insights for investment decision-making, illustrating the potential financial impact of adverse market movements. As observed by Fornell et al. (2009), expressing risk in monetary terms enhances

risk communication and facilitates more informed investment decisions, particularly for stakeholders without specialized financial knowledge.

3.4. Portfolio Analysis

3.4.1. Portfolio Expected Return and Risk

Table 11. Portfolio Expected Return and Standard Deviation

Metric	Portfolio (60% ASSA, 40% BIRD)
Expected Return	0.04%
Standard Deviation	1.02%

The portfolio's expected return (0.04%) matches BIRD's expected return despite ASSA's larger weight in the portfolio, while its standard deviation (1.02%) is notably lower than both individual stocks (ASSA: 2.53%, BIRD: 1.87%), demonstrating the risk reduction benefits of diversification. This supports Doeswijk et al.'s (2019) observation that even within the same sector, combining assets with different business models can achieve significant risk reduction.

3.4.2. Portfolio Monte Carlo Simulation

Table 12. Portfolio Expected Return and Standard Deviation from Monte Carlo Simulation

Metric	Historical	Simulation
Expected Return	0.04%	0.07%
Standard Deviation	1.02%	0.98%

The simulation-based expected return for the portfolio (0.07%) is slightly higher than the historical expected return (0.04%), suggesting potential improvement in future performance. According to Zhu and Yang (2022), such positive divergence between historical and simulation-based returns often indicates favorable future prospects.

3.4.3. Portfolio VaR Analysis

Table 13. Portfolio VaR Results at Different Confidence Levels

Confidence Level	VaR	VaR (IDR)
99% (1%)	-2.20%	-Rp 2,202,714
95% (5%)	-1.53%	-Rp 1,536,686
90% (10%)	-1.18%	-Rp 1,181,629

The portfolio VaR results demonstrate lower downside risk compared to both individual stocks at all confidence levels, highlighting the risk reduction benefits of diversification. At the 99% confidence level, the portfolio's VaR (-2.20%) is significantly lower than both ASSA (-2.55%) and BIRD (-2.93%). According to Ben-Shan (2012), such risk reduction through portfolio construction represents a fundamental benefit of strategic asset allocation, particularly relevant for risk-averse investors.

4. Discussions

The empirical findings from this integrated management-engineering analysis reveal several important insights into the risk-return dynamics of Indonesian transportation stocks and their portfolio implications. This section discusses these findings in the context of strategic investment management and their broader implications.

4.1. Contrasting Business Models and Return Patterns

The analysis reveals distinct risk-return profiles for ASSA and BIRD, reflecting their different business models within the transportation sector. BIRD demonstrates a positive expected return (0.04%) but with higher downside risk, while ASSA shows a negative expected return (-0.06%) with lower extreme risk potential. This pattern aligns with Campbell et al.'s (2001) findings that business model characteristics significantly influence financial performance patterns.

ASSA's higher volatility (2.53% vs. BIRD's 1.87%) reflects the greater operational complexity of its vehicle leasing and logistics services business. As Rajyaguru (2023) notes, diversified service offerings often introduce multiple risk

factors that contribute to return variability. The higher standard deviation suggests that ASSA faces greater operational uncertainties, possibly related to fleet management, contract terms, and logistics coordination complexities.

BIRD's taxi service model, while generating positive expected returns, demonstrates higher downside risk at extreme confidence levels. This apparent contradiction supports Blavatskyy's (2022) observation about the non-linear relationship between expected returns and extreme risks. The taxi business may generate more stable average returns but remains vulnerable to severe market disruptions, regulatory changes, and competitive pressures from ride-hailing services as discussed by Zhu (2013).

4.2. Diversification Benefits Within a Sector

Perhaps the most striking finding is the significant risk reduction achieved through portfolio diversification, even with stocks from the same sector. The portfolio's standard deviation (1.02%) is substantially lower than both individual stocks, while its VaR at all confidence levels is lower than either stock individually. This supports Latuamury's (2023) conclusion that intra-sector diversification can be particularly valuable when stocks represent companies with different business models.

The portfolio's expected return (0.04%) equals BIRD's expected return despite ASSA's larger weight (60%), demonstrating how strategic portfolio construction can neutralize the negative impact of an underperforming asset. As Utz and Steuer (2024) observe, such portfolio effects highlight the importance of understanding correlation structures and business model interactions rather than focusing solely on individual performance metrics.

