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Evaluation of Optimal Stock Portfolio Performance by Grouping Issuers Based on Stock Price Movements

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ABSTRACT

Stock investment has a high risk, one of which is caused by changes in stock prices that occur in trading on the stock exchange every day, thus affecting the level of stock returns which also changes. Investors will face uncertainty in making choices and evaluating stock performance in the future because the returns obtained are uncertain and depend on the risks that affect it. Risk in investing can be reduced by investing in various types of stocks by forming an optimal stock portfolio. These problems are solved in this study by taking a calculation approach in selecting stocks and determining the optimal portfolio with the advantage of a single index model that can explain the relationship between the returns of each stock and the market index returns to calculate the variance of a stock. portfolio. There are 4 stocks with the largest excess return to beta, namely MEGA, JECC, UNIC, and KICI stocks. Performance measurement in this study was carried out using the Treynor Index, because this index used systematic risk as measured by Beta.

Keywords: Single Index Model, Treynor, Dynamic Time Wraping

INTRODUCTION

Investment is not a foreign term for some Indonesians where investment activities have been widely carried out by individuals or companies in investing their assets both in rill assets and in financial assets, this is in the number of investors in the capital market in 2020 increased by 45% compared to the previous year.

Increasing investors in the capital market can be a positive thing, but there needs to be more understanding for novice investors so as not to be affected by the "pompom" of stocks without anilysis first. Especially since the beginning of 2020 the Composite Stock Price Index (JCI) is experiencing fluctuations. Market sentiment is affected by pandemics and their impact on the economy.

Therefore, investors in the capital market need to be equipped with knowledge so as not to be easily influenced by information that circulates that can affect the purchase of certain stocks, giving a good impression to certain companies but not in accordance with the reality so as to make the stock price rise - fall in a short time that can make investors experience losses if without based on knowledge in anilysis of shares to minimize risk in the market. Choose stocks on the capital market. The problem that is often faced by investors in conducting investment analysis is in risk assessment. In general, investors want a maximum level of return with an optimal level of risk. In fact, stock investment can provide a high rate of return but the greater the level of return given, the greater the risk that will be borne because the stock is high risk high return, which has a high risk but the return is also high. The relationship of risk and return is the law and basic principle

of investment theory known as the term high risk high return, low risk low return.

Risk in investing can be reduced by investing in different types of stocks by forming an optimal stock portfolio to overcome losses on one stock with gains on other stocks. The difference between the actual return and the expected return can be called risk. In a stock portfolio, risk depends on the proportion of individual stocks, variance, and covariance so that the change in risk depends on changes in variables so that when creating a stock portfolio by choosing several stocks randomly then the portfolio risk will decrease according to the number of different stocks entered into the portfolio (Statman, 1987).

The desired risk and return limitations in this study begin by conducting a stock classification analysis first by using the time series hierarchy clustering method by detecting the independence between time series data from the movement of data at any time using Dynamic Time Warping distance. This distance method is superior because it not only takes into account the proximity of values, but also takes into account the similarity of patterns and movements of the data. Classification is done to determine the risk limit borne by investors and determine the desired return because in measuring the performance of portfolio can not only see from the return but must be coupled with measuring the risk limit that will be borne by investors.

Realistic investors will diversify in investing in various types of investments in the hopes of getting maximum return by minimizing existing risks. This problem is solved in this study by taking a calculation approach in choosing stocks and determining the optimal portfolio with the advantages of a single index model that can explain the relationship between the return of each stock and the return of the market index to calculate the variance of a portfolio.

A very important stage in making an investment in the capital market must certainly consider and assess the performance of its investment in the form of a portfolio so that it can be used to evaluate performance in the optimal stock portfolio. Performance measurements in this study were conducted using the Treynor Index, because the index uses systematic risks as measured by Beta.

The formulation of this research problem is due to problems about assessing the risks faced by investors. Based on the research, the author is interested in conducting further research on optimal portfolio formation and analysis using the single index method, namely (1) What is the best stock classification based on stock price patterns with grombol analysis?; (2) How to determine the optimal portfolio composition of the best stock classification formed with a single index model? ; (3) What is the optimal portfolio performance of the best stock classification using the treynor index model?

This research aims to find out the general condition of stocks on the Indonesia Stock Exchange (IDX) and make a classification of issuers in the IDX based on the sector viewed from the stock price pattern to further determine the best group in each sector as the best recommendation for stock investment and determine the optimal portfolio composition with a single index model and measure the performance of stock portfolios formed using the Treynor model.

