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Mutual Fund Performance Analysis Using Information Ratio, STJ Ratio and Value at Risk

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Abstract. Measuring performance solely by relying on returns is probably not enough, it is important to consider both returns and risks. Some measurement methods that consider both of these factors are the Sharpe Ratio index, Treynor Ratio, Jensen Alpha, M^2, and Information Ratio. Risk analysis using Value at Risk Monte Carlo simulation is also important to determine the potential for extreme risks. The purpose of this study is to provide a good understanding of the performance and risk of mutual fund investments. Based on the performance results, Schroder is the most superior mutual fund, with the highest Information Ratio, Sharpe Ratio, and Jensen Ratio, indicating that they are able to generate good returns considering the risks taken. However, Schroder also has the highest VaR, meaning it has the potential for large losses in the worst market conditions. On the other hand, MNC is at the bottom in almost all performance methods, indicating poor performance with low returns and lower risks.

Keywords: Mutual Fund, Performance, Ratio, Value at Risk

1. INTRODUCTION

The mutual fund industry continues to grow in many countries because it offers easy access for investors to invest their funds in professionally managed portfolios. The mutual fund industry has the largest number of investors in the capital market, and its growth trend continues to increase. Mutual funds are a collection of funds from various investors that are professionally managed by investment managers. One of the investment options for capital providers or investors, especially investors with small capital and do not have much time or ability to measure the risk of their investments (Rebiman and Waspada, 2022). Its simple yet effective concept makes it attractive to both individual investors and financial institutions.

The transaction value of a mutual fund is determined based on the Net Asset Value (NAV). Although NAV provides daily information about a mutual fund, investors cannot directly compare its performance with other mutual funds. When selecting a mutual fund, it is important to analyze its performance by not only looking at the yield, but also analyzing the overall performance of the mutual fund. Measuring performance by taking into account risk factors provides investors with information about how well the results or performance provided by the investment manager are related to the level of risk borne to achieve that performance. (Rebiman and Waspada, 2022).

To evaluate the performance of mutual funds, it is important to have a relevant comparison. The Composite Stock Price Index (IHSG) is one of the benchmarks commonly used in evaluating the performance of stock mutual funds. Using IHSG as a benchmark allows

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investors to compare the mutual fund's rate of return with the overall market performance. If the mutual fund's rate of return exceeds the IHSG's rate of return, then it can be said that the mutual fund's performance is good. Conversely, if the mutual fund's rate of return is lower than the IHSG, then its performance is considered less than optimal.(Hamid and Cahyadi, 2018). Thus, IHSG becomes an important tool in evaluating mutual fund performance.

Measuring performance solely by relying on returns alone is probably not enough, it is important to consider both returns and risks. Some measurement methods that consider both of these factors are the Sharpe Ratio, Treynor Ratio, Jensen Alpha, and Information Ratio indexes. Information Ratio measures the potential of a mutual fund to generate returns that exceed the expected returns of the benchmark portfolio.(Arnianti et al., 2021). The Information Ratio value is obtained by calculating the difference between the mutual fund return rate and the benchmark return rate, then divided by the standard deviation of the difference in return rates.

*Treynor Ratio*measures the performance of a portfolio relative to its beta or systematic risk. This ratio provides information about how well a portfolio compensates investors for the systematic risk taken. The use of the Treynor Ratio is relevant in situations where investors have a well-diversified portfolio, where systematic risk is a primary concern.(Putri et al., 2022). The Sharpe Ratio measures portfolio performance relative to total risk, which includes systematic risk and unsystematic risk.(Rebiman and Waspada, 2022). This ratio provides information about how well a portfolio performs compared to a risk-free investment, after adjusting for the total risk taken. The Jensen Ratio is based on the concept of the security market line (SML), which describes the relationship between the market portfolio and the risk-free investment option. In equilibrium, all portfolios with the same risk have a rate of return that differs from the rate of return at the SML, so this difference is called the Jensen Ratio, where risk is measured using beta (market risk or systematic risk)(Hamid and Cahyadi, 2018).

Risk analysis in mutual funds is also very important in unstable market conditions because high volatility can increase the potential for losses for investors.(Diana and Hilal, 2023). Financial markets often experience high volatility, characterized by extreme asset price volatility and rapid changes in economic conditions. In volatile market conditions, risk analysis becomes very important for investors to manage their portfolios effectively. One of the risk measurement methods that is often used is Value at Risk (VaR) (Jannah et al., 2022). Value at Risk (VaR) is a statistical method used to measure the maximum potential loss that an investment may experience at a certain level of confidence over a certain period of time.(Lahi et al., 2023). Value at Risk (VaR) provides an overview of the possible risks by calculating the largest amount of loss that is expected not to be exceeded within a certain time period.

