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Stock Selection Using Skewness to Construct a Portfolio and the Effects of Variables on Portfolio Return

Adler Haymans Manurung, Nera Marinda Machdar*, John Edward Harly Jacob Foeh, Jhonni Sinaga

Faculty of Economic and Business, Universitas Bhayangkara Jakarta Raya, Jakarta, Indonesia
Email: *nera.marinda@dsn.ubharajaya.ac.id

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Abstract

This study aims to investigate the effects of stock selection while constructing a portfolio using Skewness as well as the factors affecting portfolio return. This study was carried out in three stages: stock selection based on skewness, asset allocation based on Quadratic Programming, and portfolio return calculation based on market return and external factors. To assess and select portfolios, this study employs a novel methodology that combines key financial and non-financial characteristics with a skewness model. The research's findings are as follows. First, skewness could be used to select the stocks that are added to a portfolio. Second, the market capitalization weighted portfolio generated the best return compared to the other two portfolios. Third, market return and the pandemic era have a significant impact on portfolio returns that are equally weighted, market capitalization weighted, and Markowitz weighted. Fourth, investors do not require fund management expertise to manage investor funds.

Keywords

Portfolio Construction and Return, Skewness and Quadratic Programming, Market Capitalization

1. Introduction

Financial markets are getting more and more complicated until today. To increase earnings, investors should take a wide range of variables and market characteristics into account. Numerous techniques have been created to investigate the behaviour of financial markets as a result of advancements in financial engi-

neering. Consequently, portfolio selection is a crucial area for research. To ensure that the fund grows more successfully, firms should set up a good performing portfolio. The portfolio that will provide the best return is chosen by the fund management or owner from a variety of portfolios. When firm anticipates that a stock will underperform, a fund manager or owner fund always modifies it in the portfolio. This action will be carried out each year, especially at the start of the year because the fund manager or owner fund frequently changes the portfolio in response to new facts. A portfolio containing a variety of various assets will offer the investor a variety of returns while lowering risk (Galankashi et al., 2020). The investor must distribute the portfolio among several asset classes in order to achieve portfolio optimization. Because future returns are uncertain, portfolio construction is regarded as one of the primary concerns in securities investing (Elton et al., 2014).

From the point of view of end investors, investing is a multi-asset class problem, because investing in different asset classes provides diversification and reduces overall risk. When portfolio can invest in multiple asset classes, asset allocation is usually considered the first step in portfolio construction phase followed by security selection performed within each individual asset class (Fahmy, 2014). The degree to which the returns on the various investments tend to change either simultaneously or in the opposite direction is a critical factor in determining the risk of the portfolio (Kierkegaard, et al., 2007). The correlation between the returns on the various securities in the portfolio determines the level of risk.

Markowitz (1952) does not mention to select stock directly, but the construction of a portfolio becomes important. Portfolio construction is considered to be one of the main concerns in securities investment as the future returns are uncertain (Hunjra et al., 2020). In the process of portfolio, stock selection becomes important that it will make good portfolio. Stock selection will be had in the construction portfolio through risk and return. In finance, the risk is the possibility of deviation identified with the inconstancy of future. Every level of return has a portfolio that offers the lowest risk, and every level of return has a portfolio that delivers the highest return. Any portfolio at the top of the curve is efficient because it offers the best expected return at a given amount of risk (Artzner et al. 1999).

Investors can reduce risk by diversifying their investments. Investment diversification will provide optimum benefits if the returns between investments in one portfolio are negatively correlated. Asset allocation is the first step in portfolio construction (Fahmy, 2014). In this step, the investment manager seeks to define an overall asset allocation across asset classes that best meet all risk and return objectives stated and implied by the investment strategy in the planning phase. Markowitz (1952) has proven that investment risk can be reduced by combining several assets into a portfolio. The Markowitz method shows that if the financial assets in a portfolio have a return correlation that is smaller than

positive one, the overall portfolio risk can be reduced. The minimum risk will be achieved if the investment return correlation is perfectly negative (Sartono & Setiawan, 2009). Consider a scenario in which the investor might arrange a table of all the portfolios with the same level of risk. The optimal portfolio is the one with the highest return, even though the risk of the various portfolios is the same but investors have varied returns. One would select the option with the lowest risk, and vice versa. The theoretically ideal portfolio will have the highest projected return for a given level of risk and the lowest risk for a given level of return.

