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Single Index Model Analysis for Optimum Portfolio in Pharmaceutical Companies Registered in Indonesia Stock Exchange

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ABSTRACT. Investment is an interesting thing to analyze during the Corona Virus Disease (COVID-19) pandemic because at this time the economy is experiencing a decline so specifically for investors, they must consider the level of risk in their shares. The purpose of this study is to determine the condition of Consumer Goods Industry stocks with a concentration of pharmaceutical companies that can form an optimal portfolio and to determine the proportion of each selected stock and the level of return and risk of the resulting portfolio. The method that used is Single Index Model approach. The results of the analysis show that using the Single Index Model, Consumer Goods Industry stocks with a concentration of pharmaceutical companies from December 2016 to November 2020 can form an optimal portfolio consisting of SIDO with a proportion of 26.10%, PYFA with a proportion of 23 , 02%, DVLA with a proportion of 50.89% and a portfolio expected return of 5.79% and a risk of 6.95%.

Keyword: consumer good industry; single index model; optimum portfolio

INTRODUCTION

Investing in the capital market has a high risk. To reduce risk, investors can analyze the company's financial health through financial reports as well as analyze stock values and calculate stock returns from previous years. Compiling a portfolio can also be an alternative to reduce risk through stock diversification. In compiling a stock portfolio, the analysis carried out by investors needs to be more thorough and in-depth so that investors need to carry out a portfolio analysis. Portfolio analysis will assist investors in making decisions to determine which portfolio is the most efficient that has the highest expected rate of return with the least risk.

The author tries to analyze stock portfolios in one of the industries listed on the Indonesia Stock Exchange, namely the Consumer Goods Industry with a concentration of pharmaceutical companies. This industry was chosen because companies engaged in the pharmaceutical industry are currently experiencing very significant developments related to the Covid-19 pandemic. The Corona Virus Disease (COVID-19) pandemic has resulted in increased consumption of medicines and the use of vitamins. Thus, this study will reveal the expected rate of return in the pharmaceutical industry and also determine the best portfolio structure. In this study the authors limit the problem to the formation of 9 securities portfolios from the consumer good industry sector with a concentration of pharmaceutical companies on the Indonesia Stock Exchange. The data used is data on monthly share price movements of 9 securities from December 2016 to November 2020.

The model used in this research is the Markowitz model. Markowitz model tries to maximize portfolio expected return for a given amount of portfolio risk, or homogeneously minimize risk for a given level of expected return, with the correct proportions of various securities. This model presumes that investors are rational and markets are efficient, tends to illustrate an asset's return as a normally distributed random variable, identifies risk as the standard deviation of return, and demonstrates a portfolio. By combining different assets whose returns are not perfectly positively correlated, modern portfolio theory seeks to reduce the total variance of the portfolio return. This model looks for reduction of the total variance of the portfolio return, by combining different assets whose returns are not perfectly positively (Markowitz, 1952). Calculations were performed using the Single Index Model. The purpose of this study is to determine the expected average level of return and risk of each security and to provide an overview of the most efficient portfolios.

METHODS

This study aims is to determine which stocks are eligible to be included in the formation of an optimal portfolio using the Single Index Model on consumer good industry stocks with a concentration of pharmaceutical companies from December 2016 to November 2020 on the Indonesia Stock Exchange.

The data used in this study is secondary data in the form of stock prices of companies listed in the consumer good industry with a concentration of pharmaceutical companies on the Indonesia Stock Exchange. Secondary data is data that is not collected and is not processed independently but is obtained through other people, from companies, or institutions related to research. For example, the Indonesia Stock Exchange can be accessed through www.idx.co.id.

The population used in this study were shares of pharmaceutical companies that were included in the consumer good industry from December 2016 to November 2020, namely 12 companies. The sample in this study were 9 companies obtained using purposive sampling method with the criteria of consumer good industry stocks with a concentration of pharmaceutical companies that always appeared consecutively during the observation period December 2016 to November 2020.
The data method used in this study is the non-behavioral observation method, namely observations made without involving oneself and only as independent observations. Data is collected from the the official website of the Indonesia Stock Exchange (IDX), namely www.idx.co.id.
The variable that used in this study consists of:

Stock Return

Stock return is the rate of return obtained from the amount of investment in stocks and can be calculated using a formula (Jogiyanto, 2014 : 265)

$$\boldsymbol{Ri = \frac{(Pt - Pt - 1)}{Pt - 1}}$$

Ri : Return from stock i
Pt : Price in t period
Pt-1 : Prices in the previous period

Market Return

Market return is the rate of return obtained from investing in all shares on the stock exchange where the shares are reflected in the Composite Stock Price Index (IHGS) (Jogiyanto, 2014: 408):

$$\boldsymbol{Rm = \frac{(It - It - 1)}{It - 1}}$$

Rm : Market Return
It : Observation period market index
It-1 : Market index in the previous period