Monte Carlo simulation is a method used to estimate risk by simulating various possible market scenarios. In its application to mutual funds, Monte Carlo simulation involves using NAV data to generate a series of possible return scenarios based on a certain probability distribution. This process begins by collecting NAV return data from a mutual fund portfolio. This data is then used to generate a probability distribution of future returns.

Value at Risk (VaR) analysis and Monte Carlo Simulation can help investors detect potential losses and take preventive measures. By simulating various extreme market conditions, this method provides a complete picture of possible risks, helping investors make better investment decisions and reduce potential losses. Monte Carlo Simulation assumes that returns follow a normal distribution (Priyantono et al., 2023).

In researchArnianti et al. (2021) analyzed the performance of sharia mutual funds in the Indonesian capital market using the Information Ratio method. The results of the study showed that sharia mutual funds have a performance that exceeds the performance of their market, namely the Jakarta Islamic Index (JII). Meanwhile, research (Ahmad Karim, 2019) used Sharpe, Treynor and Jensen to evaluate the performance of sharia equity mutual funds in the Indonesian capital market. This study shows that of the 3 methods used, there are 2 mutual funds that are consistently the best, namely Sucorinvest Sharia Equity Fund and Sharia Pacific Saham Syariah.

Lahi et al. (2023) in his research on calculating the Value at Risk (VaR) risk of a single asset using the Monte Carlo simulation approach found that the level of confidence is directly correlated with the risk value. The higher the level of confidence used, the smaller the possibility of maximum loss that will be experienced by investors, and vice versa. This study shows that the Monte Carlo simulation method provides more accurate results in measuring potential losses in various market conditions.

This study examines in more depth the analysis of mutual fund performance using the Information Ratio and STJ Ratio (Sharpe, Treynor, Jensen) methods. Furthermore, calculating the risk with Value at Risk (VaR) using the Monte Carlo simulation method. The purpose of this study is to provide a good understanding of the performance and risk of mutual fund investment.

2. RESEARCH METHODS

This study uses a quantitative approach. A quantitative approach is a study or collection of data in the form of numbers that aims to test the data statistically. The data used in this study are the Net Asset Value (NAB) data of Avrist Equity – Cross Sectoral, BNI-AM Inspiring Equity Fund, BNP Paribas Equity, Mandiri Investa Cerdas Bangsa Class A, Manulife Dana Saham Class A, MNC Dana Ekuitas, and Schroder Dana Prestasi Plus.

The analysis in this study uses Information Ratio, Sharpe Ratio, Treynor Ratio, and Jensen Ratio to measure mutual fund performance, Monte Carlo Simulation to measure Value at Risk (VaR).

3. RESULTS AND DISCUSSION

Calculating Stock and Market Return Value

From 7 stock mutual funds selected for analysis in the period from January 2, 2023 to January 2, 2024, the return value was calculated using Microsoft Excel software. This return value is calculated based on the Net Asset Value (NAV) of each stock mutual fund, using equation (2.1). The first step is to calculate the daily return value on stock mutual funds and the market (IHSG), for example Avrist Equity - Cross Sectoral with a period of January 2, 2023 to January 2, 2024. An example of calculating the return of the 1st Avrist stock mutual fund based on Avrist's NAV on January 3, 2023 ($P_{Avrist2} =$) and Avrist's NAV on January 2, 2023 ($P_{Avrist1} = 932.50$), so that the return value of the Avrist Equity - Cross Sectoral mutual fund is940.51

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

$$R_{Avrist1} = \frac{940.51 - 932.50}{932.50} = 0.0085898$$

For the calculation of the 1st market return based on the close data on January 3, 2023 ($P_{IHSG2} = 6{,}888.76$)and on January 2, 2023 (.$P_{IHSG1} = 6{,}850.98$)

$$R_{IHSG1} = \frac{6{,}888.76 - 6{,}850.98}{6{,}850.98} = 0.0055136$$

Next, the return of stock mutual funds for Avrist Equity mutual funds 2nd, 3rd to 239th and the return of the market 2nd, 3rd, to 239th are calculated using the same method. The calculation of returns for 6 other stock mutual funds is also done in the same way. The results of the calculation of returns from 7 stock mutual funds and market returns in the period from January 2, 2023 to January 2, 2024.