The Fund Manager does research to some stock then it selects the good stock. Simply examining the predicted risk and return of one specific stock is insufficient for investors. An investor can profit from diversification by purchasing multiple stocks, which lowers the volatility of their entire portfolio (Markowitz, 1959). The good stock will have good result by return and risk.

The combination of each of these assets into a product group or portfolio causes issues. It is common knowledge that diversification within a product category or portfolio is required to lower risk. Due to the numerous techniques used to assess the risk of combining multiple assets into a product group or portfolio, risk measurement has grown challenging. The goal of investors and fund managers is to attempt to quantify risk at all times. The majority of traditional risk quantification tools are sensitivity tools. Sensitive risk assessment considers how variations in one risk factor affect the returns on a portfolio. Traditional measurements only produce results in terms of the potential magnitude of loss. These measurements do not give a comprehensive picture of the possibility or likelihood that the loss will occur. Additionally, the conventional measurement is applied to specific assets, giving each asset a unique risk measuring strategy. Selection stock could be done using skewness that it has right tail. The stock selection approach with skewness provides a remedy for the shortcomings of the aforementioned conventional risk measurement techniques. This method's ability to be used with all traded financial items is one of its benefits. The amount was calculated by adding up all the risks associated with the product as a whole.

The skewness method will be used to set up a portfolio for this study. By combining significant financial and non-financial variables with a skewness model to evaluate and choose portfolios, this research employs a novel methodology. As far as the authors are aware, Indonesia's portfolio does not contain a lot of research. Most of fund managers only use non-financial information instead of any methodology. Of course, this is more practical than conventional calculation techniques, which require that each product be calculated separately. This method is mostly simple and helps fund manager to build a portfolio for their starting using research.

The remainder of this paper is structured as follows. Section 1 goes over the relevant Theoretical background. Section 2 then outlines the methodology. The

results are then presented and discussed in Section 3. Finally, in section 4, the conclusions are presented.

2. Theoretical Background

Markowitz introduced the Theory of Portfolio for the first time in 1952, emphasizing risk and return as crucial factors in the optimal portfolio. Investors should base their decisions, on both the risk and expected return of their investment. Markowitz (1952) assumed that most investors are cautious and seek to incur the least amount of risk in order to earn the maximum potential return, optimizing the return to risk ratio. Theory of Portfolio develops a framework in which any expected return is composed of various future outcomes and is thus risky, and this risk-return relationship can be optimized through diversification (Kierkegaard, et al., 2007). Every portfolio that meets these two conditions is referred to as an efficient portfolio. At the same degree of risk, no other portfolio will produce a higher return (Markowitz, 1959). If it is possible to increase expected return without increasing risk or decrease risk while maintaining the same level of expected return, a portfolio is inefficient (Markowitz, 1991).

Jensen (1969) used systematic risk from the CAPM to develop a performance evaluation model of a risky portfolio. For the years 1945 through 1954, this study used annual data from 115 mutual fund companies. The difference between the actual rate of return of the portfolio during each period and the expected rate of return on the portfolio with risk-free assets is used to measure portfolio performance. The findings demonstrated that the Mutual Fund companies under investigation generally produced inferior and inefficient outcomes.

Cohen and Pogue (1967) evaluated the ex-ante and ex-post performance of various portfolio selection models over a single period using the Markowitz model. The time span of observation is divided into two parts: 1947-1957 (ex-post) and 1958-1964 (ex-ante). The data used for the ex-ante period consists of 157 stocks and 150 stocks for the ex-post period. The findings demonstrated that the formulation for the stock and the study period did not significantly influence the ex-post performance of the index model.

Wainscott (1990) conducted research on stock and bond investment instruments in the United States to calculate portfolio risk using the correlation coefficient. This study used data from January 1925 to June 1988, with rolling monthly data of one, three, five, and ten years. The study's findings revealed that changes in the correlation coefficient between investment assets during the study period have a significant impact on the optimal asset allocation from one period to the next.

Manurung (1994) used the Markowitz model with Quadratic Programming to analyze an investment portfolio at the Indonesia Stock Exchange. The data used is weekly data derived from the Jardine Flemming Sector Industry Index from August 1992 to June 1994. According to the study's findings, the correlation coefficient between sectors shifted from one period to the next. Aside from that,

the sector's asset allocation is changing.