LITERATURE REVIEW

Portfolio Theory

A portfolio is a combination of individual assets or securities (Mary et al, 2015). According to Jones (2014), a portfolio is a collection of stocks in which a relatively limited amount of money can be spent by buying shares in companies in various industries. The issue of portfolio selection is one of the classic problems of the financial world that first appeared introduced by Markowitz through a Journal of Finance article in 1952 and continued with his book in 1959 which covered two main components, return and risk. The main

purpose of the problem is to maximize expected profits at a certain level of risk or minimize the expected risk at a certain level of return. Markowitz's contribution to the economy is his analysis of the impact of securities diversification in his portfolio and covariance relationships (Mangram, 2013). Markowitz's portfolio theory emphasizes analyzing the performance of a particular portfolio based on the means and variance of asset returns contained in a portfolio, assuming investors are risk-averse, and willing to get small risks at certain expected levels of return (Marling &Emanuelsson, 2012). The assumption of Markowitz's approach to portfolio analysis is that investors are essentially risk averse, this means that investors must be given higher returns to accept higher risk (Gautam, 2014). According to Markowitz's theory, investors would take risks from portfolio.

Portfolio Risk and Return

According to Sharpe (1995), risk and return are two hallmarks of investing, so it's important to understand how it came from. It is necessary to identify and assess the main factors that cause it. This is the main goal of equity research, and the results are critical in forming a portfolio, revising, reviewing, and deciding on a long-term investment plan. Return is a profit or investment that is usually expressed as an annual percentage rate. A stock's return is an expected stock gain on an investment made in the form of a stock or group of shares through a portfolio. Return is the amount of investment profit plus changes in market price, usually calculated as a percentage of the initial market price (Van Horne, 2008). This stock return can be used as an indicator of trading activity in the stock market. According to Jones (2014) "return is the yield and capital gain or loss". In general, a stock's return is the advantage of having a stock investor on his or her investment consisting of dividends and capital gains/losses. Return is divided into two, namely the actual return calculated based on historical data and expected return that will be obtained by investors in the future. Total return, relative return, average return, and modified or cumulative return will all be used to calculate realized returns. Expected returns are measured using the average return distribution, which is a calculation of the average return distribution or central trend (Elton and Gruber, 1995).

Risk is the difference between actual return and expected return that can result in losses for investors (Fabozzi, 2002). The probability of a negative outcome is known as risk (Brigham and Houston, 2013). Dowd's definition of risk (2000) is risk as a result of price changes, such as changes in the stock price of a public company, and interest rates, such as interest rates and exchange rates. Risk is often described as the actual probability of an investment return that deviates or fluctuates from the expected return (Elton and Gruber, 1995). Two ways to measure this risk are using variance and using downside risk. Risk budgeting is a risk management practice in which a portfolio changes at all times necessary to withstand predictable risks within predetermined limits. The risk of a stock portfolio is determined by the proportion of individual stocks, as well as their variance and covariance. These variable changes will have an impact on portfolio risk. The fact is that when stocks are randomly selected and mixed into a portfolio, portfolio risk decreases as the number of shares increases (Statman, 1987). Empirical evidence shows that the more types of stocks collected in a portfolio basket, the risk of loss of one stock can be neutralized with the profit of another stock.

According to Solnik (1995), the overall risk of a portfolio is determined not only by the number of shares in a portfolio, but also by the risk of each particular stock and the degree of risk independence. Furthermore, according to Solnik, domestic stocks tend to grow or fall in tandem because they are influenced by domestic factors such as money supply announcements, interest rate movements, budget deficits and national growth.

Different risks are divided into two categories in modern investment theory, namely systematic risk and unsystematic risk. Systematic risk is a form of risk that is influenced by external factors such as economic, political, and other macro factors and cannot be mitigated by diversification. Unsystematic risk is one form of risk affected by business or market circumstances that can be mitigated by diversification (Brigham and Houston, 2013).

