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Formation of LQ 45 Stock Portfolio Using Sharpe Ratio, Treynor Ratio and Jensen Alpha Metode Methods

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ABSTRACT

This study aims to determine the performance of the LQ 45 stock portfolio using the method *Sharpe Ratio, Treynor Ratio*and Jensen Alpha and to find out whether or not there are differences between the three methods. This type of research is descriptive quantitative. The sample selection used a purposive random sampling technique, and a sample of 22 stocks was obtained in the 2017 - 2020 period with secondary data. This study uses an analysis with one of the quantitative methods, namely times series analysis. Testing the hypothesis using the Kruskal Wallis H test and the Mean Rank contained in the SPSS software. The test results with Kruskal Wallis obtained x2 0.137 with a probability of 0.937. It is known that the test probability is > 0.05. The results showed that there was no difference between the tests using the three methods. Thus the hypothesis H0 in this study is accepted. The test results between the three treatments have a difference in the mean rank, indicating that there is no significant difference between each treatment. The Sharpe method has the lowest mean rank difference compared to the other two methods, which means that Sharpe is the most consistent with non-difference.

1. Introduction

The capital market is one of the pillars of the economy in a country. In Indonesia, this can be seen from the number of companies listed on the stock exchange. In 2020 the Financial Services Authority (OJK) and*Self-Regulatory Organization*(SRO) has issued various guidelines to control capital market fluctuations due to the Covid-19 pandemic (Republika.com). As a result of the pandemic, Indonesia's economic growth in the fourth quarter of 2020 is estimated to be negative 2.50% y/y from the previous quarter, which was recorded at -3.49% y/y.

In the past year, domestic investment (PMDN) plus foreign direct investment both recorded relatively stable growth of 7%. Overall, the surge in FDI and PMDN investasi investmentshows that Investor confidence in Indonesia's medium-term prospects remains encouraging (CNBC Indonesia).

Measured by Unique Investor Identification,Indonesia's capital market grew from 2017 to 2020. In 2017, the number of investors in the Indonesian capital market was 1,122,668, and in 2018 it was 1,619,372. This is equivalent to an increase of 44.24%. The number of investors rose again to 2,484,354 or 53.41% in 2019, and the number of investors rose to 3,871,248 or an increase of 55.83% in 2020. Of these investors, 3,838,784 were private investors and 32,464 institutional investors.

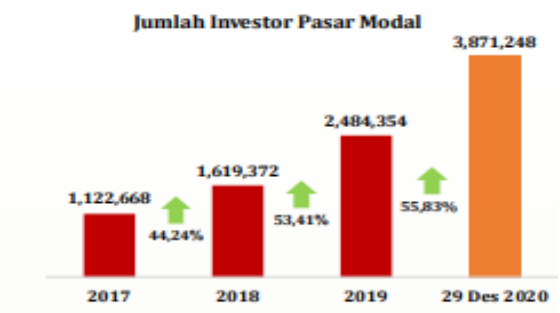

Fig 1 Growth of Capital Market Investors in Indonesia

Pratomoand Nugraha (2009:6) believe that a person has at least three reasons to invest, namely: first, future needs that cannot be met today; one needs to multiply or protect existing wealth; and finally, inflation. Pratomo (2008: 14) also explains that in addition to future demand, the desire to invest is also driven by various uncertain or unexpected things such as health problems, natural disasters, limited funds, and investment market conditions as well as inflation dynamics. will be purchased.

One of the models to measure investment performance is the risk-adjusted return model. Hartono (2013) explains that risk-adjusted return is a calculation of return that is adjusted to the risk borne. Plaatinga and Groot (2001) believe that risk-

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adjusted returns are calculated based on the assumption that investors are risk adverse and must compensate for risk. Various methods are used for risk-adjusted returns, including the Sharpe Index, Trainor Index, Jensen's Alpha, Roy Safety Index, M-Square Index (M2), Sortino Ratio, MSR, FPI, and Information Ratio. Many studies have also been carried out using risk-adjusted returns to measure portfolio performance.

