

Analysis of Optimal Stock Portfolio Investment on The LQ45 Index Using the Markowitz Model and Single Index Model

Fadlan Alkindi¹, Isfenti Sadalia², Iskandar Muda²

^{1,2}Magister of Management Study Program on Postgraduate School of University of Sumatera Utara

Corresponding Author: Fadlan Alkindi

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ABSTRACT

This Markowitz model can overcome the weakness of random diversification. The assumption that increasing the number of shares in a portfolio continuously will provide greater benefits is different from the Markowitz model. This model believes that the addition of stocks continuously in one portfolio, at a certain point, will further reduce the benefits of diversification and will increase the level of risk (Tandelilin, 2010). The Markowitz portfolio also provides quite efficient results because it has a positive expected return value from each portfolio (Supriyadi and Hadmar, 2009). Single Index Model is one method for forming a portfolio that can be used by investors. The optimal portfolio analysis technique using the Single Index Model is a security analysis technique that is carried out by comparing the excess return to beta (ERB) to the cut off rate (Ci) of each stock. This study uses a population of issuers that are included in the LQ45 calculation for the period February 2018 - July 2020 with a total sample using the purposive sampling method of 31 samples. Based on the optimal portfolio formation of the Markowitz Model, 4 stocks form a portfolio with an expected return of 0.0074 while for portfolio risk of 0.0428 and the proportion of funds formed is BBKA 50.81%, E XCL 9.83%, ICBP 30, 59%, and KL B F 8, 77. The formation of a single index model portfolio obtained 2 optimal portfolio formations with a portfolio return of 0.1486 and a risk of 0.0873 while the proportion of funds formed by ANTM was 10.5%, and BBKA was 89.5%. Based on the results of the study proves that the single index model can

generate a profit of 14.86% with a risk level of 8.73% compared to the Risk-Free Assets Return rate of 5.17%. Meanwhile, the Markowitz model can generate a portfolio return of 0.74% with a portfolio risk of 4.28% not providing optimal returns because the expected return from the Markowitz model portfolio is lower than the Risk-Free Asset Return Rate.

Keywords: Markowitz Model, Single Index Model, Portfolio Optimal, Stock

BACKGROUND

To reduce the accepted risk, investors can avoid or reduce the risk. In avoiding risk, investors do not sell or buy, while reducing risk can be done by diversifying. Diversification is combining various securities in investment to form a portfolio. A portfolio is a combination of securities with an expected rate of return and several risks that can be minimized by dispersing risk through various assets (Ferlistya 2014). Rational investors will choose the most efficient portfolio among existing portfolios before investing. By determining an efficient portfolio, investors can determine the optimal portfolio.

There are several types of portfolios, one of which is a stock portfolio. A stock portfolio is a collection of investment assets in the form of shares, both individual shares and company shares. Shares registered in The Indonesia Stock Exchange are classified into 10 sectors according to industry classification. These sectors include the

Agriculture Sector, Mining Sector, Basic and Chemical Industry Sector, Miscellaneous Industry Sector, Consumer Goods Industry Sector, Property Sector, Real Estate and Building Construction, Infrastructure Sector, Utilities and Transportation, Finance Sector, Trade Sector, Services and Investment, and Manufacturing Sector.

The Markowitz model

This Markowitz model can overcome the weakness of random diversification. The assumption that increasing the number of shares in a portfolio continuously will provide greater benefits is different from the Markowitz model. This model believes that the addition of stocks continuously in one portfolio, at a certain point, will further reduce the benefits of diversification and will increase the level of risk (Tandelilin, 2010). The Markowitz model introduces a portfolio diversification model. Non-systematic risk reduction is carried out by diversification so that only systematic risk is left behind, known as the insurance principle. The optimal portfolio with the Markowitz model selected from many alternative efficient portfolios can provide a certain level of return according to the risk that investors are willing to bear (Ticoh, 2010). The Markowitz portfolio also provides quite efficient results because it has a positive expected return value from each portfolio (Supriyadi and Hadmar, 2009). The Markowitz model is the first model used to predict the price or return of securities by using input parameters in the form of the expected return of each security, the variance of each security and the covariance between securities (Hunan, 2003:102). Portfolio theory with the Markowitz model is based on three assumptions, namely:

- a. Single investment period, for example, one-year
- b. No transaction fees
- c. Investor preferences are based solely on the expected return and risk. (Hartono, 2015:312).

