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Optimal Portfolio Formation with Single Index Model Approach on Lq-45 Stocks on Indonesia Stock Exchange

Rizkar Abrami[1], Bambang Santoso Marsoem[2]
University of Mercu Buana, Jakarta, Indonesia

Abstract:- This study aims to find out the combination of average trading volume, ratio, expected profit level and optimal portfolio risk of the formed stock group and not an optimal portfolio candidate. A single index model is used to determine the optimal portfolio by comparing excess return to beta (ERB) with cut-off points (Ci). The research is that all stocks listed in the LQ45 index group in the period February 2019 - July 2019. sampling of data is carried out purposive sampling. Sample benchmarks are stocks listed in the LQ45 Index continuously during the research period, and there are 29 stocks that can be included in the research sample selection criteria. Data analysis and testing is carried out by determining which stocks are included in the optimal portfolio and which stocks are not included in the optimal portfolio, as well as comparing the average stock trading volume between stocks that are optimal portfolio candidates with stocks that are not candidates for optimal portfolios. Portfolio. From the calculation using a single index model, 8 stocks are optimally included in the portfolio and the ratio is BBCA 62%, WSKT 10%, ICBP 7%, TLKM 7%, BBTN 7%, BMRI 4%, PTBA 2% and BBRI.1%. Where the expected profit ratio is 1.88% and the risk is 0.12%. From the results of different tests, it is known that there is a difference in average transaction volume between stocks included in the optimal portfolio candidate and stocks that are not included in the optimal portfolio candidate. Therefore, investors should choose stocks that belong to optimal portfolio candidates".

Keywords:- *Single Index Model, Optimal Portfolio, LQ45 Index, ERB, Ci, Expected Profit Level, Portfolio Risk, Trading Volume.*

I. INTRODUCTION

Investment is the current consumption delay to be included in productive assets for a certain period (Jogiyanto, 2016). Investment activities are carried out because of these activities " which is oneof the factors that motivate investors to invest and appreciate the courage of investors in facing the risks they bear will bring returns in the form of returns(Tandelilin, 2010). The advancement of the global economy can make people realize that real assets such as land, houses, gold and other precious metals are not just invested.

Generally investors do not particularly like risk (avoid risk), but desperately want the maximum rate of return, so investing in the capital market is the main choice of investors because it promises a higher rate of return compared to actual investments. sector and money market.

Portfolio analysis helps investors decide to determine the optimal portfolio so that the expected return rate is maximized with a particular risk or provides the smallest risk with a certain level of return. Portfolio analysis is the determination of which securities to choose and how much funds will be invested in each of those securities. The number of targeted securities is chosen to reduce the risk to investors.

(Sharpe, 1963) developed a model called the Single Index Model. This Single Index Model can also be used to calculate the expected return rate and portfolio risk. Analysis of securities is carried out by comparing Extra Return on Beta (ERB) with the cut-off rate (Ci) of each stock. While ERB can be defined as the difference between the expected rate of return and risk-free return, while the cut-off rate (Ci) is the limiting point that determines the limit of the ERB value (Hartono, 2014).

Many companies are listed on the Indonesia Stock Exchange and confuse investors with their choices, which securities are best and best for investment, so the Indonesia Stock Exchange seeks to help investors make their choice by creating an index, one of them. This is known as fluid index 45 (LQ-45). This index consists of stocks with high market value and high liquidity (Jogiyanto, 2016)".

Rational investors can be understood from the extent to which investors follow stock selection procedures and determine the optimal portfolio of historical data of stocks traded on the Stock Exchange. In this case it can be answered with two approaches, the first is stock selection and optimal portfolio determination with a single index model, and the second is the pattern of investor behavior in the stock market that is reflected in trading activities. included in the stock market portfolio.

Previous research on optimal portfolio creation according to the Single Index Model has shown the results of different portfolio combinations. In the research conducted by Budi Santoso (2016) entitled "Analysis of The Establishment of Optimal Portfolio ofLQ45 Shares Listed

on the Indonesia Stock Exchange (IDX) (Period February 2013-July 2015)" in the results of 27 samples of member shares, in can the results of 18 stocks entered as candidates and 9 stocks are not included in the optimal portfolio candidates with an ERB value greater than the cut-off point of 0.01329.