Calculating Mean Return Value of Stocks and Markets

After getting the return from each stock mutual fund and market return, the next step is to calculate the mean return for each stock mutual fund and market. This mean return is calculated using the return data contained in Appendix 2, using equation (2.3). For example, the calculation of the mean return for the Avrist Equity stock mutual fund is as follows.

$$\bar{R}_{Avrist} = \frac{1}{T}\sum_{t=1}^{T} R_{Avrist}$$
$$= \frac{(R_{Avrist1} + R_{Avrist2} + \cdots + R_{Avrist238})}{238}$$
$$= \frac{(0.0085898 + (-0.0114724) + \cdots + 0.0048143)}{238}$$
$$= 0.000326$$

The calculation of mean return for the market is as follows.

$$\bar{R}_{IHSG} = \frac{1}{T}\sum_{t=1}^{T} R_{IHSG}$$
$$= \frac{(R_{IHSG1} + R_{IHSG2} + \cdots + R_{IHSG238})}{238}$$
$$= \frac{(0.0055136 + (-0.0109626) + \cdots + 0.0069839)}{238}$$
$$= 0.000299$$

The following are the mean return values or average returns for each mutual fund.

Table1. Mark*Mean Return of Equity Mutual Funds*

BNI AM	0.0327181
BNP Paribas	0.0140206
Mandiri	0.0012963
Manulife	0.0015288
Avrist	0.000326
Schroeder	0.1126954
MNC	-0.0006881

Among the 7 stock mutual funds, the mean return value of MNC stock mutual funds shows a negative value, meaning that stock prices tend to fall from one time to the next in the

period under review. Meanwhile, other stock mutual funds show a positive value, meaning that stock prices tend to increase.

Calculating Standard Deviation

The calculation of standard deviation is done by using the return data listed in Appendix 2 and the mean return listed in Table 1, by applying equation (2.5). This standard deviation will provide an overview of the level of volatility or variation in returns from each stock mutual fund. For example, the calculation of standard deviation for Avrist stock mutual funds is explained as follows.

$$\sigma_i = \sqrt{\frac{1}{T}\sum_{t=1}^{T}(R_{it} - \bar{R}_i)^2}$$

$$\sigma_{Avrist} = \sqrt{\frac{\sum_1^{238}(R_{Avrist\,t} - \bar{R}_{Avrist})^2}{238}}$$

$$= \sqrt{\frac{\sum_1^{238}(R_{Avrist\,1} - \bar{R}_{Avrist})^2 + \cdots + (R_{Avrist\,238} - \bar{R}_{Avrist})^2}{238}}$$

$$= \sqrt{\frac{(0.0085898 - 0.000326)^2 + \cdots + (0.0048143 - 0.000326)^2}{238}}$$

$$= \sqrt{\frac{(0.0082638)^2 + \cdots + (0.0044883)^2}{238}}$$

$$= 0.0219422$$

After that, the standard deviation for the other 6 stock mutual funds is calculated using the same method. The following are the results of the standard deviation calculation for each mutual fund.

Table 2. Standard Deviation Value of Stock Mutual Funds

BNI AM	0.5661245
BNP Paribas	0.2696432
Mandiri	0.0522981
Manulife	0.0639417
Avrist	0.0219422
Schroeder	1.1225643
MNC	0.0085523

Calculating the Risk Free Rate Value

Risk Free Rate calculated based on the SBI interest rate for the January 2024 period of 6% using equation (2.8), namely(R_f)

$$R_f = \frac{BI\ Rate}{T}$$

$$R_f = \frac{0.06}{239} = 0.000251$$

Calculating Beta Value

Before calculating the stock beta, first calculate the IHSG variance and covariance between the stock and the IHSG. The variance is calculated using equation (2.4). An example of calculating the IHSG variance is as follows.

$$\sigma^2_{IHSG} = \frac{1}{T}\sum_{t=1}^{T}(R_{it} - \bar{R}_i)^2$$

$$\sigma^2_{IHSG} = \frac{\sum_1^{238}[R_{IHSG\ t} - \bar{R}_{IHSG}]^2}{238}$$

$$= \frac{[R_{IHSG\ 1} - \bar{R}_{IHSG}]^2 + \cdots + [R_{IHSG\ 238} - \bar{R}_{IHSG}]^2}{238}$$

$$= \frac{[0.0055136 - 0.000299]^2 + \cdots + [0.0069839 - 0.000299]^2}{238}$$

$$= \frac{[0.0052146]^2 + \cdots + [0.0066849]^2}{238}$$

$$= 0.0000373$$

After obtaining the IHSG variance value, the next step is to calculate the covariance between the shares and the IHSG using equation (2.11).