Optimal and Efficient Portfolio

The ideal portfolio, according to Reily and Brown (1995), is an efficient portfolio with the greatest utility for investors, because an efficient portfolio is created by maximizing one of two dimensions, namely expected return or portfolio return. A portfolio is considered efficient if a portfolio has the same level of risk but can provide a higher rate of return or generate the same level of benefit but with a lower risk. While the optimal portfolio is the portfolio chosen by an investor from the many options that exist in an efficient portfolio pool. Portfolio optimization is a method that measures the selection of different investment options achieving maximum results at the risk level (Feksi and Barazandeh, 2019). To create the best portfolio, the first step is to determine how much risk they are willing to take, with that risk being a risk that correlates with the stock, known as beta. Portfolio optimization is concerned with the allocation of capital among several assets. Portfolio optimization is an important area of research in the field of risk management. Generally investors will choose to achieve maximum return with the least possible risk in portfolio stocks. Nevertheless, high yields also result in higher risks (Fekri and Barazandeh, 2019).

Portfolios are classified as effective according to Sharpe (1995) if they have the same level of risk, but can offer higher returns, or can provide the same rate of return but with lower risk. Since the size of an efficient portfolio is closely related to the element of return and risk, it must be measured using quantitative formulas (Van Horne, 2008). The correlation coefficient of return of each asset in the portfolio should be considered when building an effective portfolio. The correlation coefficient measures how close the return relationship of an investment is that makes up a portfolio. If the correlation coefficient is -1 (perfect negative), the return of all assets has a tendency to move in the opposite direction over time. Although the correlation coefficient is +1 (positively perfect), the return on both investments has a tendency to change direction at the same time, thus making portfolio formation and diversification ineffective (Markowitz, 1952).

METHODS

The data used in this study is secondary data obtained from the Indonesia stock exchange page on http://www.idx.co.id. The data is stock price data with daily units of time according to the issuer consisting of 482 open companies that meet the research requirements. The available data is daily data with a time span from January 1, 2015 to December 31, 2020.

The first thing to do is to do aombol analysis of stock price data. Swarming is one of the techniques used to form a group that has similar or similar characteristics with each other from several observations where between the swarms have different characteristics. In conducting a cluster analysis there are several algorithms that can be used where each has a special way of determining the group depending on the purpose of the swarm to measure similarities and determine efficient groups. The concept of distance as one of the references to the similarity or kemiripin of some observes done to form a swarm.

In the distance series clustering used to determine the swarm is using the distance between patterns in the time series where one of the methods used to calculate the distance between two time series data can

be calculated using the Dynamic Time Wraping (DTW) method. DTW has an advantage over other distance methods that can calculate the distance of two vector data with different lengths. DTW mining is an algorithm used to perform dynamic distance calculations by comparing two time series data and finding the optimal curve between the two data for time series data mining (Berndt and Clifford 1994).

DTW is different from minkowski, DTW breaks down the one-one alignment restriction and also supports unequal time series. In DTW the local cost matrix measuring n x m is used for X and Y alignment representing all paired distances between the two.

The local cost matrix is derived from the following equation (Monday, 2008):

$$C\mathbf{i,j} = >X\mathbf{i} - y\mathbf{j}>, i \in [1: n], j \in [1: m]$$

Formally, the alignment path built by DTW is the order of

$$p =)1,p^*, \dots, pk^*, p1 =)i,pj^* \in [1: n], j \in [1: m]$$

Must meet the following criteria:

1. **Boundary conditions:** p1 = (1,1) and pK = (N, M). The beginning and end point of the curved path should be the first and last aligned sequence points.
2. **Monotonicity:** n 1 ≤ n 2 ≤... ≤ n K and m 1 ≤ m 2 ≤... ≤ m K. This condition maintains the time order of points.
3. **Step size conditions:** This criterion limits the curved path of the jump length (shifting in time) while aligning the sequence. It will currently use the basic step size condition formulated as p l + 1 −p l ∈ {(1,1), (1,0), (0.1)}.

Each element (i, j) in the matrix represents the cumulative cost of the element (i, j) and the minute value of the three elements adjacent to (i, j), 0 ≤ i ≤ n and 0 ≤ j ≤ m, or can be formulated with the following equations (Niennattrakul and Ratanamahatana, 2007):

$$dtw\mathbf{i,j} = C\mathbf{i,j} + \mathbf{min}\{C\mathbf{(i.1)(j.1)}, C\mathbf{(i.1)j}, C\mathbf{i(j.1)}$$

The matrix provides the smallest cumulative distance of all warping paths, allowing it to find the optimal warping path. DTW is derived from the following equation:

$$d_{DTW} = \min R \quad \$ \quad p_k \qquad k\#1$$

Next, analyze the issuer's data on the best swarms by using a single index method to determine an efficient portfolio set. The Single Index model is based on the idea that a stock's profit rate is influenced by the level of market portfolio profits or fluctuates in the direction of a market portfolio. In general, stocks increase if the stock price index rises, vice versa if the stock price index falls, most stocks experience a price decline. This illustrates that there is a possible correlation between stock gains and a general reaction to changes in market value. The concept of counting is based on Elton and Gruber's calculation model (1995) by determining the ranking (order) of stocks that have the highest ERB to the lower ERB. The ranking aims to determine the excess return of shares to risk-free returns per unit of risk. Stocks that have an excess return to beta (ERB) equal to or greater than cut-off-point (C*) are candidates in the optimal portfolio formation (Sukarno, 2007).

