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Analysis of the Effect of Stock Portfolio Diversification with the Markowitz Method Approach to Portfolio Risk and Return on Idxbumn20 Index Stocks

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Abstract. The purpose of this research is to examine the Effect of Stock Portfolio Diversification with the Markowitz Method Approach to Portfolio Risk and Return on IDXBUMN20 index stocks. This research is a qualitative descriptive research. The subject population consists of 20 stocks of the IDXBUMN20 stock segment listed on the IDX for the period January 2019 to December 2022. IDXBUMN20 contributions from the Indonesia Stock Exchange are used as the main example. at least 4 years. The results of the study show that diversification can increase returns and reduce risks seen in AGRO stocks have a risk of 33% and BRIS 24% with diversification successfully reduced to 19.33% and in ANTM stocks have an expected return of 2.94%, BMRI 1.03% and TINS 0.97% with diversification successfully increased to 3.21%.

Keywords: Diversification, Markowitz, IDXBUMN20

INTRODUCTION

Tandelilin (2010) characterizes investment as "a commitment to the use of several thousand dollars or additional resources made at the present time with the aim of obtaining a percentage related to future profits." An investor's expenditure on an investment will increase its return, exposing it to risk. Portfolio is the next method that can be used to avoid investment risk. According to Maruddani and Purbowati (2009), a portfolio is a combination of two or more assets selected as investment targets for investors within a certain period of time and subject to certain requirements, such as a specified percentage of money or capital allocation.

Investments can take many forms and involve direct or indirect financial involvement. Many investors invest in the long term with the aim of making a profit from the investment made. Many people assume that investment is the same as preventing in the hope of utilizing the money invested in the future. Investing in quantity produces a high growth rate of profit. and large, but still the benefits obtained remain proportional to the risks that will also be obtained.

The strategies used by these investors are used to improve the performance of the portfolio owned in the hope of achieving a high level of return while still considering the appropriate level of risk. There are many methods that investors can use in stock portfolio management, one of which is the diversification method which is a concept with the aim of reducing exposure to risks associated with investment. Diversification means the allocation of funds or investments in various stock instruments in the capital market. Investors carry out the

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stock diversification method is an effort to minimize the impact of stock price fluctuations on the overall performance of the portfolio owned, in other words, diversification is carried out to achieve a balance between risk and return. So that when one stock decreases, other stocks in the portfolio can provide protection or can even cover the risk obtained and also provide a more stable return.

Utilizing the Markowitz Method in an effort to diversify a portfolio of stocks within the IDXBUMN20 index is a smart move in achieving successful investment goals. By combining an understanding of the risk and return potential contained in each stock in the portfolio, investors have the opportunity to reduce risk while increasing return potential. While diversification is a useful strategy, investors should always keep in mind that all investments carry inherent risk, and past performance does not necessarily reflect future results. To address this, it is wise to consult with an experienced financial advisor before taking any significant steps in the investment world.

The main problem for investors, especially for novice investors, is the extent to which the effectiveness of stock diversification strategies can be achieved through the Markowitz method approach. Many people are interested in investing but not many like a high level of risk so that many of the people who are interested in investing will try to reduce the risk of stock portfolios and increase their investment returns. The Markowitz method, which is a mathematically powerful approach to portfolio analysis, can help investors to evaluate the risk and return that may be associated with various combinations of stocks in their portfolios.

Research Question

1. How is the effect of stock portfolio diversification with the Markowitz method approach to portfolio risk on IDXBUMN20 index stocks?
2. How is the effect of stock portfolio diversification with the Markowitz method approach to portfolio returns on IDXBUMN20 index stocks?

Research Objectives

1. Knowing the effect of stock portfolio diversification with the Markowitz method approach to portfolio risk on IDXBUMN20 index stocks.
2. Knowing the effect of stock portfolio diversification with the Markowitz method approach to portfolio returns on IDXBUMN20 index stocks.

LITERATURE REVIEW

Markoitz Method

The Markowitz method says that if you want to minimize risk, you must do a diversification strategy. The Markowitz concept is a portfolio optimization approach that emphasizes the relationship between investment risk and return. Markowitz, to be based through the concept of variance method (variance) and average (mean). The mean is a measure of exchange and the difference between the two is a measure of risk. Markowitz portfolio theory, often known informally as the mean-variance model, concentrates on approaches that maximize anticipated profits (mean) while minimizing inconsistencies/risks (variance) in the selection and arrangement of optimal portfolio investments (Mingka & Lubis, 2023).