Markowitz (1952) calculated risk and return through Quadratic Programming to estimate the efficient frontier. The efficient frontier is based on the straightforward idea that risk and return are related and that there is a relationship between them. As a result, there may be a technique to calculate the level of risk needed to achieve different levels of return (Kierkegaard et al., 2007). The efficient frontier is a trade-off graph with expected return on one axis and risk on the other (Markowitz, 1959). All portfolios that optimize expected return for a specific amount of risk are represented by **Figure 1**. The efficient frontier is just a line drawn from bottom to top, with each point representing the junction of a prospective reward and its matching amount of risk. The portfolio that offers the maximum return for a specific level of portfolio risk is considered to be the most efficient. Based on Efficient Frontier, it found asset allocation through every combination risk and return.

Figure 1 presents that there are no portfolios above the efficient frontier, and all portfolios below the border are subpar compared to those on the frontier, as seen in the above graphic. A separate efficient portfolio is represented by each point on the frontier. The risk and return both rise as one moves from lower left to higher right. Each asset in the whole portfolio needs to be weighted in a specific way in order to produce a tangent portfolio on the efficient frontier. A portfolio with equally distributed fractions of each asset will not provide contact with the efficient frontier if only one asset is used. The weighting process is important for achieving a tangent portfolio on the efficient frontier. There is a portfolio that offers the lowest risk for every level of return and a portfolio that gives the highest return for every level of risk. Any portfolio in the upper portion of the curve is efficient, meaning it provides the highest expected return for a particular level of risk.

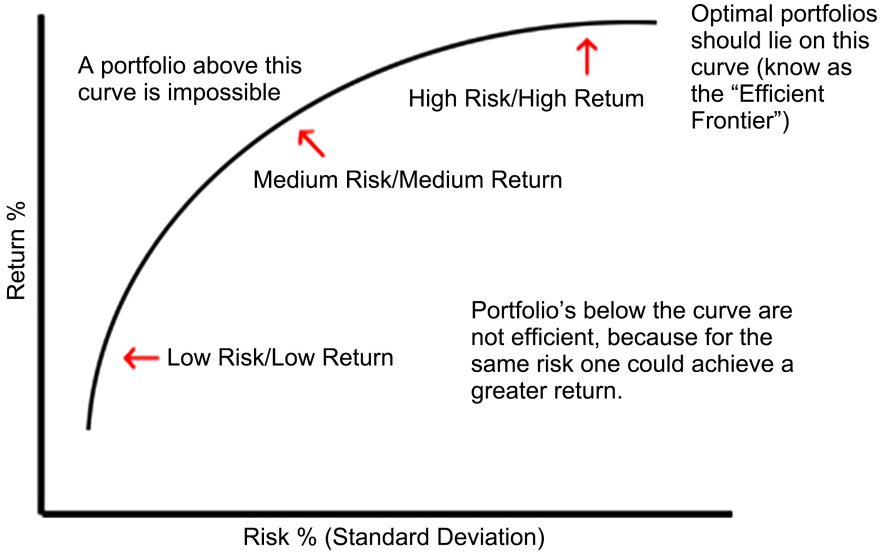

Figure 1. The efficient frontier. (Source: Markowitz, 1959).

Elton et al. (1976; 1977; 1978) introduced a portfolio that it selects from all stocks using excess return to beta. Stock that has excess return to beta is higher than a criterion (cut off value), it will become a group portfolio. Elton, Gruber, and Padberg model (1976) is based on stock performance using a reward-to-volatility (RVOL) approach, which entails dividing excess return by systematic risk. When determining the optimal portfolio using this model, assets are ranked according to their performance ranking, beginning with the highest and working down to the lowest. Assets with an RVOL value greater than the cut-off point are included in the optimal portfolio; assets with a lower RVOL value are not included in the optimal portfolio. Elton, Gruber, and Padberg (1976) model process is broken down into the following steps: 1) calculating individual stock performance, or $RVOL = \frac{\left(\overline{R}_i - R_f\right)}{\beta_i}$ defining the ranking of individual stock performance based on RVOL ratings; deciding the cut-off point; select the highest cut-off point (C*); 2) deciding the assets that go into the portfolio; and 3) comparing the individual RVOL with the highest cut-off point. Sometimes this model called single index model to select portfolio. The Single Index Model is a simple linear regression equation with individual stock returns are the dependent variable, while market returns are the independent variables.

