OPTIMAL PORTFOLIO FORMATION WITH SINGLE INDEX MODEL AND MARKOWITZ FOR COMPANIES LISTED ON SRI-KEHATI

PEMBENTUKAN PORTOFOLIO OPTIMAL DENGAN MODEL INDEKS TUNGGAL DAN MARKOWITZ PADA PERUSAHAAN YANG TERDAFTAR DI BURSA EFEK INDONESIA

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ABSTRACT
This research is a quantitative research that aims to determine the optimal portofolio stock formation in companies listed on the SRI-KEHATI Index consistently with the Single Index Model approach and the Markowitz Model. The samples obtained using the purposive sampling technique are 13 companies with the 2018-2021 period. The data analysis method used in this study is the Shapiro-Wilk Normality test and the Independent Sample t-test. The results showed that the Single Index Model formed 4 stocks, namely BBRI, PGAS, SMGR, and WIKA. Whereas the Markowitz Model produces 5 shares, namely BBNI, BBRI, BMRI, KLBF, and TLKM. The formed portofolio candidates have positive return and risk of optimal stock portofolios but have different results.

Keywords: Single Index Model, Model Markowitz, Optimal Portofolio

INTRODUCTION
Commitment to sacrifice consumption with the aim of increasing consumption in the future is the notion of investment. Another goal of investment is that if the currency experiences a devaluation due to inflation, investment can overcome it (Agustini et al., 2022). Stock investment is one of the high risk investments. Investors can reduce risk by diversifying or investing in more than one stock (forming a portofolio). (Sihaloho, 2021). Before investing in a company, investors should do research first, such as looking at the profits or dividends in the company. According to Yulianto in research (Damayanty et al., 2021) One of the basic decision making for investors is the importance of submitting financial reports in a timely manner.

(NCT Wahyuni & Darmayanti, 2019) stated his opinion that return is a rate of return that will be received by investors for the risk burden borne in an investment that has occurred or is expected to be obtained in the future. Abudanti inside (Halmahera & Oentoeng, 2021) explained his opinion that a portofolio is a collection of several assets selected from various sectors with the aim of minimizing the risks contained in the portofolio. Several methods can be used to calculate the
optimal portofolio, namely the
Markowitz Model and the Single Index
Model (Agustini et al., 2022). William
Sharpe developed a model called the
Single Index Model, this model can be
used to simplify calculations in the
Markowitz Model by simplifying the
input parameters needed in the
Markowitz Model calculations
(Muthohari & Mokoginta, 2019).
Portofolio formation is a process of
combining several asset classes that can
later produce maximum returns with
minimum risk (NCT Wahyuni &
Darmayanti, 2019). Many investors are
confused about choosing a company to
invest in, so a portofolio is formed to
assist investors in choosing a company
and determining the weight of each
security chosen to invest.

The companies used in this study
are companies listed on the SRI-
KEHATI index for the 2018–2021
period. SRI-KEHATI has a high average
return so that it attracts investors to
invest in the company. (Erawati, 2021)
The SRI-KEHATI index is formed from
25 actively traded stocks with
performance considerations in
encouraging sustainable businesses, as
well as environmental, social and good
corporate governance awareness.

Formulation of the problem
The formulation of the problem that
can be described in this study are:
1. How to calculate the optimal
portofolio return and risk level using
the Single Index Model and the
Markowitz Model?
2. How to determine investment options
in the capital market using the Single
Index Model and Markowitz Model
calculation methods?
3. What is the difference between
optimal portofolio return and risk in
the Single Index Model and the
Markowitz Model?

Research purposes
There are objectives in this study,
namely as follows:
1. To find out the calculation of return
and optimal portofolio risk level by
using the Single Index Model and the
Markowitz Model.
2. To find out how to determine the
optimal portofolio stock formation
using the Single Index Model and the
Markowitz Model.
3. To find out the difference between
optimal portofolio return and risk in
the Single Index Model and the
Markowitz Model.

LITERATURE REVIEW AND
HYPOTHESIS DEVELOPMENT
Theoretical review
Investment
According to D. Agus Harjito and
Martono in (Muthohari & Mokoginta,
2019) Investment is the investment of
funds made into an asset (asset) with the
hope of obtaining income in the future.

