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# OPTIMAL PORTFOLIO ANALYSIS OF INDEXED COMPANIES LQ 45 LISTED ON IDX

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**Abstract**

*This aims of the research are to analyze and find out the stocks of LQ 45 Index members who can form optimal portfolios,find out the the proportion of funds from each selected stock, and find out the rationale of investors in the selection of stocks from LQ 45 members reflected in the high return value with minimal risk and volume of the views included in the optimal portfolio determination.This research was conducted in the Indonesia Stock Exchange (IDX) on shares listed in the Company LQ45 as many as45 shares. The sampel consisted of 30 stocks selected based on the criteria having been determined. The result indicate that there are 12 stocks that make up the optimal portfolio of 30 types of stocks studied with a cut-off-point value of 0.0034. The optimal portfolio is formed by 12 stocks with a high ERB value. The proportions of funds from each optimal portfolio share are INCO 31.33%, INKP 30.31%, BBCA 17.26%, ANTM 0.95%, EXCL 0.68%, AKRA 0.65%, KLBF 0.63%, MNCN 0.59%, BMRI 0.58%, INTP 0.54%, PTBA 0.39%, and SMGR 0.01%.*

**Keywords :** *Optimal portfolio, single index model, LQ 45 index.*

## INTRODUCTION

Activities in determining an optimal portfolio is a very important area of activity both among institutional investors as well as among individuals themselves in determining the best consolidation between the rate of return and risk so that the desired optimal portfolio is formed. The optimal portfolio selected from the many options that exist from the efficient portfolio, the optimal portfolio will show aporisma return with various levels of moderate risk.

This study tried to apply the Single Index Model,which is a simplification previously developed by Markowitz. In addition, a single index model can also be used to calculate portfolio expectation returns and risks, which is used as the reason researchers choose to use a single index model as an instrument to analyze and form optimal portfolios on stocks in LQ 45.

Of the many stocks in IDX, one of the leading stocks is the LQ 45 Index. LQ 45 shares became the object of this research because companies that register themselves into the LQ 45 market are still classified as the company's favorite stocks by investors to invest their capital, even LQ 45 generally has a stock capitalization. In addition, LQ 45 shares also have a very high probability of business growth as well as a lower Beat-As-Spread that will automatically make the ability of stocks on the exchange to be higher.

## LITERATURE REVIEW

### Portfolio

William F. Sharpe (1963) developed the Single Index Model portfolio method which is a simplification of the index model that Markowitz had previously developed. The Single Index Model reveals the interaction between returns based on each individual security and market index returns. Simplification of this model provides an alternative method for calculating variants of a portfolio, calculation using the single index method is simpler and easier, when compared to the calculation method by Markowitz.

Empirical evidence suggests that the more types of shares collected in the portfolio basket, the risk of loss of one stock can be neutralized with the profits of the other stock. Portfolio theory uses the assumption that the capital marketis efficient market hypothesis. Efficient capital markets mean that the share price thoroughly reflects all the information on the exchange (Reilly & Brown, 2003).

### Return

"The purpose of investors in investing is to maximize returns, without forgetting the risk factors that must be faced. Return is one of the factors that motivate investors to invest and is also a reward for the courage of investors to bear the risk or investment they make" (Tandelilin, 2010).

### Risk

"A decision is said to be in a state of risk if the outcome of the decision cannot be known in advance with certainty, but knows its probality (probability value), wherethe uncertainty (uncertainly)can be measured by probability. If it is associated with investor's prefence to risk, then the risk is distinguished into three" (Halim, 2014) namely:

a) Risk seeker,is an investor who when faced with two investment options that provide the same level of return with differentrisks, then he will prefer to take investments that are greater risk. Usually this type of investor is aggressive and speculative in making investment decisions.

b) Risk Neutrality, is an investor who will ask for an increase in the same rate of return for each increase in risk, this type of investor is generally quite flexible andprudentin making investment decisions.

c) Risk Averter, is an investor who when faced with two investment options that provide the same level of grazing with different risks, then he will prefer to take investments with less risk, usually this type of investor tends to always consider carefully and planned his investment decisions.

### Single Index Model

The Single index method assumes that the return rate between two or more securities will correlate i.e. it will move side by side and have the same reaction to one factor or single index included in the method (Halim, 2014).

This single index method is related to the calculation of returns on each asset there is a market index return. Mathematically, the single index method is as follows (Tandelilin, 2010) :

$Ri = \alpha I + \beta i\ Rm + ei$

Ri = Return of securities i

Rm = Retun market index

αI = the return of i securities that are not affected by performance

Market

βi = measure of securities return sensitivity i to changes in market return

ei = residual error

### Portfolio Optimal

An efficient portfolio is a combination of investments that provide the same return with a minimum level of risk or with the same level of risk will provide maximum returns (Brigham &

Daves, 2012).