Sandyduino (2017) shows that 17 stocks including UNVR, AALI, AKRA, ICBP was included in the optimal portfolio in the research entitled "Optimal Portfolio Analysis ofLQ45 Shares Using Single Index Model for the period 2013-2016 on the Indonesia Stock Exchange. , GGRM, LSIP, BBCA, BBRI, KLBF, JSNR, BBNI, BSDE, LPKR, CPIN, INTP, UNTR and INDF", except for the results of different tests in the know there is no rationality of investors in stock selection and optimalportfolio formation. Indonesia with Single Index Model on the Stock Exchange.

Abbokar, Ayham, Ebrahim and Mohammed (2019) conducted a study entitled "*The Construction of Optimum Portfolio Using Sharpe's Index Model—A Study With Reference To Selected Companies of Bse Sensex*"*The* results showed 10 selected companies from 5 different sectors. In the 2-year period from January 2015 to December 2016 only 2 of these selected companies (Biocon & Head Office) were selected for optimal portfolio development.

Chanifah, Hamdani, Gunawan (2020) conducted a research entitled "*The Comparison of Applying Single Index Model and Capital Asset Pricing Model by Means Achieving Optimal Portfolio*"*The* results of this study point out that portfolios created with the Single Index Model have taken into account all aspects of the economy that guarantee security and prevent losses. While the Capital Asset Pricing Model only takes into account certain risks in an efficient combination of portfolios.

Based on the above, the main problems that the authors want to examine in this study are:

a. What flagship stocks fall into the category to be included in the portfolio?
b. What is the proportion of each stock to get an optimal portfolio?
c. What is the expected level of profit and risk from a formed portfolio?
d. Is there a difference between the average trading volume of the stock group that is the optimal portfolio candidate and the average trading volume of the stock group instead of the optimal portfolio candidate?

II. LITERATURE

a. Portfolio

According to Sunariyah (2011) Portfolio is a combination of several assets invested by both individuals and institutions and owned by investors.

b. Diversification

According to Manurung (2016) diversification is the spread of assets to reduce risk.

c. Efficient Portfolio

"According to Jogiyanto (2016) efficient portfolio is a group of portfolios with maximum expected results at a certain level of risk or portfolio groups with minimum risk at a certain rate of return.

d. Optimal Portfolio

An optimal portfolio is one that maximizes investor preferences in terms of returns and risk. (Elton and Gruber, 2003).

e. Single Index Model

The Single Index Model is a simplification of the Markowitz model developed by William Sharpe (1963) and can be used to calculate expected returns and portfolio risks. The single index model is based on the observation that the price of a security fluctuatesin the direction of the market price index, due to the return of the securities and the return of the market index.

f. Portfolio Return

According to Jogiyanto (2016), portfolio return is the weighted average of the realization of each asset in the portfolio. Similarly, the expectation of portfolio returns, which is the weighted average of the expected returns from each asset in the portfolio"

g. Portfolio Risk

According to Sharpe (1963), risk is a tool to measure deviations in actual return on expected return. The most important thing is the possibility of unintended and unwanted results that can cause losses if not managed properly.

III. CONCEPTUAL FRAMEWORK

In general, this research framework can be revealed in the diagram presented in the imagebelow:

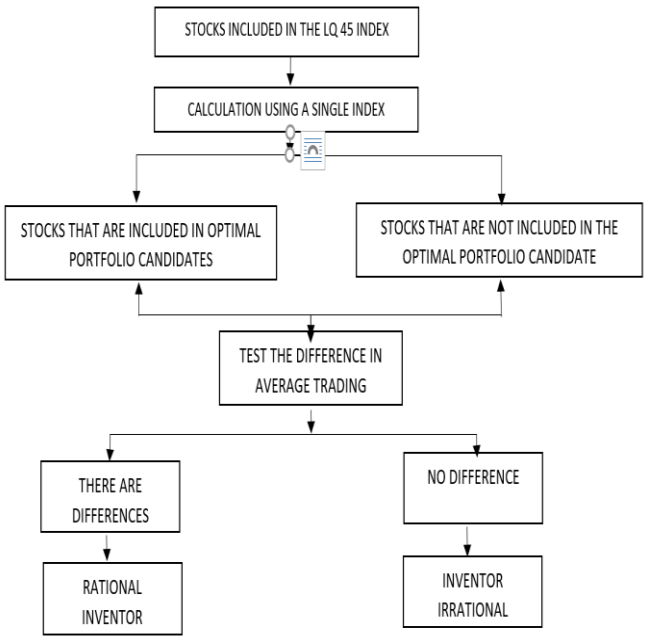

Figure 1 : Conceptual Framework

a. Hypothesis Development

Tandelilin's optimal portfolio (2020) is a portfolio selected by investors from many options in an efficient portfolio pool, from which it can be said that there is or is no rationality of investors in choosing stocks and determining the most suitable portfolio. Indonesia Securities Foam, reflected by the high volume of stock trading. Based on these statements, hypotheses are presented in this study:

H_1 : There is a difference in average transaction volume between stocks included in optimal portfolio candidates and stocks not included in optimal portfoliocandidates.

IV. RESEARCH METHODS

A. Types of Research

"This research uses qualitative approach with descriptive analytical research type to identify securities that can form optimal portfolio and resulting performance. Optimal portfolio formation using the Single Index Model for the period August 2014 – July" 2019. In addition, the optimal portfolio created will be analyzed with various tests to find out the difference between the volume "of stock trading that is the optimal portfolio candidate andthose stocks. not included in the optimal portfoliocandidates".

B. Research Variables

a. *Actual Return on* Stocks

Actual Return of Shares is comparing the difference between the initial price and the actual end price of a stock in a given period with the initial price of a share as a percentage. Can be written mathematically:

$$\boldsymbol{R_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}}}$$

b. *Expected Return on* Stocks

Expected return on individual shares is the daily average return on shares "to-I" is currently in the range of "n-day". Mathematically, the equation looks like this:\:

$$\boldsymbol{E(R_i) = \sum_{t-1}^{n} \frac{R_{it}}{n}}$$

c. *Actual Market* Return

Actual market return is a comparison (percentage) of the difference between the baseline value and the final value of the Composite Stock Price Index (JCI) over a certain period of time with the baseline value of JCI. Can be written mathematically:

$$\boldsymbol{R_{mt} = \frac{IHSG_t - IHSG_{t-1}}{IHSG_{t-1}}}$$

d. Expected Market Return

Expected market return is the average daily return of actual JCI during the"N-day" interval. Can be written mathematically:

$$\boldsymbol{E(R_m) = \sum_{t=1}^{n} \frac{R_{mt}}{n}}$$

e. Standard Deviation and *Variance*

Standard deviation and *variance are* parameters to see how much each data deviates from its average value. Both parameters are used to measure the risk of market return expectations. Equation used:

$$\boldsymbol{\sigma_x = \sqrt{\frac{\sum_{t=1}^{n}[R_{xt} - E(R_{xt})]^2}{n-1}}}$$

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$$\boldsymbol{\sigma_x^2 = \frac{\sum_{t=1}^{n}[R_{xt} - E(R_{xt})]^2}{n-1}}$$

f. *Individual Stock Covariance* with Market Indices

Covariance between individual shares to i with the market is a parameter used to see the extent to which individual stock returns to i and market return tendencies move together Additionally, this parameter will be an input to calculate the Beta coefficient as i() for each stock. Equation used :

$$\boldsymbol{\sigma_{im} = \frac{\sum_{t=1}^{n}[R_{it} - E(R_i)][R_{mt} - E(R_m)]}{n}}$$

g. *Individual Stock Beta Coefficient*

Coefficient beta of individual shares to i is a systematic risk factor (market) responded by each stock i. Beta coefficient in estimated using equations:

$$\boldsymbol{\beta_i = \sigma_{im}/\sigma_{x^2}}$$

h. *Variance Residual Error Of Individual Stocks*

The residual variance error of each individual stock to the i is the unique risk ofthe1st stock,which is also an asymmetric factor. Equations used:

$$\boldsymbol{\sigma_{ei}{}^2 = \sigma_i{}^2 - \beta_i{}^2 \sigma_m{}^2}$$

i. *Alpha Individual Stocks*

Alpha individual shares to i is the expected value of the *return* of individual shares to i that are independent of market *returns* that are calculated using the equation:

$$\boldsymbol{\alpha_i = E(R_i) - \beta_i E(R_m)}$$

j. *Excess Return to Beta of Individual Stocks*

Excess return to Beta of individual shares to i is the excess return to i ratio relative to one unit of risk that cannot be diversified(β). The ERB value will be used to select the candidates for the shares that will be included in the optimal portfolio. The equations used are:

$$\boldsymbol{ERB_i = [E(R_i) - R_{BR}]/\beta_i}$$

k. *Delimiter Value*

The limiting value (Ci) is the C value for the to i security estimated from the calculation of values A_1 to Ai_{and} values B_1 to B_i, where the values A_1 and B_1 start from the largest positive ERB values. The equations used are:

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

With

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

l. *Cut-Off Point Value*

Cut-Off Point (C*) is the largest Ci value, where the last ERB value in the list order is still greater than the Ci value.

C∗ ≥ERB

m. Proportion of Shares in Optimal Portfolio

Based on the proportions for individual shares into i in optimal portfolios estimated using equations:

$$w_i = \frac{Z_i}{\sum_{j=1}^{k} Z_j}$$

With

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

n. *Expected Return* Portfolio

Expected portfolio return is the weighted average of the expected return of each single asset (share) in that portfolio. The equations used are:

$$ER_p = \sum_{i=1}^{n} (w_i R_i)$$

o. Portfolio Risk

Portfolio Risk can be estimated by determining the variance of the portfolio. The equations used are:

$$\sigma_{p^2} = \beta p^2 . \sigma m^2 + \left(\sum_{i=1}^{n} w_i . \sigma_{ei}\right)^2$$

p. Hypothesis Test

Testing is carried out by grouping the average trading volume of a stock into two, which is included in the prospective portfolio and which is not included in the prospective portfolio. Then the average values of both sample groups were compared and tested with test criteria based on the level of significance resulting from the output of the SPSS for Windows program.

The significance level used in this study is 5% according to the data source used which is secondary data.

Hypothesis:

- Significance < / = 5% , which means the hypothesis is accepted where there is a difference in average trading volume between stocks that enter the optimal portfolio candidate and stocks that are not included in the optimal portfolio candidate.
- Significance > 5% , which means the hypothesis is rejected where there is no difference in average trading volume between stocks that enter optimal portfolio candidates and stocks that are not in the optimal portfolio candidate".

C. Population and Sample

The population in this study was all stocks included in the LQ45 index group in the last period of this study, namely February 2019 to July 2019, with a total of 45 stocks listed on the LQ45 Index during the period. Researchers determined samples from these populations using purposive sampling methods.

The research subjects in this study were 29 stocks that continue to be listed in the LQ45 Index in the period August 2014 - July 2019. :

No	Kode	Nama Saham
1	ADHI	Adhi Karya (Persero) Tbk.
2	ADRO	Adaro Energy Tbk.
3	AKRA	AKR Corporindo 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	GGRM	Gudang Garam Tbk.
12	ICBP	Indofood CBP Sukses Makmur Tbk.
13	INCO	Vale Indonesia Tbk.
14	INDF	Indofood Sukses Makmur Tbk.
15	INTP	Indocement Tunggal Prakarsa Tbk.
16	JSMR	Jasa Marga (Persero) Tbk.
17	KLBF	Kalbe Farma Tbk.
18	LPPF	Matahari Department Store Tbk.
19	MNCN	Media Nusantara Citra Tbk.
20	PGAS	Perusahaan Gas Negara Tbk.
21	PTBA	Bukit Asam Tbk.
22	PTPP	PP (Persero) Tbk.
23	SCMA	Surya Citra Media Tbk.
24	SMGR	Semen Indonesia (Persero) Tbk.
25	TLKM	Telekomunikasi Indonesia (Persero) Tbk.
26	UNTR	United Tractors Tbk.
27	UNVR	Unilever Indonesia Tbk.
28	WIKA	Wijaya Karya (Persero) Tbk.
29	WSKT	Waskita Karya (Persero) Tbk.