Markowitz's model shows that the variation of stock portfolio returns is affected not only by the likelihood of each investment in the portfolio, but also by how risky the stocks are associated with. Through analyzing the covariance of asset returns, Markowitz modeled a stock diversification method that attempts to package assets in an optimal portfolio while maintaining current returns and reducing risk.

The foundation of the Markowitz portfolio model is to provide input to investors to avoid risk and achieve maximum profit on every investment decision (Fahmi, 2012). In connection with the agreement with Jogiyanto in (Fahmi, 2012), the Markowitz model has the following assumptions:

1. No single time period was used.
2. There is no cost yet.
3. An investor's value is related to the predicted return as well as the risk of the portfolio.
4. No intentional borrowing or saving.

Markowitz's approach predicts optimal risk by considering investor preferences, which involve risk recommenders versus risk averse. The most appropriate measurement idea offers a projection of maximum return with individual desired risk that is closest to each investor's risk preference. (Anam et al., 2021).

Diversification

Diversification is a risk reduction strategy that involves spreading capital across different financial instruments, businesses and other categories. Diversification is a great way to reduce the potential dangers of stock investing. The issue to be aware of is unsystematic risk, which can be reduced by structuring an investment portfolio. If you diversify your portfolio into too many stocks, one stock's overall earnings will be driven by the results of other stocks in the portfolio. As a result, it can reduce the risk of large losses. (Ramadhan et al., 2020).

Markowitz is a modeling framework that educates about investing by dividing invested funds and then directing them in several different directions. There is an opinion that the differentiation of money can reduce the dangers that will occur in the future. The decision to diversify assets will result in the development of financial security conditions, or rather, the construction of an ideal portfolio.

Stocks

According to (Cashmere, 2010) understanding In the designation of acquired shares, shares are increasing which is the usual form of ownership. Shares can be traded to other parties. Meanwhile (Fahmi, 2012) characterizes shares as an affirmation of capital / fund ownership surrounding a corporation, represented by paper that clearly shows the name of the organization concerned, the nominal value, and the rights and obligations outlined to each holder. (Muliadi & Fahmi, 2016).

Stock Portfolio

A portfolio is an accumulation of financial instruments with a given rate of return and risk. The emergence of portfolios is intended to provide investors with important explanations to help them make informed investment decisions. Investment analysis sometimes encounters difficulties, especially in determining the risks faced by investors. The level of return demanded by investors will increase as the risk associated with the investment increases. Diversification of stock types in a portfolio can help investors reduce investment losses/risks. Portfolios are closely related to spending in different types of stocks The documentary film can be traded on securities exchanges and currency exchanges to use alternative resources and potential hazards. (Manurung, 2019).

A portfolio is also defined as a collection of various assets invested and held by investors, including individuals and institutions. High-risk, high-return investment refers to the inverse relationship between return and risk, which suggests that because the greater the potential danger to be accepted, the greater the reward will be the return on the investment created. Investing not only in one form of investment, but in various types of investment in the hope of limiting risk and optimizing rewards. (Manurung, 2019).

Return

The amount of payment a customer gets for an investment is called a stock return. (Tandelilin, 2001) Return is defined as the reward that offsets the investor's courage in bearing the potential danger of his investment. The overall reward of an investment is the sum of dividends and capital gains. According to (Ramadhan et al., 2020) Investment returns include two important parts:

a. Yield, is the portion of investment returns that shows the cash flows and income generated through an investment on a continuous schedule.
b. Capital gain (loss), an element of investment returns that consists of an increase (reduction) in the purchase price of a security (which can be in the form of shares or relatively long term loan instruments) that can result in a gain (loss) for the investor.

The notion of "stock returns" signifies income shown as a proportion of initial capital expenditure. In this scenario, investment income includes income from buying and selling shares. Stock return is the income that a shareholder is entitled to receive as a result of investing his money. Return examines the actual or established earnings delivered by different investment options at the intended rate of return.