In Statistics, there is an indicator to measure normality of Bell curve that is called Skewness. Skewness is a measure of the asymmetry of a distribution. A distribution could be stated asymmetrical when its left and right side are not mirror images. A distribution can have right (or positive), left (or negative), or zero skewness. Skewness could be used to set up a portfolio by Fund Owner. Stocks will be selected to become a portfolio through return that has return in right skewness. When the portfolio return is negatively skewed, an extreme left-tail event is more likely than an extreme right-tail event (Kim et al., 2014). Therefore, the typical investor favors return distributions that are more positively biased. For instance, a portfolio that is more favorably skewed has a stronger Sortino ratio and less semi-deviation (Sortino & Van der Meer, 1991).

3. Methodology

This study uses daily stock price information obtained from https://www.finance.yahoo.com/. Data is available from 2016 through June 2022. This period has two types of situations: stable periods and pandemic periods, which provide more varied data to analyze. Data is gathered from 92 stocks based on the Kompas Index. This study employed an adjusted price that took dividends, rights issues, and all business activity to stock price into account.

Stock Return calculated as follows:

$$R_{i,t} = \frac{\text{Adjusted Clossing Price}_{i,t}}{\text{Adjusted Clossing}_{i,t-1}} \times 100\% \quad (1)$$

Risk calculated by standard of Deviation as follows:

$$\sigma_t = \mathrm{SQRT}(250) * \sqrt{\frac{\sum_{i=1}^{252}\left(\mathrm{ACP}_{i,t} - \overline{\mathrm{ACP}}\right)^2}{n-1}} \tag{2}$$

The indicator will be used to choose stocks and calculate asset allocation using quadratic programming. In an operational research investigation, the weight of a group for reaching the target function can be solved using quadratic programming. Risk minimization is the goal of portfolio management. Following is the quadratic programming equation:

Objective Function:

$$\mathrm{Min}\sigma = \sqrt{\sum_i^n \sum_j^m \left[w_i^2 \sigma_i^2 + 2 w_i w_j \,\mathrm{cov}(i,j) \right]} \tag{3}$$

Subject to

$$w_1 + w_2 + \cdots + w_n = 1 \tag{4}$$

$$w_1 * R_1 + w_2 * R_2 + \cdots + w_n * R_n = R_p \tag{5}$$

$$w_1, w_2, \cdots, w_n > 0 \tag{6}$$

This research uses the quadratic programming method to find weight of every stock in a portfolio (Markowitz, 1952; Manurung, 1997a; 1997b).

4. Results and Discussion

The explanation will be divided into three parts in this section. It begins with descriptive statistics, then moves to portfolio construction, and finally to causality analysis.

4.1. Statistics Descriptive

The statistics descriptive of risk and return for 92 equities listed on the Indonesia Stock Exchange are explained in **Table 1**. By the year 2016, the highest return will be 1026.9%, and by the pandemic-era year 2021, the second-highest return will be 759.28%. **Table 1** shows that 2019 has the lowest standard deviation and average return. This suggests that the fund manager failed to deliver an impressive performance for 2019.

4.2. Portfolio Construction

This section will describe how to set up the process portfolio for the construction portfolio. First, this investigation chose stocks for a portfolio group. Skewness approaches are used with the selection stock. It implies that we employ the rights-tail skewness. In this study, the mean and median were computed, and stocks with returns of greater than 10% were then chosen. The market rate for this return is 8%, and the risk premium is roughly 2%. This research identified 24 stocks that might be included in a portfolio based on the criteria. The weights assigned to each stock in this study were then determined using quadratic programming (Markowitz, 1952; Manurung, 1997a), which revealed the portfolio's effective frontier at **Figure 2** as follows:

Table 1. Statistics descriptive.

	n	2016	2017	2018	2019	2020	2021	2022
Minimum	92	−0.4384	−0.7755	−0.9120	−0.8658	−0.6971	−0.559	−1.2265
Maximum	92	10.269	4.7273	2.8098	2.159	4.2273	7.5928	3.9899
Median	92	0.1756	0.0827	−0.0658	0	−0.0248	−0.0697	0.0711
Average	92	0.7746	0.2641	0.0293	0.0625	0.2126	0.3551	0.1775
Stdev	92	1.8669	0.7843	0.5218	0.4458	0.6747	1.1929	0.8187
Skewness	92	3.4717	3.4105	2.6559	1.7689	3.3068	3.5852	2.0603
Kurtosis	92	12.766	14.548	10.533	5.6844	14.634	16.198	6.7261
JarqueBera	92	550.4	689.55	325.67	75.602	686.52	864.85	118.31

Source: compiled by the authors.