Expected Stock Return

Expected Return is the return that investors expect to be able to generate by the investment they make, calculated by the formula (Zubir, 2011: 5).

$$\boldsymbol{E(Ri) = \frac{\sum_{t-1}^{n} Rit}{n}}$$

E(Ri) : Expected Return stock i
Rit : Return stock i
n : Total observation

Market Expected Return

Market expected return is the return expected by investors to be generated by the market and can be calculated using the formula (Jogiyanto, 2014: 409)

$$\boldsymbol{E(Rm) = \frac{\sum_{t=1}^{n} Rmt}{n}}$$

E(Rm) : Market Expected Return
Rmt : Market return on t period
n : Total observation

Market Risk

Market risk is the difference between the expected market return and the market return and can be calculated using the formula (Sari, 2010)

$$\sigma m^2 = \sum_{t=1}^{n} = 1 \frac{[Rmt - E(Rm)]^2}{n}$$

σm^2 : Market Return Variance
Rmt : Market return on t period
E(Rm) : Market Expected Return
n : Total observation

Beta

Beta is a coefficient that measures the effect of market returns on changes that occur in stock returns. Beta can be calculated by first calculating the covariance between market returns and stock returns using the formula (Jogiyanto, 2014: 452)

$$\sigma im = \sum_{i=1}^{n} [Ri - E(Ri)][Rm - E(Rm)]$$

σim : Covariance between stock i return and market return
Ri : Return stock i
E(Ri) : Expected Return Stock i
Rm : Market Return
E(Rm) : Expected Market Return

Alpa

Alpha is a variable that is not influenced by return and can be calculated with the formula (Bodie et.al, 2002: 295)**:**

$$ai = E(Ri) - \beta i.E(Rm)$$

ai : Stock *i* alpha
(Rm) : Market Expected Return
Rm : Market Return

The variance of the residual error

The variance of the residual error is a variable that shows the presence of unsystematic risks that occur within the company and can be calculated using the formula (Bodie et.al, 2002: 295):

$$\sigma ei^2 = \sigma i^2 - \beta i^2 \beta i.\sigma m^2)$$

σei^2 : The variance of the residual error
σi^2 : Variance Return stock *i*
βi : Stock *i* beta
σm^2 : Market Return Variance

Excess Return to Beta (ERB)

The level of Excess Return to Beta (ERB) can be calculated with the formula (Jogiyanto, 2014: 430):

$$\boldsymbol{ERBi} = \frac{\boldsymbol{E(Ri) - Rbr}}{\boldsymbol{\beta i}}$$

ERBi : Excess Return to Beta stock i
E(Ri) : Expected Return stock i
Rbr : Return of stock assets i
βi : Stock i beta

Cut off rate (Ci)

Cut off Rate (Ci) is the limiting point used to determine whether a stock can be included in the portfolio or not. The selected stocks are with CI ≤ ERb. Before calculating Ci, you must calculate Ai and Bi with the formula (Jogiyanto, 2014: 431):

$$\boldsymbol{Ai} = \frac{\boldsymbol{[E(Ri) - Rbr]\beta i}}{\boldsymbol{\sigma ei^2}}$$

E(Ri) : Expected Return Stock i
Rbr : Return of stock assets i
βi : Beta stock i
σei^2 : The variance of the residual error

$$\boldsymbol{Bi} = \frac{\boldsymbol{\beta i^2 \beta i}}{\boldsymbol{\sigma ei^2}}$$

βi : Beta stock i
σei^2 : The variance of the residual error

After obtaining the values of Ai and Bi, then Ci can be calculated using the formula (Jogiyanto, 2014: 431):
Calculating the amount of the proportion of funds is done after the portfolio is formed, calculated by the formula (Jogianto, 2014: 434):

$$\boldsymbol{Zi} = \frac{\boldsymbol{\beta i^2}}{\boldsymbol{\sigma ei^2}}\boldsymbol{(ERBi - C*)}$$

Wi : Proportion of shares to i
k : the number of shares in the portfolio
βi : Stock i beta
σei^2 : The variance of the residual error
ERBi : Excess Return to Beta stock i
C* : Cut off Points, which is the largest Ci value

Expected Return Portfolio

Portfolio Expected Return can be calculated with the formula (Jogiyanto, 2014: 424):

$$\boldsymbol{E(Rp) = \alpha p + \beta p . E(Rm)}$$

E(Rp) : Portfolio Expected Return
αp : the weighted average of negligence per security
βp : the weighted average of the beta of each security
(Rm) : Market Expected Return

$$\boldsymbol{ap} = \sum_{\boldsymbol{t=1}}^{\boldsymbol{n}} \boldsymbol{Wi . ai}$$

$$\boldsymbol{Bp = \sum_{t=1}^{n} Wi.ai}$$

Meanwhile, risk can be calculated by (Kewal 2013)

σp^2 : Portfolio Variance

$\beta p.\sigma m^2$: Market related risk

$Wi^2.\sigma ei^2$: weighted average of each firm's unsystematic risk

$$\boldsymbol{\sigma p^2 = \beta p.\sigma m^2(\sum_{t=1}^{n} Wi^2.\sigma ei^2}$$

RESULT AND DISCUSSION

To answer the objectives, the first research was carried out by collecting stock price data at closed price and IHSG for the period December 2016-November 2020, as well as the reference interest rate as a risk-free profit rate.

