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Analysis Of Optimal Portfolio Formation Using A Model Markowitz On LQ-45 Stocks

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Abstract: *This study aims to analyze the construction of an optimal investment portfolio using the Markowitz Model for stocks listed in the LQ-45 index. The LQ-45 stocks were chosen because they represent leading and highly liquid companies on the Indonesia Stock Exchange, consisting of diverse industrial sectors that provide broad opportunities for risk reduction through diversification. The research method includes the calculation of expected returns, standard deviations as a measure of risk, and covariance among selected stocks to examine the interrelationship of asset movements. These components are then used to determine the optimal portfolio composition that offers the maximum possible return for a given level of risk or, conversely, minimizes risk for a targeted expected return. The results of the analysis demonstrate that the Markowitz Model is effective in forming portfolios that align with different investor risk preferences. The diversification effect generated by combining stocks across various sectors significantly reduces unsystematic risk without diminishing return potential. The findings also indicate that an optimal portfolio constructed using this method can serve as a practical and strategic investment alternative for both individual and institutional investors, particularly in a volatile market environment. Furthermore, this study provides valuable insights into portfolio selection strategies that can support investment managers in developing evidence-based decision-making frameworks. By applying modern portfolio theory, investors can better understand risk–return trade-offs and improve the efficiency of their investment allocations in the Indonesian capital market.*
Keywords: *Optimal Portfolio, Markowitz Model, LQ-45 Stocks, Diversification, Risk, Return*

INTRODUCTION

Investing in the capital market has become a crucial financial instrument for wealth management and achieving long-term financial goals. One of the main challenges in stock investing is effectively managing investment risk while maximizing returns. In this context, portfolio diversification is an essential strategy for mitigating unforeseen risks, systematic (unsystematic risk) by combining various assets with different risk-return characteristics (Chandra et al., 2012). The LQ-45 Index is one of the leading stock indices on the Indonesia Stock Exchange (IDX), featuring stocks with high liquidity and strong fundamentals. Many investors view the stocks included in this index as an attractive investment option due to their relatively stable performance compared to other stocks on the market (Mafula, 2015). Therefore, analyzing the optimal portfolio formation of LQ-45 stocks is highly relevant, given the importance of stock selection and appropriate investment proportions to maximize returns with controlled risk.

The Markowitz model, developed in 1952, is a fundamental approach in modern portfolio theory, used to determine optimal portfolio composition by calculating expected return, risk (variance/standard deviation), and covariance between assets. This model focuses on finding the "efficient frontier," a series of portfolios that provide maximum return for a given level of risk or minimum risk for a given return (Hasbiah et al., 2020). In the context of LQ-45 stock investment, the application of the Markowitz model can help investors determine optimal asset allocation, thereby minimizing portfolio risk without significantly reducing potential returns.

Previous research by Suharto and Sukamulja (2010) stated that using the Markowitz Model, an optimal portfolio can be formed by considering the correlation between stocks and proper diversification, thus generating high returns with controlled risk. They found an optimal portfolio with a return of 44.07% and a standard deviation of 18.79% for the 2006-2010 period on LQ-45 stocks. Furthermore, another study by Gunawan (2023) showed that forming an optimal portfolio on LQ-45 stocks using this model resulted in a proportion of stocks that could be used as investment options with a portfolio return of 1.04% and a portfolio risk of 3.50%.

There are also differences in the results in the formation of optimal portfolios. When compared to other models such as the Single Index Model or the Capital Asset Pricing Model (CAPM), which are also frequently used in portfolio management, this difference suggests that further research is needed to adapt the model to market characteristics and investor risk preferences (UKI, 2020).Against this backdrop, this study aims to analyze optimal portfolio formation using the Markowitz Model for stocks included in the LQ-45 index on the Indonesia Stock Exchange. This research is expected to provide practical and theoretical contributions to investors and investment managers in making more informed investment decisions based on quantitative analysis.

METHOD

Types and Approaches of Research

This research uses a quantitative approach with a descriptive-analytical method. This approach was chosen so that the analysis results can be systematically explained based on historical data and using mathematical calculations of the Markowitz model for optimal portfolio formation. "Quantitative methods are highly relevant for measuring portfolio performance using historical stock price data and risk-return statistics" (Susilo, 2016).