Portofolio
According to (Agustini et al.,
2022) A portofolio is a collection of
investments that have the goal of
reducing risk by diversification.

Return Portofolio
Stock return according to
Jogiyanto is the result obtained from
investment. According to Irham Fahmi,
expected return is the amount of funds
placed by investors and provides the
expected profit (Muthohari &
Mokoginta, 2019).

Portofolio Risk
The consequences that investors
will get when making an investment are
called risks. Portofolio risk can be
calculated by the magnitude of the
standard deviation or variance of the
return values of single securities in it (NCT Wahyuni & Darmayanti, 2019).

**Optimal Portofolio**

Portofolio formation is closely related to the basic concept of efficient portofolio and optimal portofolio (Agustini et al., 2022). The optimal portofolio can be determined using the Markowitz Model and the Single Index Model.

**Single Index Model**

According to Adiningrum in (Kartika, 2021) Single Index Model is a model used in calculating the return and risk of a portofolio. In general, the relationship between stock returns and market index returns can be stated as follows: (Balkis, 2019).

\[ R_{i} = \alpha_i + \beta_i \cdot R_m + e_i \]

Information:
- \( R_i \) = returnsi-th stock
- \( \alpha_i \) = expected value of stock returns that are independent of market returns
- \( \beta_i \) = beta which is a coefficient that measures changes due to changes \( R_iR_m \)
- \( R_m \) = rate of return from the market index which is also a random variable
- \( e_i \) = residual error

The steps taken to analyze with the calculation of the Single Index Model are as follows:
1. Calculates market value returns and market expected returns.
2. Calculating the alpha and beta values of each stock.
3. Calculate the return value and expected return of each stock.

The formula for calculating the market's expected return value:

\[ E(R_m) = \frac{\sum_{n=1}^{n} R_m}{n} \]

Information:
- \( E(R_m) \) = market expected return
- \( R_m \) = market return
- \( n \) = number of observation periods

2. Calculating the alpha and beta values of each stock.

Beta formula:

\[ \beta_i = \frac{\sigma_{im}}{\sigma_m^2} \]

Information:
- \( \beta_i \) = beta of stock i
- \( \sigma_{im} \) = covariance of returns on the i-th stock with market returns
- \( \sigma_m^2 \) = market return variance

Alpha formula:

\[ \alpha_i = -E(R_i)(\beta_i \times E(R_m)) \]

Information:
- \( \alpha_i \) = stock alpha i
- \( E(R_i) \) = expected return on stock i
- \( \beta_i \) = beta of stock i
- \( E(R_m) \) = market expected return

3. Calculate the return value and expected return of each stock.

The formula for calculating stock returns:

\[ R_i = \alpha_i + \beta_i \cdot R_m \]

Information:
- \( R_i \) = stock return i
- \( \alpha_i \) = expected value of stock returns that are independent of market returns
- \( \beta_i \) = beta which is a coefficient that measures changes due to changes \( R_iR_m \)
- \( R_m \) = rate of return from the market index which is also a random variable

The formula calculates the value of the expected rate of return for each:

\[ E(R_i) = \alpha_i + \beta_i \cdot E(R_m) \]

Information:
E(R_i) = value expected stock returns i
E(R_m) = value expected market returns

4. Calculating the value of investment risk.
σ_i² = β_i²σ_m² + σ_ei²
Information:
σ_ei² = variance unique or unique risk
σ_m² = variance of market returns
σ_i² = variance of return share

5. Calculate excess return to beta.
ERB = (E(R_i) - R_f) / β_i
Information:
E(R_i) = Expected return on stock i
R_f = risk free set (SBI)
β_i = stock beta i

6. Calculate the value and A_i B_i
A_i and the indicators used to calculate the value of C*B_i
Formula A_i :
A_i = \left[ E(R_i) - ERB \right] . β_i
Formula B_i :
B_i = \frac{β_i²}{σ_ei²}

