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Research Article

Optimal Portfolio Analysis of Listed Companies in IDX 30

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Abstract.
Investors face the dual considerations of return and risk when making investment decisions. Therefore, proper analysis is crucial, especially during the COVID-19 crisis, to achieve maximum returns while minimizing risk. This research used three portfolio optimization models, the Mean-Variance Model, the Mean-Absolute Deviation Model and the Value-at-Risk Model, to construct a stock portfolio. The findings indicated that the Mean-Variance Model can yield an expected return of 16.55% and a portfolio risk of 258.66%. The result from the Mean-Absolute Deviation Model was that the target return is 16%, along with a portfolio risk of 282.43%.

Keywords: Portfolio Optimization, Mean-Variance, Mean Absolute Deviation, Value at Risk, R Language, IDX30

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1. Introduction

In 2020 Indonesia's economy experienced a decline due to the coronavirus disease 2019 (Covid-19) pandemic. This virus initially broke out in Wuhan, China, in early 2020 and began spreading worldwide, including in Indonesia. The pandemic resulted in a significant increase in the number of investors in the capital market in Indonesia. The number of investors in 2020 touched 3.88 million, and there will be a more significant increase in 2021, namely the number of investors to 7.49 million.

The pandemic has also resulted in stocks in Indonesia being in bad condition. One stock index that needs to be in better shape is the IDX30 index. The IDX30 index is a stock index consisting of 30 stock issuers where the criteria for the stock issuers are to have high liquidity and a large market capitalization, and a good company basis or fundamentals.

At the beginning of the publication, the closing price of IDX30 was 359.05. The value of the closing price of IDX30 fluctuates every year. However, there was a significant depreciation at the beginning of 2020, namely, 480.39 in February 2020 and 383.01 in March 2020. In April 2020, the closing price value gradually increased until the end of

2020, which was 502.27. Until the end of 2022, the value of the closing price of IDX30 continues to recover even though several declines are not too deep. The stock price, which continues to improve, indicates that the impact of the pandemic in Indonesia has ended.

Investors who invest will be confronted by two things, namely return and risk. According to Lubis [1], return is a level of profit obtained by investors due to the funds they have invested. Return can be divided into two, namely, expected return and actual return. The higher the expected return offered, the higher the risk investors have to bear.

According to Tandelilin [2], investors must diversify their portfolios to reduce investment risk. Portfolio diversification can be done by combining several assets to minimize risk without reducing the expected return. There are many theories and models for diversification, one of which is the Mean-Variance Model. This model was put forward by Markowitz [3] by making variance the main factor in measuring risk. Markowitz [3] also suggests that in compiling portfolios, investors can focus on the risk-reward as a whole rather than compiling individual securities portfolios.

After Markowitz, Konno and Yamazaki [4] adopted the mean-absolute deviation as a measure of risk in a portfolio or commonly known as the Mean-Absolute Deviation Model. This model has several advantages, namely that it does not need to calculate the covariance matrix, the calculation is not as complicated as using the mean-variance, and this model usually has fewer assets so that it can reduce transaction costs when revising the portfolio. Wang [5] also developed a model to optimize risk using value at risk. This model is very similar to the mean-variance model, except that in this model, it is minimized, namely the value at risk, not the variance value.

Based on this background, the researcher decided to conduct a study to find out **``Optimal Portfolio Analysis of Listed Companies in IDX30''.**

2. Theory, Literature Review, And Hypothesis

2.1. Investment

Lubis [1]states that investment is spending financial resources or other resources to own an asset in the present to obtain future profits. Meanwhile, according to Putranto et al.[6], investment is made to increase the ability to add value to life. Investments included in the macro economy are investments in capital goods, buildings or construction and finished goods inventories [6]. Based on some of the definitions above, it can be concluded that

investment is saving money in the form of assets which can later benefit from these savings to add value to life.

