Markowitz Model for Forming an Optimum Stocks Portfolio in The January Effect

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Abstract

This research aims to analyze the formation of an optimal portfolio using the Markowitz model for stocks listed in the LQ45 Index during the period from December 2022 to Jan 2024. The population of this research includes all 45 stocks in the LQ45 over this timeframe, with a sample of 5 stocks selected through purposive sampling and January Effect criteria. Data collection was carried out through documentation, and the analysis followed the steps of the Markowitz model, starting from gathering closing stock prices to determining the optimal portfolio. The findings reveal that four stocks are part of the optimal portfolio: BBTN 32.4%, BMRI 22.7%, ICBP 39.4%, and MEDC 5.5%. The portfolio's expected return is 4.8 percent, with a portfolio risk of 3.6 percent, which is lower than the individual risk of any of the stocks in the sample.

Keyword: Markowitz, Stock, Optimum, January Effect

1. Introduction

Investment is one of the crucial aspects of individual and institutional financial management. In an increasingly complex and dynamic economic context, the investment process aims not only to generate profits, but also to achieve long-term financial stability. With increasing awareness of the importance of financial planning, individuals and organizations are now more active in managing their assets to maximize growth potential.

The January Effect phenomenon is one of the market anomalies that has attracted the attention of investors and academics in finance. Known as the tendency for stock prices to rise in January, this effect has been observed since the early 1940s when it was first noted by Sidney B. Wachtel. The January Effect is often attributed to several factors, such as portfolio adjustments by investors, post-sale stock purchases for tax purposes, and investor optimism towards the prospects of the new year.

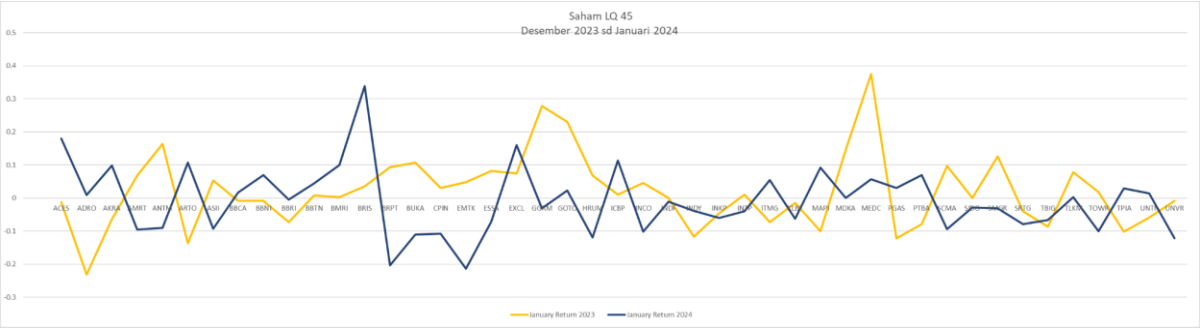

Figure 1.1. Result Markowitz for 5 Emiten

The Figure 1.1 above shows data from stocks that are included in LQ 45. The chart compares data on stock price increases in December 2023 and January 2024, if there is a striking spike in stock price increases in January 2024, that right shows the *January Effect*. In the graph above, it can be seen that there are several stocks with a fairly high spike in stock price increase in January 2024, while others do not show a strong spike. This shows that there is a *January Effect* on stocks that are members of the LQ 45. Modern portfolio theory, developed by Harry Markowitz in the early 1950s, has become an important cornerstone of investment management. Markowitz's model introduced a systematic approach to optimizing portfolios by considering risk and return. In the investment world, proper stock selection is critical to achieving financial goals, and this approach provides a framework that assists investors in making more informed decisions.

2. Literature Review

2.1 Capital Markets

In discussing investment management, it is necessary to know the terms in it, one of which is the capital market. The capital market is a scope for buying and selling long-term

financial instruments, such as stocks and bonds. According to the law, the capital market involves activities related to shares issued by public companies and related institutions. The capital market is not only a means of buying and selling financial instruments but also has an important role in the movement of a country's economy. The following is the role of the capital markets:

As a means of increasing capital

The capital market is needed as a means for companies to launch bussiness, by buying and selling shares, companies can obtain funds to increase their business capital.