Stock returns are the projected amounts that constitute the return on investment for expenditures made by various groups of parties in a portfolio. According to (Hartono, 2010), there are two kinds of stock returns: negative and positive:

a. Recognized returns are returns that have been successfully realized and are based on past data, while anticipated returns are returns that are anticipated to materialize in the not-too-distant future. Actual returns are incorporated and successfully calculated using data. As one of the company's measurement tools, realized returns are very important. These recognized returns can be used to estimate future profits and risks.
b. Projected return is the amount of money returned whose services are expected to be received by the investor in the future, but has not yet occurred. Market models are used to calculate expected returns in two stages of development, namely:
    1. By formulating simulated expectations based on authentic information from the estimation period and
    2. Estimate the anticipated return within the time window using this expectation model.Return Required
c. Historically found returns, i.e. the minimum value of exchange desired by shareholders based on their subjective risk appetite.

The profit gained from the difference between the selling and buying prices of shares through an investment instrument is sometimes referred to as stock returns. Stock returns are highly dependent on the stock market price of the stock or other instrument, which means that the stock must be traded with an eye on the market. Trading causes an adjustment in the purchasing power of an investment instrument, resulting in an increase in stock returns. The quantity of investment returns is calculated through an assessment of previous returns over time. (Simorangking, 2019).

Risk

Risk is the possible difference between actual and expected returns. The higher the potential difference, the greater the investment risk.

Risks in stocks are classified into two types: systematic hazards and unsystematic risks. Systematic risk, often called market risk, is a type of risk that impacts the market as a whole. As a result, movements in the overall stock market will have an impact on changes in the price of a particular company. Investors have little control over this systemic risk, and diversification will not eliminate it.

Whereas unsystematic risk, commonly referred to as particular risk, is the chance of a particular event of a company that will have an impact on the company's share price. Unsystematic risk includes the danger of company failure, financial risk, managerial risk, and so on. This risk is reduced or avoided by stock investors by building a stock portfolio, especially by diversifying. (Ramadhan et al., 2020).

In addition, there are several hazard indicators that affect investment risk:

a. Interest rate risk
b. Financial risk
c. Market risk
d. Liquidity risk
e. Inflation risk
f. Currency exchange rate risk
g. Business risk
h. country risk

The risk associated with a portfolio of stocks can be estimated based on the percentage of each stock market, as well as its volatility and covariance. Changes in these factors will affect portfolio risk. (Manurung, 2019).

IDXBUMN20

The IDXBUMN20 Stock Index tracks the price performance of twenty stocks in state-owned enterprises (SOEs), regionally-owned enterprises (BUMDs), and subsidiaries of these companies. The IDXBUMN20 benchmark index consists of SOEs that have the largest fundamentals. (Madina et al., 2022).

Previous Research

1. (Mingka & Lubis, 2023) The purpose of this research is to create an ideal portfolio using the Markowitz Method and the Single Index Model, then compare the results of the two strategies. The base number used in this study consists of seven banks included

in the LQ45 index. There are two stocks, BBNI and BMRI, which were created using the Markowitz method with a portfolio ratio of 0.0247 and a risk of 0.0033. There are currently five stock combinations created using the Single Index Model, consisting of BMRI, BRIS, BBRI, BBNI, and BBCA stocks, with a portfolio risk of 0.0018 and a portfolio return of 0.019, respectively. Because the risk in the Single Index Model is smaller than the Markowitz Method, this model is a good model.

2. (Anam et al., 2021) The purpose of this research is to find out which stocks are included in the ideal portfolio, how high the return and risk the ideal portfolio has, and what percentage of each stock from the ideal portfolio should be invested in the Jakarta Islamic Index. Listed on the Indonesia Stock Exchange from December 2020 to May 2021. Thirty stocks capitalize the Indonesia Islamic Index. Excel problem solving tools can be used to determine the optimal portfolio using the stages of the Markowitz model. That the possible stocks as portfolio managers can be generated by the best portfolio construction study Markowitz Model 6 (six).
3. (Jumrahma & Haeruddin, 2022) The purpose of this research is to design an optimal portfolio using the Markowitz model based on the IDX30 index that can be used as a backup investment or to build a portfolio. The base case of this research consists of all investor stocks or companies listed on the IDX30 Index of the Indonesia Stock Exchange between February 2017 and January 2022 or totaling 53 companies. The sample consists of 50 stocks of companies that have made decisions about themselves. Based on the methodology. In the case of targeted taint proliferation, it is a non-investigative strategy based on probability. Based on the research findings, 50 cases of the IDX30 index were used as a sample of the research problem. According to the research, the ideal portfolio consists of 14 stocks.