Tabel 1 : List of the LQ45 Index in the period August 2014 - July 2019

D. Types and Data Sources

In this study, data collection method using non-participant observation method. Non-participatory observations are carried out by observing and recording all the data needed in this study as historical data on the monthly closing price of LQ45 Index shares in IDX.

E. Data Collection Methods

The data collection method needed in this study, the author uses the library method. In this study, the data of the research library can be obtained from theoretical books, the internet, literature studies and other information related to and support this research as the Capital Market Reference Center (PRPM) in IDX. The method of collecting data in this research is by using documentation techniques, namely by reviewing and reviewing the historical stock price data of all issuers that belong to the LQ45 Index group for five years.

F. Data Analysis Method

Data analysis is done by using a single index model to determine the optimal portfolio, and its calculation tools using Excel. Optimal portfolio formation took place between August 2014 - July 2019. In addition, it is carried out a different analysis test to find out the difference in the trading volume of stocks included in the prospective optimal portfolio and stocks that are not included. Portfolio candidates and calculation tools are best suited by using SPSS programs for Windows.

V. RESULTS AND DISCUSSIONS

A. Processing of Individual Stock Data

The first step in determining which stocks are expected to be included in the optimal portfolio is to calculate the actual returns, expected returns, standard deviations, and variances of each share. It then calculates the actual returns, expected returns,standard deviations and variants of the marketindex (JCI) and calculates the covariance of individual stocks with market indices, beta coefficients of individual stocks, residual fault variants of individual shares, and Alpha of individual shares.

Issuer	E(Ri)	Standard Deviation (σ)	Variance (σ^2)	Covariance (σ_{im})	Beta (β)	Var. Residual Error Shares individually (σ_{ei}^2)	Alpha (α)
Adhi	-0,0034	0,1134	0,0129	0,0016	1,6624	0,0103	-0,0105
Adro	0,0063	0,1022	0,0104	0,0000	1,4638	0,0084	0,0000
Akra	0,0018	0,0829	0,0069	0,0012	0,7922	0,0063	-0,0016
ASII	0,0006	0,0656	0,0043	0,0017	1,5386	0,0021	-0,0060
BBCA	0,0176	0,0483	0,0023	0,0010	1,0615	0,0013	0,0131
BBNI	0,0120	0,0821	0,0067	0,0026	1,9353	0,0032	0,0037
BBRI	0,0140	0,0688	0,0047	0,0018	1,6223	0,0023	0,0071
BBTN	0,0186	0,0983	0,0097	0,0040	1,7922	0,0066	0,0110
Bmri	0,0173	0,1448	0,0210	0,0051	0,8085	0,0204	0,0139
BSDE	0,0013	0,0793	0,0063	0,0029	1,6233	0,0038	-0,0056
GGRM	0,0073	0,0599	0,0036	-0,0004	0,6884	0,0031	0,0043
Icbp	0,0226	0,1611	0,0260	0,0007	0,3060	0,0259	0,0213
Inco	0,0064	0,1522	0,0232	-0,0015	1,0610	0,0221	0,0018
Indf	0,0025	0,0707	0,0050	-0,0014	1,1906	0,0037	-0,0026
INTP	0,0032	0,0979	0,0096	0,0009	1,5814	0,0073	-0,0036
JSMR	0,0016	0,0743	0,0055	0,0015	1,1791	0,0042	-0,0034
KLBF	-0,0010	0,0571	0,0033	0,0017	1,2199	0,0019	-0,0063
LPPF	-0,0163	0,1077	0,0116	0,0005	1,3121	0,0100	-0,0219
MNCN	0,0001	0,1497	0,0224	0,0010	1,6738	0,0198	-0,0071
PGAS	-0,0096	0,1299	0,0169	0,0032	1,9288	0,0134	-0,0179
PTBA	0,0618	0,5255	0,2761	-0,0003	0,0080	0,2761	0,0618
PTPP	0,0070	0,1205	0,0145	0,0041	1,7392	0,0117	-0,0005
SCMA	-0,0116	0,0801	0,0064	0,0011	1,2843	0,0049	-0,0171
SMGR	-0,0003	0,0902	0,0081	0,0051	1,6199	0,0057	-0,0072
TLKM	0,0096	0,0543	0,0030	-0,0002	0,5543	0,0027	0,0072
UNTR	0,0044	0,0773	0,0060	0,0000	0,8437	0,0053	0,0007
UNVR	0,0073	0,0552	0,0030	0,0004	0,7494	0,0025	0,0041
Wika	0,0060	0,1193	0,0142	0,0007	1,7715	0,0113	-0,0016
WSKT	0,0216	0,1087	0,0118	0,0013	1,5987	0,0094	0,0148
IHSG	**0,0043**	**0,0306**	**0,0009**	**0,0017**	**1,0000**	**0,0000**	**0,0000**