$cov_{Avrist.IHSG}$

$$= \frac{\sum_1^{238}[R_{Avrist\ 1} - \bar{R}_{Avrist}][R_{IHSG\ 1} - \bar{R}_{IHSG}] + [R_{Avrist\ 238} - \bar{R}_{Avrist}][R_{IHSG\ 238} - \bar{R}_{IHSG}]}{238}$$

$$= \frac{\begin{matrix}[0.0085898 - 0.000326][0.0055136 - 0.000299] + \cdots \\ +[0.0048143 - 0.000326][0.0069839 - 0.000299]\end{matrix}}{238}$$

$$= \frac{[0.0082638][0.0052146] + \cdots + [0.0044883][0.0066849]}{238}$$

$$= -0.0000151$$

Then the covariance of other stock mutual funds is calculated in the same way, presented in the following table.

Table 3. Stock Covariance Values with the Market

BNI AM	0.000064
BNP Paribas	0.000053
Mandiri	-0.0000061
Manulife	0.0000081
Avrist	-0.0000151
Schroeder	-0.0001293
MNC	0.0000066

After obtaining the variance and covariance values, the beta value of each stock mutual fund is then calculated. Stock beta is calculated based on the market variance value and the stock covariance with the market using equation (2.10). An example of calculating the Avrist stock beta value is as follows.

$$\beta_{Avrist} = \frac{cov_{Avrist.IHSG}}{\sigma^2_{IHSG}}$$
$$= \frac{-0.0000151}{0.0000373}$$
$$= -0.4066772$$

The beta values of the other 6 stock mutual funds were calculated in the same way, presented in Table 4.

Table 4. Stock Beta Values

BNI AM	1.7156181
BNP Paribas	1.4207415
Mandiri	-0.1639883
Manulife	0.2186500
Avrist	-0.4066772
Schroeder	-3.4650344
MNC	0.1782531

Calculating Performance Using Information Ratio

*Information Ratio*measuring the efficiency of investment managers in generating returns that exceed the benchmark, by using the average excess return as a divisor, and the standard deviation of the excess return or what can be called Tracking Error in this method.

*Excess return*obtained by subtracting the mutual fund return value from the Composite Stock Price Index (IHSG) return value, which represents the market return. After obtaining the excess return value for each period, the next step is to average it. This average excess return value is then used as a divisor in calculating mutual fund performance using the Information Ratio method. An example of calculating excess return on the 1st Avrist stock mutual fund return (0.008589812) with the 1st IHSG return (0.00551365) is as follows.

$$Excess\ return = 0.0085898 - 0.0055136$$
$$= 0.0030761$$

For the calculation of the 2nd, 3rd to 238th excess returns, the same method applies, presented in Appendix 3. After obtaining the excess return from each stock mutual fund with the market, the mean return is calculated from the excess return using equation (2.3).

$$\bar{R}_{er\ avrist} = \frac{1}{T}\sum_{t=1}^{T} R_{er}$$
$$= \frac{(R_{er\ avrist\ 1} + R_{er\ avrist\ 2} + \cdots + R_{er\ avrist\ 238})}{238}$$
$$= \frac{(0.0030761 + (-0.0005098) + \cdots + (-0.0021695)}{238}$$
$$= 0.0000269$$

*Tracking error*obtained by calculating the standard deviation of the excess return. The standard deviation is calculated using equation (2.5).

$$\sigma_{er\ avrist} = \sqrt{\frac{\sum_1^{238}(R_{er\ avrist\ t} - \bar{R}_{er\ avrist})^2}{238}}$$
$$= \sqrt{\frac{\sum_1^{238}(R_{er\ avrist\ 1} - \bar{R}_{er\ avrist})^2 + \cdots + (R_{er\ avrist\ 238} - \bar{R}_{er\ avrist})^2}{238}}$$
$$= \sqrt{\frac{(0.003076 - 0.000026)^2 + \cdots + \left((-0.002169) - 0.000026\right)^2}{238}}$$
$$= \sqrt{\frac{(0.00305)^2 + \cdots + (-0.002195)^2}{238}}$$
$$= 0.023440654$$

Thus, the tracking error value of Avrist mutual funds obtained is 0.023440.

After getting the results of excess return and tracking error, the next step is to calculate the Information Ratio using equation (2.6) with the Avrist mutual fund as an example.

$$IR = \frac{\overline{R_\iota - R_m}}{\sigma\,(R_i - R_m)}$$
$$= \frac{0.0000269}{0.0234406}$$
$$= 0.0011499$$

For the calculation of the Information Ratio method on other mutual funds, the same method applies. The Information Ratio value of each mutual fund is presented in the following table.

