Investment Strategy to Determine an Optimal Portfolio in Banking

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Abstract. The purpose of this study is to determine the banking stocks to include in an optimal portfolio and the proportion of the final funds of each company's shares. This research was conducted on the Indonesia Stock Exchange on stocks listed on the IDX from 2017–2021. This study used secondary data with a non-participant observation for the data collection method. The research sample of 32 was obtained through a purposive sampling method with data analysis techniques using the Markowitz Model. The results showed that there were 15 stocks that deserved to be a member of the optimal portfolio of the Markowitz model on the Indonesian Stock Exchange. The 15 stocks include BBCA, BBMD, BBNI, BBRI, BBTN, BDMN, BJBR, BMRI, BNGA, BNII, BTPN, BTPS, MEGA, NISP, PNBN which provide an expected return portfolio of 0.02 percent with a portfolio risk level of 0.13 percent.

Keywords: IDX · Investment · Optimal Portfolio · Markowitz Model

1 Introduction

When an investor engages in investment activities in the capital market, they require expertise in minimizing investment risk in the hope of profiting from an increase in stock prices or from a number of dividends that will be obtained in the future, as a reward for the time spent on and risk taken for the investment. One way is to construct a portfolio. A portfolio is a collection of investments that are combined to meet investment objectives [1]. It can be interpreted as a strategy to maximize the level of expected profits and minimize the risk faced. The target of the investment portfolio certainly depends on each investor. In addition, the combination of various investment instruments also determines the high risk and profit potential of the portfolio. Jogiyanto [2] said that the purpose of constructing a portfolio is to minimize risk for those who hold the portfolio. Risk minimization can be implemented by diversifying the portfolio. The construction of a portfolio involves identifying securities that are valuable for investors and the portion of funds that can be allocated or invested in each of the selected securities. In addition, it is targeted that an optimal portfolio will be constructed, namely a portfolio chosen by investors from the many available in an efficient portfolio. The portfolio chosen by an investor is definitely a portfolio that meets the preferences of the concerned investor in terms of the return and the risk they can bear. In order to achieve the expected return

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on investment, it is necessary to have financial literature that can provide guidance on the selection of various investment instruments. Stock exchanges offer various sectors that can be used as investment options, especially in constructing a portfolio. In several previous studies, there was a tendency for investors to invest in the manufacturing sector compared to the banking sector [3]. However, after having seen the rapid development of the banking world today, some analysts have predicted that the banking sector would be able to bring profits to investors. Portfolio theory is an investment approach initiated by Harry M. Markowitz, an economist who graduated from the University of Chicago, and received the Nobel Prize in economics in 1990. Portfolio theory is concerned with investors' estimates of risk and return expectations, which are statistically measured to create investment portfolio. Markowitz describes how to combine assets into an efficient diversified portfolio. In this portfolio, risk can be minimized by increasing the number of types of assets into the portfolio and the level of expected return can increase if there is a difference in the price movements of the combined assets ("Harry Max Markowitz"). Inpractice, investors in securities often diversify in their investments by combining various securities, in other words they construct a portfolio.

Modern portfolio theory pioneered by Markowitz (1952) [4] is widely used in practice, however, it is assumed that the Markowitz portfolio rule and most of its extensions not only work under the performance of "nave" 1/N strategies (which invest equally in every N asset) in simulations, but also lose money on adjusted risk. Tu and Zhou [5] proposed in this study that the optimal combination of the "nave" 1/N method with one of four advanced strategies—Markowitz strategy, Jorion strategy (1986) [6], MacKinlay and Pastor (2000) [7] strategy, and Kan strategy and Zhou (2007) [8] as a way to improve performance. The results of this study explained that the combination of these strategies not only had a significant impact on improving the sophisticated strategy, but also outperformed the 1/N strategy in almost every scenario. Because the combination is theory-based, this research can be interpreted as a confirmation of the utility of Markowitz theory in practice.

Portfolio theory states that both risk and return must be considered, assuming that a formal framework exists to measure them in the construction of a portfolio. In its basic form, portfolio theory begins with the assumption that future rates of return on securities can be estimated and then determines risk by varying the distribution of returns. With certain assumptions, portfolio theory produces a linear relationship between risk and return.