1. Realized Return (Rt) is the percentage change in the closing price of share A in the month to t minus the closing price of A shares A day to t-1 then the result is divided by the closing price of shares A day to t-1.
2. The expected return rate of each individual stock is the average percentage realized return of i shares divided by the amount of realized return of i shares.
3. Standard Deviation (SD) is used to measure the risk of realized return, which can be calculated with excel programs using the STDEV formula.
4. Variance (α2) is used to measure the expected return risk of i shares. Variance can be calculated in a way, i.e.

squaring standard deviation or calculated with excel programs.

5. Beta (βi) is the unique risk of an individual stock, calculating the slope realized return of a stock with a realized market return (JCI) in a given period. Beta is used to calculate the Excess Return to Beta (ERB) and Bj required to calculate Cut Off Point (Ci).
6. Beta (βi) is the unique risk of an individual stock, calculating the slope realized return of a stock with a realized market return (JCI) in a given period. Beta is used to calculate the Excess Return to Beta (ERB) and Bj required to calculate Cut Off Point (Ci).
7. Variance (σei) is a variant of residual error of i stock that is also a unique or non-systematic risk.
8. Excess Return to Beta (ERB) is used to measure premium return, a stock relative to a single unit of un-diversified risk as measured by Beta. ERB shows the relationship between return and risk which is the determining factor of investment.
9. Ai values are calculated to get Aj values and Bi is calculated to get Bj values, both are required to calculate Ci.
10. Limiting Point (Ci) is the value of C for the 8th stock calculated from the accumulation of values A1 to Ai and values B1 through Bi. Ci value is the result of market variant and premium return to stock variance error with market variant and sensitivity of individual stocks to stock variance error.
11. Cut Off Point (C*) is the largest Ci value of a series of ci stock values, calculated by the Excel program using the MAX formula.
12. The proportion of funds (Xi) of each stock in the optimal portfolio is calculated by the Excel program using the IF formula
13. Percentage of the proportion of funds (Wi) of each optimal portfolio forming stock
14. Covariance is the average deviation of each data, is a comparison of the calculation of realized return of share A with realized return of share B. Covariance is calculated by the Excel program using the Covar formula.
15. Correlation or correlation coefficient between stocks is a comparison of the calculation of realized return of stock A with the calculation of realized return of stock B in a certain period. The correlation coefficient between the two data groups is calculated with the Excel program using correl formula.
16. Expected return of portfolio E(Rp) is a weighted average of individual returns of each portfolio forming stock
17. Risk or standard portfolio deviation (σp) is the weighted average of the individual standard deviation of each portfolio-forming stock.
18. A portfolio beta (βp) is a weighted average of the individual beta of each portfolio-forming stock.
19. Covariance (σp) portfolio

After getting an optimal portfolio, the next stage is to measure portfolio performance using the treynor index method. Treynor index is one of the indices used to measure portfolio performance, the measurement in the treynor index using site matrix risk is the risk that best describes the individual state of the company by assuming the portfolio is highly diversified or called the Reward to Volatility Ratio (RVOR), because market returns have affected portfolio returns.

In the Treynor index the calculated portfolio performance is the net result of the portfolio at a risk-free interest rate per unit of the portfolio market risk in this case the assumption to note in the portfolio index that the results provide evaluation at one period because the portfolio return rate and risk require a long period. In addition, the assumption of normality of the return level needs to also be considered. Treynor's performance index is calculated by the following formula:

$$Tp = \frac{R_p - R_f}{\beta}$$

Information:
T_p = Treynor performance index.
R_p = portfolio return or market return rate.
R_f = risk-free return risk-free interest rate.
β_p = market risk from portfolio or systematic risk of portfolio

In calculating the Treynor index, the assumption must be noted that the results provide an evaluation at one period, because the level of portfolio return and risk requires a long period. If the period used is short enough then the risk calculated by beta gives unnatural or unrepresentative results. In addition, the assumption of normality of the return level needs to also be considered (Sulistyorini, 2009).