Enhancementthe number of investors indicates that the more people who know how to invest, the greater the need to evaluate the effectiveness of investments. The author's interest in stock portfolio performance prompted the author to conduct research using various measurement methods "Formation of the LQ 45 stock portfolio using the Sharpe Ratio, Treynor Ratio and Jensen Alpha" from 2017 to 2020, the non-financial sector.

2. Literature review

2.1. Modern Portfolio Theory

Modern Portfolio Theory(MPT) was first proposed by a financial magazine in 1952 by Harry M. Markowitz. This theory is based on the desire of investors to minimize investment risk. TheoryModern portfolios require investing in several different issuers or companies to avoid losses or diversify the portfolio. According to Rodoli and Ali (2010: 73), portfolio is a series of tools formed to achieve general investment goals. Portfolio is a collection of real and non-real assets. At the same time, Abdul Halim (2005: 54) explains that the essence of portfolio construction is minimizing risk through performance and diversification, and allocating funds to various negatively correlated investment options.

Abdul Halim (2005:34) explains that compared to other investment portfolios, if the investment portfolio meets the following requirements, then the investment portfolio is considered effective.

a. Returns the highest expected return with the same risk.
b. Returns the smallest risk with the same expected return.

2.2. Efficient Market Hypothesis

In 1970, Eugne Fama proposed the efficient market theory. The idea behind this theory is that stock prices reflect circulating information. As new information emerges, prices will adjust to prevent investors from getting unusual returns (abnormal returns). According to Kusvardhani (2001), the market is considered efficient when information quickly affects the price of issued shares.

According to Eugne Fama, there are three forms of market efficiency:

a. Weak form efficient market hypothesis
b. The semi-strong form of efficient market hypothesis
c. The efficient market hypothesis is strong form.

2.3. Capital Asset Pricing Model (CAPM)

The capital asset pricing model was first introduced in the mid-1960s by Sharpe, Lintner, and Mosin. According to Tandelilin (2010: 187), CAPM is a model that combines expected returns from risky assets with risk based on portfolio theory in a balanced market. Lubis (2008: 142) believes that the CAPM is a model for valuing assets based on risk. Based on this view, the CAPM is actually an equilibrium model whose purpose is to determine asset prices, rates of return and take into account the existing risks.

In an efficient stock grouping based on the CAPM it can beFigure it in the form of a line using the Securities Market Line (GPS) or Security Market Line (SML). SML is a Fig in the form of a line that shows the relationship between systematic risk (β) and the expected return. In the CAPM, effective stocks provide higher than expected personal returns [(Ri) > E(Ri)]. In this case, the existence of effective shares is higher than SML.

Fama and French (1993) assume that the expected return of an investment portfolio can be explained by its sensitivity to market returns and differences in returns based on firm size and value (Fama French's three-factor model).

2.4. Portfolio Return

Abdul Halim (2005:34) explains that the return in the context of investment management is the return received by investors. Return on investment can be divided into two parts: one is the actual profit calculated based on historical data and the expected future profit. The expected return is used in investment decisions. According to Hartono (2012: 283), the expected return is more important than the historical return because the expected return is The expected return is the expected return from the investment made (Hartono, 2012: 283).

Tandelilin (2010:102) return is the return on investors' courage to take investment risk. Return is the difference between the selling price and the purchase price (capital gain), which can be distributed to investors and shareholders in the form of capital loss or capital gains plus dividends. Return is one of the factors that influence or motivate investors to invest and is also a reward for the courage of investors to bear the risk of the investment made.

Return Investment consists of two main components, namely:

a. *Yield,* component of return that reflects the cash flow or income received periodically from an investment
b. *Capital gain* (loss), the return component which is an increase or decrease in the price of a securities (can be stocks or long-term debt securities), which can provide profits or losses for investors.

*Return*realized return is the return that has occurred, the actual return which is calculated based on historical data. Historical returns are useful as a basis for determining expected returns and future risks.

*Return*expected return will be obtained by investors in the future. In contrast to the realized returns that have already occurred (ex post data), the expected returns are estimated results so that they have not yet occurred (ex ante data).

