COSTING:Journal of Economic, Business and Accounting
Volume 7 Nomor 4, Tahun 2024
e-ISSN : 2597-5234

OPTIMAL PORTOFOLIO 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*

ABSTRAK

Penelitian ini merupakan penelitian kuantitatif yang bertujuan untuk mengetahui pembentukan portofolio saham yang optimal pada perusahaan yang terdaftar di Indeks SRI-KEHATI secara konsisten dengan pendekatan Model Indeks Tunggal dan Model Markowitz. Sampel yang diperoleh dengan menggunakan teknik purposive sampling sebanyak 13 perusahaan dengan periode 2018-2021. Metode analisis data yang digunakan dalam penelitian ini adalah uji Normalitas Shapiro-Wilk dan Independent Sample t-test. Hasil penelitian menunjukkan bahwa Model Indeks Tunggal membentuk 4 saham, yaitu BBRI, PGAS, SMGR, dan WIKA. Sedangkan Model Markowitz menghasilkan 5 saham, yaitu BBNI, BBRI, BMRI, KLBF, dan TLKM. Kandidat portofolio yang terbentuk memiliki return dan risiko yang positif terhadap portofolio saham optimal namun memiliki hasil yang berbeda.

Kata Kunci: Model Indeks Tunggal, Model Markowitz, Portofolio Optimal

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

Theoritical 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 Modelis 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).

$R_i = \alpha_i + \beta_i . R_m + e_i$

Information :

R_i =*returns*i-th stock

α_i = expected value of stock returns that are independent of market returns

β_i = beta which is a coefficient that measures changes due to changes$R_i R_m$

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.

The formula for calculating market value returns:

$$R_{m,t} = \frac{IHSG_t - IHSG_{t-1}}{IHSG_{t-1}}$$

Information :

$R_{m,t}$ = t-year market return

$IHSG_t$ = Composite Stock Price Index t-year

$IHSG_{t-1}$ = Composite Stock Price Index t-year or the previous year

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 :

β_i = beta of stock i

σ_{iM} = covariance of returns on the i-th stock withmarket returns

${\sigma_M}^2$= market return variance

Alpha formula:

α_i= -$E(R_i)(\beta_i$ x $E(R_m))$

Information :

α_i = stock alpha i

$E(R_i)$= expected return on stock i

β_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:

$R_i=\alpha_i + \beta_i . R_m$

Information :

R_i= stock return i

α_i= expected value of stock returns that are independent of market returns

β_i= beta which is a coefficient that measures changes due to changes$R_i R_m$

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:

$E(R_i)=\alpha_i + \beta_i . E(R_m)$

Information :

$E(R_i)$ = value*expected*stock returns i
$E(R_m)$= value*expected*market returns

4. Calculating the value of investment risk.

$$\sigma_i^2 = \beta_i^2 . \sigma_m^2 + \sigma_{ei}^2$$

Information :
σ_{ei}^2 = variancese_ior unique risk
σ_m^2=variance of market returns
σ_i^2 = variance of*returns*share

5. Calculate excess return to beta.

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

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 :

$$A_i = \frac{[E(R_i) - ERB_i] . \beta_i}{{\sigma_{ei}}^2}$$

Formula B_i :

$$B_i = \frac{{\beta_i}^2}{{\sigma_{ei}}^2}$$

7. Calculating the Cut-off Point value.

$$C_i = \frac{{\sigma_m}^2 \sum_{i=1}^{n} A_i}{1 + {\sigma_m}^2 \sum_{i=1}^{n} B_i}$$

Information :
${\sigma_m}^2$ =market return variance

8. Calculating the value (weight or proportion of each share).W_i

The value must be known first Z_i :

$$Z_i = \frac{\beta_i \, (ER\beta_i - C^*)}{{\sigma_{ei}}^2}$$

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 portofolio

9. Calculating the value of portofolio beta and portofolio alpha.

Portofolio beta formula:

$$\beta_\rho = \sum_{i=1}^{n} W_i \, . \, \beta_i$$

Information :
β_ρ= weighted average of the beta of each stock.