**Conceptual Model**

Before making a decision to make an investment, an investor must first reevaluate which stocks are worth selecting. Automatically the selected shares are stocks that generate maximum returns with a certain level of risk, or certain returns with minimal risk. By forming an optimal portfolio, investors can find out which stocks are worth investing in.

The stock portfolio formation activities in this study used a single index method. Through this method, it can be known which stocks make up the optimal and not optimal portfolio. Furthermore, to find out the difference between stocks that enter the portfolio optimally and not optimally, a different test analysis will be carried out. The variable used is Excess Return to Beta (ERB),a value β the single index method can be searched using microsoft excel. The stocks included in the portfolio (ERB>C*) will be selected by, then from that can be selected stocks that produce the optimal portfolio.

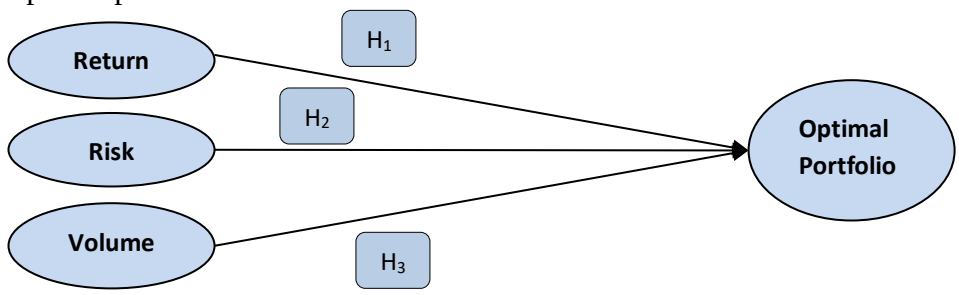



**Figure 1**: The Conceptual Model

The hypotheses tested in this study are as follows:

$H_1$ There is a significant difference between the return on stocks including optimal and non-optimal portfolios.

$H_2$ There is a significant difference between the risks of stocks inluding optimal and non-optimal portfolios.

$H_3$ There is a difference in the volume of trade between stocks optimal and non-optimal portfolio.

## RESEARCH METHOD

### Location and Research Design

This research was conducted on companies indexed LQ 45 listed on the IDX (Indonesia Stock Exchange) accessed through its official website, www.idx.co.id.

This study uses a descriptive quantitative approach, which is a research to find out the value of independent variables, be it one or more variables without doing comparisons or connecting with other variables (Sugiyono, 2010). The description described in this study is everything related to the establishment of an optimal portfolio of stocks listed on the LQ 45 Company on the Indonesia Stock Exchange 2015-July 2019.

### Population or Samples

The population in this study is all companies that have been listed in LQ 45, as many as 45 companies.

The selection of samples of this research are companies registered in LQ 45 conducted purposive sampling, where this method is a technique of determining samples according to some criteria of the following IDX so that it is feasible to be sampled:

a. Transaction activities in the regular market, namely the value, volume and frequency of transactions.
b. Number of trading days in the regular market.
c. Market capitalization at a certain period of time.

d. In addition to considering the liquidity criteria and market capitalization mentioned above, the financial condition and growth prospects of the company will also be seen.

**Table 1.** List of Research Sample

| No. | Code | Company |
|---|---|---|
| 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 (Persero) Tbk. |
| 7 | **BBRI** | Bank Rakyat Indonesia (Persero) Tbk. |
| 8 | **BBTN** | Bank Tabungan Negara (Persero) Tbk. |
| 9 | **BMRI** | Bank Mandiri (Persero) Tbk. |
| 10 | **BSDE** | Bumi Serpong Damai Tbk. |
| 11 | **CTRA** | Ciputra Development Tbk. |
| 12 | **EXCL** | XL Axiata Tbk. |
| 13 | **GGRM** | Gudang Garam Tbk. |
| 14 | **HMSP** | H. M. Sampoerna Tbk. |
| 15 | **ICBP** | Indofood CBP Sukses Makmur Tbk. |
| 16 | **INCO** | Vale Indonesia Tbk. |
| 17 | **INDF** | Indofood Sukses Makmur Tbk. |
| 18 | **INKP** | Indah Kiat Pulp & Paper Tbk. |
| 19 | **INTP** | Indocement Tunggal Prakarsa Tbk. |
| 20 | **JSMR** | Jasa Marga (Persero) Tbk. |
| 21 | **KLBF** | Kalbe Farma Tbk. |
| 22 | **LPPF** | Matahari Department Store Tbk. |
| 23 | **MNCN** | Media Nusantara Cipta |
| 24 | **PGAS** | Perusahaan Gas Negara Tbk. |
| 25 | **PTBA** | Bukit Asam Tbk. |
| 26 | **SMGR** | Semen Indonesia (Persero) Tbk. |
| 27 | **TLKM** | Telekomunikasi Indonesia (Persero) Tbk. |
| 28 | **UNTR** | United Tractors Tbk. |
| 29 | **UNVR** | Unilever Indonesia Tbk. |
| 30 | **WSKT** | Waskita Karya (Persero) Tbk. |

Source: Proessed Data

## Data Collection Method

The data source used for this research is secondary data. Seondary data is the collection of data indirectly, in the form of books, notes, existing evidence, or archives both published and not publicly published.