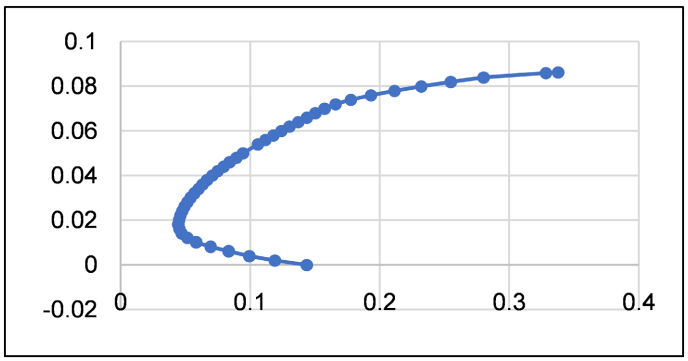

Figure 2. Efficient frontier for 24 stocks (Source: compiled by the authors).

The portfolio's ideal starting point will be a monthly return of 1.8% and a monthly risk of 4.47% based on Figure 2. The picture also demonstrates that an investor may have a portfolio with an 8.62% return and a 33.78% risk. When compared to weighted each stock in return of 8.62% and risk of 33.78%, the weighted of each stock in return of 1.8% and risk of 4.47% is different. These two outcomes, however, fall inside the efficient frontier line. In Portfolio Stocks, it signifies that the outcomes support Markowitz's theory.

This research sets up three portfolios based on stocks selection using skewness which return more than 10%. These weighted Portfolios will construct using Quadratic Programming three methods which is Equal weighted, based market capitalization on the stock and using Quadratic Programming. This result wants to be compared to test Fund Manager Skill to manage portfolio. The quadratic Programming and Market Capitalization always used by Fund Manager. Equal Weighted is used by investor never discussion of portfolio. The result of a portfolio group is presented in Table 2, as follows:

Table 2. Weighted stock in portfolio.

No.	Company	Code	Equal Weighted	Market Cap	Quadratic Programming
1	Adaro Energy Indonesia Tbk.	ADRO	4.17%	11.55%	5.31%
2	Bank Raya Indonesia Tbk.	AGRO	4.17%	6.54%	0.00%
3	Sumber Alfaria Trijaya Tbk.	AMRT	4.17%	8.10%	22.10%
4	Adi Sarana Armada Tbk.	ASSA	4.17%	1.90%	0.00%
5	Bank Mandiri (Persero) Tbk.	BMRI	4.17%	2.82%	30.69%
6	Bank Bumi Arta Tbk.	BNBA	4.17%	1.43%	0.00%
7	Bumi Resources Minerals Tbk.	BRMS	4.17%	2.20%	5.07%
8	Centratama Telekomunikasi Indonesia Tbk.	CENT	4.17%	1.16%	1.55%
9	Elang Mahkota Teknologi Tbk.	EMTK	4.17%	22.08%	6.23%
10	Erajaya Swasembada Tbk.	ERAA	4.17%	1.53%	0.00%
11	Surya Esa Perkasa Tbk.	ESSA	4.17%	1.33%	0.00%
12	Harum Energy Tbk.	HRUM	4.17%	4.32%	0.00%
13	Indosat Tbk.	ISAT	4.17%	5.41%	0.00%
14	Steel Pipe Industry of Indonesia Tbk.	ISSP	4.17%	0.45%	3.59%
15	Indo Tambangraya Megah Tbk.	ITMG	4.17%	3.59%	0.00%
16	Link Net Tbk.	LINK	4.17%	1.77%	7.32%
17	Matahari Department Store Tbk.	LPPF	4.17%	1.71%	0.00%
18	Multipolar Tbk.	MLPL	4.17%	0.87%	0.00%
19	Mitra Pinasthika Mustika Tbk.	MPMX	4.17%	1.88%	1.80%
20	Metrodata Electronics Tbk.	MTDL	4.17%	1.51%	7.94%
21	Sarana Meditama Metropolitan Tbk.	SAME	4.17%	1.02%	0.00%
22	Samudera Indonesia Tbk.	SMDR	4.17%	0.52%	0.00%
23	Saratoga Investama Sedaya Tbk.	SRTG	4.17%	6.07%	3.04%
24	Tower Bersama Infrastructure Tbk.	TBIG	4.17%	10.24%	5.35%
			100%	100%	100%

Source: compiled by the authors.

Figure 3 shows the cumulative return for the market capitalization-weighted portfolio return, equal-weighted portfolio return, and quadratic programming (Portfolio with Markowitz weighted). Market capitalization-based weighted portfolios have ranged from 0.45% to 22.08%. Three equities each have a weighting of over 10%. Two equities have weights of more than 20% using quadratic programming, whereas the remaining stocks typically have weights of less than 10%.