Based on research conducted by Febriani and Media (2020) [9], from a number of banking stocks listed in LQ-45 there are choices of BBCA and BBRI stocks which are the top two stocks of choice in forming an optimal stock portfolio, while in LQ-45 it is recorded that it has 5 banking stocks. In a study conducted by Ni Wayan and Putu Ayu (2019) [10], it was stated that the shares of BSWD, BEKS, MAYA BTPN and BBNI are 5 stocks that are members of the optimal portfolio of banking stocks on the IDX, while on the IDX it is recorded that there are 43 banking stocks. It can be concluded that the remaining 38 banking stocks are not optimal and are not worthy of investment by investors. Then, based on the considerations that have been stated previously, the research was conducted on stocks in the banking sector using the Markowitz model in determining the optimal portfolio. The use of the Markowitz model analyzes, measures,

and calculates risk and return on the portfolio in order to determine and provide clear information for investors in making stock investment decisions in the capital market. From some of the main problems that can be formulated, phenomena arise, such as which shares of banking companies are included in the optimal portfolio combination using the Markowitz model, how large the proportion of funds that must be invested in each banking company stock, and the expected level of portfolio return and the risk of the optimal portfolio. This study aims to determine the stocks that are included in the optimal portfolio combination, the amount of fund allocation, the rate of return, and the risk of the optimal portfolio constructed. Although investment in the capital market promises a higher rate of return, it should be noted that the greater the return is, the greater the risk is. Thus, as a rational investor, the most important thing to focus on is how the investment can generate optimal returns at the minimal level of risk.

2 Method

This research was conducted on the Indonesia Stock Exchange (IDX) on banking stocks listed on the Indonesia Stock Exchange (IDX) during the period between 2017 and 2021. The object of the research in this study were banking stocks listed on the Indonesia Stock Exchange (IDX) from 2017 to 2021. The population used in this study were banking companies on the Indonesia Stock Exchange from 2017 to 2021, totaling 32 banking stocks.

The stock price used in this study was the closing price of the shares every month in each banking company for the period from 2017 to 2021.

The method used in this optimal portfolio research was the Markowitz Model calculation. Where the steps taken include:

1. Calculating stock returns from each sample of company shares in the banking sector expressed in percent units using the formula [11].

   Where:

$$R_i = \frac{P_t - P_{t-1} + D_t}{P_t - 1} \tag{1}$$

   Pt = stock price in period t.
   Pt-1 = stock price in period t-1
   D1 = dividend distribute

2. Calculating the expected return of each sample with the formula [12].

   Where:

$$E(R_i) = \frac{\sum_{t=1}^{n} R_{it}}{n} \tag{2}$$

   E(Ri) = the average expected return of the I company shares
   Rit = rate of return on investment I
   N = number of possible events

3. Calculating the variance and standard deviation of each stock using the formula [13]:

Where:

$$\sigma_i^2 = \frac{\sum_{t=1}^{n}(R_{it} - E(Ri))^2}{(n-1)} \tag{3}$$

The standard deviation is the result of the square root variance. Standard deviation can be calculated using the formula:

$$\sigma_p = \sqrt{\sigma_p^2} \tag{4}$$

4. Finding the covariance value between two stocks in the portfolio.

$$Cov(RA.RB) = \sum_{i=1}^{n} \frac{[(R_{Ai} - E(R_A).(R_{Bi} - E(R_B)))]}{n} \tag{5}$$

5. Portfolio variance is calculated using the formula [11]:

Where:

$$\sigma_p^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} W_i W_j Cov(ri, rj) \tag{6}$$

σ p2 = Portfolio Variant
Wi = Weight of shares I
Wj = Weight of shares j
Cov (ri,rj) = Covariance between stocks i and j

After the variance is calculated, it can determine the Standard Deviation of the portfolio with the formula:

$$\sigma_p = \sqrt{\sigma_p^2} \tag{7}$$

6. Calculating the expected return of the portfolio that has been formed.

Where:

$$E(R_p) = \sum_{i=1}^{n} Wi.E(Ri) \tag{8}$$

E(Rp) = Expected return portfolio
Wi = Investment proportion
E(Ri) = Expected stock return I

In determining the expected return of the portfolio, temporarily, the portion is made equal. The terms of the portion of the audience are that if they add up, they will produce a value of 100%. This portion of the stock will be sought to determine the optimal portfolio.

7. Calculating the expected return and optimal portfolio risk. The calculation of expected return and variance uses the same formula as in the calculation of the sixth stage but with the portion obtained.