*Return*the required return, the historically obtained return which is the minimum level of return desired by the investor on the investor's subjective preference for risk. The expected return estimation can be done by calculating the average return both arithmetically (arithmetic mean) and geometric mean (geometric mean). The arithmetic mean is better used to calculate the

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average value of the flow of returns that is not cumulative. While the geometric average should be used to calculate the rate of change in the flow of return in a serial or cumulative period, for example 5 or 10 consecutive years.

2.5. Risk (Risk)Portfolio

Hartono (2012: 255) states that the concept of portfolio risk was first introduced in 1950 by Harry M. Markowitz. He suggests that risk can usually be reduced by combining several separate securities into a portfolio. Rodoni and Ali (2010: 69) believe that risk in the context of investment management is the magnitude of the deviation between expected returns and actual returns. There are many definitions related to risk, namely future uncertainty and changes in expected return volatility. Tandelilin (2010:103) argues that there are several sources that can affect the level of investment risk, namely: interest rate risk, market risk, inflation risk, risk business risk, financial risk, business risk, exchange rate risk, and country risk.

According to Samsul (2015: 310) investors can reduce this risk by knowing the types of risks. The types of investment risks are divided into:

a. Systematic risk or market risk

Systemic risk, also known as undifferentiated risk, is the risk that cannot be eliminated by building a portfolio. This risk is influenced by macro factors that affect the market as a whole. If there is systemic risk, it will affect all types of stocks, so diversification will not reduce losses. Examples of systemic risks include inflation, interest rates, economic growth, fiscal policy, business cycles, and exchange rates.

b. Unsystematic risk

Unsystematic risk, also known as unique risk/specific risk, is the risk that can be eliminated by building a portfolio. Because this risk occurs within the company, fluctuations in risk vary from company to company. This means that each stock has a different sensitivity to market changes, for example in terms of liquidity and factors related to asset structure.

c. Overall risk

Overall risk is a combination of systemic and unsystematic risk (portfolio standard deviation/σp). Tandelilin (2010:104) believes that an investment portfolio may not ultimately yield maximum returns, but may strive to achieve the best risk-adjusted returns.

The amount of investment risk is measured by the standard deviation of *return*which is expected. The standard deviation is the square root of the variance which indicates how much the random variable spreads among the mean. The greater the spread, the greater the variance or standard deviation of the deviation. Systematic risk or beta (β) is a measure of risk derived from the relationship between the rate of return of a stock and the market rate of return, in other words beta is the quotient between the covariance of the stock and the market variance.

2.6. Portfolio Performance Measurement

a. Sharpe Ratio Method

The Sharpe Ratio method is a method that uses the concept of the capital market line (CML) or a technique commonly referred to as the Reward to Variability Ratio (RVAR) to compare portfolio performance. The Sharpe index was developed in 1966 by William F. Sharpe. The Sharpe index is calculated by dividing the excess return by the variability of the portfolio return (Hartono, 2017:729). Sharpe is estimated by comparing the portfolio risk premium (the difference between the average portfolio return and the risk-free interest rate) with the portfolio risk, or standard deviation (σ). Use the following equation to calculate the Sharpe Index (Tandellilin, 2010: 494.):

$$Sp = \frac{Rp - Rf}{p}$$

Information:

Sp : Sharpe Indeks Index
Rp : average return
Rf : risk-free average return
p : standard deviation

According to Tandellin (2010: 494), the Sharpe Index can be used to rank different portfolios based on their performance. The higher the Sharpe index score of a portfolio, the better the performance of that portfolio compared to other portfolios.

b. Treynor Ratio Method

Treynor recommends mentioning a highly diversified investment portfolio as return volatility (RVOR). The Treynor index was developed by Jack L. Treynor in 1966. The Treynor index can be calculated using the following formula (Hartono, 2017:733):

$$Tp = \frac{Rp - Rf}{p}$$

Information:

tp : Index *Treynor*
Rp : average *return* total
Rf : average *return* risk free
p : *beta*