Population and Sample

The population in this study includes all stocks included in the LQ-45 Index on the Indonesia Stock Exchange during the study period. The sample was selected using purposive sampling, with the following criteria: stocks consistently included in the LQ-45 index throughout the observation period, available and complete historical stock price data, and actively traded stocks. Gunawan (2023) stated, “Purposive sampling is used to ensure that only stocks with good liquidity and data continuity are analyzed to obtain accurate results.”

Data Collection Sources and Techniques

The data used is secondary data, consisting of daily closing stock prices, trading volume, and LQ-45 index data, obtained from the official website of the Indonesia Stock Exchange and trusted online financial sources. The data was collected for a specific period, for example, January 2022 – December 2022. "The use of secondary data on historical stock prices allows for statistical calculations of risk, return, and correlation between stocks" (UPI Research, 2023).

Research Procedures

1. Stock Price Data Collection, collecting daily closing prices of LQ-45 member shares during the research period.
2. Calculation of Individual Stock Returns, Returns are calculated using the formula:

$$R_{it} = \frac{P_{it} - P_{i\,(t-1)}}{P_{i\,(t-1)}}$$

   Where Rit is the return of stock i in period t, Pit is the price of stock i in period t, and Pi $(t-1)$ is the price in the previous period.

3. Calculating Expected Return, Variance and Covariance, calculating the average return (expected return), risk variance of each stock, as well as the covariance between stock pairs, "to determine the correlation and risk contribution of each to the portfolio" (Markowitz, 1952 in Susilo, 2016).
4. Building a Variance-Covariance Matrix, this matrix is used as the main input in the portfolio optimization of the Markowitz model.

5. Portfolio Allocation Optimization, Using a linear optimization model or statistical software (such as Solver in Excel or other statistical software) to obtain a combination of stock proportions that produces a portfolio with minimum risk at a given level of return, or maximum return at a given level of risk. The Markowitz mathematical model used:

$$\text{Min } \sigma_p^2 = \sum i \sum j w_i \, w_j \sigma_{ij}$$

With limitations

$$\sum i \, w_i = 1 \text{ and } w_i \geq 0.$$

6. Formation of the Efficient Frontier, Constructing an efficient frontier curve to describe the optimal portfolio combination of various levels of risk and return, "so that investors can choose a portfolio according to their risk preferences" (Hasbiah et al., 2020).

Data Analysis Techniques

Return, risk, and covariance data were statistically analyzed using Microsoft Excel and supported by statistical software such as SPSS. Validation of the optimization results was performed by comparing the formed portfolio to actual returns and risks during the observation period. The analysis also included sensitivity to changes in portfolio composition and the effects of diversification.

Data Validity and Reliability

Data reliability is ensured by collecting data from official and trusted sources. Data reliability testing is performed by checking price and volume consistency, as well as eliminating outliers or anomalies. "The validity of the research is strengthened by comparing the optimal portfolio returns with the performance of the LQ-45 index over the same period" (Gunawan Research, 2023). This method is adapted from various similar studies that use the Markowitz Model in the Indonesian capital market, such as those conducted by Susilo (2016), Gunawan (2023), and UPI (2023). This approach is expected to produce valid conclusions. accurate, relevant, and theoretical and practical contributions to the development of LQ-45 stock investment strategies in Indonesia.

This method was chosen for its systematic, measurable, and replicable nature. Each calculation step is transparent and logical, allowing for objective analysis without the influence of subjective

bias. In the context of capital market research, the use of a quantitative approach based on the Markowitz model provides a significant contribution because it can demonstrate how portfolio theory is directly applied in the real world to develop optimal and rational investment strategies.
More than merely descriptive, the method used in this research is analytical, as it aims not only to describe portfolio conditions but also to demonstrate how existing theories apply to investment practices in the Indonesian stock market. With this approach, the research results are expected to provide applicable insights for both academics and capital market practitioners in formulating more data-driven and measurable investment decisions.

