ANALYSIS OF EFFICIENT PORTFOLIO FORMATION USING THE MARKOWITZ MODEL IN PALM OIL COMPANIES IN BEI FOR THE PERIOD 2020-2022

Dinda Ayu S. W *[1]
Departement of Management, Universitas 17 Agustus 1945 Surabaya
dinda.dindaayu2001@gmail.com

Rachelia Putri N. A
Departement of Management, Universitas 17 Agustus 1945 Surabaya
racheliapna07@gmail.com

Istiono
Departement of Management, Universitas 17 Agustus 1945 Surabaya
istionomba@untag.sby.ac.id

ABSTRACT
This study aims to see the expected return of each portfolio combination and the risk associated with each portfolio combination and determine which Investment portfolio combination can be an efficient investment. The data used in this study is stock closing price data for the period November 2020 to October 2022 (2 years). The sample of this study used 5 palm oil companies listed on the IDX. Based on the results of the calculations that have been carried out, there are 5 stock portfolios with different proportions of funds. Efficient portfolios based on the Markowitz model are: Portfolio 4 with a combination of funds PSGO (35%), SGRO (20%), SIMP (10%), CSRA (20%), and ANJT (15%) because it produces the highest return of 0.024 with a risk of 0.074. But if investors do not like risk, then investors choose portfolio 5 with a combination of PSGO (5%), SGRO (60%), SIMP (20%), CSRA (10%), and ANJT (5%) funds because it produces the lowest risk of 0.061 with a return of 0.020.
Keywords: Portfolio, Markowitz Model, Profit Rate, and Risk Rate

INTRODUCTION

In general, a portfolio is defined as a collection of documents from individuals, groups, institutions, organizations, companies, and the like that contain all the work done in a neatly organized manner. In investment, a portfolio refers to a collection of investments owned by an individual, company/business, or financial entity. This portfolio covers a wide range of matters including asset management, resource allocation, and diversification in minimizing risk and increasing potential returns.

As the complexity of financial markets grows, portfolios have become an important instrument for investors in achieving long-term financial goals. The portfolio itself is designed to achieve specific investment objectives, such as capital

---

[1] Correspondence author

growth, income or protection from inflation risk. Portfolio management involves the process of resource allocation, risk diversification and overall asset management to achieve desired outcomes. The goal of a portfolio is to achieve various financial outcomes, such as capital growth, income, risk diversification, capital protection, and meeting long-term financial goals, such as retirement or education. By managing a portfolio wisely, investors can maximize potential gains while minimizing risks.

When it comes to portfolios, investors often look for efficient portfolios as a way to achieve their investment goals with well-managed risk. An efficient portfolio is a combination of investments that provides the highest level of return for a given level of risk or that provides the lowest level of risk for a given level of return. Efficient portfolios are the result of proper diversification, where different investments are combined to reduce overall risk.

One sector that plays an important role in the Indonesian economy is the palm oil industry. The Indonesian stock market, represented by the Indonesia Stock Exchange (IDX), also has a number of listed palm oil companies. In investing in the stock market, the formation of an efficient portfolio becomes the main focus for investors who want to maximize their returns by adjusting the risks they face.

However, in the context of palm oil companies on the IDX, there have not been many studies that specifically apply the Markowitz model to analyze efficient portfolio formation. Therefore, this study aims to fill the void by analyzing the formation of efficient portfolios using the Markowitz model on palm oil companies listed on the IDX.

By analyzing the formation of efficient portfolios, this research will provide valuable insights for investors, investment managers, and market participants related to optimal portfolio management in the palm oil sector. This research can also provide useful recommendations in making smarter and more effective investment decisions.

In addition, this study can contribute to the academic literature in the field of portfolio management, particularly in the context of palm oil companies in Indonesia. By expanding the understanding of efficient portfolio formation using the Markowitz model, this study can be the basis for further research and the development of more sophisticated methodologies in portfolio management and investment.