RESULT

In the early stages of this study, stock price data was grouped by sector into eleven groups namely raw goods, primary consumers, non-primary consumers, energy, finance, health, industry, infrastructure, property and real estate, technology, transportation and logistic. Further cleaning is done for data that does not meet certain criteria. The data that is eliminated is one of them due to having different units of time. In addition, issuers who have the same price in the long term are also eliminated because it is indicated not to be traded at that time.

Before entering the analysis stage, the daily unit of time is transformed into weekly using averages. Furthermore, normalization is carried out on all data so that each resulting pattern is on the same scale and facilitates in the next stage of analysis.

The initial stage in grouping is to use the analysis of colliding swarms with the dynamic time wrapping method as a measure of distance for the data analyzed, using ward links. The number of swarms formed is determined based on the exploration of data from dendrogram graphs and also the resulting time series plot.

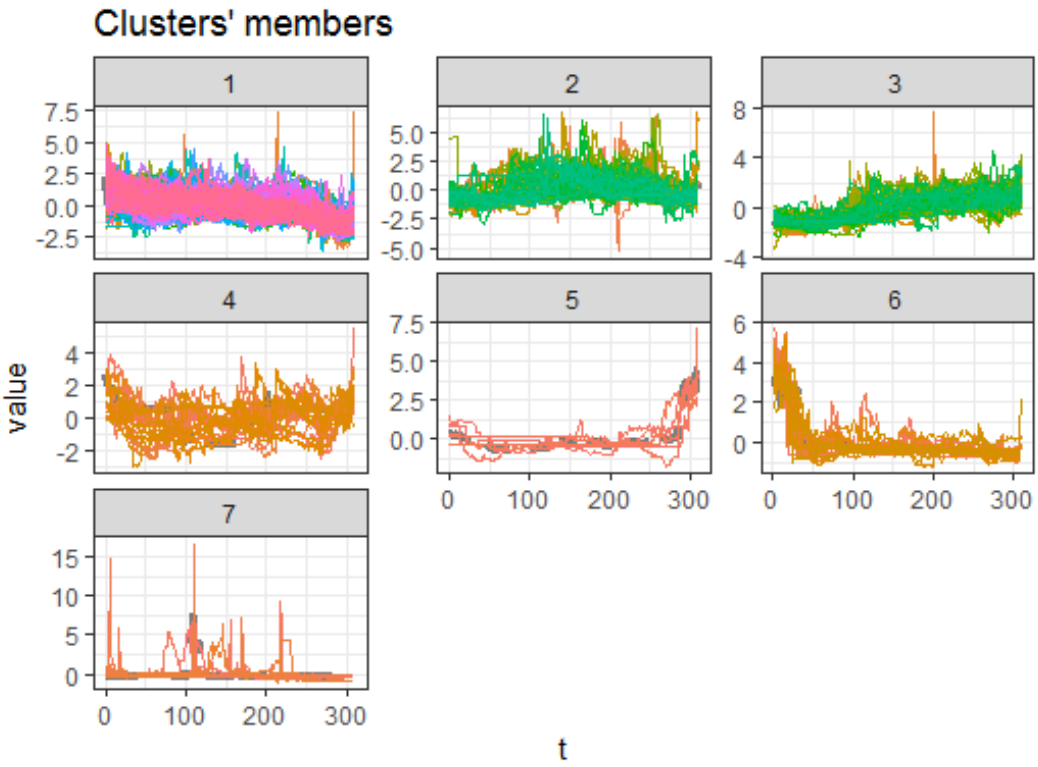

Figure 3 The issuer's plot based on the resulting swarm

Each of these groups occupies seven groups with characteristic stock price patterns formed and also different levels of fluctuation. The first group (1) becomes a swarm that contains issuers with characteristics of stock price movements

that tend to be negative and have low fluctuations. The second bluff (2) has the characteristics of stock price movements that tend to be stable with low fluctuation. The third bluff (3) has characteristics of stock price movements that tend to be positive and have low fluctuations. The fourth clusters (4) tends to be characteristic in contrast to other clusters where the movement of stock prices tends to be random with high fluctuations. The fifth clusters (5) has the characteristics of stock price movements that tend to be stable in 2015-2018 then positive in the last two-year period and high stock interest. The sixth bluff (6) is almost similar to the fifth bluff has high fluctuations but stock price movements that tend to be negative in 2015 then stabilize in the remaining period. The seventh (7) bluff also has high fluctuations with stock price movements that tend to be stable over a period of time but at some point there are high price spikes. Hierarchically, the third bluff is the best and recommended for investment in stock investment.