2.2. Return and Risk

There are two sides to an investment, namely return and risk. In investing, please note that law says the higher the return offered, the higher the risk investors must bear. According to Lubis [1], return is a level of profit obtained by investors due to the funds they have invested. Return can be divided into two, namely, expected return and actual return. The expected return is a profit estimated to be obtained in the future, while the actual return is the actual profit that investors have received. Expected returns can be the average of the returns obtained or occurred in the past.

Putranto et al. [6] suggest that several company conditions can affect internal and external profits. The situation within the company consists of the quality of human resources, the technology used and the company's efficiency level. Some of these aspects directly relate to the expected profit, where the higher the quality of human resources, technology and company efficiency, the higher the expected profit and vice versa. On the other hand, there are several circumstances outside the company, such as government policies, socio-political factors, security factors and domestic and international economic growth.

According to Hidayat [7], investment risk is the possibility that the results obtained from an investment may differ from the expected return value. Risks are divided into three, namely:

1. Pure risk is the risk that arises from the object itself.
2. Systematic risk is an uncertainty that comes directly from the entire market. This risk is macro or diversifiable. Systematic risk is related to the level of volatility, which also indirectly shows fluctuations in stock prices. Systematic risk is also known as market risk.
3. Unsystematic risk is a risk that only affects one or a small portion of the assets in the market. This risk is divided into two, namely business risk and financial risk. Business risk is the risk that is influenced by the company's type of business, while financial risk is the risk that occurs due to a company having debt.

In calculating the risk of a stock, you can use the standard deviation. The higher the standard deviation value, the higher the risk value of an investment, and vice versa. The investment risk will also be lower when the standard deviation value is lower.

2.3. Diversivication

To avoid the risk of an investment, investors need to diversify. Diversification means that investors make investments spread across various industrial sectors. This is done with the aim that if one sector is experiencing a decline, then investors still have other investment reserves. According to Hartono [8], diversification of risk is considered very important, especially for risk-averse investors, because the dangers obtained can be minimized without reducing the value of returns received by investors.

2.4. Portofolio

One way that investors can do diversification is to form a portfolio. Hidayat [7] suggests that a portfolio combines various investment assets created to minimize risk at a certain rate of return. There are two types of portfolios, namely efficient portfolios and optimal portfolios. An efficient portfolio differs from an optimal portfolio, where an efficient portfolio has only one best factor, namely the expected return factor or risk factor. In contrast, the optimal portfolio combines expected return with the best or minimum risk [8]. There are two mathematical models to describe the portfolio process, namely static and dynamic portfolio models. A static portfolio is a replicated portfolio for a given static asset while a dynamic portfolio is a replicated portfolio for a given asset, this is for small changes in the underlying parameters, such as time, asset prices that vary and always adjust to the portfolio itself [9].

2.5. Mean-Variance Model

Markowitz [3]was the first to have introduced the analysis of an investor's portfolio choice using the Mean Variance analysis method. The Mean Variance Model means that for a given expected return, the variance of the return will reach the lowest value assuming that the investor's choice of portfolio will depend on the mean and variance. After determining an acceptable level of risk by quantifying risk using variance, an investor may seek the highest return while determining risk using variance [9]. Markowitz [3] developed a mean-variance model using stock diversification, where several types of assets are formed and combined in a portfolio. Kulali [10] describes the analysis of this model as follows:

1. Calculating the return of each stock

$$Return = \frac{(P_t - P_{t-1})}{P_{t-1}} \quad (1)$$

where Pt means the stock price index in period t and Pt-1 means the stock price in period t-1.

1. Calculating the expected return of each stock

$$E(Ri) = \frac{\sum_{i=0}^{n} R_{it}}{n} \quad (2)$$

where E(Ri) means the expected return on stock i and Rit means the return of stock i on period t.

1. Calculating the investment risk of each stock

$$\sigma i2 = \sum_{i=1}^{n} \frac{(Rij - E(Ri))}{n} \quad (3)$$

where $\sigma i2$ means the variance on stock i and Rij means the return on stock i.