These numbers show that the standard deviation of the portfolio will differ for each of the three portfolio groups. Additionally, it will affect the portfolio return model.

This figure shows how the return on a portfolio is probably comparable to three different types of portfolios. Market capitalization weighted portfolio return has outperformed other portfolios since the year 2020's conclusion. The return on the Markowitz-weighted portfolio is the lowest compared to the others. The upshot of this finding is that investors do not require fund managers to assist them in managing their portfolios. Manurung's (1997a; 1997b) research is supported by this study. Additionally, when looking at the list of stocks in a portfolio, the majority of the stocks are not well-known to investors. The portfolio's stocks were chosen based on risk and return. This will also turn out to be a shortcoming for this portfolio research.

4.3. Causality

This section will describe how Portfolio Return is caused. A multifactor model is used to investigate some portfolio return factors. The factors that affect portfolio return include market return, appreciation in foreign exchange, and pandemic era. The Multifactor model's coefficients are shown in Table 3.

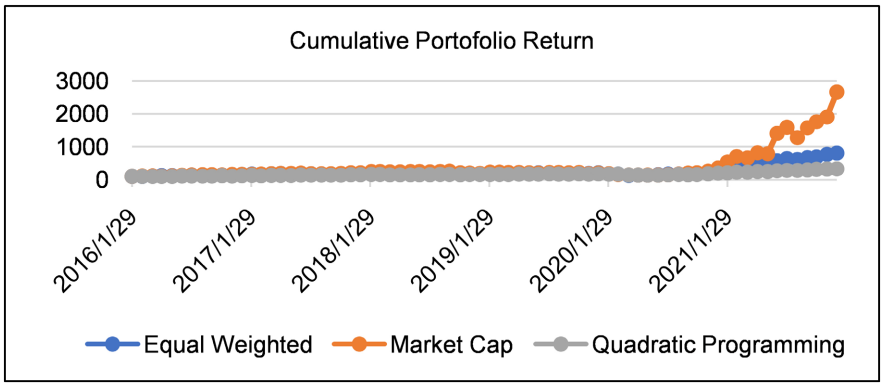

Figure 3. Cumulative portfolio return.

Table 3. Multifactor model for portfolio.

No.	Portfolio Eighted	Constant	Market	Appreciation of Foreign Exchange	Pandemic	R^2
1	Equal Weighted	0.00653	1.3137**	0.2968	0.062**	59.33%
			(−6.354)	(−0.989)	(−4.617)	
2	Market Capitalization	0.00635	1.274*	1.1623	0.1423**	27.05%
			(−2.317)	(−1.457)	(−3.982)	
3	Markowitz	0.00736	0.7559**	−0.1215	0.0226**	59.47%
			(−6.115)	(−0.677)	(−2.815)	

*5% significant; **1% significant; t-test in bracket; Source: compiled and processed by the authors.

5. Conclusion

This study set out to investigate the effects of stock selection when utilizing Skewness to construct a portfolio as well as the variables influencing portfolio return. The research's findings are as follows. First, skewness could be used to select the stocks that are added to a portfolio. Second, the market capitalization weighted portfolio generated the best return compared to the other two portfolios. Third, market return and the pandemic era have a significant impact on portfolio returns that are equally weighted, market capitalization weighted, and Markowitz weighted. Fourth, investors do not require fund management expertise to manage investor funds.

The majority of the stocks in the portfolio are not well-known to investors, which is a restriction of the study. Based on risk and return, stocks are chosen for the stock portfolio. This will be a disadvantage for the portfolio research as well. Perhaps these occurrences have an impact on portfolio results in one way or another. As a result, the return model is not well understood. Therefore, it is advised that future study investigates other internal elements and how they affect portfolio returns in addition to risk and return while expanding the computation methodologies. Portfolio returns may be impacted by cash flow, competition, and operational effectiveness.

This study discovered that stock returns ranged from 2% to 77% from 2016 to June 2022. This return exceeds the return on fixed-income securities. For the research period, the stock risk ranges from 44% to 187%. It also demonstrated that the Indonesian Stock Exchange is a developing market. Investors found that some Fund Managers have a good reputation and produce good results, while others produce poor results. Investors should choose a portfolio manager with a good reputation and a good track record. Based on this research, we recommend that the investor carefully selects the Fund Manager for his portfolio management.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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