RESEARCH METHODOLOGY

Type of Research

This type of research is descriptive qualitative research. The purpose of using this type of qualitative descriptive research is to explain how the use of the Markowitz model affects the risk and return of a portfolio on IDXBUMN20 index stocks on the Indonesia Stock Exchange (IDX).

Data and Data Sources

The sources used consist of the monthly closing prices of shares of companies included in the IDXBUMN 20 Index for the period January 2019 to December 2022. There are a total

of sixty files that can be downloaded from Yahoo.com containing historical stock data. The website is http://finance. The monthly interest data of Bank Indonesia Certificates (SBI) for 2019-2022 is temporarily uploaded from http://bi.go.id.

Data Collection Methods

The method used in collecting data to conduct this research is to use a literature study with data from records related to the object of research. The data comes from previous research, literature, and reports published by the IDX. Company data listed on the IDX SOE 20 Stock Index is the data needed for this study.

Population and Sample

In the stocks examined in this study, the researcher is talking about stocks that fall under the IDXBUMN-BEI stock category from the beginning of the year to December of the same year. 20 stocks have been added to the IDXBUMN20 list. The non-probability sampling approach is the name given to the statistical method used by the researchers in this study. In contrast, a non-probabilistic examination strategy does not provide an equal opportunity for each component or all components as a whole to be included in the examination. In the non-probability sampling approach, a weighted sample with the following company characteristics is used: persistent notation in the capital market for at least four years.

Data Analysis Technique

A model has been applied to the data evaluation part of this research approach Markowitz calculated using Microsoft Excel 2016 application, The limitations of this research object are nine variables, including: expected return, return, Standard Deviation, Covariance, Variance, correlation coefficient, Proportion, portfolio return, and portfolio expected return. Here are the formulas according to (Hartono, 2017):

1. Calculating the return of each stock

$$R_{it} = (P_{it} - P_{it-1}) + D_1/P_{it-1}$$

2. Calculate the expected return for each share price.

$$E(R_i) = \frac{\sum_{t=1}^{N} R_{it}}{N}$$

3. Determine the Standard Deviation of the risk variance for each stock return.

$$\sigma_i^2 = \frac{\sum_{j=1}^{N} [R_{ij} - E(R_i)]^2}{N}$$

And

$$\sigma_p^2 = a^2 \cdot \sigma_A^2 + b^2 \cdot \sigma B^2 + 2 \cdot a \cdot b \cdot \sigma_{AB}$$

4. Calculate the standard deviation risk for each stock settlement.

$$\sigma_i = \sqrt{\sigma_i^2}$$

And

$$\sigma_p = \sqrt{\sigma_p^2}$$

5. Calculating the covariance between stocks of sample companies

$$\sigma_{ij} = \sum_{i=1}^{n} = \frac{\left[\left(R_{ij} \cdot E(R_i)\right) \cdot \left(R_{jt} \cdot E\left(R_j\right)\right)\right]}{N}$$

6. Calculating the Portfolio Correlation Coefficient

$$R_{A,B} = \rho_{A,B} = \frac{Cov(R_A, R_B)}{\sigma_A \cdot \sigma_B}$$

7. Determine the percentage of funds coming from the prospective portfolio.

$$\sigma p^2 = \sum_{i=1}^{n} \sum_{j=1}^{n} W_i \cdot W_j \cdot \sigma_{ij}$$

8. Calculate the rate of return of the Portfolio according to (Hartono, 2017):

$$(R_P) = \sum_{i=1}^{n} W_i E(R_i)$$

9. Calculating the expected return of the portfolio

$$E(R_P) = \sum_{i=1}^{n} W_i E(R_i)$$

RESULTS AND DISCUSSION

IDXBUMN20

IDXBUMN20 is a stock index in Indonesia that focuses on the performance of 20 stocks from State-Owned Enterprises (SOEs) and similar affiliated entities. The following is a list of 20 companies that are included in the IDXBUMN20:

No.	Kode Saham	Nama Perusahaan
1	ADHI	PT Adhi Karya (Persero) Tbk
2	ANTM	PT Aneka Tambang Tbk
3	BBNI	PT Bank Negara Indonesia (Persero) Tbk
4	AGRO	PT Bank Raya Indonesia Tbk
5	BBRI	PT Bank Rakyat Indonesia (Persero) Tbk
6	BRIS	PT Bank Syariah Indonesia Tbk
7	BBTN	PT Bank Tabungan Negara (Persero) Tbk
8	BJBR	PT Bank Pembangunan Daerah Jawa Barat dan Banten
9	BMRI	PT Bank Mandiri (Persero) Tbk
10	MTEL	PT Dayamitra Telekomunikasi Tbk
11	ELSA	PT Elnusa Tbk
12	JSMR	PT Jasa Marga (Persero) Tbk
13	PGAS	PT Perusahaan Gas Negara Tbk
14	PTBA	PT Bukit Asam Tbk
15	PTPP	PT PP (Persero) Tbk
16	SMGR	PT Semen Indonesia (Persero) Tbk
17	TINS	PT Timah Tbk
18	TLKM	PT Telkom Indonesia (Persero) Tbk
19	WIKA	PT Wijaya Karya (Persero) Tbk
20	WSKT	PT Waskita Karya (Persero) Tbk

Table 1: List of IDXBUMN20 Companies

Expected Return Stock

The following are the results of the calculation of expected stock returns for 4 years, starting from 2019 to 2022. Of the 20 companies listed in IDXBUMN20, there is one company whose shares are not updated only until 2020, so we can only calculate the expected stock returns of 19 companies listed in IDXBUMN20 on the Indonesia Stock Exchange.

No.	Kode Saham	Nama Perusahaan	ER(i)
1	ADHI	PT Adhi Karya (Persero) Tbk	-0,0101
2	ANTM	PT Aneka Tambang Tbk	0,0294
3	BBNI	PT Bank Negara Indonesia (Persero) Tbk	0,0079
4	AGRO	PT Bank Raya Indonesia Tbk	0,0451
5	BBRI	PT Bank Rakyat Indonesia (Persero) Tbk	0,0088
6	BRIS	PT Bank Syariah Indonesia Tbk	0,0407
7	BBTN	PT Bank Tabungan Negara (Persero) Tbk	-0,0016
8	BJBR	PT Bank Pembangunan Daerah Jawa Barat dan Banten	-0,0057
9	BMRI	PT Bank Mandiri (Persero) Tbk	0,0103
10	ELSA	PT Elnusa Tbk	0,0047
11	JSMR	PT Jasa Marga (Persero) Tbk	-0,0036
12	PGAS	PT Perusahaan Gas Negara Tbk	0,0025
13	PTBA	PT Bukit Asam Tbk	0,0019
14	PTPP	PT PP (Persero) Tbk	-0,0100
15	SMGR	PT Semen Indonesia (Persero) Tbk	-0,0079
16	TINS	PT Timah Tbk	0,0097
17	TLKM	PT Telkom Indonesia (Persero) Tbk	0,0014
18	WIKA	PT Wijaya Karya (Persero) Tbk	-0,0066
19	WSKT	PT Waskita Karya (Persero) Tbk	-0,0206

Table 2: Expected Return

Based on the table above, the company that has the highest expected return is PT Bank Raya Indonesia Tbk (AGRO) with a value of 0.0451. The expected return calculation results are supported because PT Bank Raya Indonesia Tbk (AGRO) is a national private bank that focuses on the MSME segment. MSMEs are a segment that has high growth potential in Indonesia. AGRO also has a diversified credit portfolio, so the risk is lower.

While the company that has the lowest expected return is PT Waskita Karya (Persero) Tbk (WSKT) with a value of -0.0206. This can happen because PT Waskita Karya (Persero) Tbk (WSKT) is a construction company that has a high debt burden. This high debt burden can hinder WSKT's future growth. In addition, WSKT also faces intense competition from other construction companies.