1. Calculating covariances

$$Cov(x, y) = \frac{1}{n-1} \sum_{i=1}^{n} [(X - X\square(Y - Y\square] \quad (4)$$

where X means the return on stock x, X□means the expected return on stock x, Y means the return on stock y, and Y□means the expected return on stock y.

1. Calculates the correlation coefficient

$$\rho xy = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)]^2 - [n\sum x^2 - (\sum x)]^2}} \quad (5)$$

where pxy means the correlation coefficient between return stock x and y.

1. Calculating the expected return of the portfolio

$$E(Rp) = \sum_{i=1}^{n} (W_i i E(R_i)) \quad (6)$$

where $E(Rp)$) means the portfolio's expected return and Wi means portion of security i to all securities in the portfolio.

1. Calculating portfolio risk

$$\sigma_p^2 = \beta_p^2 \times \sigma_m^2 + (\sum_{i=1}^{n} W_i^2 \times \sigma_{ei}^2) \quad (7)$$

where σ_p^2 means the portfolio risk, β_p^2 means the portfolio beta, σ_m^2 means the market risk, W_i^2 means the proportion of funds, and σ_{ei}^2 means the variance error.

2.6. Mean-Absolute Deviation Model

According to Konno & Yamazaki[4], the Mean-Absolute Deviation model is one of the models for optimizing portfolios by using expected returns and realized returns. The primary step taken in this model is to determine the minimum return that can be obtained from the smallest expected return value and has a positive value. This model uses the following equation:

$$E\sum_{j=1}^{n} R_j x_j - E\left(\sum_{j=1}^{n} R_j x_j\right)$$

where R_i means the random return of asset j

2.7. Value-at-Risk Model

Value at risk (VaR) is another widely used model for risk optimisation in the financial services industry. According to Stambaugh [11], VaR is a value that relates the number of possible losses in a particular portfolio with its probability. This model uses the following equation:

$$VaR = W \times \alpha \times \sigma \times \sqrt{t}(9)$$

where W means the market value of the portfolio, means the confidence level, means the portfolio volatility, and t means time horizon.

The framework of this study is the formation of an optimal portfolio using Mean-Variance, Value at Risk, and Mean Absolute based on data on company shares listed on the IDX30 index. Based on this description, the following research framework is in the figure below:

3. Research Methods

This study has several models for forming an optimal portfolio: the Mean-variance model, the mean-absolute deviation model, and the value-at-risk model.

4. Results and Discussion

This section presents the results of processing daily data of stocks listed on the IDX30 index into portfolios using Rstudio. The portfolio is analyzed using the mean-variance model, mean-absolute deviation model, and value-at-risk model methods which aim to

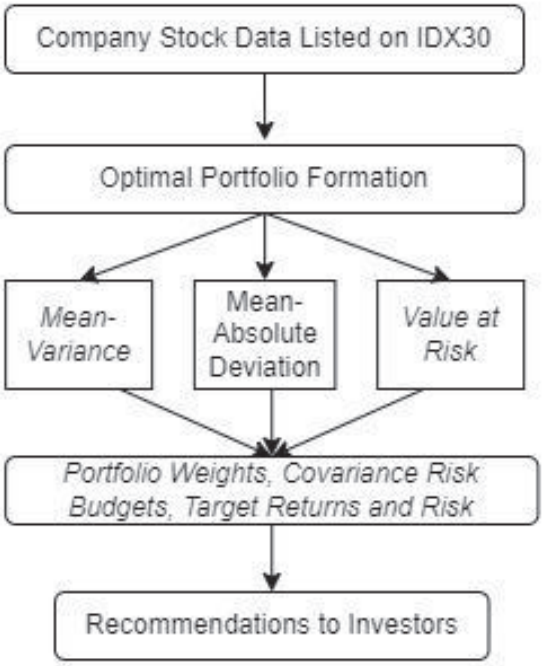

Figure 1: Research Framework.

provide recommendations to investors regarding which stocks can be selected with maximum return and minimum risk.