Table 2: Expected Return, Standard Deviation, Variance, Covariance, Beta, Variance Residual, and Alpha Calculation Results

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1.1. Lq45 Index Optimal Portfolio Formation

After all the parameters are estimated and sumked, the next step is to calculate the Excess Return on Beta (ERB) of each stock, rank the shares from highest to lowest with ERB value, Positive ERB value, Cutoff Point (C*), last ERB in list order is the ER value which is still greater than Ci, and create an optimal portfolio of individual shares with ERB * C *.

a. Optimal Portfolio on the LQ45 Index

Issuer	Erb	Ai	Bi	Ci	C*	Conclusion
PTBA	7,1140	0,0016	0,0002	0,0000	0,0054	Candidates
Icbp	0,0576	0,2086	3,6200	0,0002	0,0054	Candidates
Bmri	0,0153	0,4916	32,1155	0,0004	0,0054	Candidates
BBCA	0,0119	10,5438	884,3606	0,0054	0,0054	Candidates
WSKT	0,0104	2,8264	271,0303	0,0021	0,0054	Candidates
TLKM	0,0084	0,9640	115,3458	0,0008	0,0054	Candidates
BBTN	0,0076	3,6833	483,2368	0,0024	0,0054	Candidates
BBRI	0,0056	6,4445	1158,8718	0,0029	0,0054	Candidates
BBNI	0,0036	4,1781	1156,6573	0,0019	0,0054	-
GGRM	0,0034	0,5070	150,4502	0,0004	0,0054	-
UNVR	0,0031	0,6937	222,8662	0,0005	0,0054	-
Inco	0,0013	0,0668	50,9305	0,0001	0,0054	-
PTPP	0,0012	0,2991	258,6439	0,0002	0,0054	-
Adro	0,0009	0,2268	253,8948	0,0002	0,0054	-
Wika	0,0006	0,1561	277,8684	0,0001	0,0054	-
UNTR	-0,0007	-0,0982	134,0030	-0,0001	0,0054	-
INTP	-0,0011	-0,3961	344,8701	-0,0003	0,0054	-
Indf	-0,0021	-0,8117	386,3049	-0,0006	0,0054	-
BSDE	-0,0022	-1,5503	689,9394	-0,0009	0,0054	-
JSMR	-0,0028	-0,9350	329,9654	-0,0007	0,0054	-
ASII	-0,0029	-3,2391	1134,5246	-0,0015	0,0054	-
MNCN	-0,0029	-0,4147	141,6305	-0,0003	0,0054	-
SMGR	-0,0032	-1,5025	462,5972	-0,0010	0,0054	-
Akra	-0,0040	-0,4000	99,9581	-0,0003	0,0054	-
KLBF	-0,0049	-3,9128	794,4911	-0,0021	0,0054	-
Adhi	-0,0050	-1,3490	268,9103	-0,0010	0,0054	-
PGAS	-0,0076	-2,1013	278,0145	-0,0016	0,0054	-
SCMA	-0,0129	-4,3763	338,6401	-0,0031	0,0054	-
LPPF	-0,0162	-2,7979	172,2916	-0,0023	0,0054	-