The single Index Model

The Single index method assumes that the rate of return between two or more effects will be correlated, that is, they will move together and have the same reaction to a single factor or index. Included in the method (Halim, 2014). The single index method can be used in determining the optimal portfolio by comparing the excess return to beta (ERB) with the cut-off rate (C_i). Excess return to beta (ERB) is the excess of stock returns over risk-free asset returns (risk-free rate) which is called the return premium per unit of risk as measured by beta. The cut-off rate (C_i) is the quotient of the market variance and the return premium on the stock variance error of the market variance on the individual sensitivity of the stock variance error. The calculation concept is based on Gruber's (2003) calculation method, namely by determining the ranking (sequence) of stocks that have a high ERB to a lower ERB. The ranking aims to determine the excess of stock returns to risk-free returns per unit of risk. Stocks that have excess return to beta (ERB) there with or greater than the cut-off point (C^*) are candidates for optimal portfolio formation.

The LQ45 index

The LQ45 index is the market capitalization value of the 45 most liquid stocks and has a large capitalization value, it is an indicator of liquidation. The LQ45 index, using 45 stocks selected based on stock trading liquidity and adjusted every six months (beginning) February and August). Thus the stocks contained in the index will always change. The LQ45 index fluctuates from year to year but is generally growing. These fluctuations occur as a result of systematic risk and non-systematic risk. Systematic risk is a risk that cannot be avoided. Examples of systematic risk are an increase in interest rates (interest rate risk), an increase in inflation (inflationary risk) and high market volatility (market risk). Non-systematic risk is often referred to as specific risk, corporate risk or unsystematic risk. In general, non-

systematic risk can be managed using a portfolio. Examples of non-systematic risk are liquidity risk, financial/credit risk and operational risk. Two models can be used in forming an optimal portfolio, namely the Markowitz model and the single index model.

Yunita (2018) through his research Markowitz model in optimal portfolio formation (case study in Jakarta Islamic Index) shows that 10 stocks are included in the optimal portfolio, including AKRA (3.4%), ADRO (3.3%), ICBP (4.7%), INCO (2.6%), MYRX (13.6%), PTPP (4.9%), PWON (11.3%), TPIA (1%), UNTR (15.7%) and UNVR (39.5%). The average portfolio return rate is 1.22% and the portfolio risk is 0.0312, the risk is below the risk of each stock forming the optimal portfolio. Tania (2019) Through his research, the application of the single index

model in the formation of an optimal portfolio of lq45 shares on the Indonesian stock exchange showed that of the 45 shares in lq45, 13 optimal shares would be purchased by investors.

Conceptual Framework

In the initial stage of investing in stocks, investors need to assess the performance of each stock seen from the level of risk and return contained in it. The method used to calculate the level of risk and return is the Markowitz Method and the Single Index Method. By using this method, an optimal portfolio will be produced. The results of the analysis from this study will be recommended to investors and are expected to be information for investors for reference and consideration in choosing and making decisions to invest in stocks.