As an allocation of resources

The capital market is an intermediary that connects those who need funds with those who have excess funds so that they can indirectly help each other encourage a more productive and efficient allocation of resources.

As a driver of economic growth

The capital market contributes to a country's economy by increasing the production capacity of business actors, in this case companies. Funds raised from the capital market allow companies to invest more so as to create new jobs and increase national income.

The existence of the capital market is a means to put excess funds owned by investors in securities in accordance with the expected return they want to get (Tandelilin, 2018). It can be concluded that the capital market not only functions as a means of trading securities, but also plays an important role in supporting economic growth, resource allocation, and providing benefits for the parties involved such as issuers, investors, and the government.

2.2 January Effect

In the capital market there is a term known as the January Effect. This term is widely known and very commonly known by investors or capital market players, issuers and the IDX as an operator who doubles as a capital market exchange trading regulator. The January Effect itself has a definition which states that the average stock return in January tends to be higher than in other months. This is a market anomaly phenomenon.

When an anomaly occurs, an investor will get a high abnormal return, either in the form of positive or negative or loss. The January effect can give an investor a very high abnormal return due to market conditions that move very quickly (Absalom et al., 2021). The January effect is an aberration in the capital market where returns in January experience a significant increase. This is a way for investors to maximize returns, abnormal returns obtained by investors.

January Effect is an event related to the change of the tax year when the tax year ends in December and the tax year begins in January. The things that can trigger the occurrence of the January Effect phenomenon are tax reductions due to the sale of shares at the end of the year, the realization of capital gains, the effect of window dressing portfolios, or the sale of shares by investors for vacation (Pratomo, 2007).

Overall, the phenomenon that occurs in the capital market or the so-called January effect is related to investor behavior at the end and beginning of the year. However, empirical evidence on its persistence is mixed and depends on the market context. The January effect is regional in nature and depends on macroeconomic and psychological conditions of investors so it cannot be assumed that this phenomenon will occur in all stock markets in the world

without additional context and capital market conditions in a particular country. With this phenomenon, the future risk of stocks is full of uncertainty, so a portfolio is needed to measure several stocks in comparison with the optimal goal of obtaining maximum returns.

2.3 Markowitz Theory

In investment, an investor is required to create a portfolio to analyze which stocks are performing well so that the investment objective of maximum return can be achieved. This relates to Markowitz theory which is a theory that focuses on how investors build an optimal investment portfolio by minimizing risk and maximizing expected returns.

Markowitz theory introduces a mathematical approach that combines two main elements, namely (Hasbiah et al., 2022)

Expected Return : The average expected return of the securities in a portfolio.

Variance : A measure of risk or fluctuation in returns. The model seeks to maximize the expected return for a given level of risk.

The basic assumptions in Markowitz theory are based on several key assumptions namely rational and risk-averse investors, investors who have equal access to information and make decisions based on expected returns and risk, no transaction costs and no risk-free loans. This paper aims to find stocks in the LQ45 index that perform well with a filter indicator, namely the January Effect phenomenon.

2.4 The Relationship Between Markowitz Theory and the January Effect

Investors in finding good performing stocks need to know that Markowitz Theory, which focuses on portfolio optimization by minimizing risk and maximizing return, does not directly explain the January Effect phenomenon, but can provide a framework for understanding why stock returns are often higher in January, by knowing the relationship between Markowitz and the January Effect, which includes:

Portfolio Optimization

Markowitz's theory suggests that investors can reduce risk by mixing different assets in a portfolio. In January, many investors rebalance their portfolios after the end of the year, which often involves buying stocks that were previously sold for tax purposes or to improve the appearance of financial statements. This activity can lead to increased demand for stocks, especially small caps, which often experience price spikes in January (Yoga, 2010).