The simulation-based expected return for the portfolio (0.07%) exceeds the historical expected return (0.04%), suggesting potential future improvement. According to Zhu and Yang (2022), such positive divergence often indicates favorable future prospects that may not be fully captured in historical data. This finding emphasizes the value of forward-looking simulation approaches in strategic investment planning.

4.3. Risk-Return Trade-offs and Management Implications

The analysis reveals important risk-return trade-offs between the two transportation stocks. BIRD shows better expected returns but higher downside risk, while ASSA shows negative expected returns with lower extreme risk. As Amaroh and Nasichah (2021) note, such situations require careful consideration of investor risk preferences and investment horizons.

From a management perspective, this suggests different strategic priorities for the two companies. For ASSA, addressing the underlying causes of negative expected returns should be a priority. As Chen et al. (2014) suggest, negative expected returns often reflect fundamental strategic or operational issues that require management intervention. ASSA might benefit from reconsidering its service mix, operational efficiency, or market positioning to improve return prospects.

For BIRD, the higher downside risk despite better expected returns suggests opportunities for implementing risk mitigation strategies while maintaining profitable operations. As noted by McLean and Pontiff (2015), companies with higher tail risks often benefit from targeted risk management approaches that address specific vulnerability factors rather than broad operational changes.

4.4. Methodology Effectiveness and Practical Applications

The comprehensive methodology employed in this study, integrating statistical analysis with Monte Carlo simulation and VaR, proved effective in capturing the complex risk-return dynamics of transportation stocks. As emphasized by Sharma and Shekhawat (2022), such integrated approaches are particularly valuable in markets characterized by higher volatility and complex risk factors.

The translation of percentage-based risk measures into monetary values (VaR in Indonesian Rupiah) enhances the practical applicability of the findings. As Felder and Mayer (2022) note, expressing risk in absolute monetary terms facilitates more intuitive understanding and communication of risk, particularly for stakeholders without specialized financial knowledge.

The stability of the portfolio's risk-return characteristics across both historical and simulation-based analyses suggests reliability in the findings. According to Han et al. (2021), such convergence between different analytical approaches often indicates robust results that can serve as a reliable foundation for strategic decision-making.

4.5. Strategic Investment Implications

For investors and portfolio managers in the Indonesian transportation sector, this research offers several strategic implications. First, it demonstrates the value of portfolio diversification even within a single sector, provided the selected stocks represent different business models. Second, it highlights the importance of considering both expected returns and downside risk measures when evaluating investment opportunities. Third, it underscores the benefits of a comprehensive risk assessment methodology that integrates multiple analytical approaches.

The findings also suggest potential directions for corporate management within these transportation companies. For ASSA, the negative expected return indicates a need to address operational or strategic challenges affecting financial performance. For BIRD, the higher downside risk despite better expected returns suggests opportunities for implementing risk mitigation strategies while maintaining profitable operations.

In conclusion, this integrated management-engineering analysis provides valuable insights for strategic investment decisions in the Indonesian transportation sector, highlighting the complex interplay between business models, risk-return dynamics, and portfolio construction strategies. The findings contribute to both theoretical understanding and practical applications in transportation investment management.

5. Conclusion

This study conducted a comprehensive risk-return analysis of two Indonesian transportation stocks - PT. Adi Sarana Tbk (ASSA) and PT. Blue Bird Tbk (BIRD) - and their combined portfolio. Through the application of traditional statistical measures, Monte Carlo simulation, and Value at Risk (VaR) analysis, the research has provided valuable insights into the investment characteristics of these stocks and their implications for portfolio management.

The analysis revealed distinct risk-return profiles for the two transportation companies. PT. Blue Bird Tbk demonstrated a positive expected return (0.04%) but with higher downside risk as measured by VaR at all confidence levels. In contrast, PT. Adi Sarana Tbk showed a negative expected return (-0.06%) with lower downside risk. These differences reflect the companies' distinct business models within the transportation sector - BIRD focusing primarily on taxi services and ASSA on vehicle leasing and logistics services.

The portfolio analysis demonstrated significant benefits of diversification, even within the same sector. The combined portfolio, constructed with 60% allocation to ASSA and 40% to BIRD, achieved a positive expected return (0.04%) while maintaining lower risk than either individual stock. The portfolio's standard deviation (1.02%) was substantially lower than both ASSA (2.53%) and BIRD (1.87%), and its VaR at all confidence levels was lower than either stock individually. This highlights the value of strategic asset allocation in managing the risk-return trade-off.

The Monte Carlo simulation provided forward-looking perspectives on potential investment outcomes, reinforcing the patterns observed in the historical data while suggesting potential improvements in the portfolio's future performance. The simulation-based expected return for the portfolio (0.07%) was slightly higher than the historical expected return (0.04%), with a marginally lower standard deviation (0.98% vs. 1.02%).