8. Calculating the optimal portfolio expected return with the same formula as in the fifth step.
9. Determining the optimal portfolio variance using the same formula as the portfolio variance calculation but with the addition of the final proportion/weight that has been calculated previously with the following formulation [11].

If all the steps have been carried out correctly, an optimal portfolio consisting of potential stocks will be obtained. The optimal portfolio will be seen from the results shown by the calculation of the proportion of investment in each stock. The number of stocks in an optimal portfolio may differ from the number of stocks in an efficient portfolio.

3 Result and Discussion

The results of this study include the process of determining the optimal portfolio construction on the IDX index for the period from 2017–2021 using the Markowitz model. The Table 1 is a sample of 15 companies with PER values as follows;

The following are the stages of the process of determining the optimal portfolio construction.

1. Stage One

The first stage is to find the closing price of shares per month on each IDX index stock for the period from 2017 to 2021 including research samples on www.idx.co.id.

Table 1. PER Value of Each Company Share for the period from 2017–2021.

No.	Code	Name	PER
1	BBCA	Bank Central Asia	28.17
2	BBMD	Bank Mestika Dharma	19.74
3	BBNI	Bank Negara Indonesia	34.11
4	BBRI	Bank Rakyat Indonesia	28.76
5	BBTN	Bank Tabungan Negara	11.47
6	BDMN	Bank Danamon Indonesia	26.97
7	BJBR	Bank Pembangunan Daerah Jawa Barat	9.33
8	BMRI	Bank Mandiri (Persero) Tbk.	17.65
9	BNGA	Bank CIMB Niaga Tbk.	13.24
10	BNII	Bank Maybank Indonesia Tbk.	24.28
11	BTPN	Bank BTPN Tbk.	13.09
12	BTPS	Bank BTPN Syariah Tbk.	30.11
13	MEGA	Bank Mega Tbk.	20.31
14	NISP	Bank OCBC NISP Tbk.	9.50
15	PNBN	Bank Pan Indonesia Tbk	7.91

2. Stage Two

The second stage is to calculate the return and expected return of each share included in the research sample. Expected return explains the expected profit that may be obtained from each share which can be positive or negative. Return is obtained from the difference between the current share price and the previous share price divided by the previous share price. Expected return is obtained based on the average value of the total return of each share.

The results of the calculation of the return and expected return of each share included in the research sample can be seen in Table 2.

Table 2 shows that of the 15 company shares that became the research sample, the 15 company shares gave a positive expected return and none of the shares gave a negative expected return. The Table 2 also shows that shares with the highest expected return are BBCA shares with an average of 4.59%, while the shares with the lowest expected returns are BNGA and MEGA shares with an average of 0.17%. Thus, the 15 shares that provide a positive expected return will qualify as candidates for determining the optimal portfolio.

The following are company shares that have a positive expected return and are candidates for determining the optimal portfolio, as can be seen in Table 3.

Table 2. Return and Expected return of Each Share IDX Index for the period from 2017 to 2021.

Sample	Issuer	Stock Return ($\sum$Rit)	Expected return (ER)
1	BBCA	−1.54%	4.59%
2	BBMD	5.05%	1.80%
3	BBNI	−2.59%	0.90%
4	BBRI	10.73%	2.24%
5	BBTN	25.97%	1.04%
6	BDMN	9.57%	0.99%
7	BJBR	38.56%	3.41%
8	BMRI	20.47%	3.06%
9	BNGA	3.43%	0.17%
10	BNII	30.93%	4.54%
11	BTPN	13.82%	2.35%
12	BTPS	20.19%	3.06%
13	MEGA	3.35%	0.17%
14	NISP	31.18%	4.54%
15	PNBN	13.42%	2.35%

Table 3. Expected return of IDX Index Shares with Positive Value for the period from 2017 to 2021.

Sample	Issuer	Expected return (ER)
1	BBCA	4.59%
2	BBMD	1.80%
3	BBNI	0.90%
4	BBRI	2.24%
5	BBTN	1.04%
6	BDMN	0.99%
7	BJBR	3.41%
8	BMRI	3.06%
9	BNGA	0.17%
10	BNII	4.54%
11	BTPN	2.35%
12	BTPS	3.06%
13	MEGA	0.17%
14	NISP	4.54%
15	PNBN	2.35%

3. Stage Three

The third stage is to calculate the standard deviation of each research sample share that has a positive expected return. Standard deviation is used to calculate stock risk. The Table 4 is the result of calculating the standard deviation of each share that has a positive expected return, namely:

Table 4 shows the shares that provide the highest standard deviation are BBMD shares with a value of 19.12%, while the shares that provide the lowest standard deviations are BTPN and PNBM shares, each with a value of 7.73%.