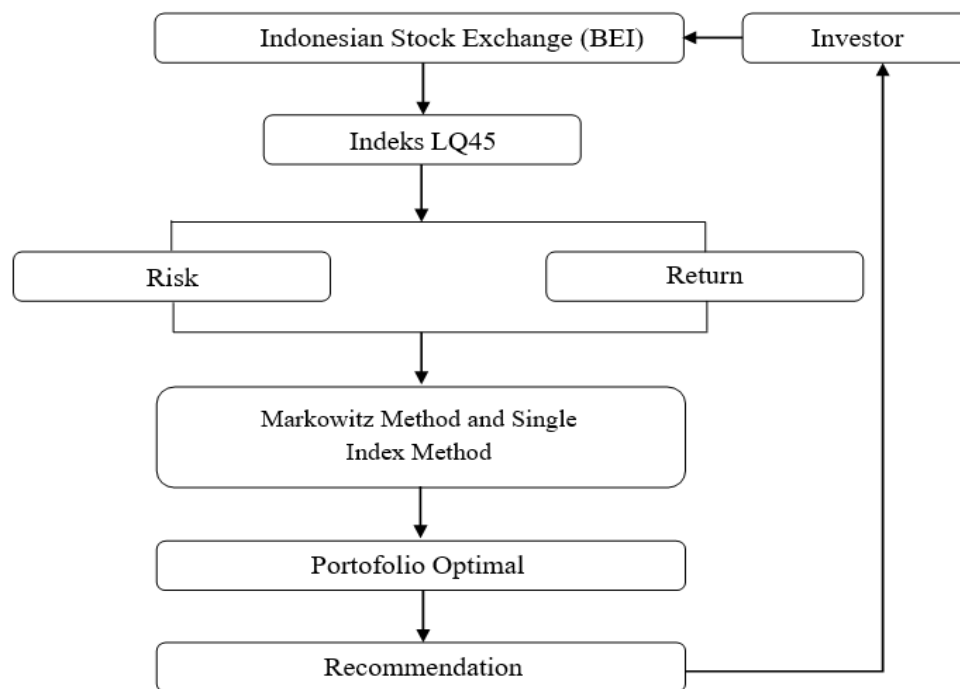


Figure 1. Conceptual Framework

RESEARCH METHOD

The type of data used in this research is descriptive research with quantitative data analysis techniques and is secondary data, namely data that has been published and processed previously. The data collected in

this study include data on the monthly closing price of companies that have gone public on the Indonesia Stock Exchange, monthly JCI, and interest rates for Bank Indonesia Certificates (SBI). The data was obtained from IDX Statistics 2017 – 2020,

the Indonesia Stock Exchange website. The research was conducted at the North Sumatra Representative Office of the Indonesia Stock Exchange from February 2020 to July 2020. The population in this study are all issuers who are included in the LQ45 calculation for the period February 2018 - July 2020. Based on the population observations on the LQ45 Index on the Indonesian Stock Exchange from February 20218 - July 2020 totalling 59 shares. In this study, the author will use the purposive sampling method and get as many as 31 samples with the following criteria the company does not take corporate action during the observation period that directly affects the stock price on the IDX and Companies that are consecutively listed in 5 periods of the LQ 45 index.

The data analysis methods used to determine the optimal portfolio are Markowitz and the Single Index Method. In this study, the data analysis method used was the Markowitz Model and the Mathematical Single Index Model.

Table 1. Sample

NO	CODE	STOCKS
1	ADRO	Adaro Energy Tbk.
2	AKRA	AKR Corporindo Tbk.
3	ANTM	Aneka Tambang Tbk.
4	ASII	Astra International Tbk.
5	BBCA	Bank Central Asia Tbk.
6	BBNI	Bank Negara Indonesia Tbk.
7	BBRI	Bank Rakyat Indonesia Tbk.
8	BBTN	Bank Tabungan Negara Tbk.
9	BMRI	Bank Mandiri Tbk.
10	BSDE	Bumi Serpong Damai Tbk.
11	EXCL	XL Axiata Tbk.
12	GGRM	Gudang Garam Tbk.
13	HMSP	H.M. Sampoerna Tbk.
14	ICBP	Indofood CBP Sukses Makmur Tbk.
15	INCO	Vale Indonesia Tbk.
16	INDF	Indofood Sukses Makmur Tbk.
17	INTP	Indocement Tungal Prakarsa Tbk.
18	JSMR	Jasa Marga Tbk.
19	KLBF	Kalbe Farma Tbk.
20	LPPF	Matahari Department Store Tbk.
21	MNCN	Media Nusantara Citra Tbk.
22	PGAS	Perusahaan Gas Negara Tbk.
23	PTBA	Bukit Asam Tbk.
24	PTPP	PP Tbk.
25	SCMA	Surya Citra Media Tbk.
26	SMGR	Semen Indonesia Tbk.
27	SRIL	Sri Rejeki Isman Tbk.
28	TLKM	Telekomunikasi Indonesia Tbk.
29	UNTR	United Tractors Tbk.
30	WIKA	Wijaya Karya Tbk.
31	WSKT	Waskita Karya Tbk.

RESULT AND DISCUSSION

Value of Return & Market Risk

Determining the value of return and market risk in this study is based on the closing price of the LQ 45 Index on the Indonesia Stock Exchange with an observation period from February 2018 to July 2020, in calculating the market index using market realized return (R_m), market expectation return $E(R_m)$ and market risk (σ^2) with the market price index in the LQ 45 Index as the input variable.