The VaR analysis, conducted at 99%, 95%, and 90% confidence levels, provided comprehensive insights into the downside risk associated with these investments. The translation of VaR into monetary terms (Indonesian Rupiah) enhanced the practical applicability of the risk assessment, offering tangible insights into potential financial losses under adverse market conditions.

From a managerial perspective, this research offers several important implications for investment decision-making in the transportation sector. First, it demonstrates the value of comprehensive risk assessment methodologies that integrate multiple analytical approaches to provide a more nuanced understanding of investment risk. Second, it highlights the importance of considering both expected returns and downside risk measures when evaluating investment opportunities. Third, it underscores the benefits of strategic portfolio construction and diversification, even within a single sector.

The findings also suggest potential directions for corporate management within these transportation companies. For ASSA, the negative expected return indicates a need to address operational or strategic challenges that may be affecting financial performance. For BIRD, the higher downside risk despite better expected returns suggests opportunities for implementing risk mitigation strategies while maintaining profitable operations.

This research contributes to the literature on portfolio management in emerging markets, particularly within the transportation sector. The integrated methodological framework employing Monte Carlo simulation and VaR analysis provides a robust approach to risk assessment that can be applied to other sectors and markets. The findings on intra-sector diversification benefits offer valuable insights for portfolio managers seeking to optimize risk-return trade-offs.

Future research could extend this analysis by exploring optimal portfolio weights through formal optimization techniques, investigating the impact of macroeconomic factors on these transportation stocks, or comparing the risk-return characteristics across different sectors in the Indonesian market. Additionally, the application of alternative risk measures beyond VaR could provide complementary insights into the risk profiles of these investments.

In conclusion, this research demonstrates that effective portfolio management in the transportation sector requires a nuanced understanding of risk-return dynamics, strategic asset allocation, and comprehensive risk assessment. By integrating these elements, investors and portfolio managers can make more informed decisions that align with their risk preferences and investment objectives.

References

Adindu-Dick, J. (2022). Investigating the Rate of Return from Portfolio Management Strategies. *African Journal of Mathematics and Statistics Studies*, 5(3):, 99-108.

Agustina, N., & Rachman, R. (2023). Alternative Measurement of The Rate of Return on Investment Portfolio in Insurance Company. *Proceeding of The International Seminar on Business, Economics, Social Science and Technology (ISBEST)*.

Amaroh, S., & Nasichah, C. (2021). Risk-Return Analysis on Optimum Portfolio Selection of Islamic Stocks. *EQUILIBRIUM*, 9(1), 65.

Ben-Shan, S. (2012). Comparative Analysis of Optimal Portfolio based on RAROC of Loan Return and Gross Return. *Technoeconomics & Management Research*, 0(8), 92-96

Blavatskyy, P. (2022). Expected return - expected loss approach to optimal portfolio investment. *Theory and Decision*, 94, 63-81.

Cakici, N., & Zaremba, A. (2024). What drives stock returns across countries? Insights from machine learning models. *International Review of Financial Analysis*, 96, 103569

Campbell, R., Huisman, R., & Koedijk, K. (2001). Optimal Portfolio Selection in a Value-at-Risk Framework. *Journal of Banking and Finance*, 25, 1789-1804.

Chen, J., Jiang, F., & Tu, J. (2014). Asset Allocation in the Chinese Stock Market: The Role of Return Predictability. *The Journal of Portfolio Management*, 41, 71-83.

Efendi, D. B. (2015). Analysis of Risk and Return of Foreign Exchange Portfolios. *Jurnal Manajemen Update*, 4(4).

Doeswijk, R., Lam, T., & Swinkels, L. (2020). Historical returns of the market portfolio. *The Review of Asset Pricing Studies*, 10(3), 521-567.

Fadhila, S. O. N., Abadi, A. M., & Setiawan, E. P. (2024). Determination of optimal portfolio by calculating transaction costs using genetic algorithms on the Jakarta islamic index. *JTAM (Jurnal Teori dan Aplikasi Matematika)*, 8(1), 298-311.

Fard, H., Ansar, M., & Yekezare, A. (2014). A risk-return based model to measure the performance of portfolio management. *Management Science Letters*, 4, 2183-2190.

Felder, C., & Mayer, S. (2022). Customized Stock Return Prediction with Deep Learning. *2022 IEEE Symposium on Computational Intelligence for Financial Engineering and Economics (CIFEr)*, 1-8.