The analysis techniques in this study used a single index method calculated using microsoft office excel 2010 program to determine the optimal portfolio set.

## Data Analysis Method

### Return Realization/Return Realized

This measurement is used to calculate the return of each issuer's shares.

$$R_{t(i)} = \frac{P_{t(i)} - P_{t-1(i)}}{P_{t-1(i)}}$$

Description:

$R_i$ = realized return on i shares

$P_t$ = stock closing price i on the day to t

$P_{t-1}$ = stock closing price i on day t-1

### Expected Return

Expected return calculation on each individual stock is calculated using Excel program with Average formula, is percentage of average return of stock realization i divided by the amount of return on realization of shares i.

$$E(Ri) = \frac{\Sigma R_{t(i)}}{}$$

N

Description:
E(Ri = Expected return
$R_t$ = Return on realisation of shares i
n = number of realized return shares i

**Standard Deviation**

This formula used to measure the risk of return realization

$$SD = \sqrt{\sum_{i-}^{n} \frac{(x_i - x)^2}{n-1}}$$

Description:
σ = standard deviation (SD)
$X_i$ = realized return to i shares i
X = average realized return on i shares
n = number of realized return shares i

**Variance**

In this formula is used to measure the risk of expected return of i shares.

$$\sigma^2_{ei}(i) = \sigma^2 i - (\sigma^2_m * (\alpha_i)^2)$$

$\sigma^2$ ei(i) = Variance ei stock i
$\sigma^2$i = Variance market i
$\sigma^2$IHSG = Variance market
αI = Alpha stock i

**Beta**

Beta calculations are used to calculate, Excess Return to Beta (ERB) and Bi to calculate Cutt-of Point (Ci).

$$\beta_i = \left( \frac{\sigma_i}{\Sigma_m} \right) r_{im}$$

Description:
$B_i$ = Beta stock i
$\sigma_i$ = Standard deviation of shares i
$\sigma_m$ = Standard market deviation
rm = Correlation of realized return of shares i with realized return market

**Alpha**

For alpha calculations are used to calculate variance error ($e_i$).

$$\sigma_i = R_i - \beta_i * R_m$$

Description:
σi= Alpha stock i
βi = Market Return

**Excess Return To Beta (ERB)**

The ERB is used to measure excess returns relative to a diversified unit of risk measured by Beta.

$$ERB_i = \frac{E(R_i) - Rf}{\beta_i}$$

Description:
ERB = Excess Return to Beta shares i
$E(R_i)$ = Expected return on i shares

$R_f$ = Beta stock i

**$C_i$/Limiting Point**

$C_i$ is the result of division of market variants and premium return to variance of stock error with market variants and vulnerability of individual shares to variance of stock error.

$$C_i = \frac{\sigma_m^2 \sum_{j=1}^{i} \frac{(R_i - R_f)\beta_i}{\sigma_{ei}^2}}{1 + \sigma_m^2 \sum_{j=i}^{i} \left[\frac{\beta_i^2}{\sigma_{ei}^2}\right]}$$

Description:

$\sigma_m^2$ = Variance realized return market (JCI)

**Cutt-off Point (C*)**

Cutt-off Point is the largest value of C i of a number of C values$_i$ shares, which is calculated by excel program with max formula.

**Determining the Proportion of funds**

To get the result of the proportion of stock funds in the optimal portfolio can be calculated by if formula or using the formula:

$$Xi = \frac{\beta i}{\sigma_{ei}^2}(ERB - C^*)$$

Description:

Xi = Proportion of stock funds i

$\beta i$ = Beta stock i

$\sigma_{ei}^2$ = Variance error stock i

ERB = Excess return to beta stock i

C* = Cutt-off point



## EMPIRICAL RESULTS

### Calculation of Standard Deviation, Expected Return, Variance, LQ 45 INDEX and 7-Day Repo Rate .

The stock that provides a high expected return is Semen Indonesia (Persero) Tbk. (SMGR) shares of 18.5212. The stock that produced the lowest expected return was Matahari Department Store Tbk. (LPPF) stock of -0.0187.

Then, in the calculation of standard deviation and variance of profit share profit calculates the amount of risk can be seen in the table above, SMGR shares have the highest risk value of 18557.897, while BBCA shares have the lowest risk with a value of 0.0492.