Table 2. Market Realized Return, Market Expected Return and Market Risk

Market Index	Market Realization ($\sum R_m$)	Market Expectations $E(R_m)$	Market Risk (σ^2)
Index LQ 457	-0,269	-0,009	0,003

According to Jogiyanto (2017: 322), the relationship between market expectations and market risk has a positive relationship, the greater the risk of a security or market, the greater the expected return and vice versa, this positive relationship only applies to returns that have not yet occurred, but In this study, this positive relationship did not occur so that the value of market expectations in the LQ 45 Index in Table 4.1 shows a low value for market risk, which means that a positive relationship does not always occur.

Calculating changes in stock prices to the market and changes in prices on the other hand and calculating unsystematic risk

After obtaining the value of the return and market risk described in the previous section, and then looking for the value of beta, alpha and residual error variance, this calculation in addition to market risk and return, also requires the value of individual returns and risks of each stock which has also been determined. described in the results of the optimal portfolio analysis of the Markowitz Model, beta is the sensitivity of a security's return to returns from the market and beta is used to calculate the

excess return to beta (ERB) and (B_i) , the value of (B_i) is also used to calculate (C_i) , the beta calculation is done by using the excel program with the slope formula, which calculates the realized return of stock and calculates the realized return of the market index in a certain period. Alpha, which is the change in market prices for securities, is used to find the value (A_i) needed in the calculation (C_i) , the alpha value calculation is carried out using the excel program with the intercept formula, while the residual error variance is used to calculate the value $(A_i=A_j)$, $(B_i=B_j)$ and the proportion of funds.

It can be seen that the value of alpha (α) ranges from -0.0349 to 0.1383, if a positive alpha value indicates that the stock's performance is better than the market index, the higher the value of course the better if the alpha value is negative then indicates that the performance of the stock is worse than the market index and the lower it is, the worse it is. beta (β) of each share ranges from 0.2081 to 2.2886 if the stock has a beta value equal to or more than -0.009 then the sensitivity of the stock is the same as the market sensitivity in other words if the market index decreases by -0.009 or 1% then the stock is also decreased by 1%. In the context of this study, the highest beta value was obtained by PP (Persero) Tbk (PTPP) of 2.2886, which means the sensitivity level of PP (Persero) Tbk (PTPP) shares was 228% or above the LQ45 index. If the LQ 45 index rose by 1% then PP (Persero) Tbk (PTPP) share price could increase by 2.2886 or 228%. The risk (σ^2) in Table 4.2 is the variance of the stock residual error (ϵ_i) which is also a unique or unsystematic risk, the greater the value of the variance ϵ_i , the greater the unsystematic risk that will be borne by investors and vice versa unsystematic risk is a risk that can be eliminated by diversifying, the factors at this risk such as capital structure, asset structure, liquidity level, profit level and so on.

