Indonesia Auditing Research Journal, 11 (3) (2022), pp. 97-106

Published by: Institute of Accounting Research and Novation (IARN)

Indonesia Auditing Research Journal

Journal homepage: https://journals.iarn.or.id/index.php/ARJ/index

Optimum portfolio formation analysis with *Single-index models*on lq 45 shares for the period 2006-2010

Almira Harmayati

Management Study Program, Indonesian College of Economics Banking School Jakarta, Indonesia

Article Info

Article history:

Received Sep 02, 2022
Revised Sep 15, 2022
Accepted Sep 29, 2022

Keywords:

Optimum portfolio ;
Single-index models.

ABSTRACT

Stock is the type of investment with the high risk high return that is having the high risk but could produce the hight profit as well. Stock portfolio is a collection of shares that are owned by an investor. Optimal stock portfolio will maximize the value of expected return and minimized the risk by combining some stocks with the right proportions. The method used in this research is the Single Index Model. The Single Index Model is a method in which an issuer's stock return has a linear relationship with the market return. The main purpose of this research is to investigate and analyze the portfolio of expected return and optimal risk portfolios based on the Single Index Model. The research results showed there were seventeen stocks with a cut-off point (C*) 0.024365. Optimal portfolio is formed by the seven stocks that have returned the excess beta (ERB) is greater than the cut-off point. Bukit Asam Coal Mine(PTBA), Astra Agro Lestari (AALI), United Tractors (UNTR), State Gas Company (PGAS), Indofood Sukses Makmur (INDF), Holcim Indonesia (SMCB), and Astra International (ASII) with excess return to beta (ERB) of 4.31%, 3 , 37%, 3.21%, 2.94%, 2.85%, 2.63% and 2.56%. The proportion of seven shares of the fund is 29.42%, for PTBA 15.93% for Aali, 16.74% for UNTR, 9.86% for PGAS, 9.71% for INDF, 7.29% 2.63% and 2.56%. The proportion of seven shares of the fund is 29.42%, for PTBA 15.93% for Aali, 16.74% for UNTR, 9.86% for PGAS, 9.71% for INDF, 7.29% 2.63% and 2.56%. The proportion of seven shares of the fund is 29.42%, for PTBA 15.93% for Aali, 16.74% for UNTR, 9.86% for PGAS, 9.71% for INDF, 7.29%

Corresponding Author:

Rachmat Anggara Supriyadi,
Management Study Program,
Indonesian Banking School of Economics, Jakarta,
Jl. Kemang Raya No. 35, RT. 6/RW. 1, Bangka, Kec. Mampang Prpt., City of South Jakarta,
Email: Anggara@gmail.com

1. INTRODUCTION

The capital market in Indonesia in recent years has attracted the attention of many parties, especially the business community. This is due to the growing capital market activities and the increasing desire of the business community to seek alternative sources of business financing other than banks. A company can issue shares and sell them on the capital market to obtain the necessary funds(M. Sukarno, 2007)

The capital market which is considered as an alternative for investors is influenced by several factors. One of the determining factors according toBawazier and Sitanggang (1994)is the level of ability of investors to choose shares rationally. The rationality of investors can be measured by the way they choose stocks that provide maximum returns at a certain level of risk or have minimum risk

at a certain level of return. The approach that can be taken by investors is to carry out calculations in selecting and determining portfolios.

Investors often face uncertainty when they have to choose stocks to form their preferred portfolio and the number of combinations of stocks in the portfolio. In forming an optimal portfolio, investors first determine an efficient portfolio.According to Husnan (1998) efficient portfolio is a portfolio that generates a certain level of profit with the lowest risk, or a certain risk with the highest level of profit. While the optimal portfolio according toTandelilin (2001) is a portfolio that an investor chooses from among the many choices that exist in an efficient portfolio set.

To analyze the portfolio, several calculations are needed through a number of data as input about the portfolio structure. One of the optimal portfolio analysis techniques performed by Elton and Gruber (1995) is to use the Single Index Model. That is, the analysis of securities is done by comparing the excess return to beta (ERB) with the cut-off rate (Ci) of each stock. Stocks that have an ERB greater than Ci are used as a portfolio, while on the contrary, namely Ci greater than ERB, they are not used as a portfolio.