Alpha portofolio formula:

$$\alpha_\rho = \sum_{i=1}^{n} W_i \, . \, \alpha_i$$

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.

$$E(R_p) = \alpha_p + \beta_p \, . E(R_m)$$

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.

$$\sigma_p^2 = \beta_p^2 \, . \sigma_m^2 + (\sum_{i=1}^{n} W_i \, . {\sigma_{ei}}^2)$$

Description :
σ_p^2= portofolio variance
σ_m^2= variance of*returns*market
σ_{ei}= residual error variance

Markowitz Model

Provide a material consideration for investors to deal with risks and provide maximum benefits in every decisioninvesting is the foundation of Markowitz. Harry Harkowitz 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:

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

Information :

$E(Ri)$=*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

3. Calculating the correlation coefficient between stocks

$$\rho_{AB} = \frac{n\sum_{i=1}^{n} R_A R_B - \sum_{i=1}^{n} R_A \sum_{i=1}^{n} R_B}{\sqrt{n\sum_{i=1}^{n} R_A^2 - (\sum_{i=1}^{n} R_A)^2}\ \sum_{i=1}^{n} R_B^2 - (\sum_{i=1}^{n} R_B)^2}$$

Information :

ρ_{AB} = correlation between stocks A and B

n = number of shares

4. Calculating stock covariance

$$\sigma_{AB} = \sum_{i=1}^{n} [R_{A,i} - E(R_A)]\,[R_{B,i} - E(R_B)]pr_i$$

Information :

σ_{AB} = covariance between shares A and B

$R_{A,i}$=*returns*A stock

$E(R_A)$ =*returns*A stock expectation

n= the number of possible yields on the securitycertain period

pr_i= probability of event*returns*i.e

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 :

σ_p = portofolio variance

σ_{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 investation can megenerate toluck seas expected. Then deThat's it for po candidatesrtofolioooptimal is chosen which bervalue popositive if the value is re*turn* meshow po resultssitif then investor would meget toprofit from investingstock station tersebut curryna re*turn*who diterhyme melebihi re*turn*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 portofolio 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, namelywww.bi.go.idused 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

Variabel	Definisi	Keterangan	Pengukuran
Model Indeks Tunggal	Model Indeks Tunggal yaitu adanya korelasi antara tingkat pengembalian saham dengan tingkat pengembalian pasar. Elton JE G. M dalam (Agustini et al., 2022)	*Return* Saham	$Ri = \alpha_i + \beta_i . R_m + e_i$
Model Markowitz	Model Marmowitz atau mean-variance model yaitu *mean* artinya *return* ekspektasi yang banyak dihitung dengan rata-rata dan variance adalah pengukur risiko yang digunakan (Agustini et al., 2022)	*Return* Saham	$R_{i(t)} = \frac{P_{i(t)} - P_{i-1(t)}}{P_{i-1(t)}}$
		Return Ekspektasi Saham	$E(Ri) = \frac{R_{i(t)}}{n}$
		Standar Deviasi	$SD = \sqrt{\frac{\sum_{i=1}^{n}[R_{it} - E(R_i)]^2}{n-1}}$
		Korelasi Saham A dan B	$\rho_{AB} = \frac{n\sum_{i=1}^{n} R_A R_B - \sum_{i=1}^{n} R_A \sum_{i=1}^{n} R_B}{\sqrt{n\sum_{i=1}^{n} R_A^2 - (\sum_{i=1}^{n} R_A)^2}\ \sqrt{\sum_{i=1}^{n} R_B^2 - (\sum_{i=1}^{n} R_B)^2}}$
		Kovarian Saham A dan B	$\sigma_{AB} = \sum_{i=1}^{n}[R_{A,i} - E(R_A)]\,[R_{B,i} - E(R_B)]\,pr_i$
		Return Ekspektasi Portofolio	$E(R_p) = \sum_{i=1}^{n} W_i E(R_i)$
		Varians Portofolio	$\sigma_p = \sqrt{\sum_{i=1}^{n}\sum_{i=1}^{n} W_i W_j \sigma_{ij}}$

Source: Data processed by the author. 2023

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 Elxcel 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

No.	Saham	α	β	No.	Saham	α	β
1	ASII	-0,00573	0,83766	8	KLBF	0,00038	0,39146
2	BBNI	-0,00162	0,69512	9	PGAS	0,00360	1,86959
3	BBRI	0,00576	1,03726	10	SMGR	0,15886	0,79297
4	BMRI	-0,00128	0,96320	11	TLKM	-0,00083	0,46102
5	BSDE	-0,00806	1,14265	12	UNTR	-0,00624	0,47489
6	INDF	-0,00291	0,51846	13	WIKA	0,00349	1,77866
7	JSMR	-0,00587	1,03753				