Stock Variant

Stock variance is an indicator that reflects changes in stock prices over time. A high level of stock variance indicates that the stock price fluctuations from time to time increase more significantly. The following are the results of the calculation of stock variants which can be seen in the table below:

No.	Kode Saham	Nama Perusahaan	σi^2
1	ADHI	PT Adhi Karya (Persero) Tbk	0,0379
2	ANTM	PT Aneka Tambang Tbk	0,0319
3	BBNI	PT Bank Negara Indonesia (Persero) Tbk	0,0139
4	AGRO	PT Bank Raya Indonesia Tbk	0,1111
5	BBRI	PT Bank Rakyat Indonesia (Persero) Tbk	0,0068
6	BRIS	PT Bank Syariah Indonesia Tbk	0,0590
7	BBTN	PT Bank Tabungan Negara (Persero) Tbk	0,0273
8	BJBR	PT Bank Pembangunan Daerah Jawa Barat dan Banten	0,0121
9	BMRI	PT Bank Mandiri (Persero) Tbk	0,0078
10	ELSA	PT Elnusa Tbk	0,0166
11	JSMR	PT Jasa Marga (Persero) Tbk	0,0127
12	PGAS	PT Perusahaan Gas Negara Tbk	0,0207
13	PTBA	PT Bukit Asam Tbk	0,0110
14	PTPP	PT PP (Persero) Tbk	0,0283
15	SMGR	PT Semen Indonesia (Persero) Tbk	0,0121
16	TINS	PT Timah Tbk	0,0248
17	TLKM	PT Telkom Indonesia (Persero) Tbk	0,0046
18	WIKA	PT Wijaya Karya (Persero) Tbk	0,0203
19	WSKT	PT Waskita Karya (Persero) Tbk	0,0302

Table 3: Stock Variants

From the calculation table above, the company with the highest variance is PT Bank Raya Indonesia Tbk (AGRO) with a variance of 0.1111. The company with the lowest variance is PT Telkom Indonesia (Persero) Tbk (TLKM) with a variance of 0.0046.

Stock Standard Deviation

The following are the results of the calculation of the standard deviation of shares which can be seen in the table below:

No.	Kode Saham	Nama Perusahaan	σi
1	ADHI	PT Adhi Karya (Persero) Tbk	0,195
2	ANTM	PT Aneka Tambang Tbk	0,179
3	BBNI	PT Bank Negara Indonesia (Persero) Tbk	0,118
4	AGRO	PT Bank Raya Indonesia Tbk	0,333
5	BBRI	PT Bank Rakyat Indonesia (Persero) Tbk	0,082
6	BRIS	PT Bank Syariah Indonesia Tbk	0,243
7	BBTN	PT Bank Tabungan Negara (Persero) Tbk	0,165
8	BJBR	PT Bank Pembangunan Daerah Jawa Barat dan Banten	0,110
9	BMRI	PT Bank Mandiri (Persero) Tbk	0,088
10	ELSA	PT Elnusa Tbk	0,129
11	JSMR	PT Jasa Marga (Persero) Tbk	0,113
12	PGAS	PT Perusahaan Gas Negara Tbk	0,144
13	PTBA	PT Bukit Asam Tbk	0,105
14	PTPP	PT PP (Persero) Tbk	0,168
15	SMGR	PT Semen Indonesia (Persero) Tbk	0,110
16	TINS	PT Timah Tbk	0,157
17	TLKM	PT Telkom Indonesia (Persero) Tbk	0,068
18	WIKA	PT Wijaya Karya (Persero) Tbk	0,142
19	WSKT	PT Waskita Karya (Persero) Tbk	0,174

Table 4: Standard Deviation of Stocks

From the calculation table of the standard deviation of shares above, it is known that PT Bank Raya Indonesia Tbk (AGRO) is the company with the highest standard deviation of 0.333. While PT Telkon Indonesia (Persero) Tbk is the company with the lowest stock standard deviation of 0.068.

Covariance

The following are the results of the covariance calculation which can be seen in the table below:

	ANTM	BBNI	AGRO	BBRI	BRIS	BMRI	ELSA	PGAS	PTBA	TINS	TLKM
ANTM	0,031198	0,007323	0,033512	0,006735	0,028230	0,005191	0,012387	0,012631	0,005511	0,022466	0,003901
BBNI		0,013596	0,005460	0,006914	0,005321	0,007961	0,009122	0,012672	0,004375	0,009838	0,004029
AGRO			0,108763	0,008601	0,060127	0,005567	0,016427	0,016487	0,008262	0,030744	0,004302
BBRI				0,006618	0,008476	0,004998	0,005953	0,006981	0,003462	0,006957	0,002622
BRIS					0,057772	0,007375	0,012031	0,012052	0,004935	0,022049	0,000529
BMRI						0,007647	0,005462	0,008143	0,001888	0,006347	0,001925
ELSA							0,016260	0,013887	0,005020	0,014351	0,005013
PGAS								0,020274	0,006982	0,015414	0,004854
PTBA									0,010729	0,006449	0,002145
TINS										0,024237	0,004552
TLKM											0,004518

Table 5: Covariance

In the covariance calculation table above, it is found that the highest covariance value is in BRIS and AGRO, which means that the two companies have a close relationship and tend to move in the same direction. While the lowest covariance value is in TLKM and BRIS, which means that the two companies have movements that tend to go in the opposite direction.