Table 5. Values*Information Ratio*

BNI AM	0.057273
BNP Paribas	0.050912
Mandiri	0.0188976
Manulife	0.0191827
Avrist	0.0011499
Schroeder	0.1001128
MNC	-0.1000819

Of the 7 equity mutual funds analyzed, Schroder mutual funds have the highest Information Ratio value (0.1001128) which indicates that the portfolio managed by Schroder significantly generates excess returns above the benchmark, even after taking risk into account. This indicates that Schroder mutual funds have an effective investment strategy in managing risk while still generating higher returns.

In BNI-AM mutual funds (0.057273) and BNP Paribas (0.050912) also have relatively high Information Ratio values, although not as high as Schroder mutual funds. These positive values indicate that both mutual fund investment managers have succeeded in providing excess returns above the benchmark, with fairly efficient performance in managing risk.

Mandiri (0.0188976) and Manulife (0.0191827) mutual funds have small but still positive Information Ratio values. These mutual funds show that the portfolios of these two mutual funds generate higher returns than the benchmark, but the difference is not significant. The investment strategy of these mutual funds provides small excess returns after taking risk into account.

Avrist mutual funds have a small Information Ratio value of (0.0011499), but are still positive. This mutual fund shows that the return generated is slightly higher than the benchmark, but the difference is almost insignificant. Although still profitable, this investment strategy is less efficient in generating returns relative to risk.

Finally, MNC mutual fund with Information Ratio value (-0.1000819) is the only mutual fund in this study that has a negative Information Ratio value. This mutual fund indicates that MNC mutual funds experience worse performance than the benchmark after taking risk into account. MNC's investment strategy is inefficient, with lower returns and higher risks compared to the benchmark.

Calculating Performance Using Sharpe Ratio

This ratio is used to evaluate how much return is obtained per unit of risk, so the higher the Sharpe Ratio value, the better the portfolio performance in generating returns that are commensurate with its risk. The Sharpe Ratio is calculated based on the mean return (4.2), standard deviation (4.3), and risk free rate value (4.4) using equation (2.7) with Avrist mutual funds as an example.

$$SR = \frac{\bar{R}_i - R_f}{\sigma_i}$$
$$= \frac{0.000326 - 0.000251}{0.0219422}$$
$$= 0.00341505$$

For the calculation of the Sharpe Ratio method on other mutual funds, the same method applies. The Sharpe Ratio value of each mutual fund is presented in the following table.

Table 6. Values*Sharpe Ratio*

BNI AM	0.0573496
BNP Paribas	0.0510658
Mandiri	0.0199864
Manulife	0.0199825
Avrist	0.003415
Schroeder	0.1001674
MNC	-0.1098075

Schroder has the highest Sharpe Ratio of (0.1001674), which means that this mutual fund has succeeded in providing the most optimal returns compared to the risks faced by investors. In other words, Schroder's investment performance shows excellent efficiency in balancing risk and return.

BNI-AM has a Sharpe Ratio of (0.0573496), placing it in second place in the analyzed mutual funds with the best performance. This positive and fairly high Sharpe Ratio indicates that BNI-AM is able to generate significant returns with a measurable level of risk. This performance shows that BNI-AM's investment management has succeeded in balancing risk with potential returns.

BNP Paribas also showed good performance with a value of (0.0510658), although its Sharpe Ratio was slightly lower than BNI-AM. This shows that BNP Paribas is still able to provide a fairly decent return with a risk level.

Mandiri with Sharpe Ratio (0.0199864) and Manulife with Sharpe Ratio (0.0199825) show almost identical performance.The difference between the two Sharpe Ratio values is very small, indicating that both mutual funds have almost the same performance in terms of returns relative to their risks. However, Mandiri is slightly superior to Manulife in optimizing returns for each unit of risk.

Avrist has a Sharpe Ratio of (0.003415), which is close to zero. This is a very low Sharpe Ratio value.shows that the performance of this investment is relatively low in generating returns per unit of risk compared to other alternatives such as Mandiri and Manulife which have a higher Sharpe Ratio.In other words, the returns generated by Avrist do not significantly exceed the risks faced by investors.

MNC has a negative Sharpe Ratio of (-0.1098075), which indicates a very poor performance in terms of risk and return management. A negative Sharpe Ratio means that the returns generated by this mutual fund are not only low but may also be negative after considering the risks. In other words, the returns from MNC are not enough to compensate for the level of risk faced by investors. A negative Sharpe Ratio generally indicates that investing in this mutual fund may not be worth the risk.