The RVOR value reflects portfolio performance, the higher the RVOR value, the better the portfolio performance. Treynor believes that the investment portfolio formed must be optimal, so that unique risks (non-systematic risk) and only systemic risk (β) can be ignored (Hartono, 2017:733). This is because Treynor considers that the investment portfolio is highly diversified, i.e. the risks deemed relevant are systemic (Tandellilin, 2010: 497).

c. Jensen Alpha method

Jensen Alpha Index launchedby Michael Jensen in 1968 and is a further development of the CAPM. Hartono (2017:742) explains that Jensen Alpha is used to measure the historical performance of a portfolio, so the historical average is used for the

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expected value and risk-free asset value in the CAPM equation. Jensen Alpha is the difference between the average portfolio return and the CAPM value. The formula for calculating the Jensen index is as follows (Hartono, 2017:743):

$$p = Rp - [Rf + p\ (Rm - Rf)]$$

or

$$Rp - Rf = p + p\ (Rm - Rf)$$

Information:

p : *Jensen's Alpha* (differential return measure)
Rp : average *return* total
Rf : average *return* totally risk free
rm: average return of total market
p : beta portfolio

Tandelilin (2010: 500) explains that if the Jensen index has a positive value then the portfolio produces a return that is greater than the expected return, so it has a relatively high return for the level of systematic risk, and vice versa..

2.7. Framework

This research was conducted by selecting stocks that fall into the LQ 45 category according to the sample criteria, then from these stocks searched *return*its shares (Rp) and its market return. After knowing the return value, it is continued by calculating the standard deviation, and beta to calculate Sharpe, Treynor and Jensen.

Next is to calculate the value of each index for each company to find which company has the best index value before ranking. The last stage is to test whether there is a difference between the performance of the stock portfolios of the three methods by using the test*Kruskal Wallis* and test treatment mean rank after the data is transformed into Zscore.

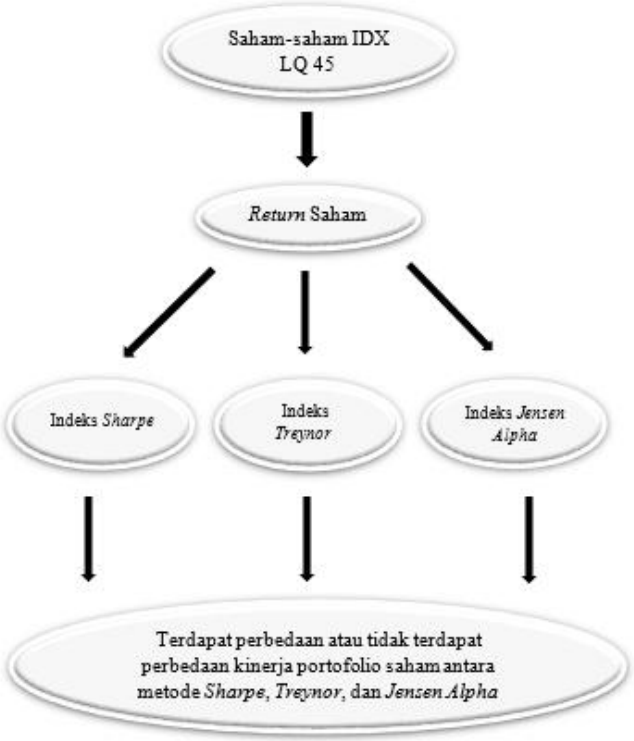

Fig 2 Framework

The hypothesis proposed in this study is

H0 = There is no difference in portfolio performance between LQ 45 stocks as measured by the Sharpe Ratio, Treynor Ratio and Jensen Alpha methods.

H1 = There is a difference in portfolio performance between LQ 45 stocks as measured by the Sharpe Ratio, Treynor Ratio and JensenAlpha methods.

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3. Research methods

The research model used is a research model that compares the performance of the LQ 45 stock portfolio which has been measured using the Sharpe Ratio, Treynor Ratio and Jensen Alpha calculation methods. include stock returns, interest rates (BI interest rates), and Composite Stock Price Index (JCI) returns.