Determining the optimal portfolio with the Single Index Model shows that the Single Index Model can be used as a way to choose stocks and determine the optimal portfolio on the IDX (Indonesian Stock Exchange). However, the large number of companies listed on the IDX makes it difficult for investors to make the right choice. Therefore, the Liquid 45 Index (LQ 45) was created where this index consists of stocks that have large market capitalization and high liquidity.

The problem formulated in this study is how to determine the stocks that make up the optimum portfolio of LQ 45 stocks with the Single Index Model? How to find out and analyze the optimal portfolio expected return and risk based on the Single Index Model?

2. RESEARCH METHOD

This research is descriptive quantitative. The object of this research is the shares of companies listed on the Indonesia Stock Exchange in the form of an index. The index used is the LQ 45 index. The data used by researchers is secondary data. In this study the sampling method used was purposive sampling method.

3. RESULTS AND DISCUSSIONS

Optimal portfolio analysis

Calculating individual stock returns (Ri)

$$Ri = \frac{\mathrm{Pt} - \mathrm{Pt} - 1}{\mathrm{Pt} - 1} \ldots$$

For example, looking at the equation above, it can be calculated how much individual issuers' returns are owned by shares of Astra Agro Lestari Tbk. (AALI) for January 2006 is

The share price on December 31, 2005 = IDR 4,900

The share price on January 31, 2005 = IDR 5,050.

$$Rm = \frac{\mathrm{ISGt} - \mathrm{IHSGt} - 1}{\mathrm{IHSGt} - 1} \ldots$$

$$= 0.03061$$

After calculating the Ri above, it can be seen that the return on shares of Astra Agro Lestari Tbk. (AALI) in January 2006 was 0.03061 or 3.06% for each share.

Calculating Expected ReturnE(Ri) and Stock Risk (σi2)

Table 1 List of expected return (e(ri)) and stock risk list (σi2)

No.	Issuer Name	Securities Code	E(Ri)	σi2
1	Astra Agro Lestari	AALI	0.040208	0.021464
2	Various Mines (Persero)	ANTM	0.018487	0.02775
3	Astra International	ASII	0.03743	0.004937

4	Bank Central Asia	BBCA	0.018232	0.009459
5	Bank Rakyat Indonesia	BBRI	0.027901	0.005317
6	Bank Danamon Indonesia	BDMN	0.011688	0.008771
7	Bank Mandiri (Persero)	BMRI	0.031219	0.005221
8	International Nickel Indonesia	INCO	0.035066	0.014129
9	Indofood Success Prosperous	INDF	0.038031	0.01915
10	Indosat	ISAT	0.004584	0.006713
11	Medco Energi International	MEDC	0.008668	0.009186
12	National gas Company	PGAS	0.026502	0.013803
13	Bukit Asam Coal Mine	PTBA	0.055713	0.025566
14	Holcim Indonesia	SMCB	0.038515	0.011816
15	Indonesian Telecommunications	TLKM	0.008503	0.00409
16	Bakrie Sumatra Plantations	UNSP	0.018681	0.037867
17	United Tractors	UNTR	0.044505	0.01975

Based on table 1, it can be seen that the stock that has the highest expected return is the Bukit Asam Coal Mine (PTBA) stock with a total of 0.0557132 or 5.57% per share and the lowest expected return is Indosat stock (ISAT) of 0.0045843 or 0 .46% per share. The biggest share risk is Bakrie Sumatra Plantations (UNSP) stock risk, which is 0.037867 or 3.79% per share and the lowest risk is Telekomunikasi Indonesia (TLKM) stock, which is 0.00409 or 0.41%.