	ACES	ADRO	ANTM
2019-01-02	1.3333609	0.81967859	-3.3225679
2019-01-03	4.5315161	0.40733743	1.3422965
2019-01-04	1.2578773	12.22895526	1.3245341
2019-01-07	3.0771796	0.00000000	1.3072027
2019-01-08	0.0000000	1.42858506	-1.3072027
2019-01-09	2.9852937	-1.06951394	2.5975379
2019-01-10	2.6126283	0.71426947	1.2739055
2019-01-11	-3.2026078	0.00000000	0.0000000
2019-01-14	-0.8915357	0.35524447	-1.2739055
2019-01-15	0.0000000	3.48468120	5.0010454
2019-01-16	-3.3387071	0.00000000	5.9189001

Figure 2: Some stock returns listed in the idx30 index.

The following is the return of stocks listed in the IDX30 index using daily closing price data from the beginning of 2019 to the end of 2022. Furthermore, data processing is carried out using the three methods above. The results will show the portfolio weight, covariance risk budget, and return and risk target.

i. *Result of Mean-Variance Model*

Based on the results obtained from the Mean-Variance Tangency Model, there is a target return value of the optimal portfolio of 16.55% with an optimal portfolio risk of

Table 1: Company Listed in IDX30 Period 2018-2022.

No.	Code	Companies Name
1	ACES	PT. Ace Hardware Indonesia Tbk.
2	ADRO	PT. Adaro Energy Tbk.
3	ANTM	PT. Aneka Tambang Tbk.
4	ARTO	PT, Bank Artos Indonesia Tbk.
5	ASII	PT. Astra International Tbk.
6	BBCA	PT. Bank Central Asia Tbk.
7	BBNI	PT. Bank Negara Indonesia (Persero) Tbk.
8	BBRI	PT. Bank Rakyat Indonesia (Persero) Tbk.
9	BBTN	PT. Bank Tabungan Negara Tbk.
10	BMRI	PT. Bank Mandiri (Persero) Tbk.
11	BRPT	PT. Barito Pacific Tbk.
12	BSDE	PT. Bumi Serpong Damai Tbk.
13	CPIN	PT. Charoen Pokphand Indonesia Tbk.
14	ERAA	PT. Erajaya Swasembada Tbk.
15	EMTK	PT. Elang Mahkota Teknologi Tbk.
16	EXCL	PT. XL Axiata Tbk.
17	GGRM	PT. Gudang Garam Tbk.
18	HMSP	PT. Hanjaya Mandala Sampoerna Tbk.
19	HRUM	PT. Harum Energy Tbk.
20	ICBP	PT. Indofood CBP Sukses Makmur Tbk.
21	INCO	PT. Vale Indonesia Tbk.
22	INDF	PT. Indofood Sukses Makmur Tbk.
23	INKP	PT. Indah Kiat Pulp & Paper Tbk.
24	INTP	PT. Indocement Tunggal Prakarsa Tbk.
25	ITMG	PT. Indo Tambangraya Megah Tbk.
26	JPFA	PT. Japfa Comfeed Indonesia Tbk.
27	KLBF	PT. Kalbe Farma Tbk.
28	MDKA	PT. Merdeka Copper Gold Tbk.
29	MIKA	PT. Mitra Keluarga Karyasehat Tbk.
30	MNCN	PT. Media Nusantara Citra Tbk.
31	PGAS	PT. Perusahaan Gas Negara Tbk.
32	PTBA	PT. Bukit Asam Tbk.
33	PTPP	PT. Pembangunan Perumahan Tbk.
34	PWON	PT. Pakuwon Jati tbk.
35	SMGR	PT. Semen Indonesia (Persero) Tbk.
36	TBIG	PT. Tower Bersama Infrastructure Tbk.
37	TINS	PT. Timah Tbk.
38	TLKM	PT. Telkom Indonesia (Persero) Tbk.
39	TOWR	PT. Sarana Menara Nusantara Tbk.
40	UNTR	PT. United Tractors Tbk.
41	UNVR	PT. Unilever Indonesia Tbk.