7. Calculating the Cut-off Point value.
C_i = \frac{σ_m² \sum_{i=1}^{n} A_i}{1 + σ_m² \sum_{i=1}^{n} B_i}
Information:
σ_m² = market return variance
σ_ei² = residual error variance

8. Calculating the value (weight or proportion of each share) W_i
The value must be known first Z_i :
Z_i = \frac{β_i (ERβ_i - C*)}{σ_ei²}
Calculating formula W_i :
W_i = \frac{Z_i}{\sum_{j=1}^{K} Z_i}
Information:
W_i = share proportion i
K = the number of shares in the optimal portfolio

9. Calculating the value of portofolio beta and portofolio alpha.
Portofolio beta formula:
β_p = \sum_{i=1}^{n} W_i . β_i
Information:
β_p = weighted average of the beta of each stock.

Portofolio alpha formula :
α_p = \sum_{i=1}^{n} W_i . α_i
Information:
α_i = weighted average of the alpha of each stock
W_i = proportion of shares to – i

10. Determine the value of the portofolio’s expected rate of return.
E(R_p) = α_p + β_p . E(R_m)
Information:
E(R_p) = expected portofolio return rate
α_p = portofolio alpha
β_p = portofolio beta
E(R_m) = expected market returns

11. Determine the risk value of the portofolio.
σ_p² = β_p²σ_m² + \left( \sum_{i=1}^{n} W_i . σ_ei² \right)
Description :
σ_p² = portofolio variance
σ_m² = variance of returns market
σ_ei² = residual error variance

Markowitz Model
Provide a material consideration for investors to deal with risks and provide maximum benefits in every decision investing is the foundation of Markowitz. Harry Markowitz recommends diversifying investments so that investments are far from risk (Dewi & Candradewi, 2020). The steps in forming a portofolio using the Markowitz Model are as follows: (Balkis, 2019).
1. Calculating the return value and expected return of each stock. The formula for the return value of each share:

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

Information:
- \( R_{t(i)} \) = returns stock i
- \( P_{t(i)} \) = closing price of stock i in month t
- \( P_{t-1(i)} \) = closing price of shares i the previous month (t - 1)

Expected return formula for each stock:

\[ E(R_i) = \frac{R_{t(i)}}{n} \]

Information:
- \( E(R_i) \) = expected stock returns i
- \( R_{t(i)} \) = returns stock i
- \( n \) = number of periods

2. Calculating the risk of each stock

\[ SD = \sqrt{\frac{\sum_{i=1}^{n}|R_{it} - E(R_i)|^2}{n - 1}} \]

Information:
- \( SD \) = Standard Deviation
- \( n \) = number of shares

3. Calculating the correlation coefficient between stocks

\[ \rho_{AB} = \frac{n \sum_{i=1}^{n} R_{Ai} R_{Bi} - \sum_{i=1}^{n} R_{Ai} \sum_{i=1}^{n} R_{Bi}}{\sqrt{n \sum_{i=1}^{n} R_{Ai}^2 - (\sum_{i=1}^{n} R_{Ai})^2} \sqrt{n \sum_{i=1}^{n} R_{Bi}^2 - (\sum_{i=1}^{n} R_{Bi})^2}} \]

Information:
- \( \rho_{AB} \) = correlation between stocks A and B
- \( n \) = number of shares

4. Calculating stock covariance

\[ \sigma_{AB} = \sum_{i=1}^{n} (R_{Ai} - E(R_A)) (R_{Bi} - E(R_B)) \]

Information:
- \( \sigma_{AB} \) = covariance between shares A and B
- \( R_{Ai} \) = returns stock A
- \( E(R_A) \) = stock expectation
- \( n \) = number of possible yields on the security/period
- \( pr_i \) = probability of event

5. Calculating the expected return value and risk of a portofolio.

Expected return value formula:

\[ E(R_p) = \sum_{i=1}^{n} W_i E(R_i) \]

Information:
- \( E(R_p) \) = expected return of the portofolio
- \( E(R_i) \) = expected return on stock i
- \( W_i \) = weight of stock i in the portofolio
- \( n \) = number of shares in the portofolio