Table 3
The Value of Changes in Share Prices to the Market

No	Code	Stocks	α	β	σ^2
1	ADRO	Adaro Energy Tbk.	0,138	2,601	0,780
2	AKRA	AKR Corporindo Tbk.	0,019	0,739	0,004
3	ANTM	Aneka Tambang Tbk.	0,019	1,373	0,024
4	ASII	Astra International Tbk.	0,015	1,515	0,023
5	BBCA	Bank Central Asia Tbk.	0,006	0,208	0,004
6	BBNI	Bank Negara Indonesia Tbk.	0,020	2,454	0,045
7	BBRI	Bank Rakyat Indonesia Tbk.	0,009	0,881	0,016
8	BBTN	Bank Tabungan Negara Tbk.	0,013	1,729	0,025
9	BMRI	Bank Mandiri Tbk.	0,007	0,709	0,007
10	BSDE	Bumi Serpong Damai Tbk.	0,009	1,175	0,010
11	EXCL	XL Axiata Tbk.	0,007	2,886	0,059
12	GGRM	Gudang Garam Tbk.	0,006	2,008	0,033
13	HMSP	H.M. Sampoerna Tbk.	0,005	1,347	0,013
14	ICBP	Indofood CBP Sukses Makmur Tbk.	0,003	1,354	0,029
15	INCO	Vale Indonesia Tbk.	0,001	2,110	0,046
16	INDF	Indofood Sukses Makmur Tbk.	0,000	1,779	0,023
17	INTP	Indocement Tungal Prakarsa Tbk.	-0,001	1,707	0,024
18	JSMR	Jasa Marga Tbk.	-0,001	1,275	0,013
19	KLBF	Kalbe Farma Tbk.	-0,003	1,640	0,023
20	LPPF	Matahari Department Store Tbk.	-0,003	1,093	0,015
21	MNCN	Media Nusantara Citra Tbk.	-0,014	2,381	0,041
22	PGAS	Perusahaan Gas Negara Tbk.	0,001	0,466	0,006
23	PTBA	Bukit Asam Tbk.	-0,004	0,956	0,009
24	PTPP	PP Tbk.	-0,008	0,999	0,013
25	SCMA	Surya Citra Media Tbk.	-0,015	1,256	0,015
26	SMGR	Semen Indonesia Tbk.	-0,013	0,873	0,015
27	SRIL	Sri Rejeki Isman Tbk.	-0,035	1,716	0,039
28	TLKM	Telekomunikasi Indonesia Tbk.	-0,004	0,343	0,003
29	UNTR	United Tractors Tbk.	-0,022	0,944	0,011
30	WIKA	Wijaya Karya Tbk.	-0,011	0,464	0,009
31	WSKT	Waskita Karya Tbk.	-0,010	0,286	0,008

Risk-Free Asset Return

Risk-free assets are assets that have a certain expected return with a risk equal to zero (Jogiyanto: 2008: 301), meaning that if an investor invests his funds in an asset type, the amount of profit that will be obtained in the future can be known. In this study, the return on risk-free assets is sourced from Bank Indonesia for the period February 2018 to July 2020, the average monthly return value of risk-free assets will be used as the value (R_f) for the calculation of the optimal portfolio formation. the average growth of risk-free assets from 2018 to 2020 has increased by a difference of 0.45%, while the average growth of risk-free assets from 2019 to 2020 has decreased by a difference of 1.16%.

Optimal Portfolio Forming Stocks

Based on the results of the study (ERB) the highest obtained by Aneka Tambang Tbk of 0.0426 for the highest (C_i) value obtained by Bank Central Asia Tbk of 0.0039 which will be used as the limiting point (C^*) because it has the highest (C_i) value.

The criteria for determining the inclusion of a security in the optimal portfolio are if the value (ERB) of a share is equal to or greater than the limiting point value (C^*) so that the shares that enter the optimal portfolio are Aneka Tambang Tbk and Bank Central Asia Tbk.

Stocks that are included in the optimal portfolio have a positive value, which means that each individual's expected return is greater than the return on risk-free assets higher than investing in risk-free securities or assets, namely Bank Indonesia Certification (SBI), excess return to beta (ERB) is used to measure stock premium returns relative to a unit of risk that cannot be diversified as measured by beta. (ERB) shows the relationship between return and risk which is a determining factor for investment.