Andika Setiawan (2015), has discussed and researched portfolio formation using the Markowitz model in the case study of insurance companies in Indonesia with the research period 2012-2014 and a total sample of 4 stocks. The sampling technique of this study used *Purposive Sampling.* The samples used in the study included AMAG, AHAP, ASRM, and ASJT. Data analysis techniques used in this study are *return* (rate of return), *expected return* (expected rate of profit standard deviation and variance (level of risk, correlation coefficient (level of relationship between variables), *expected return* portfolio and portfolio risk. Based on the results

of the study obtained that the efficient portfolio is a stock portfolio between ASRM 60% and ASJT 40% can be selected as an efficient portfolio of 2.54% with a risk of 18.24%. Because it has a profit of 1.14 times with a risk level of 1.03 times from the combination of portfolio shares between AHAP and ASJT.

Thus, previous research has differences with research that will be developed at this time, namely carried out on different companies. In previous studies, the analysis of portfolio formation using the Markowitz model was carried out on insurance companies in Indonesia, while the current research was conducted on palm oil companies on the IDX. Therefore, with the formation of an efficient portfolio using the Markowitz model, investors can further maximize the level of *return* for a certain risk, or minimize the risk for a certain level of *return*.

OVERVIEW
Investment

Investment or the term investment used in English can be interpreted as planting. Investment is a commitment to invest a number of funds at this time with the aim of obtaining future profits. (Tandelilin, 2022: 02). In addition, investment can be interpreted as a delay in current consumption to be put into productive assets over a certain period of time (Jogiyanto, 2022: 02). According to Jones, investment is an activity of placing funds in one or more of an asset over a period of years in the hope of earning income or increasing the value of the investment (Jones, 2015: 229). Investment behavior is defined as how investors decide, explain, analyze and review procedures for decision making, which include investment psychology, information gathering, defining and understanding and researching and analyzing. This whole process is called "Investment Behavior" (Alfaredo and Vicente: 2015:230).

Portfolio Theory

According to J. Fred Weston and Thomas E. Copeland (2015: 366), portfolio theory is a modern theory of decision making in situations of uncertainty, the goal is to choose the optimal combination of stocks owned (efficient portfolio), in the sense of providing the highest possible expected return for each level of risk, or the lowest possible risk level for each expected return. Portfolio according to Suad Husnan (2015: 367) is a set of investment opportunities.

Markowitz Portfolio Model

The Markowitz (1959) model is the main idea used to build an optimal portfolio in order to achieve the goal of maximizing return and minimizing risk. Portfolio theory is based on the mean and variance approach, where the mean is a measurement of the level of return and variance is a measurement of the level of risk. Portfolio theory with the Markowitz model uses the assumptions that the time used is only one period, there are no transaction costs, investor preferences are only based on expected returns and portfolio risk, and there are no risk-free loans and deposits

(Hartono, 2017: 388). The Markowitz approach overcomes the weaknesses of naive diversification, because by using the Markowitz model investors can utilize all available information as a basis for portfolio formation is still a normative theory that emphasizes how investors should diversify optimally. Basically, portfolio theory with the Markowitz model is based on three assumptions, namely:

1. Single investment period, e.g. 1 year.
2. No transaction fees.
3. Investor preferences are based solely on expected return and risk.

Efficient Portfolio

An efficient portfolio is defined as a portfolio that provides the greatest expected return with a certain level of risk or provides the smallest risk with a certain expected return (Hartono, 2017: 127). Markowitz (1952) states that there is a portfolio that provides the maximum expected return and minimum variance.

RESEARCH METHODS

The type of research used is qualitative research using a descriptive approach. This type of qualitative descriptive research will describe a social event and the information or data displayed as it is. The data sources used in this study are secondary data sources, in the form of palm oil company data for the period November 2020 - October 2022 which can be accessed via www.idx.co.id. and monthly closing price data can be accessed via www.finance.yahoo.com. as well as by reading journals related to the research.