Portofolio risk formula:

\[ \sigma_p = \sqrt{\sum_{i=1}^{n} \sum_{i=1}^{n} W_i W_j \sigma_{ij}} \]

Information:
- \( \sigma_p \) = portofolio variance
- \( \sigma_{ij} \) = variance of shares i and j
- \( W_i \) = weight of stock i in the portofolio
- \( W_j \) = weight of stock j in the portofolio
- \( n \) = number of shares in the portofolio

**SRI-KEHATI Stock Index**

Referring to the Sustainable and Responsible Investment (SRI) procedures made by the KEHATI Foundation in collaboration with the Indonesian Stock Exchange (IDX). The SRI-KEHATI index consists of 25 company stocks.

**Research Hypothesis**

(S. Wahyuni, 2021) investor must mehave toexpert in medo an analysis to investest can mgenrate toluck seas expected. Then deThat's it for po candidatesstofolioooptimal is chosen which bvalue poppositive if the value is return meshow po resultsitif then investor would meget toprofit from investing stock station tersebut curryna return who diterhimy melebihhi return which are expected.

**Ha : Formation of stocks on the SRI-KEHATI index formed by the Single Index Model and the Markowitz Model will have an**
optimal portfolio with a positive rate of return and risk.

RESEARCH METHODS
Research design

The method used in this research is quantitative. While the data source used is secondary. This research requires data such as companies listed on the SRI-KEHATI Index for 2018-2021 through the IDX, then stock prices at the end of each month. In addition, the Composite Stock Price Index (IHSG), BI-7 Day Reverse Repo Rate (BI7DRR) are obtained through Bank Indonesia (BI) monthly reports with the company's official website, namely www.bi.go.id used to calculate risk-free return on assets.

The sample selection in this study used a purposive sampling technique, namely determining the sample based on certain criteria, as follows: (1) Companies listed on the Indonesia Stock Exchange (IDX); (2) Companies that are actively traded in the 2018-2021 SR-KEHATI Index; (3) Companies that publish complete annual financial reports for the 2018-2021 period; (4) Companies that did not carry out stock splits during the study period, namely 2018-2021.

Measurement

Optimum polytolfolio formation is carried out by using Single Index Moldel and Markowitz Calculations, as follows:

Table 1. Variable Measurement

RESULTS AND DISCUSSION
Research data

Research data used to form the optimal stock polyolfolliol formulation with the Moldel Single Index and Model Markowitz for companies registered on the SRI-KEHATI Index by using Microsoft Excel software and IBM SPSS Statistics 26 software.

Portofolio Formation Single Index Model
Calculating Market Expected Return

Expected Return market turn is calculated find the value of return market first. After that, then expected return can be calculated.

1. Alpha and Beta

The following form a table alpha and beta for each share:

Table 2. Alpha and Beta of Individual Shares

Expected Return Individual Shares

The following is a table of expected returns for each stock:

Table 3. Expected Return of Individual Shares

2. Risk individual

The following is a table of risk individual:

Table 4. Variance and Standard Deviation of Individual Shares

Source: Data processed by the author. 2023
3. Excess Return to Beta

The following is a table of excess return to beta:

<table>
<thead>
<tr>
<th>No</th>
<th>Saham</th>
<th>Vari</th>
<th>$\alpha^2$</th>
<th>No</th>
<th>Saham</th>
<th>Vari</th>
<th>$\alpha^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ASII</td>
<td>0.0000</td>
<td>0.0000</td>
<td>8</td>
<td>KLBF</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>2</td>
<td>BBNI</td>
<td>0.0143</td>
<td>0.0139</td>
<td>9</td>
<td>PGAS</td>
<td>0.0586</td>
<td>0.1635</td>
</tr>
<tr>
<td>3</td>
<td>BBRI</td>
<td>0.0198</td>
<td>0.1039</td>
<td>10</td>
<td>SMI</td>
<td>0.3704</td>
<td>0.7247</td>
</tr>
<tr>
<td>4</td>
<td>BMRI</td>
<td>0.0000</td>
<td>0.0000</td>
<td>11</td>
<td>TLKM</td>
<td>0.0063</td>
<td>0.0000</td>
</tr>
<tr>
<td>5</td>
<td>BSDE</td>
<td>0.0172</td>
<td>0.0135</td>
<td>12</td>
<td>UNTR</td>
<td>0.0895</td>
<td>0.0932</td>
</tr>
<tr>
<td>6</td>
<td>ENDF</td>
<td>0.0042</td>
<td>0.0073</td>
<td>13</td>
<td>WIKA</td>
<td>0.0078</td>
<td>0.0148</td>
</tr>
</tbody>
</table>

Source: Data processed by the author.

