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Optimal Portfolio Analysis with Solver Application in Wetland Plantation Subsector

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ABSTRACT

Investments made by investors should submit to a Markowitz portfolio, where the goal is to get an optimal portfolio investment from several existing stocks. The goal of a portfolio is to maximize stock returns and minimize risk. The object of this study is plantation sub-sector companies listed on the IDX for the 2018-2022 period. The population is 19 companies in the plantation sub-sector, while the sampling method is 6 companies using purposive sampling. Through this research, investors are expected to be able to see which stock portfolio is the most optimal of several efficient portfolios in the agricultural sector. In addition, the plantation sub-sector supports government programs on food security for industry and consumers and increases non-oil and gas income, and increases the income of all relevant stakeholders, which in turn can increase the income and welfare of the Indonesian people.

1. Introduction

Plantations have an important and strategic role in national development, especially in increasing the prosperity and welfare of the people, earning foreign exchange, providing employment, obtaining added value and competitiveness, meeting domestic consumption needs, domestic industrial raw materials, and optimizing resource management. Nature in a sustainable manner. The plantation sub-sector is an expected sector by the government in order to contribute to the gross domestic product (GDP), which continues to increase every year.

Over the past five years, the growth rate of production, exports, and consumption of palm oil has tended to increase, especially production and consumption. However, exports have decreased

slightly from 2020 to 2022 due to the 2020 COVID outbreak. It is bright for investors if they have shares in the plantation sub-sector so that they become the target of investors and potential investors in the capital market in Indonesia. The plantation sector also contributes to state revenue (GDP) for the country (Katadata.co.id, 2023). In forming a portfolio, investors always want to maximize the expected return with a certain risk they are willing to bear or look for a portfolio that offers the lowest risk with a certain return, in line with (Indrayanti, 2013; Nurdianingsih, 2021). This characteristic of a portfolio is referred to as an efficient portfolio. The portfolio that an investor chooses from among the many choices in an efficient portfolio is called the optimal portfolio (Tandelilin, 2010).



Formation of the optimal portfolio can be done in several models, one of which is the Markowitz Model. The Markowitz model is a method for forming an optimal portfolio by considering various information regarding the characteristics of each security to be included in the portfolio (Tandelilin, 2010). The purpose of the investment portfolio is to reduce the risks faced by investors according to the investor's return and risk preferences.

This research is in line with (Anam, 2021), the title of the analysis of determining the optimal portfolio on the Jakarta Islamic Index, which is listed on the Indonesian stock exchange, where the result is that the analysis of forming an optimal portfolio using the Markowitz model is able to produce 6 (six) candidates stocks as a constituent of the optimal portfolio, while in research (Avianti, 2021), analysis of optimal portfolio formation with the single index model and Z-Score on IDX BUMN 20 Issuers, that the analysis results from the single index method have a portfolio return of 0.001339 with the risk that must be faced is 0.0037724. The z-score growth investing method obtains a portfolio return value of 0.000989 and has a risk of 0.023369. Also in line with research (Dewi, 2020; Yunita, 2018), formation of an optimal portfolio on IDX80 index stocks using the Markowitz model. This study aimed to present portfolio data of the plantation sub-sector in wetlands.

2. Literature Review

Investment

According to Jones in investment, investment can be defined as a commitment to activity in placing funds in one or more assets over a certain period. Focused investment on investor property management, which is the totality of current income and the present value of future income. The term investment can relate to a wide variety of general activities in investing funds in a number of real assets in the form of land, gold, machinery, or buildings, as well as financial assets such as deposits, stocks, or

bonds. For investors who are shrewd and willing to take risks, their investment activities may also include investments in other financial assets that are more complex in nature, such as warrants, options, and futures, as well as international equities.

Specifically, according to Tandelilin (2010), there are several reasons why someone makes an investment, including a) To get a more decent life in the future. b) Reduce pressure inflation. c) The urge to save tax.

Definition portfolio

The investment decision process is a continuous process (going process) that includes five decision stages such as determining investment objectives, determining investment policies, selecting portfolio strategies, selecting assets, and measuring and evaluating portfolio performance. Investors can choose to invest their funds in various assets, both risky, risk-free or a combination of the two. A risky asset is an asset whose return rate in the future still contains uncertainty. A risk-free asset is an asset whose future rate of return can be ascertained at this time and is indicated by a return variance equal to zero. One example of a risk-free asset is a Bank Indonesia Certificate (SBI). In investor policy investing, it is very important to select a portfolio of various assets in order to maximize the expected return at a certain level of risk.