Table 3 : ERB Data Table with t Point Cut off (C) LQ45 Index*

From the results of data processing author in Table 4.2 there are eight stocks formed from the optimal portfolio of LQ45 stocks that have the value of ERB ≥ C* namely PTBA, ICBP, BMRI, BBCA, WSKT, TLKM, BBTN and BBRI.

b. Proportion of Stocks in the Optimal Portfolio of the LQ45 Index

Issuer	Z_i	W_i	Wi (%)
BBCA	5,4343	0,6151	62%
WSKT	0,8525	0,0965	10%
Icbp	0,6180	0,0700	7%
TLKM	0,6155	0,0697	7%
BBTN	0,5993	0,0678	7%
Bmri	0,3936	0,0446	4%
PTBA	0,2057	0,0233	2%
BBRI	0,1154	0,0131	1%
	8,8343	**1,0000**	**100%**

Table 4 : Optimal Portfolio Return Calculation Result

From the results of the processing of author data in the table above the optimal portfolio of LQ45 shares formed using the Single Index Model is formed with the composition of the weights of each share namely BBCA 62%, WSKT 10, ICBP 7%, TLKM 7%, BBTN 7%, BMRI 4%, PTBA 2% and BBRI 1%. BBCA shares get the largest allocation of funds compared to other shares, while the smallest proportion can be BBRI. BBCA shares are attractive to investors because they have the *largest expected return* than any other sample of LQ45 Index shares in the period August 2014 to July 2019.

c. Optimal *Portfolio Expected Return* Calculation

Issuer	w_i	$E(R_i)$	$E(R_p)$
BBCA	62%	0,0176	0,0108
WSKT	10%	0,0216	0,0021
Icbp	7%	0,0226	0,0016
TLKM	7%	0,0096	0,0007
BBTN	7%	0,0186	0,0013
Bmri	4%	0,0173	0,0008
PTBA	2%	0,0618	0,0014
BBRI	1%	0,0140	0,0002
		$\sum E(R_p)$	**0,0188**

Table 5: Optimal Portfolio Return Calculation

The expected *return on* the LQ45 optimal portfolio resulted in Table 4.4 above is **0.0188** or **1.88%**.

d. Optimal Portfolio Risk Calculation

Issuer	w_i	β_i	$w_i . \beta_i$	σ_{ei}^2	$w_i . \sigma_{ei}^2$
BBCA	62%	1,0615	0,6530	0,0013	0,0008
WSKT	10%	1,5987	0,1543	0,0094	0,0009
Icbp	7%	0,3060	0,0214	0,0259	0,0018
TLKM	7%	0,5543	0,0386	0,0027	0,0002
BBTN	7%	1,7922	0,1216	0,0066	0,0005
Bmri	4%	0,8085	0,0360	0,0204	0,0009
PTBA	2%	0,0080	0,0002	0,2761	0,0064
BBRI	1%	1,6223	0,0212	0,0023	0,0000
		$\sum w_i . \beta_i$	**1,0463**	**$\sum \sigma_{ei}^2 w_i .$**	**0,0115**
		$(\sum w_i . \beta_i)^2$	**1,0947**	**$(\sum \sigma_{ei}^2)^2 .$**	**0.0001**

Table 6 : Optimal Portfolio Risk Calculation Result

σp^2 = 1.0947 x 0.0009 + 0.0001
= **0.0012 or 0.12%**

The result of LQ45 optimal portfolio risk calculation produced in Table 4.5 above is **0.0012** or **0.12%**.