Market Anomalies and Behavioral Finance

The January Effect is a market anomaly that shows that stock returns tend to be higher in January than other months. In Keim's (1983) research shows that about 50% of the abnormal returns that occur in January come from small capitalization stocks, where investors tend to be more active in buying back these stocks after selling them at the end of the year. Markowitz theory can help explain this behavior through a diversification approach, where investors seek to take advantage of higher return opportunities by taking on greater risk at the beginning of the year.

Risk and Return

In the context of Markowitz, the trade-off between risk and return is particularly relevant, with the return to risk trade-off in January being greater than in other months. This could be due to investors' positive expectations of market performance at the beginning of the year, which encourages them to take on more risk. Though Markowitz theory does not

explicitly explain why stock returns are higher in January, it provides a framework for understanding the market dynamics that occur during this period. Portfolio rebalancing and investor behavior in the face of market anomalies such as the January Effect can be analyzed using Markowitz's principles of diversification and the relationship between risk and return.

3. Material and Method

3.1 Study Design

This study applies a robust quantitative approach to examine the influence of the January Effect on the performance of top-performing stocks. The January Effect is a common market anomaly, where stock returns during January tend to be higher than in other months (Ni Kadek Ema Yunita, 2019). This phenomenon provides investors with the opportunity to achieve returns that exceed the usual. The purpose of this study is to test whether this anomaly also applies to a stock portfolio selected based on a good historical performance record, particularly in emerging markets such as Indonesia.

This study focuses on stocks listed on the Indonesia Stock Exchange (IDX), using historical data from December 2022 to January 2024. This approach allows the analysis to cover various market conditions and economic changes, providing more comprehensive insights into the influence of the January Effect. Data collection was conducted carefully, using past stock performance to form a representative portfolio. The extended time frame allows for observing return patterns over a broader period and reduces the impact of short-term market fluctuations.

The stock selection process was carried out by identifying stocks that consistently outperformed the market, using the previous year’s return data as the main basis. The focus of this study is on high-performing stocks, to see if the January Effect is more evident in these stocks compared to those that follow the overall market trend(Banan & Tristiarto, 2023). Thus, this study aims to determine whether stocks with higher returns experience a significant increase in returns in January compared to other months (Banan & Tristiarto, 2023).

In addition, this study is also a descriptive study aimed at describing changes in the formation of an optimal portfolio using the Markowitz model and the single index model. The data used in this research is secondary data collected through documentation, including monthly stock closing prices, the IHSG (Jakarta Composite Index) closing prices, and the risk-free interest rate represented by the Bank Indonesia rate (BI rate). This data is then analyzed using the Markowitz model and the single index model.

The study population consists of stocks that have been listed in the LQ45 Index on the Indonesia Stock Exchange during the period from December 2022 to January 2024. The research sample was selected using purposive sampling, with sample criteria including companies listed on the IDX, previously included in the LQ45 Index, and having available closing price data for that period. Based on these criteria, this study successfully identified relevant stocks for analysis.

The variables in this study include the Markowitz model and the single index model in the formation of an optimal portfolio. The operational definitions and measurements of variables related to optimal portfolio formation include stock returns(Susilo et al., 2024),

which indicate the level of profit generated by each company's stock in the LQ45 Index during the period from December 2022 to January 2024.

3.2 Data Analysis

This study uses a quantitative approach focused on applying the Markowitz model in the formation of an optimal stock portfolio during the January Effect phenomenon. The study aims to analyze stock performance and portfolio optimization based on historical stock price data, following the principles of Modern Portfolio Theory (MPT) introduced by Harry Markowitz.

This study explores stocks that show strong performance during the January Effect, a market anomaly where stock prices typically experience an increase. The stocks selected for analysis are those listed on the Indonesia Stock Exchange and meet the criteria of high liquidity and good financial health. These stocks are relevant for both individual and institutional investors who aim to optimize their portfolios.

Focusing on high-performing stocks during the January Effect, this study aims to identify opportunities for investors in building an optimal portfolio, supported by proper diversification based on the historical performance of these stocks(Ramadhan et al., 2020).
The analysis involves two main stages:

Application of the Markowitz Model: The Markowitz model, often referred to as mean-variance optimization, is applied in this study to determine the most optimal combination of stocks(Melta & Murni, 2021). This model considers the expected return and risk (variance) of each stock and calculates the efficient frontier, which is a set of portfolios that provide the highest return for a given level of risk (Artanto et al., 2024).