Calculating Performance Using Treynor Ratio

*Treynor Ratio*calculated based on the mean return value (4.2), risk free rate (4.4), and beta value (4.5) using equation (2.9). An example of the Treynor Ratio calculation on Avrist stock mutual funds is as follows.

$$TR = \frac{\bar{R}_i - R_f}{\beta}$$
$$= \frac{0.000326 - 0.000251}{-0.4066773}$$
$$= -0.0001843$$

For the calculation of the Treynor Ratio method on other mutual funds, the same method applies. The Treynor Ratio value of each mutual fund is presented in the following table.

Table 7. Values*Treynor Ratio*

BNI AM	0.0189244
BNP Paribas	0.0096918
Mandiri	-0.0063739
Manulife	0.0058437
Avrist	-0.0001843
Schroeder	-0.0324512
MNC	-0.0052684

BNI-AM has the highest Treynor Ratio among the mutual funds analyzed with a value of (0.0189244), which indicates that this mutual fund provides the most optimal returns in the context of the market risk taken. This high Treynor Ratio value indicates that BNI-AM has succeeded in managing systematic risk very efficiently, providing better returns for each unit of market risk faced.

BNP Paribas has a positive Treynor Ratio of (0.0096918), indicating that this mutual fund also shows good performance in the context of market risk management. Although its Treynor Ratio value is lower than BNI-AM, BNP Paribas still managed to provide returns that exceed the market risk taken. This reflects that although not as high as BNI-AM, BNP Paribas is still effective in managing systematic risk and providing better returns compared to the market risk it faces.

Mandiri has a negative Treynor Ratio of (-0.0063739), indicating that the returns provided by this mutual fund are not sufficient to compensate for the market risk taken. This indicates that Mandiri may face challenges in managing systematic risk effectively, resulting in relatively low or even inadequate investment returns.

Manulife has a positive Treynor Ratio of (0.0058437), indicating that the fund has managed to provide positive returns relative to the market risk taken. However, the relatively

low Treynor Ratio indicates that the returns generated are not very significant when compared to the market risk faced. This means that, while Manulife offers returns that exceed market risk, the results do not reflect a striking advantage.

Avrist has a Treynor Ratio that is close to zero and slightly negative at (-0.0001843), indicating that the returns obtained are barely able to compensate for the market risk taken. This very low Treynor Ratio value indicates that Avrist mutual funds are not effective in providing adequate returns relative to the market risk they face.

Schroder has the lowest negative Treynor Ratio among all the mutual funds analyzed, with a value of (-0.0324512). This figure shows that the returns provided by Schroder are very inadequate compared to the market risk taken. With this very low Treynor Ratio, it is clear that the returns generated by Schroder are not enough to offset the market risk it faces.

MNC has a negative Treynor Ratio of (-0.0052684), indicating that the returns earned are inadequate to compensate for the market risk taken. This negative Treynor Ratio value indicates that MNC may have difficulty in managing market risk effectively, leading to relatively low returns compared to the risks faced.

Calculating Performance Using Jensen Ratio

*Jensen Ratio*calculated based on the mean return value of mutual funds and the market (4.2), risk free rate (4.4), and beta value (4.5) using equation (2.13). An example of calculating the Jensen Ratio on Avrist stock mutual funds is as follows.

$$\alpha = \left(\bar{R}_i - R_f\right) - \left(\beta\left(\bar{R}_m - R_f\right)\right)$$
$$= (0.000326 - 0.000251) - (-0.4066773(0.000299 - 0.000251))$$
$$= 0.0000944$$

For the calculation of the Jensen Ratio method on other mutual funds, the same method applies. The Jensen value of each mutual fund is presented in the following table.

Table 8. Values*Jensen Ratio*

BNI AM	0.0323847
BNP Paribas	0.0137014
Mandiri	0.0010531
Manulife	0.0012672
Avrist	0.0000944
Schroeder	0.1126106
MNC	-0.0009477

BNI-AM has a positive Jensen Ratio value of (0.0323847), which indicates that the performance of this mutual fund is able to outperform its benchmark. This means that the investment manager has managed the portfolio well and provided higher returns than what should have been generated based on the risk level.

BNP Paribas has a positive Jensen Ratio value of (0.0137014), indicating that the performance of this mutual fund also outperforms its benchmark. Although the superiority is not as large as that shown by BNI-AM, this result still shows that BNP Paribas' investment managers are able to manage the portfolio well, providing higher returns than expected from the level of risk. This smaller difference may reflect a more conservative risk management approach.

Mandiri has a positive Jensen Ratio value of (0.0010531), indicating that the performance of this mutual fund is slightly superior to its benchmark. Although the difference is relatively small, this positive figure still reflects the ability of investment managers to generate returns that exceed expectations based on the level of risk.