**Table 2. Expected Return, Standard Deviation and Variance**

| No. | Stock Code | E(Ri) | Sd | Variance ($\sigma^2$) |
|---|---|---|---|---|
| **1** | **Adro** | 0,0093 | 0,1086 | 0,0118 |
| **2** | **Akra** | 0,1428 | 1,1569 | 1,3385 |
| **3** | **ANTM function** | 0,0706 | 0,6571 | 0,4318 |
| **4** | **ASII** | 0,0012 | 0,0664 | 0,0044 |
| **5** | **BBCA** | 0,0169 | 0,0492 | 0,0024 |
| **6** | **BBNI** | 0,0097 | 0,0851 | 0,0072 |
| **7** | **BBRI** | -0,0004 | 0,1292 | 0,0167 |

| | | | | |
|---|---|---|---|---|
| **8** | **BBTN** | 0,1290 | 0,9511 | 0,9047 |
| **9** | **Bmri** | 0,1485 | 1,2388 | 1,5340 |
| **10** | **BSDE** | -0,001 | 0,0812 | 0,0066 |
| **11** | **CPIN** | 0,0131 | 0,1160 | 0,0135 |
| **12** | **Excl** | 0,1406 | 1,1498 | 1,3221 |
| **13** | **GGRM** | 0,0058 | 0,0618 | 0,0038 |
| **14** | **HMSP** | -0,0134 | 0,1454 | 0,0211 |
| **15** | **Icbp** | 0,0014 | 0,0873 | 0,0076 |
| **16** | **Inco** | 0,0087 | 0,1583 | 0,0251 |
| **17** | **Indf** | 0,1286 | 1,0381 | 1,0778 |
| **18** | **INKP** | 0,0506 | 0,1811 | 0,0328 |
| **19** | **INTP** | 0,1593 | 1,2749 | 1,6255 |
| **20** | **JSMR** | 0,0034 | 0,1140 | 0,0130 |
| **21** | **KLBF** | 0,1378 | 1,1604 | 1,3467 |
| **22** | **LPPF** | -0,0187 | 0,1098 | 0,0121 |
| **23** | **MNCN** | 0,1426 | 1,1786 | 1,3891 |
| **24** | **PGAS** | -0,0108 | 0,1354 | 0,0184 |
| **25** | **PTBA** | 0,2066 | 1,7620 | 3,1048 |
| **26** | **SMGR** | 18,5212 | 136,2273 | 18557,897 |
| **27** | **TLKM** | 0,0089 | 0,0547 | 0,0030 |
| **28** | **UNTR** | 0,0124 | 0,1151 | 0,0133 |
| **29** | **UNVR** | 0,0070 | 0,0569 | 0,0032 |
| **30** | **WSKT** | 0,0107 | 0,0971 | 0,0094 |

Source: IDX, processed.

## Calculation of Alpha, Beta, and Variance Error of Individual Shares

**Table 3. Alpha, Beta, and Variance Errors of Individual Stocks**

| No. | Stock Code | βi | αi | Var $e_i$ |
|---|---|---|---|---|
| **1** | **Adro** | 1,2334 | 0,0055 | 0,0142 |
| **2** | **Akra** | 1,8803 | 0,1369 | 1,344 |
| **3** | **ANTM function** | 1,0833 | 0,0672 | 0,4336 |
| **4** | **ASII** | 1,2433 | -0,0027 | 0,0068 |
| **5** | **BBCA** | 0,8504 | 0,0143 | 0,0003 |
| **6** | **BBNI** | 1,6843 | 0,0044 | 0,0116 |
| **7** | **BBRI** | 1,4748 | -0,0050 | 0,0201 |
| **8** | **BBTN** | -1,4289 | 0,1335 | 0,9079 |
| **9** | **Bmri** | 2,4886 | 0,1407 | 1,5443 |
| **10** | **BSDE** | 1,3091 | -0,0052 | 0,0092 |
| **11** | **CPIN** | 1,0533 | 0,0098 | 0,0152 |
| **12** | **Excl** | 0,0356 | 0,1405 | 1,3221 |
| **13** | **GGRM** | 0,5755 | 0,0040 | 0,0043 |
| **14** | **HMSP** | 0,1701 | -0,0140 | 0,0212 |
| **15** | **Icbp** | 0,5711 | -0,0004 | 0,0081 |
| **16** | **Inco** | 0,6143 | 0,0068 | 0,0256 |
| **17** | **Indf** | -3,1339 | 0,1385 | 1,0930 |
| **18** | **INKP** | 0,5204 | 0,0489 | 0,0332 |