Monthly stock price data from the selected stocks during the January Effect period were collected. This data is used to calculate stock returns, variance, and covariance, which are essential elements in constructing an optimal portfolio. The expected return of each stock is calculated based on historical data, while risk (variance) is determined from the spread of returns. Covariance between stocks is measured to evaluate the relationship in stock movements, which is crucial in reducing overall portfolio risk(Aniswahqa & Yahya, 2017).

Data Collection and Selection: The data used in this study was obtained from public stock price records and financial reports of companies listed on the Indonesia Stock Exchange. The stocks selected are those that demonstrated consistent performance during the January Effect period, chosen based on criteria such as liquidity, historical returns, and risk level. The data collected includes monthly closing prices of stocks during January for specific periods. This data is then used to calculate the expected return and standard deviation (risk) of each stock.

Data Analysis includes:

1. **Calcularing Realized Return**

   The formula for calculating the realized return of each stock is:

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

   where,

- P_t : Stock price at the current period
- P_{t-1} : Stock price at the previous period
- D_t : Devidends distributed

2. Calculating Expected Return

After obtaining the return for each period, calculate the expected return each stock using the formula:

$$E(R_i) = \frac{\sum R_{it}}{N}$$

where,

- $E(R_i)$: Expected return of stock i
- R_{it} : Return of stock i in period t
- N : Number of observation periods

3. Calculating Stock Risk (Variance and Standard Deviation)

Stock risk is calculated in the form of variance and standard deviation using the following formulas:

Variance:

$$\sigma_i^2 = \frac{\sum[(R_{it} - E(R_i))^2]}{N-1}$$

Standard Deviation:

$$\sigma_i = \sqrt{\sigma_i^2}$$

where,

- R_{it} : Realized return of stock i at time t
- $E(R_i)$: Expected return of stock i

4. Calculating Covariance

Covariance shows the risk relationship between two stock. The formula is:

Variance:

$$\sigma_{RA,RB} = \frac{\sum[(R_{At} - E(R_A))(R_{Bt} - E(R_B))]}{N-1}$$

Standard Deviation:

where,

- R_{At} and R_{Bt} : Returns of stock A and B
- $E(R_A)$ and $E(R_B)$: Expected return of stock A and B

5. Calculating Correlation Coefficient

The correlation coefficient measures the strength of the relationship between two stocks:

$$\rho_{AB} = \frac{\sigma_{RA,RB}}{\sigma_A . \sigma_B}$$

where,

- σ_A and σ_B : Standard deviations of stocks A and B

6. Calculating Expected Portofolio Return

The portofolio return is calculated as the weighted average of the expected returns of the stocks in the portofolio:

$$E(R_P) = \sum (w_i . E(R_i))$$

Where,

- $E(R_P)$: Expected portofolio return
- w_i : Weight of stock i in the portofolio
- $E(R_i)$: Expected return of stock i

7. Calculating Potofolio Risk (Portofolio Risk – Variance and Standart Deviation)

Portofolio risk is calculated as the portofolio variance, taking into account the stock weights, variances, and covariances:

Portofolio Variance:

$$\sigma_P^2 = \sum w_i^2 . \sigma_i^2 + \sum w_i . w_j . \sigma_{ij}$$

Portofolio Standard Deviation:

$$\sigma_P = \sqrt{\sigma_P^2}$$

where,

- w_i and w_j : Weight of stock i and j in the portofolio
- σ_P^2 : Variance of stock i
- σ_{ij} : Convariance between stock i and j

8. Solving Optimization Problems Using Solver in Microsoft Excel to Find the Portfolio That Offers the Best Balance Between Risk and Return, Focusing on Maximizing the Sharpe Ratio for Each Portfolio Composition.

Based on the 2023 & 2024 January stock return results (Figure 1.1), there are 5 stocks that tend to be stable (give positive returns) in two consecutive years. The following is a list of company shares included in the research sample.