Calculating Market Return (Rm)

$$Rm = \frac{\text{ISGt} - \text{IHSGt} - 1}{\text{IHSGt} - 1} \ldots$$

For example, using the formula above, the value of the market return (Rm) on LQ 45 stock is as follows:

JCI on 30 December 2005 = IDR 1,162.64
JCI on January 31, 2006 = IDR 1,232.32

$$Rm = \frac{1.232{,}32 - 1.162{,}64}{1.162{,}64} \quad \ldots\ldots(1)$$

In the above calculation it can be seen that the market return in January 2006 was 0.059932567 or 5.99% per share. Therefore, the calculation of market returns in other months and returns for LQ 45 stocks during the 2006-2010 period can be known.

Calculating the expected market return (e(rm)) and market risk (σ 2)

$$E\ (Rm) = \frac{\sum \text{ni=i Rmj}}{\text{n}} \quad \ldots\ldots(2\ )$$

For example, the magnitude of the expected market return on LQ 45 stock using the formula above is as follows:

$$E\ (Rm)\ \frac{1{,}367353016}{60} = 0{,}022789217 \quad \ldots\ldots(3)$$

From the calculation above, it can be seen that the expected market return is 0.022789217 or 2.27% per month. The expected market return obtained is a positive market expected return, so it can be concluded that the capital market provides a return for investors.

Calculating Beta (β) and Alpha (α)

The formula used to calculate beta is as follows: (Septyarini, 2009)

$$E\ (Rm) = \frac{1{,}367353016}{60} = 0{,}022789217 \quad \ldots\ldots(4)$$

The formula used to calculate alpha is as follows: (septyarini, 2009)

$\alpha_i = E(\mathrm{Ri}) - \beta i.E(\mathrm{R}m)$.....(4)

Based on the formula above, beta and alpha can be calculated for each stock. The following is a list of beta and alpha for each stock.

Table 2 List of Beta(β) and Alpha(α)

No.	Issuer Name	Securities Code	B	α
1	Astra Agro Lestari	AALI	1.150316	0.03049
2	Various Mines (Persero)	ANTM	1.180438	0.008514
3	Astra International	ASII	1.406699	0.025546
4	Bank Central Asia	BBCA	0.785818	0.011593
5	Bank Rakyat Indonesia	BBRI	1.190821	0.017841
6	Bank Danamon Indonesia	BDMN	1.063646	0.002701
7	Bank Mandiri (Persero)	BMRI	1.32072	0.020061
8	International Nickel Indonesia	INCO	1.403108	0.023212
9	Indofood Success Prosperous	INDF	1.283624	0.027186
10	Indosat	ISAT	0.752531	-0.00177
11	Medco Energi International	MEDC	1.086683	-0.00051
12	National gas Company	PGAS	0.853265	0.019293
13	Bukit Asam Coal Mine	PTBA	1.257953	0.045085
14	Holcim Indonesia	SMCB	1.410311	0.0266
15	Indonesian Telecommunications	TLKM	0.697991	0.002606
16	Bakrie Sumatra Plantations	UNSP	-0.15048	0.019953
17	United Tractors	UNTR	1.341234	0.033174

Source: Processed data

it can be seen that if the market return increases by 1%, Astra Agro Lestari (AALI) shares will increase by 1.1503162.

Calculating risk free (Rf)

Based on the results of the risk free calculation, it is known that the average risk free rate per year is 0.08633 while the average per month is 0.00144. to see a more detailed risk free calculation. The results of calculating the risk-free profit rate will be used to select stocks that will be included in the portfolio selection.

Table 3 List of lq 45 stocks that have a value (E(Ri) > Rf)