Share price data when closed priced is processed by subtracting the stock price this month from the previous month (repeated) and then averaged. The result is the average expected rate of return. Furthermore, the annual interest rate data is divided by 12 to become a risk reference per month. Stock systematic risk (βi) is obtained from calculating the slope of the linear regression line (slope) through the data points of stock return i and IHSG return.

The results of data processing are described in table 1

Table 1. Average Expected Return dan Risiko Sistematis Saham 2017-2020

No	Stock Code	Name	Average Expected Return	β
1	DVLA	Darya-Varia Laboratoria Tbk	0,0092	0,1698
2	INAF	Indofarma (Persero) Tbk	0,0590	-0,0389
3	KAEF	Kimia Farma (Persero) Tbk	0,0325	-0,8523
4	KLBF	Kalbe Farma Tbk	0,0018	0,7438
5	MERK	Merck Tbk	-0,0080	0,8266
6	PYFA	Pyridam Farma Tbk	0,0454	0,7227
7	SIDO	Industri Jamu dan Farmasi Sido Muncul Tbk	0,0373	0,0582
8	TSPC	Tempo Scan Pacific Tbk	-0,0060	0,8620
9	SDPC	Millennium Pharmacon International Tbk	0,0033	0,3439

Source: data processed (2021)

The formation of a portfolio using the Single Index Model can be done in the following steps: The first step that must be done is to determine the stock rating based on the excess return to beta (ERB) ratio, by subtracting the expected return of each stock by the risk free level, and the result divided by the beta of the relevant stock is shown in Table 2.

Table 2. Expected Return and *Excess Return to beta* (December 2016 - November 2020)

No	Stock Code	Company	E®	ERBi
1	DVLA	Darya-Varia Laboratoria Tbk	0,005172	0,030445
2	INAF	Indofarma (Persero) Tbk	0,054922	-1,40932
3	KAEF	Kimia Farma (Persero) Tbk	0,028394	-0,03331
4	KLBF	Kalbe Farma Tbk	-0,0023	-0,00309
5	MERK	Merck Tbk	-0,01207	-0,0146
6	PYFA	Pyridam Farma Tbk	0,041313	0,057161
7	SIDO	Industri Jamu dan Farmasi Sido Muncul Tbk	0,033213	0,570586
8	TSPC	Tempo Scan Pacific Tbk	-0,01007	-0,01168
9	SDPC	Millennium Pharmacon International Tbk	-0,00075	-0,00217

Source: data processed (2021)

Based on the results of Table 2, it can be seen that those with the largest excess return to beta (ERB) value are shares of the Sido Muncul Herbal Medicine and Pharmaceutical Industry company. (SIDO) of 0.570586 and the smallest is Indofarma (Persero) Tbk. (INAF) of -1.40932. Furthermore, the shares that are included in the portfolio are separated optimal and stocks that do not meet the requirements in the Optima portfolio, using the existing formula can be determined the value of Ci for each share. Furthermore, through the Ci obtained, the cut off point (C *) will be determined, which is the largest Ci value shown in Table 3.

Table 3. Cut Off Rate **dan Cut Off Point**

No	Stock Code	α	β	0	ERB	Ci	C*
1	SIDO	0,0372	0,0582	0,0283	0,5706	0,0001	0,0013
2	PYFA	0,0441	0,7228	0,0391	0,0572	0,0013	0,0013
3	DVLA	0,0089	0,1699	0,0022	0,0304	0,0007	0,0013
4	SDPC	0,0027	0,3440	0,0063	-0,0022	-0,0001	0,0013
5	KLBF	0,0005	0,7438	0,0051	-0,0031	-0,0005	0,0013
6	TSPC	-0,0075	0,8620	0,0067	-0,0117	-0,0019	0,0013
7	MERK	-0,0094	0,8266	0,0359	-0,0146	-0,0005	0,0013
8	KAEF	0,0339	-0,8524	0,0787	-0,0333	-0,0005	0,0013
9	INAF	0,0591	-0,0390	0,1867	-1,4093	0,0000	0,0013

Source: data processed (2021)

In Table 3. It can be seen that the Ci value of the shares that are spread is the Ci value of Pyridam Farma Tbk. (PYFA) shares, which is 0.0013, so the cut off point (C *) of the stocks that will form a portfolio is 0.0092 then after the value of C * is determined, a selection of stocks that can be used as candidates is made to form an optimal portfolio by comparing the ERB of each stock with the value of C * shown in Table 4.