The raw goods sector in clusters 3 recorded good results by showing an average expected return of 20 issuers in this sector for 5 years of 3.80% with a stock price pattern that tends to be positive. This makes issuers in this sector worth considering in stock investment. There are 20 issuers who are predicted to have good prospects in the future.

Energy sector issuers have a pattern that tends to be positive and low fluctuations with the average expected return of 6 issuers in this sector in the last 5 years get a positive value but the figure is only 2.11%. Even so, hopes for the sector are still wide open. Development progress that is quite vociferous in the energy sector will support energy sector players to create innovations that can increase the energy sector.

In the last 5 years provide a fairly good average expected return value with a positive value of 3.53% as well as a price pattern that tends to be positive.

Infrastructure development that is quite massive with traffic access to be better and efficient is very helpful for industry players in marketing their production so that issuers in this sector can be considered in making investments.

In this sector there is only one issuer that entered into group 3, namely issuers with the code IBST (Inti Bangun Sejahtera Tbk.) which in the last 5 years gave the 3rd highest expected return average value of other sectors of 3.95%. This positive value can be considered by investors to collect issuers with the IBST code.

The financial sector is a sector that is quite interesting to be considered to make stock investments. This sector will always be needed as a source of business funding, especially banking subsectors who make a fairly influential contribution to this sector. In the last 5 years the sector provided a fairly good average expected return value with a positive value of 2.97% as well as price patterns that tend to be positive and low fluctuations.

Health sector issuers have a pattern that tends to be positive and low fluctuations with an average expected return of 4 issuers in this sector in the last 5 years getting the highest value compared to other sectors, which is 5.44%%. Issuers in the health sector are predicted to be one of the ones that benefit in the future from the impact of the pandemic that hit Indonesia. The increasing number of positive cases of covid 19 also strengthened the performance of issuers in the health sector.

Issuers in this sector have an average expected return in the last 5 years which is 2.02%. This sector shows a pattern of stock prices that tend to be positive with low fluctuations so that this sector is quite worthy of consideration.

Over the past 5 years the primary consumer sector has shown a pattern that tends to be positive with low fluctuations. The average expected return generated in this sector is 3.13%. The value is exactly the same as the average of all sectors over the past 5 years.

Issuers in this sector have the lowest expected return compared to other sectors in the last 5 years, which is 1.36%. However, this sector shows a pattern of stock prices that tend to be positive with low fluctuations and also with government policies related to the formation of a new capital city allows for considerable opportunities for this sector in the future so that this sector is quite worthy of consideration.

In this sector there is only one issuer that goes into the group of 3 just like in the infrastructure sector. Issuers who enter this sector are issuers with the code MTDL (Metrodata Electronics Tbk.) which in the last 5 years provided an average expected return value of 2.07%. However, by looking at the development of technology that continues to develop and with a lot of support from the government and stock price patterns that tend to be positive with low fluctuations so it is worth considering in making investments.

In this sector there are two issuers that enter the group 3, namely ASSA (Adi Sarana Armada Tbk) and SAFE (Steady Safe Tbk). Issuers of the transportation and logistics sector have a pattern that tends to be positive and low fluctuations with an average expected return of 2 issuers in this sector in the last 5 years getting the 2nd highest value compared to other sectors, which is 4.04%. Issuers in the transportation and logistic sectors are predicted to feel the direct impact of infrastructure development that continues to be launched by the government that can increase the rate of transportation and logistic to be better and efficient. This will certainly greatly help transportation and logistic sector actors in developing their business.

Issuers in group 3 which become prospective stock recommendations for investors, then conducted the selection and determination of issuers from the group to become optimal portfolio candidates with a single index model method. The first thing to do is to describe JCI and SBI. The JCI data represents the market data needed to calculate market return rates (Rm) and market risk (σm). This SBI data is used as a proxy return of risk-free assets or risk free rate of return (Rf).