Portfolio theory, which was first developed by Harry Markowitz in 1952, states that, in general, risk may be reduced by combining several single securities (financial assets) into a portfolio. Markowitz also added that the main requirement in reducing risk in a portfolio is the return of each uncorrelated security +1 or perfect. This correlation can be seen in a statistical measure that shows the relative simultaneous movement between two variables called the correlation coefficient.

According to (Copeland, 2005), portfolio theory is a modern theory regarding decision-making in



situations containing uncertainty. The goal is to choose the optimal combination of owned stocks (efficient portfolio) in the art of providing the highest possible yield. Expected for each level of risk, or the lowest possible level of risk for each expected outcome.

Efficient portfolio and portfolio optimal

Investors always want the maximum return with a certain level of risk that they are willing to bear in forming a portfolio or looking for a portfolio that offers the lowest risk with a certain level of return. The characteristics of this kind of portfolio are called efficient portfolios. Another concept states that an efficient portfolio is a combination of investments that provide the same return value with a minimum level of risk or with the same level of risk that will provide a maximum return. The formation of this efficient portfolio must be guided by assumptions about investor behavior in making investment decisions where all investors do not like risk (risk converter).

The efficient portfolio then differs from the optimal portfolio. The optimal portfolio is the portfolio chosen by an investor from the many choices that exist in a collection of efficient portfolios. The portfolio that will be selected is related to the preference of the concerned investor regarding the returns and risks that will be borne.

Concept of risk and return

Portfolio risk is a variant of the return on assets formed in a portfolio. According to (Hartono, 2003), stated that the measure of risk is seen from the standard deviation. Mathematically, the formula for calculating the standard deviation is written as follows:

$$\text{Standard deviation: } O = \sqrt{\frac{\sum (R_i - E(R))^2}{n-1}}$$

O : Standard deviation

R_i : Currency returns

$E(R_i)$: Expected Return of currency

n : Number of observations

$$\text{Stock returns } R_i = \frac{P_t - P_{t-1}}{P_{t-1}}$$

R_i : Return from securities i

P_t : Securities price t period

P_{t-1} : The price of the security in period t - 1

Diversification

Diversification can be interpreted as an investment strategy by including various types of securities or investment diversification with the aim of reducing risks that will be faced in the future. Markowitz's portfolio theory requires that the criteria for diversified stocks are only stocks that do not have a perfect positive correlation. The aim of diversification is to reduce unsystematic risk to a point approaching the level of systematic risk. If these conditions cannot be met, diversification cannot be carried out.

Investors can diversify in several ways, namely by forming a portfolio containing many assets, forming a random portfolio, or diversifying using the Markowitz method (Hartono, 2003).

Diversify a lot of assets

The laws of statistics say that the larger the sample size, the closer the sample mean is to the expected value of the population. This law is called the Law of large numbers. The assumption used in this diversification is that the rate of return (rate of return) for each security is statistically independent. This means that the rate of return for one security is not affected by the rate of return for other securities.

Diversify by random

Random diversification is the formation of a portfolio by choosing securities at random without regard to the characteristics of the relevant investments. Investors simply select securities at random.

Diversification Markowitz

Mean-variance method of Markowitz using securities that have a correlation smaller than +1 will reduce the risk of the portfolio. The more securities



that are included in the portfolio the smaller the risk of a portfolio.

3. Methods

The object of this research is to use plantation sub-sector companies listed on the Indonesia Stock Exchange for the period 2018 -2022. This research is categorized as a combination of quantitative research on optimal portfolio analysis with solver applications in the wetland plantation sub-sector period 2018-2022. This study was done on a company sub-sector plantation in land wet that went public in exchange for effect Indonesia (IDX) in the period time 2018-2022 In the ULM Banjarmasin undergraduate and master library, capital market lab, etc. In this study, the population consisted of all companies that went public in the plantation sub-sector Indonesia stock exchange (IDX). The total population is 19 companies. The sample used is 6 companies in the wetland plantation sub-sector. The method used in sampling is a purposive sampling method, i.e., research sample selection method with certain criteria from the

researcher. The source of data used in this research is secondary data. Secondary data are sources of research data obtained by researchers indirectly through intermediary media such as www.idx.co.id and www.yahoofinance.com. Data analysis technique Use Researchers use monthly data on plantation sub-sector stocks during the study period. The process of determining this portfolio entirely uses the help of Microsoft Excel 2010 and solver software.

4. Results and Discussion

The results of this study include the process of forming an optimal portfolio for sectoral stocks for the 2018-2022 period. The steps are as follows: Look for the closing price per month for each stock taken from the www.yahoofinance.com site for the 2018-2022 period. Calculating monthly stock returns on each company's stock. Calculating monthly stock returns using monthly stock closing price data. The third step is to calculate the expected return on each stock for the 2018-2022 period.

Table 1. Expected return of each company's shares period 2018-2022.