258.66%. This model also produces the composition of stocks included in the optimal portfolio. These shares are ARTO, ERAA, HRUM, ITMG, and MDKA, with the following percentage composition.

TABLE 2: Mean-Variance Tangency Portfolio.

Stocks	Portfolio Weights	Covariance Risk Budgets
ARTO	0,1408	0,2234
ERAA	0,0187	0,0050
HRUM	0,1196	0,0655
ITMG	0,0841	0,0321
MDKA	0,6368	0,6740
Target Return		16,55%
Portfolio Risks		258,66%

Based on the results in Table 1 above, MDKA shares have the highest portfolio weight of 0.6368 or 63.68%, followed by ARTO and HRUM shares. MDKA shares also have a high-risk budget covariance value of 0.6740 or 67.40%, followed by ARTO shares and HRUM shares.

ii. *Result of Mean-Absolute Deviation Model*

Forming the optimal portfolio for the next stage or refinement of the Mean-Variance Model is to use the Mean-Absolute Deviation Model. The processing results using this model will produce target returns, portfolio risk, and the weight of each stock in the optimal portfolio. Table 4.2 below provides information related to the results of processing using the Mean-Absolute Deviation Model

TABLE 3: Mean-Absolute Deviation Efficient Portfolio.

Stocks	Portfolio Weights	Covariance Risk Budgets
ARTO	0,1123	0,1906
BBCA	0,0487	0,0098
ERAA	0,0542	0,0237
HRUM	0,1203	0,0849
ITMG	0,1154	0,0631
MDKA	0,5240	0,6251
MIKA	0,0251	0,0029
Target Return		16,00%
Portfolio Risk		282,43%

The results of the Mean-Absolute Deviation Model obtained a target return value of 0.16 or 16% with a portfolio risk level of 2.8243 or 282.43%. MDKA shares dominate the

composition or weight of shares in the optimal portfolio of 52.40%, followed by HRUM shares at 12.03% and ITMG shares at 11.54%.

iii. *Result of Value-at-Risk Model*

It can be known through processing the Value-at-Risk Model to determine the possible level of risk that will appear in the optimal portfolio that has been formed. The optimal portfolio that has been developed is the Mean-Variance Tangency portfolio and the Mean-Absolute Deviation Efficient Portfolio. Based on data processing, the value-at-risk value of the two portfolios is higher than the possible risk level of both portfolios. This means that investors investing in both portfolios must be more aware of future risks that depend on uncertain market conditions.

TABLE 4: Value-at-Risk.

Optimal Portfolio Model	Value-at-Risk
Mean-Variance Tangency	326,43%
Mean-Absolute Deviation Efficient	283,67%

5. Discussion

Portfolio optimization using the three optimization models, namely the Mean-Variance Model, Mean-absolute Deviation Model, and Value-at-Risk Model, produces the composition of stocks included in the optimal portfolio of the IDX30 index from 2018 to 2022. The following is Figure 2, an efficient frontier graph containing dots for return values and risk values according to investor preferences in making investments. The chart has a peak point or tangency point, which is the optimal portfolio point. With an optimal portfolio and efficient frontier, it can make it easier for investors to make investment decisions by minimizing risk and maximizing returns.