Data used is secondary data, time series, and stock cross sectional observations from members of LQ 45, Yahoo Finance (used to determine closing prices), and JCI, the Central Bureau of Statistics were used to determine SBI interest rates.

Population In this study, the shares of companies listed on the Indonesia Stock Exchange between January 2017 and December 2020 were classified as LQ 45 shares. Then, the sample shares were classified as LQ 45 non-financial shares for four consecutive years and did not do a stock split, because it would distort stock return calculation. The technique used in sampling is purposive sampling in order to obtain a representative sample in accordance with the stipulated provisions. According to this criterion, there are 22 stock samples that can be used in this study.

4. Results and Discussion

4.1. Data analysis

a. Portfolio Performance Analysis with Sharpe Ratio Method

Measurement of the Sharpe Ratio or Reward of Variance Ratio (RVAR) emphasizes the overall risk or standard deviation. The standard deviation represents the stock return deviation from the average stock return in question. For this purpose: past data is used to predict future performance. Average past stock returns are considered as expected future returns, and the standard deviation of past returns is considered a predictor of future risk.

Based on the research results, issuers with the stock code SMRG (Semen Indonesia Persero Tbk) consistently have positive performance for four years. The highest performance value fell on issuer UNTR (United Tractors Tbk) in 2017 with a value of 0.8614 and the lowest performance value fell on issuer HMSP (HM Sampoerna Tbk) in 2019 with a value of -0.7575. The higher the Sharpe Ratio results indicate the better portfolio performance and the smaller average deviation from the overall average. A positive Sharpe Ratio value indicates that the return generated by the issuer is greater than the total risk.

Table 1

Sharpe . Index Portfolio Weights

Portfolio	Sharpe	Weight
A	4.44%	18.5%
B	7.09%	29.6%
C	12.45%	51.9%

Source: Author Database

Based on table 1, portfolio C has the highest Sharpe index of 12.45% while portfolio A has the lowest Sharpe index of 4.44%. The investment allocation for A stock portfolio is 18.5%, B stock is 29.6% and C stock is 51.9%.

b. Portfolio Performance Analysis with Treynor Ratio Method

When using the Treynor Ratio or Reward to Volatility Ratio (RVOR) method to evaluatestock portfolio performance, the past average is used as the expected return, and beta is used as a risk measure. Beta measures the amount of change in stock portfolio performance in relation to changes in market performance. Beta is used as a reference for evaluating investment risk, because market fluctuations usually affect price fluctuations. Stocks with beta < 1 are considered less risky than market portfolios, and vice versa.

Based on the research results, there are three companies that consistently have positive values, namely ANTM (Aneka Tambang Tbk), SMGR (Semen Indonesia Persero Tbk), and WIKA (Wijaya Karya Persero Tbk). The highest performance value fell on issuers with stock code EXCL (XL Axiata Tbk) in 2019 with a value of 0.0764 and the lowest value fell on issuers with stock code SRIL (Sri Rejeki Isman Tbk) with a value of -1.7003. A positive result indicates that the yield to the issuer exceeds market risk.

Table.2

Treynor Index Portfolio Weights

Portfolio	Treynor	Weight
A	2.24%	73.08%
B	0.43%	14.05%
C	0.39%	12.87%

Source: Author Database

Based on table 2 above, portfolio A has the highest Treynor index of 2.24% while portfolio C has the lowest Treynor index of 0.39%. The portfolio allocation for A shares is 73.08%, B shares is 14.05% and C shares is 12.87%.

c. Portfolio Performance Analysis with Jensen Alpha . Method

The Jensen Alpha method only accepts investments whose return exceeds the expected return or lowest return, the return in question is the average return in the past, and the lowest return is the expected return calculated using the capital asset pricing model (CAPM). The difference between the average return and the minimum or expected return is called alpha.

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Based on the research results, the highest performance value fell on issuers with stock code ANTM (Aneka Tambang Tbk) in 2020 with a value of 0.1113 and the lowest value fell on issuers with stock code MNCN (Media Nusantara Citra Tbk) with a value of -0.0496. The higher Jensen Alpha results indicate the better portfolio performance.