Table 4
Formation of Optimal Portfolio of Single Index Model

No	Saham	ERB	C_i	C^*	Ket
1	ADRO	-0,0283	-0,0036	0,0039	Tidak Optimal
2	AKRA	-0,0136	-0,0048	0,0039	Tidak Optimal
3	ANTM	0,0426	0,0011	0,0039	Optimal
4	ASII	-0,0129	-0,0048	0,0039	Tidak Optimal
5	BBCA	0,0103	0,0039	0,0039	Optimal
6	BBNI	-0,0112	-0,0047	0,0039	Tidak Optimal
7	BBRI	-0,0053	-0,0022	0,0039	Tidak Optimal
8	BBTN	-0,0107	-0,0031	0,0039	Tidak Optimal
9	BMRI	-0,0084	-0,0036	0,0039	Tidak Optimal
10	BSDE	-0,0243	-0,0075	0,0039	Tidak Optimal
11	EXCL	-0,0038	-0,0005	0,0039	Tidak Optimal
12	GGRM	-0,0175	-0,0051	0,0039	Tidak Optimal
13	HMSP	-0,0369	-0,0092	0,0039	Tidak Optimal
14	ICBP	-0,0023	-0,0001	0,0039	Tidak Optimal
15	INCO	0,0015	0,0003	0,0039	Tidak Optimal
16	INDF	-0,0168	-0,0019	0,0039	Tidak Optimal
17	INTP	-0,0156	-0,0037	0,0039	Tidak Optimal
18	JSMR	-0,0042	-0,0015	0,0039	Tidak Optimal
19	KLBF	-0,0050	-0,0010	0,0039	Tidak Optimal
20	LPPF	-0,0318	-0,0072	0,0039	Tidak Optimal
21	MNCN	-0,0099	-0,0019	0,0039	Tidak Optimal
22	PGAS	-0,0084	-0,0030	0,0039	Tidak Optimal
23	PTBA	-0,0602	-0,0018	0,0039	Tidak Optimal
24	PTPP	-0,0080	-0,0034	0,0039	Tidak Optimal
25	SCMA	-0,0121	-0,0044	0,0039	Tidak Optimal
26	SMGR	-0,0019	-0,0006	0,0039	Tidak Optimal
27	SRIL	-0,0215	-0,0050	0,0039	Tidak Optimal
28	TLKM	-0,0342	-0,0036	0,0039	Tidak Optimal
29	UNTR	-0,0429	-0,0029	0,0039	Tidak Optimal
30	WIKA	-0,0027	-0,0011	0,0039	Tidak Optimal
31	WSKT	-0,0166	-0,0068	0,0039	Tidak Optimal

The proportion of Funds in Optimal Portfolio Formation

After determining the selected securities in the formation of the optimal portfolio, then determining the proportion of funds that will be invested by investors in each selected security in the optimal portfolio using a single index model.

Table 5
Calculation of the Proportion of Stock Funds for Single Index Model

No	Saham	Kode	X_i	W_i
1	Aneka Tambang Tbk	ANTM	0,129	10,5%
2	Bank Central Asia Tbk	BBCA	1,100	89,5%
Jumlah			1,129	100%

Calculating the Value of Changes in the Price of a Securities Portfolio to the Market and the Value of Changes in the Price of a Portfolio on the other hand

Before calculating the return and risk of a single-index portfolio, the beta and alpha of the portfolio must be known, the beta and alpha of the portfolio are inputs in calculating the return and risk of the portfolio, the beta value is also called the sensitivity of changes in securities to the market, while portfolio beta is the beta of individual stocks that included in the formation of the optimal portfolio with the proportion of funds invested, while the alpha portfolio is the alpha of individual securities selected in the optimal portfolio with the proportion of funds invested

Table 6
Value of Changes in Portfolio Prices to Market

No	Stocks	Code	α_p	β_p
1	Aneka Tambang Tbk	ANTM	0,1383	0,2729
2	Bank Central Asia Tbk	BBCA	0,0186	0,6611

The highest portfolio alpha value (α_p) is Aneka Tambang, Tbk, while the highest portfolio beta value (β_p) is obtained by Bank Central Asia, Tbk while portfolio alpha and beta are used in the calculation of portfolio return and risk, portfolio alpha and beta are influenced by the proportion of each fund securities, the greater the proportion of funds in a security, the greater the beta and alpha values of the security portfolio and vice versa.

Return and Risk Portfolio Single Index Model

Table 7

Return and Risk Portfolio Single Index Model

No	Stocks	Code	Return $E(R_p)$	Risiko σ_p^2
1	Aneka Tambang Tbk	ANTM	0,1359	0,0821
2	Bank Central Asia Tbk	BBCA	0,0127	0,0052
Jumlah			0,1486	0,0873

the portfolio return value ($ER\rho$) of the Single Index Model is 0.1486 while the portfolio risk ($\sigma\rho^2$) is 0.0873, this means that the formation of an optimal portfolio using the Single Index Model can produce a portfolio return of 14.8% with 2 different types of issuers if investors invest their funds at the level of risk that will be borne by 8.7%.

Markowitz Model Portfolio Analysis

Determining the value of the return and risk of each stock using the Markowitz model can be used to measure realized returns, expected returns and standard deviations on each security, realized returns are used to measure actual profits based on historical data on stock prices in the past, while expected returns measure the level of profit expected obtained in the future using historical data on stock prices in the past. To measure the risk borne by investors in the future, standard deviation is used by using historical data of realized returns and expected return data from each stock, the data processed is monthly closing stock price data for the period February 2018 to July 2020, as for return expectations and the risk of each stock that is the research sample.