Based on the research results, the target return values obtained from the two optimal portfolio models exceed the market-expected return values. This means that the two optimal portfolios have better performance than the market, or in other words, these portfolios have the potential to produce more profitable results than the market as a whole. On the other hand, the risk value of the two models exceeds the market risk value. This is not good enough if you are going to invest in the IDX30 index portfolio, even though the return value of the two models exceeds the market return value. Therefore, decision-making in investing returns to the preferences of each investor. If the investor is a risk seeker, then the optimal portfolio of the Mean-Variance Model and Mean-Absolute Deviation Model can be used to make investment decisions. However,

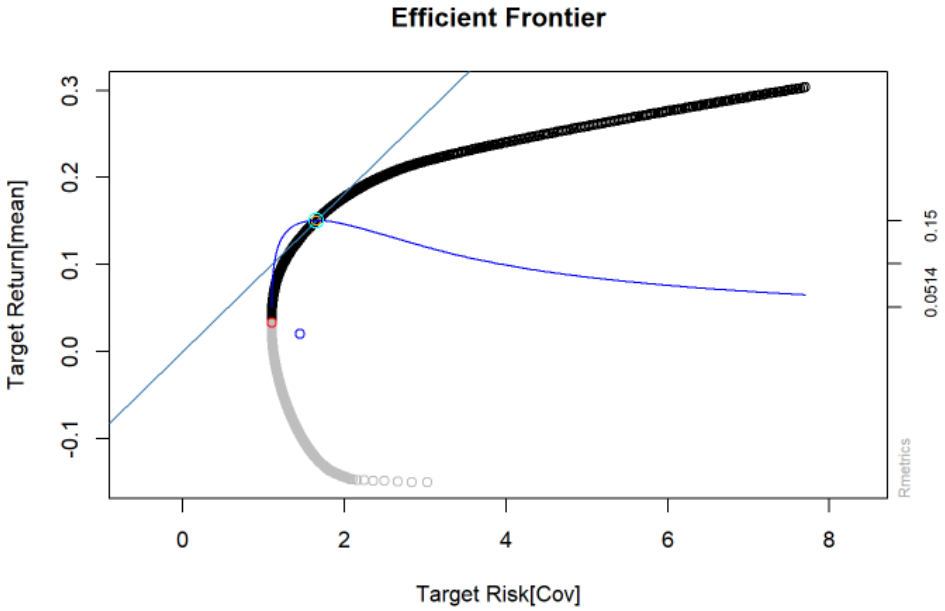

Figure 3: Efficient Frontier of Optimal Portfolio.

if investors are risk averse, investors can look for portfolios with other stock indices, such as the LQ45 index, with good fundamental analysis.

6. Finding and Conclusion

Based on the analysis and discussion regarding the formation of optimal portfolios on stocks listed on the IDX30 index using the Mean-Variance Model, Mean-absolute Deviation Model, and Value-at-Risk, it can be concluded that the Mean-Variance Model produces a target return of 16, 55% with a risk level of 296.5%. This model has a portfolio composition comprising ARTO, ERAA, HRUM, ITMG, and MDKA stocks. On the other hand, the Mean-absolute Deviation Model produces a target return of 16% with a risk level of 282.43%. The stocks included in the optimal portfolio result from processing using the Mean-absolute Deviation Model, namely ARTO, BBCA, ERAA, HRUM, ITMG, MDKA, and MIKA. This high level of risk is caused by the Covid-19 pandemic occurring in early 2020 until the end of 2022. In deciding to invest in an optimal portfolio, investors need to adjust the return and risk of their portfolio according to their individual preferences. This can be done by maximizing the return value or minimizing the risk obtained from the portfolio.

7. Implications, Limitations, and Suggestions

Based on the research results, the researcher provides both theoretical and practical suggestions that can be useful for parties; namely, on the academic aspect, this research needs to use or conduct further searches related to other portfolio optimization methods to obtain more accurate and complete results. On the practical aspect, suggestions from researchers are based on the results of research that have been done, namely that investors need to consider decision-making by looking at the basis for making decisions other than technically, namely fundamentally, so that they can obtain maximum return values and minimal risk values or vice versa according to investor preferences.

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