No.	Issuer Name	Securities Code	E(Ri)		Rf
1	Astra Agro Lestari	AALI	0.040208	>	0.00144
2	Various Mines (Persero)	ANTM	0.018487	>	0.00144
3	Astra International	ASII	0.03743	>	0.00144
4	Bank Central Asia	BBCA	0.018232	>	0.00144
5	Bank Rakyat Indonesia	BBRI	0.027901	>	0.00144
6	Bank Danamon Indonesia	BDMN	0.011688	>	0.00144
7	Bank Mandiri (Persero)	BMRI	0.031219	>	0.00144
8	International Nickel Indonesia	INCO	0.035066	>	0.00144
9	Indofood Success Prosperous	INDF	0.038031	>	0.00144
10	Indosat	ISAT	0.004584	>	0.00144
11	Medco Energi International	MEDC	0.008668	>	0.00144
12	National gas Company	PGAS	0.026502	>	0.00144
13	Bukit Asam Coal Mine	PTBA	0.055713	>	0.00144
14	Holcim Indonesia	SMCB	0.038515	>	0.00144
15	Indonesian Telecommunications	TLKM	0.008503	>	0.00144
16	Bakrie Sumatra Plantations	UNSP	0.018681	>	0.00144
17	United Tractors	UNTR	0.044505	>	0.00144

Source: Processed data

Calculating Unsystematic Variance (σei2)

Table 4.7 List of Unsystematic Variants (σei2)

No.	Issuer Name	Securities Code	σei2
1	Astra Agro Lestari	AALI	0.021464
2	Various Mines (Persero)	ANTM	0.02775
3	Astra International	ASII	0.004937
4	Bank Central Asia	BBCA	0.009459
5	Bank Rakyat Indonesia	BBRI	0.005317
6	Bank Danamon Indonesia	BDMN	0.008771
7	Bank Mandiri (Persero)	BMRI	0.005221
8	International Nickel Indonesia	INCO	0.014129
9	Indofood Success Prosperous	INDF	0.01915
10	Indosat	ISAT	0.006713
11	Medco Energi International	MEDC	0.009186
12	National gas Company	PGAS	0.013803
13	Bukit Asam Coal Mine	PTBA	0.025566
14	Holcim Indonesia	SMCB	0.011816
15	Indonesian Telecommunications	TLKM	0.00409
16	Bakrie Sumatra Plantations	UNSP	0.03786
17	United Tractors	UNTR	0.01975

Source: Processed data

Based on the table above, the shares that have the greatest unsystematic variance are Bakrie Sumatra Plantations (UNSP) shares of 0.037867. This proves that if the company's risk increases, UNSP shares will experience the greatest increase in risk. While the stock that has the smallest unsystematic variance is Telekomunikasi Indonesia (TLKM) of 0.00409. This proves that if the company's risk increases, TLKM's shares will experience the smallest increase in risk.

Calculating Excess Return to Beta (ERB)

Table 4 Multicollinearity Test

Model		Unstandardized Coefficients		St andardized Coefficients			Collinearity Statistics	
		B	std. Error	Betas	t	Sig.	tolerance	VIF
1	(Const ants)	-2. 336	1.133		-2. 062	041		
	Service Quality	.066	.019	.251	3,516	001	.465	2.152
	Custom er S atis fact	.149	.060	.172	2,480	014	.495	2020
	Corporate Image	047	072	044	.647	.519	.509	1966
	Price Perc eption	.030	080	.026	.370	.712	.485	2062
	Switching Cost	.390	072	.397	5,449	.000	.448	2,235

Source: Primary data processed by researchers

Based on the table above, it can be seen that the inflation factor (VIF) value in the regression model is not above 5 (≤ 5). This shows that among these variables there is no multicollinearity problem.

Heteroscedasticity test.

The results of the Heteroscedasticity test can be shown in the following table:

Table 5 Heteroscedasticity-Coefficients-Glacier Test

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	std. Error	Betas		
1	(Constant)	.023	.029	.273	.782	.445
	work capital efficiency	008	006		1.205	.244

a. Dependent Variable: AbsUt

Heteroscedasticity Test

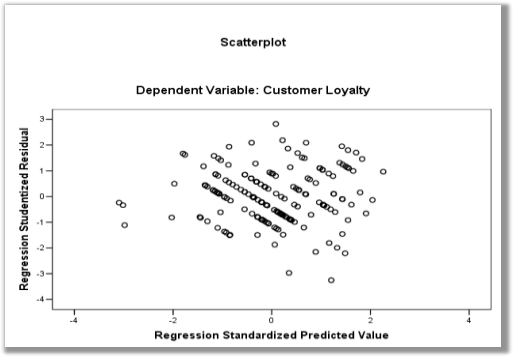

Figure 2 Heteroscedasticity test
Source: processed research data, 2009

From the scatter plot graph on Customer Loyalty it can be seen that the dots do not form a certain pattern. The scatter diagram above does not form a particular pattern. Thus it can be said that the regression does not experience heteroscedasticity disorders so that the regression model is feasible to use to predict Customer Loyalty based on independent variable input.