In 2015 JCI experienced a significant decline. This is due to the effects of the crisis in several countries such as Greece, China, Malaysia, and several other countries in mid-2015. The increasingly integrated world economy provides a domino effect for other countries, so that the crisis that occurs in some of these countries has an impact on the economy of the Indonesian state, not least on the capital market. This is because Indonesia has trade relations with China and Malaysia and has integrated global stocks.

At the end of 2015 to the beginning of 2018 JCI experienced a significant increase to touch the highest JCI value at the beginning of 2018. However, from the beginning of 2018 to the middle of 2018 JCI experienced a decline caused by the exit of financial backers from the domestic stock exchange. In 2019 the JCI experienced a very sharp fluctuating this is due to the tensions of the U.S.-China trade war again heating up.

Then there was a significant decline in 2020 caused by the Covid-19 pandemic after the World Health Organization (WHO) officially reported the Covid-19 pandemic at the end of December 2019. Around March 2020 when the Covid-19 pandemic in Indonesia began to spread, JCI experienced a significant decline to the lowest point compared to the last 5 years.

The next data needed is SBI-weekly interest rate data, obtained from the BI report during the period 2015-2020. This SBI data is used as a proxy return of risk-free assets or risk free rate of return (Rf) because the data is weekly then there needs to be a conversion first by flattening the BI rate and then converting it into weekly units.

To calculate realized return, expected return, standard deviation and variants of each individual stock, JCI and SBI use excel programs. Realized return is obtained from the percentage change in the closing price of i shares in the month to t

minus the closing price of i shares in the month to t-1 then the result is divided by the closing price of i shares in the month to t-1. Expected return is calculated with the average formula, standard deviation is calculated with the FORMULA STDev and the variant is calculated with the var formula.

Calculates the alpha, beta, and variance errors of each stock using the Excel program. Alpha is calculated by the intercept formula, which is a comparison of the return realization of a stock with the return of the market in a given period. Beta is calculated by the slope formula, reflecting the volatility of a stock's return to market return. Variance error is a unique risk or unsystematic risk of a stock. Based on the results of these calculations then calculated the value of excess return to beta (ERB) and the value of ci each stock. The ERB value obtained is sorted or ranked from the largest ERB value to the smallest ERB value. Ci value is the result of market variant and premium return to stock residual error variance with market variant on the sensitivity of individual stocks to residual error stock variance.

The Cut off point (C*) value is the maximum Ci value of a series of Ci share values. The Cut off point value is used as a limiting point to determine the stocks that enter the candidate with those that do not enter the portfolio candidate. The result of the calculation of the Cut off point value in this study is C * = 0.0046156. Stocks that are portfolio candidates are stocks that have an excess return to beta value greater than or equal to the value of the cut off point. With a Cut off point value (C*) = 0.0046156 and excess return to beta of ERB = 0.0049 obtained 51 shares that are portfolio candidates.

From the 51 stocks of the portfolio candidates are then selected the stocks that will be formed into the optimal portfolio. Selection criteria based on the magnitude of the excess return to beta value of each portfolio candidate's stock. An efficient portfolio is a portfolio formed by stocks that have a high excess return to beta value. The value of excess return to beta reflects the amount of premium return that a stock can generate relative to a single unit of un-diversified risk as measured by beta. Beta reflects a stock's volatility return to market return, measuring the systematic risk of a stock relative to market risk. This research forms an optimal portfolio by choosing the stocks that have the largest excess return to beta value.

With the selection criteria obtained 4 stocks that have the largest excess return to beta value, namely MEGA, JECC, UNIC, and KICI shares. The ERB value of each share is ERBMEGA = 0.5642%, ERBJECC = 0.1757%, ERBUNIC = 0.0825%, and ERBKICI = 0.0585%.

After determining the optimal portfolio forming stocks then calculated the correlation coefficient and covariance between stocks. The correlation coefficient is required to determine the relationship of return of stocks forming portfolios and the relationship of stock returns with market retun calculated by correl formula. Covariance is a comparison of the calculation of realized return of share A with realized return of share B. Covariance is calculated with the Excel program using the Covar formula.