2023

4. Cut Off Point

The following is a table of cut off point:

<table>
<thead>
<tr>
<th>No</th>
<th>Saham</th>
<th>Ai</th>
<th>Bi</th>
<th>Ci</th>
<th>C*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ASII</td>
<td>-0.6124</td>
<td>68.0101</td>
<td>-0.0015</td>
<td>0.0000</td>
</tr>
<tr>
<td>2</td>
<td>BBNI</td>
<td>-0.1658</td>
<td>30.5070</td>
<td>-0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>3</td>
<td>BBRI</td>
<td>0.2963</td>
<td>69.4312</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>4</td>
<td>BMRI</td>
<td>-0.7170</td>
<td>93.9117</td>
<td>-0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>5</td>
<td>BSDE</td>
<td>-0.6044</td>
<td>66.5547</td>
<td>-0.0017</td>
<td>0.0000</td>
</tr>
<tr>
<td>6</td>
<td>ENDF</td>
<td>0.3271</td>
<td>-49.7311</td>
<td>0.0014</td>
<td>0.0000</td>
</tr>
<tr>
<td>7</td>
<td>KLBF</td>
<td>-0.4661</td>
<td>67.5016</td>
<td>-0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>8</td>
<td>PGAS</td>
<td>0.0598</td>
<td>69.0283</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>9</td>
<td>SMGR</td>
<td>-0.1960</td>
<td>29.9623</td>
<td>-0.0008</td>
<td>0.0000</td>
</tr>
<tr>
<td>10</td>
<td>TLKM</td>
<td>0.0180</td>
<td>61.5472</td>
<td>0.0003</td>
<td>0.0000</td>
</tr>
<tr>
<td>11</td>
<td>UNTR</td>
<td>0.0409</td>
<td>21.6783</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>12</td>
<td>WIKA</td>
<td>0.1047</td>
<td>43.1609</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Source: Data processed by the author.

2023

5. Proportion Stock Selection

The following is a table of proportion stock selection:

<table>
<thead>
<tr>
<th>No</th>
<th>Saham</th>
<th>$Zi$</th>
<th>$W_{i}$</th>
<th>Proporsi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SMGR</td>
<td>0.0924</td>
<td>0.2095</td>
<td>20.34%</td>
</tr>
<tr>
<td>2</td>
<td>BBRI</td>
<td>0.2332</td>
<td>0.4916</td>
<td>49.12%</td>
</tr>
<tr>
<td>3</td>
<td>PGAS</td>
<td>0.0735</td>
<td>0.1530</td>
<td>15.56%</td>
</tr>
<tr>
<td>4</td>
<td>WIKA</td>
<td>0.0060</td>
<td>0.1438</td>
<td>14.39%</td>
</tr>
</tbody>
</table>

Source: Data processed by the author.

2023

6. Optimal Portofolio Share Proportion of Single Index Model

The following is a table of optimal portofolio share proportion of single index model:

<table>
<thead>
<tr>
<th>No</th>
<th>Saham</th>
<th>Proporsi</th>
<th>Return</th>
<th>Risiko</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SMGR</td>
<td>0.03367</td>
<td>0.3297</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>BBRI</td>
<td>0.00407</td>
<td>0.0076</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>PGAS</td>
<td>0.05127</td>
<td>0.0059</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>WIKA</td>
<td>0.00113</td>
<td>0.0054</td>
<td></td>
</tr>
</tbody>
</table>

Source: Data processed by the author.