Autocorrelation test

The test method used is the Durbin-Watson test.

Table 6 Auto correlation test

Model	R	R Square	Adjusted R Square	std. Error of the Estimate	Durbin-Watson
1	.758a	.575	.563	1,503	1,596

a. Predictors: (Constant), Switching Cost , Customer Satisfaction, Corporate Image, Price Perception, Service Quality
b. Dependent Variable: Customer Loyalty
Source: primary data processed by researchers

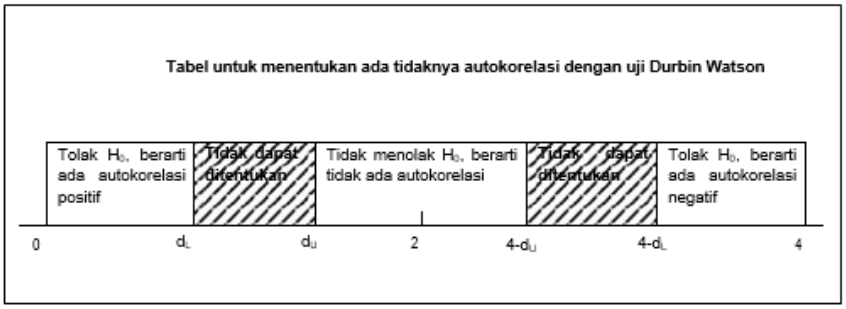

Figure 3 Auto correlation test

In this test it can be seen in the Model Summary table in model 1 where the DW value shows 1.596. which means Accept Ho, there is no serial correlation (no autocorrelation) because DW lies between 1.54 and 2.46.

Based on the following rules:

Ho : no serial correlation

H1 : there is a serial correlation

Multiple regression test

Table 7 Regression equation model

Model		Unstandardized Coefficients		St andardiz ed Coefficients			Collinearity Statistics	
		B	std. Error	Betas	t	Sig.	tolerance	VIF
1	(Constants)	-2. 336	1.133		-2. 062	041		
	Service Quality	.066	.019	.251	3,516	001	.465	2.152
	Custom er S atis fact	.149	.060	.172	2,480	014	.495	2020
	Corporate Image	047	072	044	.647	.519	.509	1966
	Price Perc eption	.030	080	.026	.370	.712	.485	2062
	Switching Cost	.390	072	.397	5,449	.000	.448	2,235

Source: Primary data processed by researchers

$$Y' = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5$$

$$\hat{Y} = -2.336 + 0.066X_1 + 0.149X_2 + 0.047X_3 + 0.030X_4 + 0.390X_5$$

Where :

$\hat{Y}$ = *Customer Loyalty*
X_1 = *Service Quality*
X_2 = *Customer Satisfaction*
X_3 = *Corporate Image*
X_4 = *Price Perception*
X_5 = *Switching Cost*

A constant of -2,336 indicates that if there is no service quality, customer satisfaction, corporate image, price perception and switching costs, then customer loyalty will decrease by -2,336. The service quality regression coefficient of 0.066 states that each additional 1 unit of service quality will increase customer loyalty by 0.066. The customer satisfaction regression coefficient of 0.149 states that each additional 1 unit of service quality will increase customer loyalty by 0.149. The corporate image regression coefficient of 0.047 states that each additional 1 unit of service quality will increase customer loyalty by 0.047. The price perception regression coefficient of 0.030 states that each addition of 1 unit of service quality will increase customer loyalty by 0.030.