Table 3

Jensen Alpha . Index Portfolio Weights

Portfolio	Jensen Alpha	Weight
A	3.92%	67.92%
B	1.40%	24.23%
C	0.45%	7.85%

Source: Author Database

Based on table 3 above, portfolio A has the highest Jensen Alpha index of 3.92% while portfolio C has the lowest Jensen Alpha index of 0.45%. The allocation for portfolio A shares is 67.92%, B shares is 24.23% and C shares is 7.85%.

d. Comparative Analysis of Portfolio Performance with Sharpe Ratio, Treynor Ratio and Jensen Alpha . Methods

In this study, portfolio performance was measured using different methods, namely Sharpe, Treynor and Jensen Alpha. Due to the different measurement equations and characteristics of each method, the calculated values will be different. Numbers, can not be directly compared with each other. This study will standardize the ordinal values of the three measurement methods.

Based on the research results, *ZSharpe* with the lowest performance score with a value of -1.1527 with the 2018 UNTR stock code and the highest performance score with a value of 1.0775 with the 2020 stock code ANTM. the last rank is UNTR (United Tractors Tbk).

ZTreynor has the lowest performance score with a value of -1.1530 with the UNTR stock code in 2019 and the highest performance score with a value of 0.8320 with the UNTR stock code in 2017. The highest value will be the first order, namely in this study UNTR (United Tractors Tbk) and the lowest value will be the last rank is UNTR (United Tractors Tbk).

ZJensen has the lowest performance score with a value of -1.1484 with the 2018 UNTR stock code and the highest performance score with a value of 1.1522 with the 2020 stock code ANTM. The highest value will be the first order, namely in this study ANTM (Aneka Tambang Tbk) and the lowest value will be the last rank is UNTR (United Tractors Tbk).

Since the data used are sequences or ranks, the tests are run using non-parametric statistics. Each sample is measured under all conditions, so for this type of design, it is called a one-sided analysis of variance based on rank, and the method used is the Kruskal Wallis test.

Table 4

NPar Tests

Descriptive Statistics

	N	Minimum	Maximum	mean	Std. Deviation
Score	36	-1.1530	1.1522	.000000	.8280813
Valid N (listwise)	36				

Source: Data retrieved using SPSS

Table 4 above shows the maximum number of 36 samples in the study, with a mean of 0 and a standard deviation of 0.8280. The minimum value of -1.1530 was obtained from the Treynor index measurement, and the maximum value of 1.1522 was obtained from the Jensen Apha index measurement using the Kruskal Wallis test.

Table 5

Kruskal Wallis Test Results against Sharpe, Treynor and Jensen Alpha . Z-score Indexes

Test Statistics, b

	Score
Chi-Square	.137
df	2
asymp. Sig.	.934
a. Kruskal Wallis Test	
b. Grouping Variable: Zscore	

Data processed with SPSS

Based on the results of the statistical tests above, it is known that Asymp.Sig 0.934 0.05 and x2 count 0.137 <x2 table 5.99, it can be concluded that H0 is accepted, which means that there is no difference between the tests using the Sharpe, Treynor and Jensen Alpha methods.

There is no difference between the three portfolio performance measurement methods. As an extension of the Kruskal Wallis test, the following test can also be used to compare the treatment average range or portfolio effectiveness calculation to find the difference between the three treatments or the average range. The following table compares the treatment or average of each method.

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Table 6
Comparison between Sharpe, Treynor and Jensen Alpha . index treatments

Ranks

	Zscore	N	Mean Rank
Score	Sharpe	12	18.58
	Treynor	12	17.67
	Jensen Alpha	12	19.25
	Total	36	

Data processed with SPSS

Based on the SPSS results in Table 6 above, it can be seen that the method with the greatest consistency among the three methods is the Sharpe index method, because it has the smallest difference compared to the other two methods.. The three methods are relatively consistent in measuring portfolio performance because the mean rank results are not much different.