Table 4. Candidate for Pharmaceutical company Stock Index for the Optimal Portopolio

No	Stock Code	Company	ERB	Ci	C*	Decision
1	SIDO	Industri Jamu dan Farmasi Sido Muncul Tbk	0,5706	0,0001	0,0013	**Optimal**
2	PYFA	Pyridam Farma Tbk	0,0572	0,0013	0,0013	**Optimal**
3	DVLA	Darya-Varia Laboratoria Tbk	0,0304	0,0007	0,0013	**Optimal**
4	SDPC	Millennium Pharmacon International Tbk	-0,0022	-0,0001	0,0013	-
5	KLBF	Kalbe Farma Tbk	-0,0031	-0,0005	0,0013	-
6	TSPC	Tempo Scan Pacific Tbk	-0,0117	-0,0019	0,0013	-
7	MERK	Merck Tbk	-0,0146	-0,0005	0,0013	-
8	KAEF	Kimia Farma (Persero) Tbk	-0,0333	-0,0005	0,0013	-
9	INAF	Indofarma (Persero) Tbk	-1,4093	0,0000	0,0013	-

Source: data processed (2021)

From Table 4. It can be seen that the stock of companies with an ERB value greater than C * is the Sido Muncul Tbk Herbal Medicine and Pharmacy Industry. (SIDO), Pyridam Farma Tbk. (PYFA), Darya-Varia Laboratoria Tbk. (DVLA) therefore these shares can be referred to as candidate stocks in order to form an optimal portfolio. After the candidate stocks that can form the optimal portfolio have been determined, the next step is to determine the proportion of each share in the optimal portfolio as shown in Table 5.

Table 5. Optimal Portfolio Fund Allocation

No	Stock Code	Company	ERB	Wi
1	SIDO	Industri Jamu dan Farmasi Sido Muncul Tbk	0,5706	26,10%
2	PYFA	Pyridam Farma	0,0572	23,02%
3	DVLA	Darya-Varia Laboratoria Tbk	0,0304	50,89%
Total				100,00%

Source: data processed (2021)

Based on Table 5. It can be seen that the funds invested in each of the selected stocks, namely: Sido Muncul's Herbal Medicine and Pharmaceutical Industry Tbk. (SIDO) with a proportion of 26.10%, Pyridam Farma Tbk. (PYFA) with a proportion of 23.02%, Darya-Varia Laboratoria Tbk. (DVLA) with a proportion of 50.89%. The final stage in calculating the optimal portfolio is calculating the amount of excpected return and optimal portfolio variance as shown in Table 6.

Table 6. Expected return and variance portfolio optimal

No	Stock Code	Company	Excpected Return	Varians Portofolio
1	SIDO	Industri Jamu dan Farmasi Sido Muncul Tbk	0,0033	0,0283
2	PYFA	Pyridam Farma	0,0454	0,0391
3	DVLA	Darya-Varia Laboratoria Tbk	0,0092	0,0022
Total			0,0579	0,0696

Source: data processed (2021)

From Table 6. It can be seen that in the period December 2016 to November 2020 investment in SIDO, PYFA, DVLA, as a portfolio capable of generating returns of 5.79% and a risk of 6.95%.

CONCLUSION

Based on the results of calculations and discussion carried out, the following conclusions can be obtained, namely:

1. Stocks that can be selected to form an optimal portfolio using the Single Index Model of 12 consumer good industry stocks with the concentration of pharmaceutical companies are as many as 3 stocks with each proportion, namely: the Herbal Medicine and Pharmacy Industry Sido Muncul Tbk. (SIDO) with a proportion of 26.10%, Pyridam Farma Tbk. (PYFA) with a proportion of 23.02%, Darya-Varia Laboratoria Tbk. (DVLA) with a proportion of 50.89%.
2. The rate of profit (excpected return) is 5.79% with a risk (variance) of 6.95%.

Based on the analysis results and conclusions, some suggestions can be given as follows:

1. Investors who want to invest in the Indonesian capital market, especially in consumer good industry shares with a concentration of pharmaceutical companies, should invest very carefully by choosing stocks that are included in the optimal portfolio, such as Sido Muncul Tbk's Herbal and Pharmaceutical Industry (SIDO).
2. For the next researcher who wants to try to form an optimal portfolio by using the Single Index Model on consumer good industry stocks with a concentration of pharmaceutical companies, adjustments should be made using the latest data on consumer good industry stocks with a concentration of pharmaceutical companies.

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