No	Stock code	$E(R_i)$
1	DSNG	0.0105
2	LSIP	0.0009
3	PALM	0.0223
4	SIMP	0.0037
5	SMAR	0.0116
6	UNSP	0.0039

Based on Table 1, the highest expected return is PALM stock (0.0223), while the lowest expected

return is LSIP stock (0.0009).

Table 2. Individual variance and standard deviation values.

No	Stock code	σ_i^2	σ_i
1	DSNG	0.0110	0.1050
2	LSIP	0.0135	0.1162
3	PALM	0.0285	0.1688
4	SIMP	0.0113	0.1061
5	SMAR	0.0112	0.1060
6	UNSP	0.0164	0.1279



Based on Table 2 of the risk calculation for each stock, it can be seen that the highest risk is owned by

PALM shares of 0.0285, and the shares with the lowest risk are owned by DSNG shares of 0.0110.

Table 3. Equal fund proportion.

No	Stock code	Proportion of funds
1	DSNG	16.00%
2	LSIP	16.00%
3	PALM	16.00%
4	SIMP	16.00%
5	SMAR	16.00%
6	UNSP	16.00%
	Total of weight	100.00%

Table 3 shows the results of calculating the proportion of funds using the variance-covariance matrix. Then calculate the optimal proportion of funds using the Solver application in Microsoft Excel 2016,

then the expected return portfolio will be calculated from the portfolio risk from the optimal proportion of funds.

Table 4. Optimal fund proportion.

No	Stock code	Proportion of funds
1	DSNG	32.44%
2	LSIP	2.70%
3	PALM	20.43%
4	SIMP	1.69%
5	SMAR	27.09%
6	UNSP	15.65%
	Total of weight	100.00%

Table 4 after the solver has been carried out for each stock, shows the results of all stocks included

in the optimal portfolio.

Table 5. Optimal portfolio.

No	Stock code	Proportion of funds
1	DSNG	32.44%
2	SMAR	27.09%
3	PALM	20.43%
4	UNSP	15.65%
5	LSIP	2.70%
6	SIMP	1.69%
	Total of weight	100.00%

Table 5 shows that there are 6 company shares that are included in the optimal portfolio, DSNG shares

have a value of 32.44% and the lowest value is owned by SIMP shares of 1.69%.

Table 6. Expected return portfolio at the same and optimal proportion of funds.

Expected return portfolio	
Equal fund proportion	10.14%
Optimal fund proportion	14.16%



Table 6 shows different results. For the same proportion of funds, it produces an expected portfolio return of 10.14%, while for the optimal proportion of funds with the help of solver, it produces an expected

return of 14.16%. Meaning that the expected is much higher than the expected return of a portfolio that only uses the same proportion of funds.

Table 7. Portfolio risk in equal and optimal proportion of funds.

Portfolio risk	
Equal fund proportion	24.28%
Optimal fund proportion	24.05%

After using the software solver, the reduced risk factor can be seen in Table 7, which shows different results, namely that the risk of a portfolio with an optimal proportion of funds decreases compared to using the same proportion of funds, which is 24.05% compared to the risk with the same proportion of funds, which is 24.28%. This means that the risk of the portfolio using the optimal proportion of funds with the help of solver software is reduced because the portfolio is carried out using the Markowitz portfolio approach.

The results of this study of the 6 optimal portfolio candidates turn out to be all stock candidates that can form an optimal portfolio. The highest proportion of funds in shares of PT. Dharma Satya Nusantara Tbk (DSNG) from the plantation sub-sector, namely 32.44%, with a relatively low-risk value of 0.0110 compared to the others. The lowest proportion of funds is in the shares of PT. Salim Ivomas Pratama Tbk (SIMP) from the plantation sub-sector, namely 1.69%, has a relatively high-risk value of 0.0113.

Judging from the results of this study, it is evident that Markowitz's diversification is able to reduce risk in an investment. Compared to investors investing only in a stock that has a high expected return with a certain risk. The optimal portfolio with the Markowitz model is perfect for risk-averse investors. Several studies are in line (Yunita, 2018) with the Markowitz model in forming optimal portfolios in case studies on the Jakarta Islamic Index (Avianti, 2021) with their research analysis of optimal portfolio formation with a single index model and Z-score on BUMN IDX Issuers

20 and (Anam, 2021) with the title determining the optimal portfolio using the Markowitz model on the Jakarta Islamic Index (JII) listed on the Indonesian stock exchange, in line (Mahayani, 2019; Sari, 2020).

5. Conclusion

It turns out that after optimizing the weight of funds with a solver application on plantation sector stocks. It turned out that all of the samples of plantation sector companies, namely the 6 companies, were included in the optimal portfolio category.

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