4. Stage Four

The fourth stage is to calculate the correlation between stocks that are candidates for the optimal portfolio. The correlation between stocks is expected to reduce the risk that occurs in investing. Stocks that have a correlation value below 0 to −1 will help reduce risk effectively. Calculation of correlation between stocks using Microsoft Excel.

5. Stage Five

The fifth stage is to calculate the variance value and standard deviation of each stock for the period from 2017 to 2021. Table 5 show the result of variant value and standard deviation of each share for the period from 2017 to 2021.

Table 5 shows that the highest variance value is generated by shares of BBMD companies and the lowest variance value is generated by shares of BBTN, BNGA, BTPN, MEGA and PNBN companies, each of which is 0.01.

Table 4. Standard Deviation of Each IDX Index Share that Has Positive Expected Returns for the Period from 2017 to 2021.

Sample	Issuer	Standard Deviation
1	BBCA	15.28%
2	BBMD	19.12%
3	BBNI	13.11%
4	BBRI	13.07%
5	BBTN	11.86%
6	BDMN	8.95%
7	BJBR	14.70%
8	BMRI	12.93%
9	BNGA	9.56%
10	BNII	14.60%
11	BTPN	7.73%
12	BTPS	12.93%
13	MEGA	9.56%
14	NISP	14.60%
15	PNBN	7.73%

6. Stage Six

Stage 6 is calculating the covariance between stocks that are candidates for the optimal portfolio. Covariance between stocks indicates the tendency of two securities to move together. A positive covariance means the tendency of two securities to move in the same direction. A negative covariance means the tendency of two securities to move in the opposite direction, while a covariance of zero means that the movement of two securities is independent or the movement of one security is not related to the movement of other securities. Calculation of covariance between stocks uses Microsoft Excel.

Covariance value of each share for the period from 2017 to 2021 shown in Table 6.

7. Stage Seven

The seventh stage is to calculate the expected return and portfolio risk using the covariance between the optimal portfolio candidate stocks with the equal proportions. The initial proportion can use the assumption that the proportion of all shares in this portfolio is equal. The calculation of the equal proportion uses the formula of 100 percent divided by the number of shares that are candidates for the optimal portfolio, so that each share gets an allocation of funds of $100/28 = 3.571$ percent. The Table 7 is the result of calculating the expected return and portfolio risk using the same proportions, namely.

Table 5. Variant Value and Standard Deviation of Each Share for the Period from 2017 to 2021.

Sample	Issuer	Variant	Standard deviation
1	BBCA	0.02	0.58%
2	BBMD	0.04	0.84%
3	BBNI	0.02	0.43%
4	BBRI	0.02	0.47%
5	BBTN	0.01	0.40%
6	BDMN	0.01	0.27%
7	BJBR	0.02	0.54%
8	BMRI	0.02	0.48%
9	BNGA	0.01	0.29%
10	BNII	0.02	0.63%
11	BTPN	0.01	0.19%
12	BTPS	0.02	0.48%
13	MEGA	0.01	0.29%
14	NISP	0.02	0.63%
15	PNBN	0.01	0.19%

Table 7 shows that the portfolio constructed by the 15 optimal portfolio candidate stocks using the equal proportion of 6.67% percent produces an expected return of 0.79% and a risk level of 2.15%.

8. Stage Eight

The eighth stage is to calculate the expected return and portfolio risk using the covariance between the optimal portfolio candidate stocks with optimal proportions. The optimal portfolio is constructed using Microsoft Excel. The calculation of the proportion using Markowitz's theory shows the proportion of optimal final funds that are appropriate to be allocated to each stock that is the optimal portfolio candidate.

Expected return and portfolio risk of each stock using optimal proportions for the period from 2017 to 2021 shown in Table 8.

Table 8 shows that the portfolio constructed by the 15 candidate stocks of the optimal portfolio using the highest optimal proportion is generated by BBCA shares of 3.83% and the lowest is generated by BNGA shares of −0.59%. Overall, it produces an expected return of 0.02% and a risk level of 0.13%.