1.2. Hypothesis Testing

Prior to the test, there was a difference in the average trading volume of stock groups that were optimal portfolio candidates with the average trading volume of stock groups that were not optimal portfolio candidates, researchers had to test normality for the average trade. Average portfolio candidate volume of a stock group - The average trading volume for a stock group is not a candidate for an optimal portfolio. The test tool used to find out normality is the Single Sample Kolmogorov Smirnov Test. The test criteria is if the significance value is > 0.05 then the data is normally distributed and if the value of significance <0.05 the data is not normally distributed. .

a. Test Normality

One-Sample Kolmogorov-Smirnov Test

		Volume
N		122
Normal Parameters[a,b]	Mean	6.290768E8
	Std. Deviation	3.1797366E8
Most Extreme Differences	Absolute	.194
	Positive	.194
	Negative	-.098
Kolmogorov-Smirnov Z		2.139
Asymp, what's going on? Sig. (2-tailed)		.000

A. Test distribution is Normal.
B. Calculated from data.

Table 7 : Normality Test Results Average Stock

Trading Volume of Optimal Portfolio Candidate Group and Not Optimal Portfolio Candidate

The table above shows that kolmogorov-Smirnov's average stock trading volume for the optimal portfolio candidate group is 2,139 with a significance of 0.000 less than 0.05 which is normal distributed data. Due to abnormal distributed data, the statistical test used is Wilcoxon test.

b. Wilcoxon Test

Test Statistics[a]

	Volume
Mann-Whitney U	8.000
Wilcoxon W	1899.000
Z	-9.486
Asymp, what's going on? Sig. (2-tailed)	.000

a. Grouping Variable: GROUP

Table 8 : Wilcoxon Test Result

Table 7 shows that the significance value of 0.000 is less than 0.05 then it can be concluded that H1 is accepted. This indicates the difference in average trading volume between stocks included in optimal portfolio candidates and stocks not included in optimal portfolio candidates. .

VI. CONCLUSIONS AND SUGGESTIONS

A. Conclusion

Based on the results of analysis on the optimal portfolio formation of LQ45 Index shares using the Single Index Model for the period August 2014 to July 2019 shows the following conclusions:

a. In the optimal portfolio of the LQ45 Index, there are 8 leading stocks named Bank Central Asia Tbk. (BBCA), Wakita Karya (Persero) Tbk. (WSKT), Indofood Sukses Makmur Tbk. (ICBP), Telekomunikasi Indonesia (Persero) Tbk. (TLKM), Bank Tabungan Negara (Persero) Tbk. (BBTN), Bank Mandiri (Persero) Tbk.

(BMRI), Bukit Asam Tbk. (PTBA) and Bank Rakyat Indonesia (Persero) Tbk. (BBRI).

b. The proportion of funds that can be invested in 8 (eight) shares are BBCA 62%, WSKT 10%, ICBP 7%, TLKM 7%, BBTN 7%, BMRI 4%, PTBA 2% and BBRI 1%.
c. The top eight portfolio stocks are expected to have a return of 0.0188 or 1.88 percent, and the risk that investors must face in investing in those eight stocks is 0.0012 or 0.12%.
d. From the normality test results, it is known that the data does not distribute normally because the significance value of 0.000 is less than 0.05. Therefore, the hypothesis was tested using the Mann-Whitney Test analysis. From the different test results can be a significance value of 0.000 less than 0.05 which means H1 is received. This indicates that the two things tested are the average trading volume of the stock group that is not an optimal portfolio candidate, and the average trading volume of the stock group that is the most suitable candidate for the optimal portfolio. .

B. SUGGESTIONS

After conducting this study, the authors have some suggestions for the parties involved:

1. Further research should use the closing price with the nearest period and a longer range so that it expects better results.
2. Further research can add optimal portfolio development methods in addition to the Single Index Model.
3. For investors, stock selection to create an optimal portfolio with a tested method that does not rely on information alone, and the realization that the stock has characteristics of high-risk highreturn.

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