Table 3.1. List of Stocks Included in the Research Sample

No	Code	Stock Name
1	BRIS	PT Bank Syariah Indonesia Tbk
2	BBTN	PT Bank Tabungan Negara Tbk
3	BMRI	PT Bank Mandiri Tbk
4	ICBP	PT Indofood CBP Sukses Makmur Tbk
5	MEDC	PT Medco Energi Internasional Tbk

4. Result

4.1 Actual Returns and Expected Returns

Based on the calculation of five sample stock that included in this research, the result for actual returns and expected returns as follow**:**

Table 4.1. Actual Returns and Expected Returns

No	Code	Stock Name	$\sum R_i$	$E(R_i)$
1	BRIS	PT Bank Syariah Indonesia Tbk	22.6%	4.52%
2	BBTN	PT Bank Tabungan Negara Tbk	-1.0%	-0.20%
3	BMRI	PT Bank Mandiri Tbk	10.6%	2.12%
4	ICBP	PT Indofood CBP Sukses Makmur Tbk	5.7%	1.14%
5	MEDC	PT Medco Energi Internasional Tbk	8.6%	1.72%

Table 4.1 shows that 4 of 5 samples have positive returns which mean investing in these stocks will provide profits for the investors. BRIS has the highest actual return by 22.6% which is also higher than the expected return which is 4.52%. It is also followed by BMRI, ICBP, MEDC which also has an actual return higher than expected return. The actual return, which is higher than expected return, indicates that the investment performance in these stocks has far exceeded expectations and can provide significant benefits to investors.

4.2 Variance and Standard Deviation

Variance and standard deviation can help the investors examine how big the fluctuation or the risk from the investment. Besides use to determine the risk, variance and standard deviation are also used to evaluate the performance and make a decision about asset allocation in the portfolio.

Table 4.2. Variance and Standard Deviation

No	Code	Stock Name	σ^2	σ
1	BRIS	PT Bank Syariah Indonesia Tbk	0.0011	0.0333
2	BBTN	PT Bank Tabungan Negara Tbk	0.0002	0.0128
3	BMRI	PT Bank Mandiri Tbk	0.0005	0.0214
4	ICBP	PT Indofood CBP Sukses Makmur Tbk	0.0001	0.0105
5	MEDC	PT Medco Energi Internasional Tbk	0.0030	0.0549

Based on the result variance and standard deviation in table 4.2, MEDC has the highest variance and standard deviation by 0,0030 and 0,0549 which means MEDC has the highest fluctuation and risk. It is different with ICBP condition which more stable with shown by the lowest result of variance and standard deviation

4.3 Intercompany Stock Price Correlation Coefficient

Table 4.3. Intercompany Stock Price Correlation Coefficient

	BRIS	BBTN	BMRI	ICBP	MEDC
BRIS	1	-0.13	0.77	0.84	-0.86
BBTN	-0.13	1	-0.73	0.44	0.62
BMRI	0.77	-0.73	1	0.30	-0.99
ICBP	0.84	0.44	0.30	1	-0.44
MEDC	-0.86	0.62	-0.99	-0.44	1

Based on the results of data processing, there are stocks which, if correlated with the same stock, give the result +1. This means that all risks cannot be diversified or the portfolio risk will not change like the risk of individual assets. In addition, if all stocks in Table 4.3 are correlated with different stocks, there will be a correlation coefficient between +1 and -1. This means that all company stocks included in the research sample can be diversified or the risk can be reduced by forming various types of shares in a portfolio. In this way, there will be a reduction in risk in the portfolio, but cannot eliminate all risk. The stock correlation coefficient matrix between companies can be seen in Table 4.3.