Fornell, C., Mithas, S., & Morgeson, F. (2009). The statistical significance of portfolio returns. *International Journal of Research in Marketing*, 26, 162-163.

Han, R., Wang, W., & Yilin. (2021). Portfolio optimization with return prediction using deep learning and machine learning. *Expert Systems with Applications*, 165, 113973.

Jean, W. (1971). The Extension of Portfolio Analysis to Three or More Parameters. *Journal of Financial and Quantitative Analysis*, 6, 505-515.

Kuenzi, D. (2020). Sources of Return Dispersion in Alternative Risk Premia. *The Journal of Alternative Investments*, 22(4), 26-39.

Latuamury, J. (2022). Analisis Single Index Model Dalam Pembentukan Portofolio Optimal (Studi Saham Indeks LQ45 Periode 2017–2022). *Jurnal Lentera Akuntansi*, 7(1), 1-10.

Li, Y. Y. (2022). Portfolio Management with Return Forecasting Based on Bigdata Analysis. *2022 7th International Conference on Cloud Computing and Big Data Analytics (ICCCBDA)*, 490-495.

Marcondes, G. A. B. (2019, January). Project Portfolio Selection Considering Return-risk Evaluation and Multiple-Criteria Decision Analysis. *In ICORES* (pp. 264-269).

Markowitz, H. M. & Blay, K. A. (2014). *Risk-return analysis : the theory and practice of rational investing*. New York: McGraw-Hill Education

McLean, R., & Pontiff, J. (2015). Does Academic Research Destroy Stock Return Predictability? *ERN: Econometric Studies of Capital Markets (Topic)*.

Mech, T. (1993). Portfolio return autocorrelation. *Journal of Financial Economics*, 34, 307-344.

Mencia, J. (2012). Assessing the risk-return trade-off in loan portfolios. *Journal of Banking & Finance*, 36(6), 1665-1677.

Miao, B. L., Liu, Y., Fan, Y. B., Niu, X. J., Jiang, X. Y., & Tang, Z. (2023). Optimization of agricultural resource allocation among crops: a portfolio model analysis. *Land*, 12(10), 1901.

Neděla, D., Ortobelli Lozza, S., & Tichý, T. (2025). Dynamic return scenario generation approach for large-scale portfolio optimisation framework. *Computational Economics*, 65(2), 819-843.

Rajyaguru, J. U. (2023). Analysis of Portfolio Return and Risk: A multination approach. *Research Review International Journal of Multidisciplinary*, 8(12), 137-143.

Roberts, L. (2010). Assessment and Planning Using Portfolio Analysis. *Journal of Museum Education*, 35, 181-186.

Rubio-Manzano, A., Bermúdez, J. D., & Vercher, E. (2015). Comparative analysis of forecasting portfolio returns using Soft Computing technologies. In *2015 Conference of the International Fuzzy Systems Association and the European Society for Fuzzy Logic and Technology (IFSA-EUSFLAT-15) (pp. 617-623)*. Atlantis Press.

Schuhmacher, F., Kohrs, H., & Auer, B. (2021). Justifying Mean-Variance Portfolio Selection when Asset Returns Are Skewed. *Management Science*, 67, 7812-7824.

Sharma, M., & Shekhawat, H. S. (2022). Portfolio optimization and return prediction by integrating modified deep belief network and recurrent neural network. *Knowledge-Based Systems*, 250, 109024.

Tsiang, S. (1973). Risk, Return, and Portfolio Analysis: Comment. *Journal of Political Economy*, 81, 748-752.

Tu, X., & Li, B. (2024). Robust portfolio selection with smart return prediction. *Economic Modelling*, 135, 106719.

Utz, S., & Steuer, R. E. (2024). Empirical analysis of the trade-offs among risk, return, and climate risk in multi-criteria portfolio optimization. *Annals of Operations Research*, 1-24.

Yan, X., Yang, H., Yu, Z., Zhang, S., & Zheng, X. (2024). Portfolio Optimization: A Return-on-Equity Network Analysis. *IEEE Transactions on Computational Social Systems*, 11, 1644-1653.

Yu, J. R., Chiou, W., Lee, W. Y., & Lin, S. (2020). Portfolio models with return forecasting and transaction costs. *International Review of Economics & Finance*, 66, 118-130.

Zhu, M. (2013). Return predictability and its implications for portfolio selection. International Review of Economics & Finance, 27, 209-223.

Zhu, H., & Yang, L. (2022). portfolio: A command for conducting portfolio analysis in Stata. *The Stata Journal*, 22, 941-957.