Manulife has a Jensen Ratio value of (0.0012672), which indicates performance that is almost in line with Mandiri mutual funds, with a slight advantage over the benchmark. Although the number is relatively small, this positive result still shows that the investment manager is able to provide slightly better returns than expected based on the level of risk.

Avrist has a Jensen Ratio value of (0.0000944), which is very close to zero, indicating that the performance of this mutual fund is almost completely comparable to the benchmark set. This very small number indicates that the mutual fund does not have a significant advantage over the market benchmark, reflecting the ability of the investment manager to generate returns that are very similar to those expected based on the level of risk.

Schroederhas a Jensen Ratio value of (0.1126106), which is the highest value among other mutual funds, indicating that the performance of this mutual fund is very superior compared to its benchmark. This significant figure shows that Schroder's investment managers have succeeded in providing much better returns, reflecting their ability to manage the portfolio effectively.

MNChas a negative Jensen Ratio value of (-0.0009477), indicating that the performance of this mutual fund is below the benchmark, although the difference is relatively small. This negative result indicates that MNC's investment managers have failed to generate adequate returns in line with the risk level. Although the difference is not too striking, it still reflects the challenges in portfolio management that may be caused by volatile market conditions.

Comparing Mutual Fund Performance Results Using Information Ratio, Sharpe Ratio, Treynor Ratio, and Jensen Ratio.

Table 9. Mutual Fund Performance Results Using Information Ratio, Sharpe Ratio, Treynor Ratio and Jensen Ratio

Equity Mutual Funds	*Information Ratio*	*Sharpe Ratio*	*Treynor Ratio*	*JensenRatio*
BNI AM	0.057273	0.0573496	0.0189244	0.0323847
BNP Paribas	0.050912	0.0510658	0.0096918	0.0137014
Mandiri	0.0188976	0.0199864	-0.0063739	0.0010531
Manulife	0.0191827	0.0199825	0.0058437	0.0012672
Avrist	0.0011499	0.003415	0.0001843	0.0000944
Schroeder	0.1001128	0.1001674	-0.0324512	0.1126106
MNC	-0.1000819	-0.1098075	-0.0052684	-0.0009477

Schroder funds are the best overall based on Information Ratio, Sharpe Ratio, and Jensen Ratio, despite having a negative Treynor Ratio, indicating poorly managed systematic risk. BNI-AM and BNP Paribas funds also show consistent good performance with positive results across all methods. MNC funds are the worst performing funds, with negative values across almost all methods, indicating that they do not provide returns commensurate with the risk taken.

In addition to calculating mutual fund performance, risk analysis in mutual funds is also very important in volatile market conditions because high volatility can increase the potential for losses for investors. While this performance indicator provides an overview of return performance and risk relative to the market, Value at Risk (VaR) provides an additional perspective on the maximum potential loss in extreme market conditions. Monte Carlo simulation allows investors to evaluate risk in more depth by considering various possible market scenarios.

Simulating Returns with Monte Carlo simulation

Simulating return values using Monte Carlo simulation is done by generating random numbers that reflect various possible asset price movements. The first step to simulate return values is to determine the parameter values of the return data. Returns are assumed to follow a normal distribution with mean (4.2) and standard deviation (4.3).$(\mu)(\sigma)$

Table 10. Simulation Parameter Values

Equity Mutual Funds	*Mean* (μ)	Standard Deviation(σ)
BNI AM	0.0327181	0.5661245
BNP Paribas	0.0140206	0.2696432
Mandiri	0.0012963	0.0522981
Manulife	0.0015288	0.0639417
Avrist	0.000326	0.0219422
Schroeder	0.1126954	1.1225643
MNC	-0.0006881	0.0085523

After obtaining the required parameter values, the next step is to generate random numbers. These random numbers will continue to change each time the simulation is run, reflecting the different dynamics in each experiment. The random number generation process is carried out based on predetermined parameters, with a total of 10,000 random numbers generated. These random numbers are generated using Python software, which allows for processing large amounts of data.

Once the random numbers are obtained, the next step is to calculate new returns and new standard deviations based on the simulation results. The results of these simulated returns and standard deviations provide a deeper insight into the potential risks and rewards of different scenarios.