4.4 Determine the Proportion of Funds for Each Share, Expected Return and Risk of the Portfolio

To determine optimal portfolio formation using the solver program in Microsoft Excel and bellow are the results

Tabel 4.4 Proportion of Funds for Each Share

No	Code	Stock Name	Proportion
1	BRIS	PT Bank Syariah Indonesia Tbk	0.0%
2	BBTN	PT Bank Tabungan Negara Tbk	32.4%
3	BMRI	PT Bank Mandiri Tbk	22.7%
4	ICBP	PT Indofood CBP Sukses Makmur Tbk	39.4%
5	MEDC	PT Medco Energi Internasional Tbk	5.5%

In the table it is known that of the 5 shares that are included in the category of shares that form an optimal portfolio, there are only 4 shares that form an optimal portfolio with the smallest proportion of portfolio risk. This is influenced by various factors such as actual return, expected return, standard deviation, covariance, and correlation coefficient between shares. And the following is the Smallest Risk Portfolio Proportion.

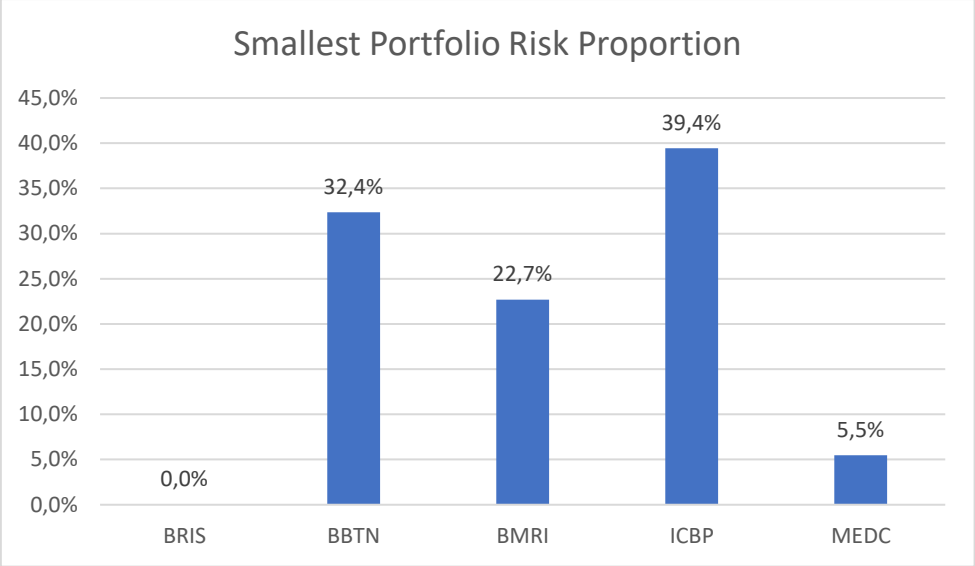

Figure 4.1 The Smallest Risk Portfolio Proportion.

Based on the proportion of funds from each share, the expected portfolio return is 4.8 percent with a portfolio risk of 3.66 percent. This portfolio risk is smaller than the risk of individual shares included in the research sample. For more details see the table;

4.5 Comparison of Individual Stock Risk and Portfolio Risk

Tabel 4.5 Comparison of Individual Stock Risk and Portfolio Risk

No	Code	Stock Name	σ	σp
1	BRIS	PT Bank Syariah Indonesia Tbk	16.63%	
2	BBTN	PT Bank Tabungan Negara Tbk	6.42%	
3	BMRI	PT Bank Mandiri Tbk	10.70%	3.66%
4	ICBP	PT Indofood CBP Sukses Makmur Tbk	5.24%	
5	MEDC	PT Medco Energi Internasional Tbk	27.44%	

From the results of this research, it can be proven that diversification in Markowitz's theory can reduce the variance with certain returns. Thus, the proportion of funds, expected portfolio return and portfolio risk are the best projection results obtained and can be used by investors in choosing which shares are optimal for investment. Based on research results, the Markowitz model is very suitable for beginner investors who want to get a certain level of profit with the smallest risk. Apart from that, the Markowitz model is also very suitable for investors who don't like risk (risk averse).