Simple regression test

This analysis is used to predict how much influence or contribution service quality has on customer satisfaction and service quality has on corporate image.

a. *Service quality*on customer satisfaction

Table 8 Simple linear regression test

Coefficients[a]

Model		UnstandardizedCoefficients		St andardiz ed Coefficients		
		B	std. Error	Betas	t	Sig.
1	(Constant)	-4.794	1,485		-3.228	001
	Service Quality	.184	.018	.608	10,356	.000

a. Dependent Variable: Customer Satisfaction

Source: Primary data processed by researchers

$$Y' = a + bX$$

$$\hat{Y} = -4.794 + 0.184X$$

Where :

Y' = Customer Satisfaction

X = Service Quality

A constant of -4,794 states that if there is no service quality, customer satisfaction will decrease by -4,794. The service quality regression coefficient of 0.184 states that each addition of 1 unit of service quality will increase customer satisfaction by 0.184.

b. *Service quality on corporate image*

Table 9 Simple linear regression test

Coefficients[a]

Model		Unstandardized Coefficients B	std. Error	Standardized Coefficients Betas	t	Sig.
1	(Constant)	-2.239	1235		-1.813	071
	Service Quality	.149	.015	.597	10067	.000

a. Dependent Variables:Corporate image

Source: Primary data processed by researchers

$$Y' = a + bX$$

$$\hat{Y} = -2.239 + 0.149X$$

Where :

Y' = Corporate Image

X = Service Quality

A constant of -2,239 states that if there is no service quality, the corporate image will decrease by -2,239. The service quality regression coefficient of 0.149 states that each addition of 1 unit of service quality will increase corporate image by 0.149.

T test

Table 10 T test results

Model		Unstandardized Coefficients B	std. Error	Standardized Coefficients Betas	t	Sig.	Collinearity Statistics tolerance	VIF
1	(Constant)	-2. 336	1.133		-2. 062	041		
	Service Quality	.066	.019	.251	3,516	001	.465	2.152
	Custom er S atis fact	.149	.060	.172	2,480	014	.495	2020
	Corporate Image	047	072	044	.647	.519	.509	1966
	Price Perc eption	.030	080	.026	.370	.712	.485	2062
	Switching Cost	.390	072	.397	5,449	.000	.448	2,235

Source: Primary data processed by researchers

So based on the above calculations in the service quality variable (X1) tcount>ttable then Ho is rejected, meaning that service quality has a real (significant) effect on customer loyalty. From the table above it can be seen that unstandardized coefficients Beta service quality of 0.066 indicates that the service quality variable has a significant effect of 6.6% on customer loyalty.

Based on the above calculations in the variable customer satisfaction (X2) tcount>ttable then Ho is rejected, meaning that customer satisfaction has a significant (significant) effect on customer loyalty. From the table above it can be seen that the unstandardized coefficients Beta customer satisfaction is 0.149 indicating that the variable customer satisfaction has a significant effect of 14.9% on customer loyalty.

Based on the above calculations in the corporate image variable (X3) tcount<ttable then Ho is accepted, meaning that corporate image has no significant (not significant) effect on customer loyalty. From the table above it can be seen that the unstandardized coefficients Beta corporate image of 0.047 indicates that the corporate image variable has a significant effect of 4.7% on customer loyalty.

Based on the calculation above, the price perception variable (X4) tcount<ttable means that Ho is accepted, meaning that price perception has no significant effect on customer loyalty. From the

table above it can be seen that the unstandardized coefficients Beta price perception is 0.030 indicating that the price perception variable has a significant effect of 3% on customer loyalty.

Based on the above calculations in the variable switching cost (X5) tcount>ttable then Ho is rejected, meaning that switching cost has a significant (significant) effect on customer loyalty. From the table above it can be seen that the unstandardized coefficients Beta switching cost of 0.390 indicates that the variable switching cost has a significant effect of 39% on customer loyalty.