In this study, the data collection technique used was non-participant observation technique, namely observing and recording all the necessary data without participating in the creation or formation of the data obtained. The population used in this study are palm oil companies listed on the Indonesia Stock Exchange. The sample used in this study is 5 stocks from palm oil companies, shown in table 1 as follows:

Table 1 Stock Samples of Palm Oil Companies

Company Name	Stock Code
PT Palma Serasih Tbk	PSGO
PT Sampoerna Agro Tbk	SGRO
PT Salim Ivomas Pratama Tbk	SIMP
PT Cisadane Sawit Raya Tbk	CSRA
PT Austindo Nusantara Jaya Tbk	ANJT

Source: www.idx.co.id

Based on the data that has been obtained, then the data is examined and analyzed using the Markowitz Method assisted by the Microsoft Excel 2010 program in its calculations. The analytical tools used in this study will be explained in the following steps:

1. Calculating the Profit Rate (Return) of Each Stock

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

Description:

R_{it} = Return at expected time

R_{it+1} = Share price at the end of the period P_{it} = Share price at the beginning of the period

2. Calculating the Expected Return of Each Stock

$$E(R_i) = \frac{\sum_{i*\$}^{n} R_{ij}}{n}$$

Description:

$E(R_i)$ = Profit rate on stock i

R_{ij} = The profit rate of stock i in period j

n = Number of observation periods

3. Calculating the Risk (Standard Deviation) of Each Stock

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

Description:

4. Determine the Investment Proportion

Usually, a person will not invest their funds in just one type of investment, but will allocate their funds to more than one type of investment (investment diversification). The proportion of investment can be determined by random numbers to get a large number of portfolio combinations. According to Husnan (2001) because short selling is not permitted, the proportion of funds invested is the sum of each security equal to 100% and the proportion of funds invested in each security is above zero.

5. Calculating the Expected Return of the Portfolio

$$E(R_p) = \Sigma^n [X_A . E(R_A) + X_B . E(R_B)]$$

Description:

X_A = Proportion of funds invested in stock A

X_B = Proportion of funds invested in B shares

$E(R_A)$ = Expected profit rate of stock A

$E(R_B)$ = Expected profit rate of stock B

6. Calculating the Correlation Coefficient

$$\rho_{ij} = \frac{n\,\Sigma XY - \Sigma X\,.\,\Sigma Y}{\sqrt{[n\,\Sigma X^2 - (\Sigma X)^2][n\,\Sigma Y^2 - (\Sigma Y)^2]}}$$

Description:

R_{ij} = Correlation coefficient between
stocks i and j n = Number of
investment periods

X = The rate of return on investment in stock 1

Y = The rate of return on investment in stock 2

7. Calculating the Risk of a Portfolio

$$\sigma = \sqrt{X_{pA}2.\,\sigma_A 2 + X_B 2.\,\sigma_B 2 + 2(X_A\,.\,X\,.\,\rho_{B\,AB}\,.\,\sigma\,.\,\sigma_{A\,B.})}$$

Description:

σ_p = Standard deviation of the portfolio

σ_A 2 = Stock
variance A σ_B 2 =
Stock variance B

X_A = Proportion of funds invested in stock A

X_B = Proportion of funds invested in B shares

ρ_{AB} = Correlation coefficient of stocks A and B

8. Determine an efficient stock portfolio

Several stock portfolios are formed as a result of the above data analysis. Among the many stock portfolios, there are efficient stock portfolios and inefficient stock portfolios. An efficient stock portfolio is a stock portfolio that is on the efficient frontier (EF). A stock portfolio is said to be efficient if it fulfills the following conditions:

1. Provides the maximum expected return for the same risk.
2. State the minimum risk with the same expected return.

RESULTS AND DISCUSSION

1. Level of Profit (Return) on Each Company's Shares

The realized return data of each stock can be shown in Table 2 as follows:

Table 2 Rate of Return

Month	PSGO	SGRO	SIMP	CSRA	ANJT
November 2020	0,010	0,189	0,164	0,109	0,102
December 2020	0,133	-0,050	0,094	0,027	0,131
January 2021	-0,160	0,084	-0,081	-0,255	-0,129