4.2. Discussion of Research Results

a. Portfolio Performance with Sharpe Ratio Method

Based on the results of the study, during the research period from 2017 to 2020 the portfolio performance calculated by the Sharpe Ratio method was dominated by negative values where in 2017 there were 10 stocks with negative values. In 2018 there were 17 stocks with negative values. In 2019 there were 9 stocks with negative values. In 2020 there are 12 stocks with negative values. The average Sharpe index which has a positive value during the study period only has three identical codes, namely ANTM, SMGR and UNTR stocks. The index values are shown in table 4.1. If the Sharpe index is positive and the portfolio return is higher, the better. The results also show that the stock with the highest index value is owned by PT. United Tractors Tbk.

b. Portfolio Performance with Treynor Ratio Method

Based on the results of the study, during the research period from 2017 to 2020 the portfolio performance calculated using the Treynor Ratio method was dominated by negative values, there were 10 stocks with negative values in 2017, 15 stocks with negative values in 2018, 9 stocks with negative values. negative values in 2019 and there were 12 stocks with negative values in 2020. On average, the Treynor index which had a positive value during the study period only contained three of the same codes, namely ANTM, SMGR and UNTR stocks. The index values are shown in table 4.2. If the Treynor index is positive and the greater the stock portfolio performance, the better. The results also show that the stock with the highest index value is PT. Aneka Tambang Tbk. The shares with the worst yields are owned by PT.

c. Portfolio Performance with the Jensen Alpha . Method

Based on the results of the study, during the research period from 2017 to 2020 the portfolio performance calculated using the Jensen Alpha method had almost the same value, namely in 2017 there were 16 stocks with negative values and 6 stocks with positive values. In 2018 there were 12 stocks with negative values and 10 stocks with positive values. In 2019 there were 6 stocks with negative values and 16 stocks with positive values. In 2020 there were 9 stocks with negative values and 13 stocks with positive values. The average Jensen Alpha index which has a positive value during the study period only has three same codes, namely ANTM, SMGR and UNTR shares. The results also show that PT Aneka Tambang Tbk has the best stock performance. And its shares are PT United Tractors Tbk.

Table 7
Stock Portfolio Expected Return Table

Portfolio	E(ri)	Rf	rm	□
A	0.286%	0.0041	0.0035	2.1893
B	0.294%	0.0041	0.0035	2.0404
C	0.370%	0.0041	0.0035	0.6704

Source: Author Database

Based on the table above, the expected return of A stock portfolio is 0.286%, B stock is 0.294% and C stock is 0.370%.

5. Conclusion

After conducting the research and discussion that has been described in the previous chapter, the author has several conclusions.

a. Performance stock portfolio in 2017 is calculated using the Sharpe Ratio method, which consists of 10 negative stocks and 12 positive stocks. In 2018, there were 17 stocks with negative ratings and 5 stocks with positive ratings. There are 9 negative stocks in 2019 and 13 positive stocks. There is12 negative stocks and 10 positive stocks in 2020. PT. United Tractors Tbk. perform best and the shares of PT. Aneka Tambang Tbk. perform worst.

b. Po performanceThe stock portfolio in 2017 which is calculated using the Treynor Ratio method is 10 shares with a negative value and 12 shares with a positive value. In 2018, there were 15 negative stocks and 7 positive stocks. There were 9 negative stocks and 13 positive stocks in 2019. There were 12 negative stocks and 10 positive stocks in 2020. During the research period the best stocks belonged to PT Aneka Tambang Tbk. And the shares of PT United Tractors Tbk performed worst.

c. In 2017, portfolio performance*Jensen Alpha*are 16 negative stocks and 6 positive stocks. OnIn 2018, there were 12 negative stocks and 10 positive stocks. In 2019, there were 16 stocks with negative values and 6 stocks with positive values. In 2020

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there were 9 negative stocks and 13 positive stocks. The results showed that PT Aneka Tambang Tbk showed the best results. The shares of PT United Tractos performed the worst.

d. The results of the Kruskall-Wallis test show that there is no difference in the stock portfolio performance of the three methods.

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