| | | | | |
|---|---|---|---|---|
| **19** | **INTP** | 5,1450 | 0,1431 | 1,6665 |
| **20** | **JSMR** | 0,9835 | 0,0003 | 0,0145 |
| **21** | **KLBF** | 1,0513 | 0,1345 | 1,3484 |
| **22** | **LPPF** | 1,0067 | -0,0219 | 0,0136 |
| **23** | **MNCN** | 3,2767 | 0,1323 | 1,4058 |
| **24** | **PGAS** | 1,2921 | -0,0149 | 0,0209 |
| **25** | **PTBA** | 4,9645 | 0,1911 | 3,1430 |
| **26** | **SMGR** | 420,5772 | 17,2020 | 18831,96 |
| **27** | **TLKM** | 0,5036 | 0,0074 | 0,0034 |
| **28** | **UNTR** | 0,7213 | 0,0102 | 0,0141 |
| **29** | **UNVR** | 0,6243 | 0,0051 | 0,0038 |
| **30** | **WSKT** | 1,1579 | 0,0071 | 0,0115 |

Source: Data processed.

**Calculation of Cutt-off-point value (C*)**

The result of calculation C* in this study is C* = 0.0034. To determine the portfolio can be seen from the shares that have an ERB value greater than or equal to the cutt-off-point value. There are 12 stocks in the portfolio. In table 5.7 the following shows 12 list of optimal portfolio stocks, sorted from the highest ERB value to the smallest ERB, while there are 18 non-optimal stocks.

**Table 4. ERB, Ci, C* and Optimal Portfolio Stocks(ERB>C*)**

| Stock | Erb | Ci | C* |
|---|---|---|---|
| **EXCL** | 3,8221 | 0,0000 | **0,0034** |
| **INKP** | 0,2970 | 0,0011 | **0,0034** |
| **INCO** | 0,2017 | 0,0001 | **0,0034** |
| **KLBF** | 0,1266 | 0,0002 | **0,0034** |
| **AKRA** | 0,0734 | 0,0003 | **0,0034** |
| **ANTM** | 0,0608 | 0,0003 | **0,0034** |
| **BMRI** | 0,0578 | 0,0004 | **0,0034** |
| **SMGR** | 0,0440 | 0,0006 | **0,0034** |
| **MNCN** | 0,0421 | 0,0005 | **0,0034** |
| **PTBA** | 0,0407 | 0,0005 | **0,0034** |
| **INTP** | 0,0300 | 0,0007 | **0,0034** |
| **BBCA** | **0,0143** | **0,0034** | **0,0034** |

Source: Data processed.

**Table 5. ERB, Ci, C* and Non Optimal Stocks**

| Stock | Erb | Ci | C* |
|---|---|---|---|
| **UNTR** | 0,0107 | 0,0006 | **0,0034** |
| **UNVR** | 0,0096 | 0,0005 | **0,0034** |
| **TLKM** | 0,0084 | 0,0009 | **0,0034** |
| **CPIN** | 0,0079 | 0,0008 | **0,0034** |
| **ADRO** | 0,0037 | 0,0005 | **0,0034** |
| **BBNI** | 0,0030 | 0,0008 | **0,0034** |
| **GGRM** | 0,0019 | 0,0002 | **0,0034** |
| **JSMR** | -0,0014 | -0,0001 | **0,0034** |
| **WSKT** | -0,0014 | 0,0008 | **0,0034** |

| | | | |
|---|---|---|---|
| **ASII** | -0,0028 | -0,0007 | **0,0034** |
| **BBRI** | -0,0035 | -0,0005 | **0,0034** |
| **BSDE** | -0,0044 | -0,0010 | **0,0034** |
| **ICBP** | -0,0059 | -0,0003 | **0,0034** |
| **PGAS** | -0,0120 | -0,0013 | **0,0034** |
| **LPPF** | -0,0233 | -0,0024 | **0,0034** |
| **INDF** | -0,0395 | -0,0005 | **0,0034** |
| **BBTN** | -0,0870 | -0,0003 | **0,0034** |
| **HMSP** | -0,1067 | -0,0002 | **0,0034** |

Source: Data processed.

**Determining the Proportion of Optimal Portfolio Forming Funds**

The largest percentage is in the shares of Vale Indonesia Tbk. (INCO) company of 31.33%. Meanwhile, those who have the smallest percentage of funds are in the shares of Semen Indonesia (Persero) Tbk. (SMGR) company of 0.01%.