February 2021	0,250	0	0,145	0,086	0,039
March 2021	-0,024	0	0,109	-0,033	-0,015
April 2021	0,025	0,080	0,173	0,020	0,015
May 2021	-0,040	-0,011	-0,096	0,067	0,068
June 2021	0,492	-0,045	-0,162	-0,100	-0,077
July 2021	-0,223	0,053	0,023	0,111	-0,031
August 2021	0,108	-0,066	-0,040	-0,013	0,118
September 2021	0,045	0,085	0,070	0,354	0,035
October 2021	0,416	0,171	0,052	-0,079	0,150
November 2021	-0,035	-0,004	-0,075	0,213	0,148
December 2021	-0,018	-0,101	0,022	0,046	0,021
January 2022	-0,111	0,003	0	0,190	0,045
February 2022	-0,010	0,080	0,088	0,252	0,005
March 2022	-0,016	0,042	0,008	-0,074	-0,019
April 2022	-0,027	-0,009	0,010	0,072	-0,059
May 2022	0,093	0,027	0,030	0,108	0,031
June 2022	-0,101	-0,074	-0,088	-0,146	-0,121
July 2022	0,006	0,028	-0,008	0,021	-0,023
August 2022	-0,033	-0,018	-0,030	-0,063	-0,018
September 2022	-0,023	-0,019	-0,096	-0,082	-0,132
October 2022	-0,094	0,029	0,029	0,008	0,034

Source: Data processed, 2024

Individual stock returns fluctuate depending on the rise and fall of the stock price each month. A positive stock return means that the stock can generate profits for shareholders, while a negative stock return will result in losses due to falling stock prices.

2. Expected Rate of Return

Based on the results of the calculation of the monthly return of each stock, the calculation of the expected return of each stock can be seen in table 3 as follows:

Table 3 Expected Return E(Ri) of Each Company

	PSGO	SGRO	SIMP	CSRA	ANJT

Expected Return	0,028	0,020	0,014	0,035	0,013
%	2,8%	2,0%	1,4%	3,5%	1,3%

Source: Data processed, 2024

A stock with a positive expected return means that it can benefit its shareholders. On the other hand, stocks with negative expected returns mean that they can cause losses for their shareholders. From the calculation results in table 2, it can be concluded that the expected return of PSGO, SGRO, SIMP, and ANJT stocks is positive. The highest expected return is on PT Cisadane Sawit Raya Tbk (CSRA) of 3.5%. While PT Austindo Nusantara Jaya Tbk (ANJT) produces the lowest expected return of 1.3%.

3. Investment Risk (Standard Deviation)

The results of the calculation of investment risk of each stock can be seen in table 4 as follows:

Table 4 Variance and Standard Deviation of Each Company

	PSGO	SGRO	SIMP	CSRA	ANJT
Variance $(\sigma)^2$	0,027	0,005	0,008	0,018	0,007
Standard Deviation (σ)	0,163	0,071	0,088	0,135	0,082

Source: Data processed, 2024

A stock that has a high standard deviation means it has a high risk, but the possibility of earning profits is also high. Vice versa, a stock that has a low standard deviation means it has a low risk, but the possibility of earning a low profit.

Based on the calculation results in table 5, it shows that the highest risk is found in PT Palma Serasih Tbk (PSGO) of 0.163. While the stock that has the lowest risk is PT Sampoerna Agro Tbk (SGRO) of 0.071.

4. Correlation Coefficient

The correlation coefficient shows the relationship between the level of profit between companies reflected in the stock price. The results can be seen in table 5 as follows:

Table 5 Correlation Coefficient

No.	Shares	Coefficient Correlation	No.	Shares	Coefficient Correlation
1	PSGO - SGRO	0,051	6	SGRO - CSRA	0,177

2	PSGO - SIMP	0,025	7	SGRO - ANJT	0,219
3	PSGO - CSRA	-0,108	8	SIMP - CSRA	0,396
4	PSGO - ANJT	0,293	9	SIMP - ANJT	0,407
5	SGRO - SIMP	0,484	10	CSRA - ANJT	0,476

Source: Data processed, 2024

A portfolio is more efficient if it has a negative correlation, because approaching -1 means it has a lower correlation, thereby reducing or minimizing portfolio risk. negative correlation coefficients cause unidirectional conditions, namely when one stock goes down, the other stock goes up.