Correlation Coefficient

The following are the results of the calculation of the correlation coefficient which can be seen in the table below:

	ANTM	BBNI	AGRO	BBRI	BRIS	BMRI	ELSA	PGAS	PTBA	TINS	TLKM
ANTM		0,35557	0,57530	0,46876	0,66495	0,33609	0,54999	0,50221	0,30121	0,81700	0,32859
BBNI			0,14198	0,72887	0,18984	0,78081	0,61349	0,76325	0,36224	0,54194	0,51408
AGRO				0,32061	0,75852	0,19305	0,39063	0,35109	0,24185	0,59881	0,19407
BBRI					0,43350	0,70262	0,57393	0,60269	0,41091	0,54931	0,47949
BRIS						0,35088	0,39255	0,35216	0,19821	0,58924	0,03273
BMRI							0,48987	0,65403	0,20844	0,46624	0,32751
ELSA								0,76486	0,38009	0,72289	0,58491
PGAS									0,46334	0,69537	0,50717
PTBA										0,39990	0,30809
TINS											0,43498
TLKM											

Table 6: Correlation Coefficient

Based on the table of correlation coefficient calculation results above, the company that has the highest correlation coefficient value is ANTM with TINS. This high correlation coefficient value indicates that ANTM shares and TINS shares have a very strong relationship and move in the same direction. This means that if the price of ANTM shares rises, the price of TINS shares also tends to rise. Meanwhile, the company that has the lowest correlation coefficient value is TLKM with BRIS. This low correlation coefficient value indicates that TLKM shares and BRIS shares have a very weak and unidirectional relationship. This means that the movement of TLKM stock prices cannot be predicted by the movement of BRIS stock prices.

Portfolio

ALTERNATIF PORTOFOLIO						
NO.	**1**	**2**	**3**	**4**	**5**	**6**
AGRO	20%	30%	10%	40%	10%	25%
BRIS	20%	25%	30%	20%	15%	30%
ANTM	20%	20%	15%	20%	40%	15%
BMRI	20%	15%	20%	10%	20%	20%
TINS	20%	10%	25%	10%	15%	10%
ER(p)	**2,71%**	**3,21%**	**2,56%**	**3,41%**	**2,59%**	**3,09%**
VARIAN	0,0277	0,0374	0,0252	0,0450	0,0232	0,0338
STADEV	**16,65%**	**19,33%**	**15,87%**	**21,21%**	**15,23%**	**18,39%**
NO.	**1**	**2**	**3**	**4**	**5**	**6**

Table 7: Portfolio

Forming a stock portfolio based on expected return, in this portfolio we take 5 stocks that have the highest expected return, so we get AGRO (4.51%), BRIS (4.07%), ANTM (2.94%), BMRI (1.03%) AND TINS (0.97%). Then by using the try and error technique we tried several combinations of stock proportions and got the best results in the second combination, namely AGRO (30%), BRIS (25%), ANTM (20%), BMRI (15%) and TINS (10%). This proves that diversification can increase returns and reduce risk as seen in table 4 AGRO shares have a risk of 33% and BRIS 24% with diversification successfully reduced to 19.33% and in table 2 ANTM shares have an expected return of 2.94%, BMRI 1.03% and TINS 0.97% with diversification successfully increased to 3.21%.

CONCLUSIONS

Based on the research that has been done, it is known that the results of the calculation of risk and return using the Markowitz method on stocks listed in the IDXBUMN20 index prove that:

1. High stock returns are always followed by high stock risk.
2. By diversifying the portfolio on 5 stocks that have the highest level of return on the IDXBUMN20 index stocks, namely AGRO, BRIS, ANTM, BMRI, and TINS also by trying 6 combinations of stock proportions, it is proven that the proportion that has the highest level of return is also followed by a high level of risk and vice versa.
3. The result of stock diversification is proven to increase stock returns and reduce the level of risk.

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