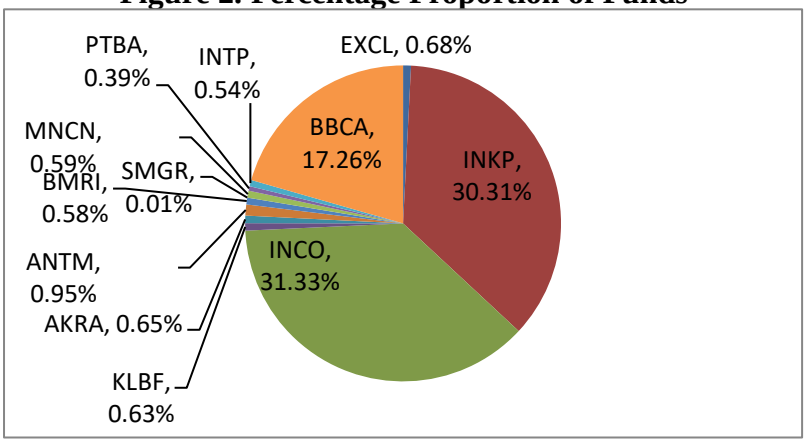
**Table 6. Proportion of Optimal Portfolio Funds**

| Stock | Zi | wi |
|---|---|---|
| **EXCL** | 0,1027 | 0,0068 |
| **INKP** | 4,5936 | 0,3031 |
| **INCO** | 4,7482 | 0,3133 |
| **KLBF** | 0,0960 | 0,0063 |
| **AKRA** | 0,0979 | 0,0065 |
| **ANTM** | 0,1434 | 0,0095 |
| **BMRI** | 0,0876 | 0,0058 |
| **SMGR** | 0,0009 | 0,0001 |
| **MNCN** | 0,0900 | 0,0059 |
| **PTBA** | 0,0588 | 0,0039 |
| **INTP** | 0,0821 | 0,0054 |
| **BBCA** | 2,6156 | 0,1726 |

Source: Data processed.

It can be seen that the largest percentage is in shares of Vale Indonesia Tbk. (INCO) company of 31.33%. Meanwhile, those who have the smallest percentage of funds are in the shares of Semen Indonesia (Persero) Tbk. (SMGR) company of 0.01%. With the largest percentage of funds will provide a good alternative in investing because according to ERB calculations that are above Ci.

**Figure 2. Percentage Proportion of Funds**



**Correlation and Covariance of Optimal Portfolio Forming Stocks**

The table below indicates that the correlation coefficient will be worth 1 if the combination of the same shares is correlated, and from that it explains that the same stock will not provide benefits for risk reduction. The largest correlation is in AKRA shares with BMRI shares of 0.9948, while the smallest correlation is in MNCN and INTP shares. The lower the correlation between stocks, the better it will be in diversifying efforts because the risks received will also be smaller.

**Table 7. Portfolio-Forming Stock Correlation Coefficient**

| Stock | EXCL | INKP | INCO | KLBF | AKRA | ANTM |
|---|---|---|---|---|---|---|
| **EXCL** | 1 | -0,0786 | 0,1379 | -0,0308 | -0,0183 | 0,0283 |
| **INKP** | -0,0786 | 1 | 0,2753 | 0,1568 | 0,5194 | 0,0334 |
| **INCO** | 0,1379 | 0,2754 | 1 | 0,10547 | 0,2471 | -0,0143 |
| **KLBF** | -0,0308 | 0,1568 | 0,10547 | 1 | 0,0006 | -0,0058 |
| **AKRA** | -0,0183 | 0,5194 | 0,24713 | 0,0006 | 1 | 0,0624 |
| **ANTM** | 0,0284 | 0,0334 | -0,0144 | -0,0058 | 0,0624 | 1 |
| **BMRI** | -0,0135 | 0,4986 | 0,2497 | 0,00094 | 0,9949 | 0,0891 |
| **SMGR** | -0,0167 | -0,1482 | 0,0113 | -0,0198 | -0,0123 | -0,0260 |
| **MNCN** | 0,0099 | -0,0329 | -0,0475 | 0,0132 | 0,0083 | -0,0411 |
| **PTBA** | -0,0165 | 0,0849 | 0,3646 | 0,0110 | 0,02272 | 0,0074 |
| **INTP** | -0,0156 | -0,1441 | 0,0219 | 0,0002 | -0,0147 | 0,0018 |
| **BBCA** | 0,0967 | 0,114 | 0,1258 | 0,0485 | 0,0542 | 0,0753 |
| | **BMRI** | **SMGR** | **MNCN** | **PTBA** | **INTP** | **BBCA** |
| **EXCL** | -0,0134 | -0,0167 | 0,0099 | -0,0165 | -0,0156 | 0,0967 |
| **INKP** | 0,4986 | -0,1482 | -0,0329 | 0,0849 | -0,1441 | 0,1139 |
| **INCO** | 0,2497 | 0,0113 | -0,0475 | 0,3646 | 0,0219 | 0,1258 |
| **KLBF** | 0,0009 | -0,0198 | 0,0132 | 0,0110 | 0,0002 | 0,0485 |
| **AKRA** | 0,9949 | -0,0122 | 0,0083 | 0,0227 | -0,0147 | 0,0542 |
| **ANTM** | 0,0891 | -0,0260 | -0,0411 | 0,0074 | 0,0018 | 0,0753 |
| **BMRI** | 1 | -0,0061 | 0,0096 | 0,0242 | -0,0065 | 0,0603 |
| **SMGR** | -0,0061 | 1 | -0,0047 | -0,0207 | 0,9924 | 0,1034 |
| **MNCN** | 0,0095 | -0,0046 | 1 | -0,0089 | -0,0014 | 0,1395 |
| **PTBA** | 0,0242 | -0,0206 | -0,0089 | 1 | -0,0184 | 0,1832 |
| **INTP** | -0,0065 | 0,9924 | -0,0014 | -0,0184 | 1 | 0,1270 |
| **BBCA** | 0,0603 | 0,1034 | 0,1396 | 0,1832 | 0,1270 | 1 |