The results of the calculation of expected return, standard deviation and optimal portfolio variants consisting of MEGA, JECC, UNIC and KICI shares are shown in the following table:

Tabel 1 E(Ri), StDev, dan ERB portofolio

Kode	E(Ri)	StDev	Wi	Beta	ERB
MEGA	0.004954	0.042449	0.417846	0.006973	0.564194
JECC	0.004575	0.056657	0.208144	0.020241	0.175681
UNIC	0.004567	0.048499	0.274822	0.043019	0.08247
KICI	0.003694	0.069228	0.099188	0.045712	0.058499
Portfolio	0.004644	0.049725	1	0.023483	0.154334

In evaluating the performance of a stock portfolio by the Treynor method or often referred to as the Reward to Volatility Ratio (RVOR), use the past average return as expected return and also beta as a risk benchmark. Beta indicates the small change in return of a stock portfolio to changes in market return. As a benchmark of investment risk is used beta because in general fluctuations in stock prices are influenced by market fluctuations. A security that has a beta < 1 is said to be less risky than the risk of a market portfolio. Conversely, a security that has a beta value of > 1 is said to have a systematic risk greater than market risk.

Return is considered the best measure for predictive guidelines, as long as the market assumptions are efficient. The comparison of return and risk shows investors that the higher the risk the higher the expected return. To analyze performance using the Treynor method requires data such as average return or expected return, beta stock, and risk free rate or standard deviation.

Beta of the calculation results between the period of 2015 to 2020 of 4 optimal portfolio stocks of 0.023483 so that it has less risk than the risk of the market portfolio with the portfolio performance of the treynor index value of 0.154416 shows positive then the stock portfolio can be said to have a good performance.

An overview of issuers selected as optimal portfolios that will be explained below will strengthen the argument that the issuer deserves consideration to be used as a portfolio in making stock investments.

Shares with issuer codes MEGA, JECC, UNIC and KICI are stocks that are recommended as optimal portfolios based on stock price patterns in bluff 3. However, if the stock is recommended as the optimal portfolio is taken from the best stock with a return above the average return of each group. 147 selected stocks from each group can be used as recommendations for further analysis using the single index model and treynor index method to get the optimal portfolio. Four stocks are recommended as optimal portfolios, namely stocks with issuer codes MEGA, PICO, ALDO, and SSTM.

The treynor index of the optimal stock portfolio at the 3 group has a greater value than the value of the optimal stock portfolio treynor index obtained from 147 stocks that have been selected from each group. The higher the value of the treynor index illustrates the better the performance of the stock portfolio. This can be a picture and consideration for investors in investing in stocks on the Indonesia Stock Exchange.

For investors or prospective investors can use this research as information to make considerations in making investments in the capital market in order to minimize the risks borne. Stock investment certainly has risks both sitematic and unsystematic. Systematic risk can be minimized through diversification by establishing an optimal portfolio. This research can be utilized in considering alternative selection and optimization of stock portfolio preparation by utilizing information that is closely related to unsystematic risk, namely by looking at beta value and excess return to beta. Optimal portfolio analysis using a single index model by comparing the value of excess return to beta with the value of the cutoff point can be used by investors as a basis for investment decision making on stocks.

Investors who will make investment transactions on the Indonesia Stock Exchange also need to see and consider stock price movements. Analysis of grouping stock price movements using DTW can provide an overview of stock price patterns to investors in determining options in investing in stocks on the Indonesia Stock Exchange. Stock price patterns that tend to rise or fall and have high or low fluctuations can be used as a consideration in making investments.

CONCLUSION

The analysis of the group with the dynamic time warping method as a measure

of the distance applied in stock price data based on the sector produces a different number of swarms in each sector. Each group is grouped into seven groups with their own characteristics. The third bluff is the best bluff with a stock price pattern that tends to rise and has fairly low fluctuations. Issuers in this group become a recommendation for investors who play in the stock market consisting of 91 stocks. Then the calculation used a single index model of 91 sample member stocks, the results showed only 51 stocks had an excess return to beta value greater than the Value Cut off point (C*) = 0.0046156. From the 51 stocks of the portfolio candidates are then selected the stocks that will be formed into the optimal portfolio. Selection criteria based on the magnitude of the excess return to beta value of each portfolio candidate's stock. With the selection criteria obtained 4 stocks that have the largest excess return to beta value, namely MEGA, JECC, UNIC, and KICI shares. The ERB value of each share is ERBMEGA = 0.5642%, ERBJECC = 0.1757%, ERBUNIC = 0.0825%, and ERBKICI = 0.0585% and becomes the optimal portfolio candidate with evaluation of portfolio performance has a beta value of calculation results between the period of 2015 to 2020 of 4 optimal portfolio candidate stocks of 0.023483 so as to have a risk less than the risk of market portfolio with portfolio performance with treynor index value of 0.154416 showing positive Then the stock portfolio can be said to have a good performance.

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