2023

Markowitz model

Expected Return of Stock

At the Single Model Index, a number of expected return selection have been determined. The following is a table of expected return after selection:

<table>
<thead>
<tr>
<th>No</th>
<th>Saham</th>
<th>$E(R)$</th>
<th>$E(R)$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BBNI</td>
<td>0.00007</td>
<td>0.01%</td>
</tr>
<tr>
<td>2</td>
<td>BBRI</td>
<td>0.00629</td>
<td>0.83%</td>
</tr>
<tr>
<td>3</td>
<td>BMRI</td>
<td>0.00107</td>
<td>0.11%</td>
</tr>
<tr>
<td>4</td>
<td>KLBF</td>
<td>0.00133</td>
<td>0.13%</td>
</tr>
<tr>
<td>5</td>
<td>PGAS</td>
<td>0.00116</td>
<td>0.82%</td>
</tr>
<tr>
<td>6</td>
<td>SMGR</td>
<td>0.16080</td>
<td>16.08%</td>
</tr>
<tr>
<td>7</td>
<td>TLKM</td>
<td>0.00330</td>
<td>0.03%</td>
</tr>
<tr>
<td>8</td>
<td>WIKA</td>
<td>0.00783</td>
<td>0.78%</td>
</tr>
</tbody>
</table>

Source: Data processed by the author.

2023

Stock Risk

The following is the standard deviation value of each share:

<table>
<thead>
<tr>
<th>No</th>
<th>Saham</th>
<th>$\sigma^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BBNI</td>
<td>12.06%</td>
</tr>
<tr>
<td>2</td>
<td>BBRI</td>
<td>11.04%</td>
</tr>
<tr>
<td>3</td>
<td>BMRI</td>
<td>8.55%</td>
</tr>
<tr>
<td>4</td>
<td>KLBF</td>
<td>6.86%</td>
</tr>
<tr>
<td>5</td>
<td>PGAS</td>
<td>16.50%</td>
</tr>
<tr>
<td>6</td>
<td>SMGR</td>
<td>126.74%</td>
</tr>
<tr>
<td>7</td>
<td>TLKM</td>
<td>8.89%</td>
</tr>
<tr>
<td>8</td>
<td>WIKA</td>
<td>16.63%</td>
</tr>
</tbody>
</table>

Source: Data processed by the author.

2023
1. Stock Correlation

The following is a correlation table between shares:

**Table 11. Correlation table between stocks**

<table>
<thead>
<tr>
<th>BBNI</th>
<th>BBRI</th>
<th>BMRI</th>
<th>KLBF</th>
<th>PGAS</th>
<th>SMGR</th>
<th>TLKM</th>
<th>WIKI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>0.26</td>
<td>0.28</td>
<td>0.04</td>
<td>0.30</td>
<td>0.05</td>
<td>0.19</td>
<td>0.26</td>
</tr>
<tr>
<td>0.26</td>
<td>1.00</td>
<td>0.49</td>
<td>0.15</td>
<td>0.30</td>
<td>0.08</td>
<td>0.19</td>
<td>0.37</td>
</tr>
<tr>
<td>0.30</td>
<td>0.49</td>
<td>1.00</td>
<td>0.23</td>
<td>0.65</td>
<td>0.08</td>
<td>0.24</td>
<td>0.39</td>
</tr>
<tr>
<td>0.04</td>
<td>0.15</td>
<td>0.23</td>
<td>1.00</td>
<td>0.23</td>
<td>0.04</td>
<td>0.31</td>
<td>0.33</td>
</tr>
<tr>
<td>0.30</td>
<td>0.61</td>
<td>0.31</td>
<td>1.00</td>
<td>0.11</td>
<td>0.35</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>0.28</td>
<td>0.08</td>
<td>0.06</td>
<td>-0.04</td>
<td>0.03</td>
<td>1.00</td>
<td>0.04</td>
<td>0.49</td>
</tr>
<tr>
<td>0.09</td>
<td>0.19</td>
<td>0.24</td>
<td>0.31</td>
<td>0.35</td>
<td>0.04</td>
<td>1.00</td>
<td>0.22</td>
</tr>
<tr>
<td>0.26</td>
<td>0.57</td>
<td>0.59</td>
<td>0.33</td>
<td>0.60</td>
<td>-0.04</td>
<td>0.22</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Source: Data processed by the author. 2023