Source: Data processed.

**Portfolio Forming Stock Covariance**

Based on the results of the calculation table below shows most covariance tends to be close to zero value. Therefore, this indicates that the movement of securities tends to be independent of each other, also more likely to move in the opposite direction. This means that the greater the benefit in risk reduction obtained in the portfolio.

**Table 8. Portfolio Forming Stock Covariance**

| Stock | EXCL | INKP | INCO | KLBF | AKRA | ANTM |
|---|---|---|---|---|---|---|
| **EXCL** | 1,3221 | -0,0164 | 0,0251 | -0,0411 | -0,0244 | 0,0214 |
| **INKP** | -0,0164 | 0,0328 | 0,0079 | 0,0329 | 0,1089 | 0,0039 |
| **INCO** | 0,0251 | 0,0079 | 0,0250 | 0,0194 | 0,0453 | -0,0015 |
| **KLBF** | -0,0411 | 0,0329 | 0,0193 | 1,3467 | 0,0009 | -0,0045 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **AKRA** | -0,0244 | 0,1088 | 0,0452 | 0,0009 | 1,3385 | 0,0475 |
| **ANTM** | 0,0214 | 0,0039 | -0,0015 | -0,0045 | 0,0475 | 0,4317 |
| **BMRI** | -0,0192 | 0,1119 | 0,0489 | 0,0014 | 1,4259 | 0,0725 |
| **SMGR** | -2,6188 | -3,6581 | 0,2444 | -3,1353 | -1,9363 | -2,3315 |
| **MNCN** | 0,0134 | -0,0070 | -0,0089 | 0,0181 | 0,0113 | -0,0318 |
| **PTBA** | -0,0334 | 0,0271 | 0,1017 | 0,0225 | 0,0463 | 0,0086 |
| **INTP** | -0,0229 | -0,0333 | 0,0044 | 0,0004 | -0,0217 | 0,0015 |
| **BBCA** | 0,0055 | 0,0010 | 0,0009 | 0,0028 | 0,0031 | 0,0024 |
| | **BMRI** | **SMGR** | **MNCN** | **PTBA** | **INTP** | **BBCA** |
| **EXCL** | -0,0191 | -2,6188 | 0,0134 | -0,0334 | -0,0229 | 0,0054 |
| **INKP** | 0,1119 | -3,6581 | -0,007 | 0,0271 | -0,0333 | 0,0010 |
| **INCO** | 0,0489 | 0,2444 | -0,0089 | 0,1017 | 0,0044 | 0,0009 |
| **KLBF** | 0,0013 | -3,1353 | 0,0181 | 0,0225 | 0,0004 | 0,0027 |
| **AKRS** | 1,4259 | -1,9363 | 0,0113 | 0,0463 | -0,0217 | 0,0030 |
| **ANTM** | 0,0725 | -2,3315 | -0,0318 | 0,0086 | 0,0016 | 0,0024 |
| **BMRI** | 1,5347 | -1,0430 | 0,0139 | 0,0530 | -0,0103 | 0,0036 |
| **SMGR** | -1,0430 | 18557,9 | -0,7521 | -4,9658 | 172,38 | 0,6932 |
| **MNCN** | 0,0139 | -0,7521 | 1,3891 | -0,0185 | -0,0021 | 0,0080 |
| **PTBA** | 0,0530 | -4,9658 | -0,0185 | 3,1048 | -0,0413 | 0,0158 |
| **INTP** | -0,0102 | 172,377 | -0,0021 | -0,0413 | 1,6255 | 0,0079 |
| **BBCA** | 0,0036 | 0,6932 | 0,0081 | 0,0158 | 0,0079 | 0,0024 |

Source: Data processed.