Table 11. Values*Return and Standard Deviation After Simulation*

Equity Mutual Funds	*Mean* (μ)	Standard Deviation(σ)
BNI AM	0.0001501	0.0369083
BNP Paribas	0.0003351	0.0173966
Mandiri	0.000051	0.0033828
Manulife	0.0000469	0.004121
Avrist	0.0000142	0.0014243
Schroeder	0.0003302	0.0719180
MNC	0.000004	0.0005624

Calculating Value at Risk (VaR)

In calculating Value at Risk (VaR), the first step that needs to be done is to determine the level of confidence, which will determine the time period of the investment risk to be analyzed. In this study, a confidence level of 95% was used, so that the value or $.(1-\alpha)\alpha = 5\%0{,}05$

For example, the calculation of the VaR value with a 95% confidence level on the Avrist mutual fund using equation (2.14) with the return and standard deviation that have been generated from the simulation and with the z-score value (1.65) is as follows.

$$VaR = 0.0000142 - (0.0014243(1.65))$$
$$= -0.0023644$$

VaR at 95% confidence level of -0.0023644 indicates that, with 95% confidence level, the maximum expected loss will not exceed 0.236% of the investment value in a 1-day period. This means that in 95% of scenarios, the investment is predicted not to experience a loss greater than 0.236% in a 1-day period. However, in the other 5% of scenarios, there is a possibility of a loss greater than that number, reflecting the less frequent extreme risk.

Table 12. Values*Value at Risk (VaR)*

Equity Mutual Funds	VaR 95%
BNI AM	6.075%
BNP Paribas	2.837%
Mandiri	0.553%
Manulife	0.675%
Avrist	0.236%
Schroeder	11.833%
MNC	0.092%

VaR Value Analysis

The highest VaR value among all the mutual funds analyzed is the Schorder mutual fund 11.833% which means that at a 95% confidence level, the maximum loss estimated will not exceed 11.833% of the investment value in a 1-day period. This reflects the high volatility in the Schroder mutual fund. Although it has the potential to provide large returns, the risks taken are also large. This mutual fund is suitable for investors who have a higher risk tolerance and are ready to face the potential for greater losses for the opportunity to get high returns.

In the BNI-AM mutual fund, the VaR value is 6.075%, which means that at a 95% confidence level, the maximum loss expected will not exceed 6.075% of the investment value in a 1-day period. The VaR value in this mutual fund reflects a fairly high level of risk, especially when compared to other mutual funds that have lower VaR values. This makes it important for investors to consider their risk tolerance, and understand that higher volatility can potentially generate higher returns, but also carries greater risk.

BNP Paribas mutual fund with a VaR value of 2,837% where 95% of possible market scenarios, the maximum loss that can be experienced by this mutual fund will not exceed 2,837% of the total investment in a 1-day period. This figure shows that the risk faced by investors is relatively lower compared to the BNI-AM VaR value, which reflects that BNP Paribas is more stable. This stability can be a special attraction for investors who prioritize security and risk management.

Mandiri mutual funds have a very low VaR value of 0.553%, which means that at a 95% confidence level, the maximum loss expected will not exceed 0.553% of the investment value in a 1-day period. This low VaR value indicates that Mandiri mutual funds implement a very effective risk management strategy. This means that this mutual fund is more focused on good risk management to maintain investment stability. Although Mandiri mutual funds have a low VaR, this also means that the potential returns that can be generated may be more limited compared to more aggressive mutual funds.

Furthermore, the VaR value of Manulife mutual funds is 0.675% with a confidence level of 95%, this mutual fund has the potential to experience a maximum loss of 0.675% of its investment value in a 1-day period. Although the value is slightly higher than that of Mandiri mutual funds, Manulife's VaR value still shows a relatively low level of risk.

Avrist mutual funds have a very low VaR value, which is 0.236% with a confidence level of 95%, this mutual fund has the potential to experience a maximum loss of 0.236% of its investment value in a 1-day period. With a low VaR value, Avrist shows that its portfolio is carefully managed to minimize losses, even in uncertain market conditions. Avrist mutual funds can be an investment option for investors looking for a low risk profile.

MNC mutual funds have the lowest VaR value among all, which is 0.092% with a confidence level of 95%, this mutual fund has the potential to experience a maximum loss of 0.092% of its investment value in a period of 1 day. This figure shows that the maximum risk of loss in this mutual fund is very small, even lower than Avrist. With a low VaR, MNC has a conservative investment strategy, focusing on risk management. This mutual fund may be

attractive to investors who prioritize stability over the potential for higher returns, because more conservative investments tend to have lower risks in the face of market uncertainty.

4. CONCLUSION

Based on the performance results, Schroder is the most superior mutual fund, with the highest Information Ratio, Sharpe Ratio, and Jensen Ratio, indicating that they are able to generate good returns considering the risks taken. However, Schroder also has the highest VaR, meaning it has the potential for large losses in the worst market conditions. On the other hand, MNC is at the bottom in almost all performance methods, indicating poor performance with low returns and smaller risks.

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