5. Determining the Expected Rate of Return and Portfolio Risk

Determine the expected return and risk of the portfolio that has been made by entering the proportion of funds that have been determined and the correlation coefficient. The results of the calculations that have been carried out there are 5 portfolios with different proportions of funds, can be seen in table 6 as follows:

Table 6 Expected Rate of Return and Portfolio Risk

Portfolio	Investment Proportion					E(Rp)	σp
	PSGO	**SGRO**	**SIMP**	**CSRA**	**ANJT**		
1	10%	2%	25%	13%	50%	0,018	0,070
2	20%	20%	20%	20%	20%	0,022	0,065
3	15%	5%	40%	30%	10%	0,023	0,073
4	35%	20%	10%	20%	15%	0,024	0,074
5	5%	60%	20%	10%	5%	0,020	0,061

Source: Data processed, 2024

Based on the results of the above calculations, it can be seen that:
- Portfolio 4 has the highest expected return of 0.024 and portfolio 1 has the smallest expected return of 0.018.
- Portfolio 4 has the highest risk at 0.074 and portfolio 5 has the least risk at 0.061.

CLOSING

A. Conclusion

Based on the calculation results of the five portfolios with different fund proportions, there are two best fund proportions that can be chosen by investors as efficient portfolios, namely:

1. Portfolio 4 with a combination of funds PSGO (35%), SGRO (20%), SIMP (10%), CSRA (20%), and ANJT (15%) because it produces the highest return of 0.024 with a risk of 0.074.
2. Portfolio 5 with a combination of PSGO (5%), SGRO (60%), SIMP (20%), CSRA (10%), and ANJT (5%) funds because it produces the lowest risk of 0.061 with a return of 0.020.

B. Suggestion

1. For investors

When deciding to invest in stocks, investors need to consider the expected return and risk level for each stock. Because a large return is likely to have a large risk as well. In addition, investors should also pay attention to any fluctuations in stock prices and seek information related to financial reports.

2. For other researchers

For those who want to conduct or revise this research, there may be some differences such as the selection of a broader topic and the addition of a longer period of time.

LITERATURE

Alfaredo and Vicente. (2015:230). Investment Management, Fundamental, Technical, Investor Behavior and Stock Returns. Ed.1, Cet.1. Yogyakarta: Deepublish.

Christiana, I. (2016). Analysis of Efficient Portfolio Formation in Ceramic, Glass and Porcelain Companies Listed on the Indonesia Stock Exchange with the Markowitz Model. Jurnal Ekonomikawan, 16(2), 78430.

Darmadji, T. and H.M. Fakhruddin (2011). Indonesian Capital Market. Third Edition. Jakarta: Fourth Edition.

Hartono, J. (2017:127). PORTFOLIO THEORY and INVESTMENT ANALYSIS. Eleventh Edition.
    Yogyakarta: BPFE

Hartono, J. (2017:388). PORTFOLIO THEORY and INVESTMENT ANALYSIS. Eleventh Edition.
    Yogyakarta: BPFE

Husnan, S. (2009). Fundamentals of Portfolio Theory and Securities Analysis. Third Edition. Yogyakarta: UPP AMP YKPN

J. Fred Weston and Thomas E. Copeland (2015: 366). Investment Management, Fundamental, Technical, Investor Behavior and Stock Returns. Ed.1, Cet. 1. Yogyakarta: Deepublish.

Jogiyanto. (2022:02). Portfolio and Investment. First Edition. Bandung: Widina Bhakti Persada Bandung.

Jones, J. P. (2015: 229). Investment Management, Fundamental, Technical, Investor Behavior and Stock Returns. Ed.1, Cet. 1. Yogyakarta: Deepublish.

Novianto, F., & Budiyanto, B. (2016). MARKOWITZ MODEL TO DETERMINE EFFICIENT PORTFOLIOS IN TELECOMMUNICATION COMPANIES IN THE BEI.
    Journal

Management Science and Research (JIRM), 5(4).

Supriyadi, M. (2012). Analysis of Efficient Portfolio Formation in Tobacco Manufacturers Industry Companies with Markowitz Model.

Tandelilin, E. (2010). Portfolio and Investment Theory and Applications. First Edition. Yogyakarta: Kanisius.

Tandelilin, E. (2022:02). Portfolio and Investment. First Edition. Bandung: Widina Bhakti Persada Bandung.

Suad Husnan (2015: 367). Investment Management, Fundamental, Technical, Investor Behavior and Stock Returns. Ed.1, Cet. 1. Yogyakarta: Deepublish.