**Calculation of Expected Return, Standard Deviation and Excess Return to Beta Of Optimal Portfolio.**

**Table 9. $E(R_i)$, SD, $W_i$, β, and ERB Portfolio**

| Stock | $E(R_i)$ | Sd | $W_i$ | B | Erb |
|---|---|---|---|---|---|
| EXCL | 0,1406 | 1,1498 | 0,0068 | 0,0002 | 3,8221 |
| INKP | 0,0506 | 0,1811 | 0,3031 | 0,1578 | 0,2970 |
| INCO | 0,0087 | 0,1583 | 0,3133 | 0,1925 | 0,2017 |
| KLBF | 0,1378 | 0,0331 | 0,0063 | 0,0067 | 0,1266 |
| AKRA | -0,0494 | 1,1569 | 0,0065 | 0,0121 | 0,0734 |
| ANTM | 0,4535 | 0,6571 | 0,0095 | 0,0102 | 0,0608 |
| BMRI | 0,1485 | 1,2388 | 0,0058 | 0,0144 | 0,0578 |
| SMGR | 18,5212 | 136,2273 | 0,0001 | 0,0252 | 0,0440 |
| MNCN | 0,1426 | 1,1786 | 0,0059 | 0,0195 | 0,0421 |
| PTBA | 0,2066 | 1,7620 | 0,0039 | 0,0193 | 0,0407 |
| INTP | 0,1593 | 1,2749 | 0,0054 | 0,0279 | 0,0300 |
| BBCA | 0,0169 | 0,0492 | 0,1726 | 0,1468 | 0,4008 |
| Portfolio | **1,660 %** | **12,088 %** | **0,069 %** | **0,081 %** | **0,441 %** |

Source: Data processed.

## Prerequisite Evaluations

### Test Normality

Data normality test using kolmogorov-smirnov one-sample test aims to determine the distribution of data on the research variables used whether distributed normally or not. The significance value generated is greater than 0.05 in the distribution of research data can be said to be

normal, but if the value of significance generated is less than 0.05 or 5% means that the data is not distributed normally.

In the test results above the value of return significance,risk and trading volume are less than alpha value (a = 5%), i.e. return of 0.000 < 0.05, risk 0.001 < 0.05, and 0.001 < 0.05 for trading volume, so it can be concluded that data is not distributed normally.

**Table 10. Kolmogorov-SmirnovTest One-Sample Normality Test Results**

| | | Return | Risiko | Volume |
|---|---|---|---|---|
| N | | 30 | 30 | 30 |
| Normal Parameters[a] | Mean | -3.736513 | 4.896627 | 78.784767 |
| | Std. Deviation | 52.6975332 | 8.0427267 | 183.9058219 |
| Most Extreme Differences | Absolute | .437 | .362 | .366 |
| | Positive | .437 | .362 | .366 |
| | Negative | -.431 | -.271 | -.336 |
| Kolmogorov-Smirnov Z | | 2.393 | 1.983 | 2.003 |
| Asymp. Sig. (2-tailed) | | .000 | .001 | .001 |

a. Test distribution is Normal.

**Mann-Whitney Test**.

Hypothetical testing is done by non-parametric test using Mann-Whitneyy Test,because the data used is not distributed normally either return, risk, or for trading volume.

**Table 11. Mann-Whitney Statistical Test**

**Test Statistics[b]**

| | Return | Risiko | Volume |
|---|---|---|---|
| Mann-Whitney U | 18.500 | 30.000 | 107.000 |
| Wilcoxon W | 189.500 | 201.000 | 278.000 |
| Z | -3.789 | -3.302 | -.042 |
| Asymp. Sig. (2-tailed) | .000 | .001 | .966 |
| Exact Sig. [2*(1-tailed Sig.)] | .000[a] | .001[a] | .983[a] |

a. Not corrected for ties.

b. Grouping Variable: Portofolio

## DISCUSSION

Based on the results of the first hypothesis test with a statement there is a difference in the return value of optimal portfolio shares and return of non-portfolio shares are acceptable. The result is indicated by a significant value of 0.000 < 0.05 or a = 5%.

The second hypothesis, indicating optimal portfolio stock risk with optimal non-portfolio stock risk there is also a significant difference which means that this hypothesis is accepted. This result is evidenced by the value of risk significance of 0.001 < 0.05; a = 5%.

Meanwhile, for the test results of the volume of trading, it is seen that between the volume of shares entered into the optimal portfolio and the volume of non-optimal shares is not acceptable. In other words, there is no difference in trading volume between optimal and non-optimal portfolio shares. This result is indicated by a significant value of 0.983 > 0.05; a = 5%.

## CONCLUSION

Return and risk are optimal and non-optimal portfolio differentiators. This indicates that optimal portfolios are formed by stocks that have high returns. While trading volume is not an optimal and non-optimal portfolio differentiator, this indicates that the difference between stocks that become optimal and non-optimal portfolios in this study is not based on trading volume.

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