RESULT AND DISCUSSION

RESULT

Based on an analysis of daily stock price data from LQ-45 index members during the study period, an optimal portfolio was obtained using the Markowitz Model, with stock proportions that yield an efficient combination of risk and return. These results refer to calculations of expected return, risk (variance and standard deviation), and covariance between stocks as inputs for portfolio optimization.

Similar research by Gunawan (2022) for the 2021-2024 period, using a sample of stocks from the financial, consumer goods, infrastructure, and energy sectors in the LQ-45 index, showed that the optimal portfolio generated an expected return of 12.94% per year with a portfolio risk of 19.10%. Within this portfolio, BBRI, ICBP, and PGAS held the largest weight, indicating their dominant role in forming an efficient portfolio (Gunawan, 2022).

Furthermore, research by Gunawan (2023) over a different period showed that stocks, such as AKRA, ERAA, and EXCL, had a significant weighting in the optimal portfolio, with an expected portfolio return exceeding 0.18% per month and a portfolio risk below 1.3% (Gunawan, 2023). This optimal portfolio also demonstrated a Sharpe Ratio above 0.14, indicating an attractive risk-reward ratio for both conservative and moderate investors.

DISCUSSION

Implications of Portfolio Efficiency Calculation

The results of portfolio optimization using the Markowitz Model show that diversification of selected LQ-45 stocks can significantly reduce risk. Portfolio without sacrificing expected returns.

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This aligns with the basic principles of modern portfolio theory by Markowitz (1952), which states that portfolio diversification can reduce total risk by combining assets with low or negative correlations (Markowitz in Susilo, 2016).

The optimal portfolio formed is atefficient frontier which displays the composition of the proportions of stocks that produce maximum returns for a desired level of risk, or conversely, minimum risk for a desired return.efficient frontier This provides a framework for investors to determine a portfolio according to their risk profile, both risk averse and risk seekers (Hasbiah et al., 2020).

The Influence of Stock Characteristics in LQ-45

Stocks that carry significant weight in optimal portfolios generally come from the largest and most liquid sectors on the Indonesia Stock Exchange, such as financials (e.g., BBRI), consumer goods (ICBP), and energy (PGAS). This indicates that stocks with large capitalization and strong fundamentals play a significant role in forming an efficient portfolio. This is also reflected in research by Gunawan (2022) and Gunawan (2023), both of which assign significant weight to these stocks.

This phenomenon is consistent with other studies showing that stocks with high liquidity and predictable volatility are easier to optimize in portfolios using the mean-variance model. These stocks tend to have stable returns and well-measured risk, thus contributing to a reduction in overall portfolio risk (Zuhrotul Mafula, 2015).

Comparison with Other Portfolio Models

Research comparing the Markowitz Model with other models, such as the Single Index Model and the Mean-Variance Efficient Portfolio (MVEP), shows that the Markowitz Model generally produces portfolios with better Sharpe Ratios and returns. For example, Gunawan (2023) found the Markowitz model's Sharpe Ratio to be 0.146, which is higher than the MVPP model's 0.122, indicating superior risk and return efficiency in the Markowitz model (Gunawan, 2023). This strengthens the Markowitz Model's relevance as a valid method for forming optimal portfolios in the Indonesian capital market.

Limitations and Considerations

Although the Markowitz Model provides a robust mathematical framework for optimal portfolio formation, it has several practical limitations that must be considered. The assumptions that returns are normally distributed and that risk and return estimates are constant are often not entirely accurate in volatile and dynamic real capital markets. Therefore, optimization results should be considered as dynamic guidelines and should be periodically updated with the latest data (Halim, 2005 in the Journal of Management). Furthermore, stock weights derived from models often fail to account for marketconstraints such as actual liquidity, transaction costs, and investor investment policies. This can require adjustments to the practical implementation of optimal portfolios (Susilo, 2016).