Source: Data processed by the author, 2023

*Expected Return*Individual Shares

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

Table 3. Expected Return of Individual Shares

No.	Saham	E(R)	E(R) (%)	No.	Saham	E(R)	E(R) (%)
1	ASII	-0,00369	-0,37%	8	KLBF	0,00133	0,13%
2	BBNI	0,00007	0,01%	9	PGAS	0,00816	0,82%
3	BBRI	0,00829	0,83%	10	SMGR	0,16080	16,08%
4	BMRI	0,00107	0,11%	11	TLKM	0,00030	0,03%
5	BSDE	-0,00528	-0,53%	12	UNTR	-0,00508	-0,51%
6	INDF	-0,00164	-0,16%	13	WIKA	0,00783	0,78%
7	JSMR	-0,00334	-0,33%				

Source: Data processed by the author. 2023

2. Risk individual

The following is a table of risk individual :

Table 4. Variance and Standard Deviation of Individual Shares

No.	Saham	Varian	σ^2	No.	Saham	Varian	σ^2
1	ASII	0,00800	0,08946	8	KLBF	0,00461	0,06789
2	BBNI	0,01425	0,11935	9	PGAS	0,02665	0,16326
3	BBRI	0,01194	0,10929	10	SMGR	1,57294	1,25417
4	BMRI	0,00682	0,08258	11	TLKM	0,00463	0,06807
5	BSDE	0,01072	0,10355	12	UNTR	0,00966	0,09829
6	INDF	0,00452	0,06723	13	WIKA	0,02708	0,16456
7	JSMR	0,01240	0,11134				

Source: Data processed by the author. 2023

3. Excess Return to Beta

The following is a table of excess return to beta :

Table 5. Expected Return to Beta

No.	Saham	ERB	No.	Saham	ERB
1	ASII	-0,00900	8	KLBF	-0,00644
2	BBNI	-0,00544	9	PGAS	0,00230
3	BBRI	0,00427	10	SMGR	0,19791
4	BMRI	-0,00289	11	TLKM	-0,00771
5	BSDE	-0,00799	12	UNTR	-0,01882
6	INDF	-0,01061	13	WIKA	0,00223
7	JSMR	-0,00693			

Source: Data processed by the author. 2023

4. Cut Off Point

The following is a table of cut off point :

Table 6. Ai, Bi, Ci, and C* values

No	Saham	Ai	Bi	Ci	C*
1	ASII	-0,61244	68,01601	-0,00165	0,00080
2	BBNI	-0,16588	30,50706	-0,00050	0,00080
3	BBRI	0,29680	69,45121	**0,00080**	0,00080
4	BMRI	-0,27140	93,91771	-0,00068	0,00080
5	BSDE	-0,69441	86,88476	-0,00178	0,00080
6	INDF	-0,52731	49,72171	-0,00149	0,00080
7	JSMR	-0,46810	67,51019	-0,00126	0,00080
8	KLBF	-0,19300	29,96232	-0,00058	0,00080
9	PGAS	0,21080	91,55472	0,00053	0,00080
10	SMGR	0,07902	0,39924	0,00026	0,00080
11	TLKM	-0,30736	39,84673	-0,00090	0,00080
12	UNTR	-0,40793	21,67383	-0,00126	0,00080
13	WIKA	0,18847	84,33619	0,00049	0,00080

Source: Data processed by the author. 2023

5. Proportion Stock Selection

The following is a table of proportion stock selection :

Table 7. Stock Selection based on ERB and C* Value

No	Saham	Zi	Wi	Proporsi
1	SMGR	0,09924	0,20936	20,94%
2	BBRI	0,23282	0,49116	49,12%
3	PGAS	0,07376	0,15560	15,56%
4	WIKA	0,06820	0,14388	14,39%

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 8. Optimal Portofolio Share Proportion of Single Index Model

No	Saham	Proporsi	*Return*	Risiko
1	SMGR	20,94%	0,03367	0,32975
2	BBRI	49,12%	0,00407	0,00761
3	PGAS	15,56%	0,00127	0,00594
4	WIKA	14,39%	0,00113	0,00540
	Σ		**0,04014**	**0,34870**

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 9. Expected Return of Individual Shares After Selection

No	Saham	E(R)	E (R) (%)
1	BBNI	0,00007	0,01%
2	BBRI	0,00829	0,83%
3	BMRI	0,00107	0,11%
4	KLBF	0,00133	0,13%
5	PGAS	0,00816	0,82%
6	SMGR	0,16080	16,08%
7	TLKM	0,00030	0,03%
8	WIKA	0,00783	0,78%

Source: Data processed by the author. 2023

Stock Risk

The following is the standard deviation value of each share:

Table 10. Markowitz Model Individual Standard Deviation

No	Saham	σ^2
1	BBNI	12,06%
2	BBRI	11,04%
3	BMRI	8,35%
4	KLBF	6,86%
5	PGAS	16,50%
6	SMGR	126,74%
7	TLKM	6,88%
8	WIKA	16,63%

Source: Data processed by the author. 2023

1. Stock Correlation

The following is a correlation table between shares:

Table 11. Correlation table between stocks

	BBNI	BBRI	BMRI	KLBF	PGAS	SMGR	TLKM	WIKA
BBNI	1,00	0,26	0,38	0,04	0,30	0,08	0,09	0,26
BBRI	0,26	1,00	0,49	0,15	0,30	0,08	0,19	0,57
BMRI	0,38	0,49	1,00	0,23	0,61	0,08	0,24	0,59
KLBF	0,04	0,15	0,23	1,00	0,31	-0,04	0,31	0,33
PGAS	0,30	0,30	0,61	0,31	1,00	0,01	0,35	0,60
SMGR	0,08	0,08	0,08	-0,04	0,01	1,00	0,04	-0,04
TLKM	0,09	0,19	0,24	0,31	0,35	0,04	1,00	0,22
WIKA	0,26	0,57	0,59	0,33	0,60	-0,04	0,22	1,00

Source: Data processed by the author. 2023

2. Stock Covariance

The following is a table of covariance between shares:

Table 12. Markowitz Model Covariance

	BBNI	BBRI	BMRI	KLBF	PGAS	SMGR	TLKM	WIKA
BBNI	0,0145	0,0034	0,0037	0,0003	0,0059	0,0120	0,0008	0,0052
BBRI	0,0034	0,0122	0,0044	0,0011	0,0054	0,0106	0,0014	0,0103
BMRI	0,0037	0,0044	0,0070	0,0013	0,0082	0,0079	0,0014	0,0080
KLBF	0,0003	0,0011	0,0013	0,0047	0,0035	-0,0033	0,0014	0,0036
PGAS	0,0059	0,0054	0,0082	0,0035	0,0272	0,0018	0,0039	0,0161
SMGR	0,0120	0,0106	0,0079	-0,0033	0,0018	1,6064	0,0035	-0,0088
TLKM	0,0008	0,0014	0,0014	0,0014	0,0039	0,0035	0,0047	0,0025
WIKA	0,0052	0,0103	0,0080	0,0036	0,0161	-0,0088	0,0025	0,0277

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

No	Saham	Proporsi
1	BBNI	9,72%
2	BBRI	5,51%
3	BMRI	13,56%
4	KLBF	36,73%
5	PGAS	0,00%
6	SMGR	0,00%
7	TLKM	34,48%
8	WIKA	0,00%
Exp. Return		**0,12%**
St. Deviasi		**0,75%**

Source: Data processed by the author. 2023

4. Optimal Portofolio

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

Table 14. The Markowitz Model Optimal Portofolio

No	Saham	Proporsi	*Return*	Risiko
1	BBNI	9,72%	0,00001	0,00154
2	BBRI	5,51%	0,00046	0,00085
3	BMRI	13,56%	0,00015	0,00134
4	KLBF	36,73%	0,00049	0,00188
5	TLKM	34,48%	0,0001	0,00184
Total		100%	0,0012 = 0,12%	0,0075 = 0,75%

Source: Data processed by the author. 2023

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Test Independent Sample t-test

Table 15. Test results Independent Sample t-test

Independent Samples Test

		t-test for Equality of Means						
				Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
	MODEL	t	df				Lower	Upper
RETURN	INDEKS TUNGGAL	5,707	5	,002	,00096	,00017	,00053	,00139
	MARKOWITZ	7,963	4,464	,001	,00096	,00012	,00064	,00128
RISIKO	INDEKS TUNGGAL	8,827	6	,000	,00483	,00055	,00349	,00616
	MARKOWITZ	6,982	2,326	,013	,00483	,00069	,00222	,00744

Source: Data processed by the author. 2023

Discussion

The hypotheses test showed that the return and risk formed by the Single Index Moldel and Model Markowitz were positive. In this study, Model Single Index formed optimal portofolio 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-taileld) smaller than 0.005. Consystem with research conducted by (Sugiarni elt al., 2021) which states that there is a difference in the return and risk of portofolio 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, where as 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 portofolio 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 Indelx Model and Markowitz Model are:
   a. Single Index Model yield a portofolio yield of 4.01% with a risk of 34.87%.
   b. Moldel 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 portofolio 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 Corelation Model, Double Indext 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.

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