5. Discussion

The descriptive statistical analysis of LQ45 stocks for January 2024 indicated that 19 stocks showed positive returns relative to the previous month, suggesting the presence of the January Effect for these stocks in 2024. Prior to incorporating these 19 stocks into an optimal

portfolio analysis, the researcher reassessed their performance in the previous year to determine whether they also exhibited the January Effect in 2023. The results showed that only 5 of these stocks demonstrated the January Effect in both years. Consequently, the researcher decided to focus the portfolio construction on these 5 stocks due to their consistent performance over the two-year period. The stocks in question were PT Bank Syariah Indonesia Tbk (BRIS), PT Bank Tabungan Negara Tbk (BBTN), PT Bank Mandiri Tbk (BMRI), PT Indofood CBP Sukses Makmur Tbk (ICBP), and PT Medco Energi Internasional Tbk (MEDC).

Applying the Markowitz model Figure 5.1, the researcher aimed to identify an optimal portfolio that minimizes risk while maximizing returns, though not necessarily targeting the highest return possible. The analysis yielded an optimal portfolio composition with the following stock weights: BRIS 0%, BBTN 32.4%, BMRI 22.7%, ICBP 39.4%, and MEDC 5.5%, which resulted in a portfolio with a 3.6% risk level and a 4.8% return. Given the zero weight assigned to BRIS, the final optimal portfolio comprises only the remaining four stocks.

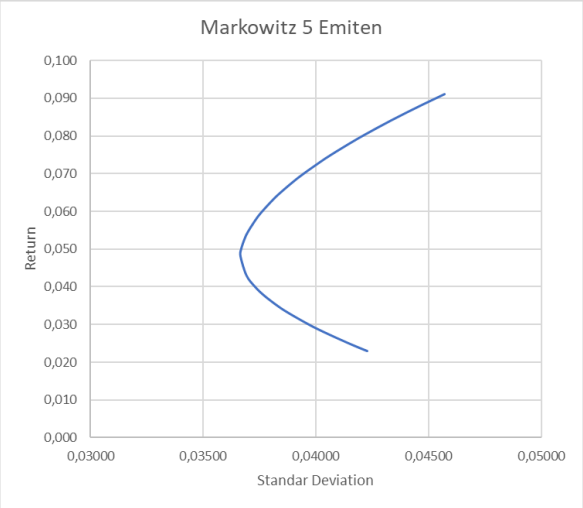

Figure 5.1. Result Markowitz for 5 Emiten

The overall risk of the portfolio was found to be lower than the individual risk levels of each stock in the sample, and the portfolio's expected return did not significantly deviate from the individual stock returns. These findings validate the application of the Markowitz model in demonstrating that diversification can effectively reduce investment risk while maintaining a certain expected return level.

6. Conclusion, Implication, and Recommendation

Considering the January Effect and Using the Markowitz model to construct an optimal portfolio for stocks within the LQ45 over the period from December 2022 to Jan 2024, four stocks were selected as part of the optimal portfolio. The stocks and their respective allocations are as follows: BBTN 32.4%, BMRI 22.7%, ICBP 39.4%, and MEDC 5.5%. These allocations vary due to differences in stock prices, expected returns, risks, and covariances among the stocks. Based on these weightings, the portfolio is projected to generate an expected return of 4.8% with an associated risk level of 3.6%. The expected return which generated from the

Markowitz model is the best expected return generated if compared to the expected return which is generated by each individual company stock. In Addition, the expected return generated by Markowitz is also not much different from expected return which is generated by one of the best expected returns generated from stock samples (BRIS). With a portfolio risk of 3.6%, it shows that the risk generated on Markowitz is smaller than the individual risk generated by each individual sample stock's company. These findings validate the application of the Markowitz model in demonstrating that diversification can effectively reduce investment risk while maintaining a certain expected return level.

Based on the findings of this research, recommendations for investors are to diversify their portfolios by paying attention to correlation and risk factors to get maximum portfolio results with high expected returns and minimal risk. Since this journal focuses on the January Effect, investors need to do checking and rebalancing the portfolio which may change significantly after the January effect. For future studies can include expanding the scope by incorporating stock investment analysis with updated data and a longer observation period. Moreover, it is suggested that subsequent researchers explore the Markowitz model by constructing optimal portfolios tailored to investors' risk preferences and investigate additional stock in LQ45 index.

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