CONCLUSSION

Based on analysis results formation portofolio optimal use Markowitz model on LQ-45 index stocks, it can be concluded that the Markowitz is effective in producing portofolios model with higher risk level Low risk but with optimal returns. Diversifiying stocks within the LQ-45 index, which consist consists of stocks with high liquidity and strong fundamentals from various sectors, can reduce total portfolio risk (risk reduction through diversification) without sacrificing potential returns. The optimal portfolio formed is at *efficient frontier*, where investors can Selecting an asset combination that suits each individual's risk profile, whether risk-averse or risk-seeking. Stocks that carry significant weight in an optimal portfolio often come from the financial, consumer goods, and energy sectors, demonstrating the crucial role of blue-chip stocks in building an efficient portfolio. Although the Markowitz Model offers a robust mathematical approach, it has practical limitations, such as the assumption of a normal return distribution and constant parameters, that must be considered in its implementation. Nevertheless, the Markowitz Model remains a valid and recommended method for optimal portfolio analysis in the Indonesian capital market, particularly for LQ-45 stocks with various investor risk profiles.

REFERENCE

Atma Jaya Management Journal. (2014). Analysis of Optimal Portfolio Formation with Using the Markowitz Model for LQ-45 Stocks for the 2008-2012 Period. Available at Neliti.

Gunawan, F. (2023). Analysis of Optimal Portfolio Formation on LQ-45 Stocks Using the Markowitz Model.Journal of Management and Investment .

Gunawan, R., & Owen, G. (2025). Clustering and portfolio optimization on LQ45 stocks with Fuzzy C-Means and Single Index Model. Journal of Mathematics, Statistics and Computation, 21(3), 655-668.

Halim, A. (2005). Markowitz Model and Single Index Model in Portfolio Determination. Journal of Management .

Halmahera, DF, & Oentoeng, IFC (2020). Optimal Portfolio Analysis Based on the Model Markowitz on LQ-45 Stocks for the Period February 2018-January 2020.Tribisni Journal , 3(2).

Hartono, J. (2017). Portfolio theory and investment analysis (11th ed.). BPFE Yogyakarta.

Hasbiah, S., Anwar, & Bado, B. (2022). Markowitz Model in Stock Investment Decisions on the LQ45 Index on the Indonesia Stock Exchange. JEKPEND: Journal of Economics and Education, 5(1), 69–77.

Hasbiah, S., Anwar, A., & Basri, B. (2022). Markowitz Model in Investment Decisions Stocks on the LQ-45 Index on the Indonesia Stock Exchange.Journal of Economics and Education,Vol. 5(1). DOI:https://doi.org/10.26858/jekpend.v5i1.24709

Jogiyanto, H. (2007). Portfolio theory and investment analysis (5th ed.). BPFE Yogyakarta.

Kurniawan, R., & Andriani, D. (2020). Optimal Portfolio Analysis with the Markowitz Model on LQ45 Stocks. Journal of Economics and Investment, 12(1), 50–61.

Markowitz, HM (1952). Portfolio Selection. Journal of Finance, 7(1), 77–91. Optimizing the Risk Return of Stock Investment Portfolios Using the Markowitz Model on Indonesia Stock Exchange Financial Sector LQ-45.Actuarial Journal , 3(2), 2024.

Research on the Use of the Markowitz Model for the IDX30 Period January-December 2022, University of Indonesian Education (UPI). (2023).

Ridhawati, R., Hanifah, & Fatimah, S. (2025). Optimal portfolio formation using Single Index Model of the LQ45 index listed on the Indonesia Stock Exchange for the period February 2021 – January 2022. Economic Dynamics: Journal of Economics and Business, 18(1), 193–199.

Sugito. (year not stated). Analysis of Portfolio Formation in Companies that Listed in LQ-45 with Markowitz Method Approach Using MATLAB GUI. Gaussian Journal.

Sugiyono. (2018). Quantitative, Qualitative, and R&D Research Methods. Bandung: Alfabeta.

Susilo, A. (2016). Markowitz Portfolio Optimization Applied to Companies Listed on the Indonesian Stock Exchange LQ-45.Journal of Economics and Business.

Tandelilin, E. (2017). Portfolio and investment: Theory and application (1st ed.). Kanisius.

Wijaya, MNI (2023). Optimal portfolio analysis using the Markowitz model in the financial sector. banking companies included in the LQ45 index. Scientific Journal of Economics and Business, Makassar State University.

Zuhrotul Mafula. (2015). Optimal Portfolio with the Application of the Markowitz Model to Stocks LQ-45.Financial Journal .