2. Stock Covariance

The following is a table of covariance between shares:

**Table 12. Markowitz Model Covariance**

<table>
<thead>
<tr>
<th>BBNI</th>
<th>BBRI</th>
<th>BMRI</th>
<th>KLBF</th>
<th>PGAS</th>
<th>SMGR</th>
<th>TLKM</th>
<th>WIKI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.094</td>
<td>0.054</td>
<td>0.037</td>
<td>0.003</td>
<td>0.009</td>
<td>0.012</td>
<td>0.006</td>
<td>0.002</td>
</tr>
<tr>
<td>0.054</td>
<td>0.004</td>
<td>0.004</td>
<td>0.011</td>
<td>0.001</td>
<td>0.004</td>
<td>0.004</td>
<td>0.019</td>
</tr>
<tr>
<td>0.037</td>
<td>0.044</td>
<td>0.070</td>
<td>0.003</td>
<td>0.082</td>
<td>0.079</td>
<td>0.014</td>
<td>0.080</td>
</tr>
<tr>
<td>0.002</td>
<td>0.011</td>
<td>0.003</td>
<td>0.047</td>
<td>0.033</td>
<td>0.004</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>0.029</td>
<td>0.005</td>
<td>0.002</td>
<td>0.035</td>
<td>0.072</td>
<td>0.018</td>
<td>0.009</td>
<td>0.016</td>
</tr>
<tr>
<td>0.016</td>
<td>0.006</td>
<td>0.009</td>
<td>-0.003</td>
<td>0.018</td>
<td>1.064</td>
<td>0.055</td>
<td>0.098</td>
</tr>
<tr>
<td>0.008</td>
<td>0.001</td>
<td>0.001</td>
<td>0.039</td>
<td>0.003</td>
<td>0.007</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td>0.003</td>
<td>0.010</td>
<td>0.009</td>
<td>0.004</td>
<td>0.016</td>
<td>0.008</td>
<td>0.005</td>
<td></td>
</tr>
</tbody>
</table>

Source: Data processed by the author. 2023

3. Share Proportion

The following is a table of the share proportion of Model Markowitz:

**Table 13. Markowitz Model Share Proportions**

<table>
<thead>
<tr>
<th>No</th>
<th>Saham</th>
<th>Proporsi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BBNI</td>
<td>9.72%</td>
</tr>
<tr>
<td>2</td>
<td>BBRI</td>
<td>5.51%</td>
</tr>
<tr>
<td>3</td>
<td>BMRI</td>
<td>13.56%</td>
</tr>
<tr>
<td>4</td>
<td>KLBF</td>
<td>36.73%</td>
</tr>
<tr>
<td>5</td>
<td>PGAS</td>
<td>0.00%</td>
</tr>
<tr>
<td>6</td>
<td>SMGR</td>
<td>0.00%</td>
</tr>
<tr>
<td>7</td>
<td>TLKM</td>
<td>34.48%</td>
</tr>
<tr>
<td>8</td>
<td>WIKI</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

Source: Data processed by the author. 2023

4. Optimal Portfolio

The table below shows the optimal portfolio yield using Model Markowitz:

**Table 14. The Markowitz Model Optimal Portfolio**

<table>
<thead>
<tr>
<th>No</th>
<th>Saham</th>
<th>Proporsi</th>
<th>Return</th>
<th>Risiko</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BBNI</td>
<td>9.72%</td>
<td>0.0001</td>
<td>0.0015</td>
</tr>
<tr>
<td>2</td>
<td>BBRI</td>
<td>5.51%</td>
<td>0.00046</td>
<td>0.00085</td>
</tr>
<tr>
<td>3</td>
<td>BMRI</td>
<td>13.56%</td>
<td>0.00015</td>
<td>0.000134</td>
</tr>
<tr>
<td>4</td>
<td>KLBF</td>
<td>36.73%</td>
<td>0.00049</td>
<td>0.00188</td>
</tr>
<tr>
<td>5</td>
<td>TLKM</td>
<td>34.48%</td>
<td>0.00001</td>
<td>0.00184</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100%</td>
<td>0.0012</td>
<td>0.0075 = 0.12%</td>
</tr>
</tbody>
</table>