Based on the relationship between return expectations and risk according to Jogiyanto (2017: 322), the greater the risk of a security, the greater the expected return, the opposite is also true, namely the smaller the expected return, the smaller the risk borne, this positive relationship only applies to expected returns -ante return (before the fact) which is for returns that have not occurred, but in Figure 4.1 a positive relationship only occurs in BBKA shares, which means that the relationship between return and risk does not always show a positive relationship.

According to Jogiyanto (2017: 388), the optimal portfolio of the Markowitz model is in the efficient set, which means that the stock must show a positive expected return value, so in this study stocks that have a negative or zero expected return value will

not be included in the next calculation, which means that it does not provide a profit during the period from February 2018 to July 2020, it was determined that the 7 issuers included in the optimal portfolio calculation were as follows.

Table 8

Optimal Portfolio Formation Stock				
No	Code	Stocks	E(Ri)	σ^2
1	ANTM	Aneka Tambang Tbk.	0,115	0,76
2	BBKA	Bank Central Asia Tbk.	0,012	0,003
3	EXCL	XL Axiata Tbk.	0,001	0,014
4	ICBP	Indofood CBP Sukses Makmur Tbk.	0,0038	0,004
5	INCO	Vale Indonesia Tbk.	0,0063	0,019
6	KLBF	Kalbe Farma Tbk.	0,0008	0,006
7	SMGR	Semen Indonesia Tbk.	0,0015	0,016

Based on the results of research using the Markowitz model, the optimal portfolio with a portfolio return of 0.0074 while portfolio risk is 0.0428 and the proportion of funds formed is BBKA 50.81%, EXCL 9.83%, ICBP 30.59%, and KLBF 8,77% for yield. The Single Index model research obtained two stocks forming the optimal portfolio with a portfolio return of 0.1486 and a risk of 0.0873 while the proportion of funds formed by ANTM was 10.5%, and BBKA 89.5%, as for the comparison of the results of the Markowitz Model and Index Model research. Single as follows:

Tabel 9

Table of Comparison of Markowitz Model Results and Single Index Model

No	Notes	Model Markowitz	Single Indeks Model
1	Preferred Shares and proportion of funds	1. BBKA 50,81% 2. EXCL 9,83% 3. ICBP 30,59% 4. KLBF 8,77%	1. ANTM 10,5% 2. BBKA 89,5%
2	Return Portfolio Optimal	0,0074	0,1486
3	Risiko Portfolio Optimal	0,0428	0,0873

Based on the comparison of the expected return of the Markowitz model and the single index model in Table 4.10 the expected return of the Markowitz model is 0.0074 and the portfolio risk is 0.0428, while the expected return of the Single Index model is 0.1486 and the portfolio risk is 0.0873, these results show that portfolio using a single index model in analyzing the

optimal portfolio produces a higher return than the Markowitz model with a greater risk value. The proportion of shares that are more in the Markowitz model thereby reducing the level of risk is greater.

CONCLUSION

Based on the results of the optimal portfolio analysis of the Markowitz model and the Single Index Model, it can be concluded as follows:

1. Based on the optimal portfolio formation of the Markowitz Model, 4 stocks form a portfolio expected return of 0.0074 while for portfolio risk it is 0.0428 and the proportion of funds formed is BBKA 50.81%, E XCL 9.83%, ICBP 30, 59 %, and KL B F 8, 77%
2. Based on the formation of a single index model portfolio, 2 optimal portfolio formations are obtained with a portfolio return of 0.1486 and a risk of 0.0873 while the proportion of funds formed by ANTM is 10.5%, and BBKA is 89.5%,
3. Based on the research results prove that the single index model can generate a profit of 14.86% with a risk level of 8.73% compared to the Risk-Free Assets Return rate of 5.17%. Meanwhile, the Markowitz model can generate a portfolio return of 0.74% with a portfolio risk of 4.28% not providing optimal returns because the expected return from the Markowitz model portfolio is lower than the Risk-Free Asset Return Rate.

Conflict of Interest: None

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