Table 8 shows that of the 15 candidate stocks for the optimal portfolio, 10 stocks are worthy of being the members of the optimal portfolio, with PWON stocks having the highest proportion of funds at 3.83%. The 10 optimal portfolio stocks consist of BBCA, BBMD, BBRI, BJBR, BMRI, BNII, BTPN, BTPS, NISP and PNBN with respective proportions of 3.83%, 1.04%, 1.48%, 2.65%, 2.30%, 3.78%, 1.59%, 2.30%, 3.78% and 1.59% with a portfolio risk level of 0.13%.

Table 6. Covariance Value of Each Share for the Period from 2017 to 2021.

Sample	Issuer	Covariance
1	BBCA	0.008
2	BBMD	0.011
3	BBNI	0.007
4	BBRI	0.009
5	BBTN	0.006
6	BDMN	0.002
7	BJBR	0.009
8	BMRI	0.009
9	BNGA	0.004
10	BNII	0.010
11	BTPN	0.002
12	BTPS	0.009
13	MEGA	0.004
14	NISP	0.010
15	PNBN	0.002

Comparison between investments in portfolios using the equal proportion of funds as investments and portfolios using optimal proportions of funds have differences that can be seen in the risk burden borne by investors and the amount of expected return obtained by investors. A portfolio using the equal proportion of funds produces an expected return of a portfolio of 0.79% while a portfolio using an optimal proportion of funds produces an expected return of a portfolio of 0.02%. Thus, the expected return of the portfolio obtained by investors decreases by 0.79–0.02 = 0.77%.

A portfolio using the equal proportion of funds produces a portfolio risk level of 2.15% while a portfolio using an optimal proportion of funds produces a portfolio risk level of 0.13%. Thus, the level of risk borne by investors decreased by 2.15 – 0.13% = 2.02%.

This comparison shows that the expected return portfolio using the optimal proportion is not much different with the equal proportion of funds and the level of portfolio risk borne is smaller when using the optimal proportion of funds compared to the equal proportion of funds. This is certainly very helpful for investors to choose stocks when investing in Indonesian Stock Exchange (IDX) index stocks.

Table 7. Expected Return and Portfolio Risk of Each Share Using the Equal Proportion.

Sample	Issuer	The equal proportion
1	BBCA	
2	BBMD	6.67%
3	BBNI	6.67%
4	BBRI	6.67%
5	BBTN	6.67%
6	BDMN	6.67%
7	BJBR	6.67%
8	BMRI	6.67%
9	BNGA	6.67%
10	BNII	6.67%
11	BTPN	6.67%
12	BTPS	6.67%
13	MEGA	6.67%
14	NISP	6.67%
15	PNBN	6.67%
	Expected return	0.79%
	Standard Deviation	2.15%

Table 8. Expected Return and Portfolio Risk of Each Stock Using Optimal Proportions for the period from 2017 to 2021.

Sample	Issuer	Optimal Proportion
1	BBCA	3.83%
2	BBMD	1.04%
3	BBNI	0.14%
4	BBRI	1.48%
5	BBTN	0.28%
6	BDMN	0.23%
7	BJBR	2.65%
8	BMRI	2.30%
9	BNGA	−0.59%
10	BNII	3.78%
11	BTPN	1.59%
12	BTPS	2.30%
13	MEGA	−0.59%
14	NISP	3.78%
15	PNBN	1.59%
	Expec. Return	0.02%
	Standard Deviation	0.13%

4 Conclusion

Based on the results of the research and data analysis on Investment Strategy Determination of Optimal Portfolio in Banking Stocks Tbk, it can be concluded that:

1. The determination of the optimal portfolio construction on the IDX stock index using the Markowitz model for the period from 2017 to 2021 showed that there were 10 company stocks that made up the optimal portfolio, namely BBCA, BBMD, BBRI, BJBR, BMRI, BNII, BTPN, BTPS, NISP and PNBN stocks.
2. The proportion of final funds for each IDX index stock that is a member of the optimal portfolio was: BBCA shares of 3.83%, BBMD of 1.04%, BBRI of 1.48%, BJBR of 2.65%, BMRI of 2.30%, BNII of 3.78%, BTPN of 1.59%, BTPS at 2.30%, NISP of 3.78%, and PNBN of 1.59%.
3. The expected return portfolio obtained from determining the optimal portfolio using the Markowitz model for the period from 2017 to 2021 was 0.02% with a risk level of 0.13%.

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