Source: Data processed by the author. 2023

**Data Analysis Using SPPS V. 26**

Test Independent Sample t-test

**Table 15. Test results Independent Sample t-test**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>t</th>
<th>df</th>
<th>Sig.</th>
<th>Std. Err.</th>
<th>95% Confidence Interval of the Difference</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indeks</td>
<td>5.707</td>
<td>109.000</td>
<td>0.009</td>
<td>0.017</td>
<td>0.013</td>
<td>0.023</td>
<td></td>
</tr>
<tr>
<td>Tunggal</td>
<td>7.943</td>
<td>4.946</td>
<td>0.001</td>
<td>0.005</td>
<td>0.003</td>
<td>0.007</td>
<td></td>
</tr>
<tr>
<td>Indeks</td>
<td>6.837</td>
<td>109.000</td>
<td>0.009</td>
<td>0.015</td>
<td>0.013</td>
<td>0.018</td>
<td></td>
</tr>
<tr>
<td>Tunggal</td>
<td>9.282</td>
<td>4.526</td>
<td>0.008</td>
<td>0.004</td>
<td>0.006</td>
<td>0.008</td>
<td></td>
</tr>
</tbody>
</table>

Source: Data processed by the author. 2023

**Discussion**

The hypotheses test showed that the return and risk formed by the Single Index Model and Model Markowitz were positive. In this study, Model Single Index formed optimal portfolio which resulted in 4 stocks with optimal returns of 4.01% with optimal returns of 34.87%, while Model Markowitz formed 5 stocks with optimal returns of 4.01%
with optimal returns of 0.12% and 0.75% greater risk.

The difference in optimal return formed by Model Single Index with Model Markowitz and optimal risk formed by Model Single Index with Model Markowitz using the Independent Sample t-test test shows that there is a difference in returns and there is a difference in risk because it has a value of Sig. (2-tailed) smaller than 0.005. Consistent with research conducted by (Sugiarni et al., 2021) which states that there is a difference in the return and risk of portfolio using the Model Markowitz and the Single Index Model has a difference.

The difference between each Model is in the Single Index Model, the optimal stock polarity formation is based on the ERB value and the cut-off value which takes into account the presence of a risk-free asset value, whereas in the Markowitz Portofolio formation is based on the covariance between shares. Each model has advantages and disadvantages that can be considered by investors. The choice of model for optimal portofolio formation can be adjusted with the preference of investors (Balkis, 2019).

CONCLUSION
1. The SRI-KEHATI index shares that form an optimal portfolio using the Single Model Index and the Model Markowitz are:
   a. There are four stocks that form optimal portofolio by using a single Model Index, namely BBRI, PGAS, SMGR, and WIKA.
   b. There are five stocks that form optimal portofolio by using Model Markowitz, namely BBNI, BBRI, BMRI, KLBF, TLKM.
2. Return and the risk of portofolio produced by optimal portofolio by using Single Index Model and Markowitz Model are:
   a. Single Index Model yield a portofolio yield of 4.01% with a risk of 34.87%.
   b. Model Markowitz produces a 0.12% portofolio return with a 0.75% seldom in risk
3. The results of this research show that the return and risk of the optimal stock portofolio are positive.
4. There are differences in return and risk of the optimal stock portofolio formed by the Single Index Model and the Markowitz Model.
5. In this study, the Single Index Model produces a higher potential return. This shows that stocks that form an optimal portfolio using the Single Index Model are stocks that have optimal return potential. However, if investors want to face smaller risks, investors can use the Markowitz Model.

The suggestions that can be given are this research only uses two optimal portofolio formation models, for further research you can use optimal portofolio formation models such as Constant Corelletion Model, Double Index Model, as well as other models. In addition, other indices can be used, and this research can be used by investors as a consideration in making decisions.

REFERENCE


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