F test

Table 11 Test results f
ANOVA b

Model		Sum of Squares	df	MeanSquare	F	Sig.
1	Regression	547,750	5	109,550	48,486	.000 a
	residual	404,434	179	2,259		
	Total	952,184	184			

a. Predictors: (Constant), Switching Cost , Customer Satisfaction, Corporate Image, Price Perception, Service Quality
b. Dependent Variable: Customer Loyalty
Source: Primary data processed by researchers

Because Fcount>Ftable (48.486 > 2.27) then Ho is rejected. So it can be concluded that there is an influence of service quality, customer satisfaction, corporate image, price perception and switching cost variables on customer loyalty simultaneously.

Analysis of the coefficient of determination (adjusted R2)

Table 11 Test results f
Summary model b

Model	R	R Square	Adjusted R Square	std. Error of the Estimate	Durbin-Watson
1	.758a	.575	.563	1,503	1,596

a. Predictors: (Constant), Switching Cost , Customer Satisfaction, Corporate Image, Price Perception, Service Quality
b. Dependent Variable: Customer Loyalty
Source: Primary data processed by researchers

Based on the table above, the Adjusted R Square value is 0.563 which means that the customer loyalty of PT. First Media in Jakarta is influenced by service quality, customer satisfaction, corporate image, price perception and switching cost variables, namely 56.3%, while the rest is caused by other factors that were not examined in the research.

Managerial implications.

In this study, the method used in determining the most optimal portfolio is to use the Single Index Model method. This model is based on the observation that the price of a security fluctuates in the direction of the market price index. The following is the result of calculating the optimal portfolio using the Single index model.

Table 12. Weight Percentage of Shares

No.	Issuer Name	Securities Code	
1	Bukit Asam Coal Mine	PTBA	29.42%
2	Astra Agro Lestari	AALI	15.93%
3	United Tractors	UNTR	16.74%

From the results of the optimal portfolio above, investors and/or potential investors should invest their funds in shares in accordance with the percentage generated. Thus investors will get an expected return of 0.040874 or 4.09% of the funds invested with a residual error variance rate of 0.116914.

4. CONCLUSION

Stocks included in the optimum portfolio are stocks that have an excess return to beta (ERB) greater than the cut off point (C*). These shares are shares of Bukit Asam Coal Mine (PTBA), Astra Agro Lestari (AALI), United Tractors (UNTR), State Gas Company (PGAS), Indofood Sukses Makmur (INDF), Holcim Indonesia (SMCB), and Astra International (ASII). Stocks that are not included in the optimal portfolio are stocks that have an excess return to beta (ERB) less than the cut off point (C*). These stocks are Aneka Tambang (ANTM), Bank Central Asia (BBCA), Bank Rakyat Indonesia (BBRI), Bank Danamon Indonesia (BDMN), Bank Mandiri (BMRI), International Nickel Indonesia (INCO), Indosat (ISAT), Medco Energi International (MEDC), Telekomunikasi Indonesia (TLKM), and Bakrie Sumatra Plantations (UNSP).

REFERENCES

Brigham, F. Eugine & Joel, F. Houston. 2004. Financial Management. Eighth Edition, Book II. Jakarta: Erlangga

Gitman, J. Lawrence. (2003). Principles of Management Finance, 10th Edition, Boston: Addison and Wesley, Inc.

Husnan, Suad. 2009. Fundamentals of Portfolio Theory and Securities Analysis, Fourth Edition: Publishing and Printing Unit of the YKPN College of Management.

Jones, Charles P. 2007. Investment: Analysis and Management, 10th edition. New York: John Wiley and Sons. Inc.

Jogiyanto, HM 2003. Portfolio Theory and Investment Analysis. Third edition. Yogyakarta : BPFE.

PutroAdhianto, Hanur. 2010. Optimum Portfolio Analysis Using the Markowitz Model on Banking Sector Stocks in 2009. Jakarta, Thesis, Indonesian Banking School College of Economics.

Ramadan, Adam. 2011. Analysis of Sharia Stock Portfolio Optimization (Case Study on the Jakarta Islamic Index Period 2005-2009). Jakarta, Thesis of the Indonesian Banking School College of Economics

Septyarini. 2009. Optimal Portfolio Analysis Based on the Single Index Model on LQ-45 Stocks. Jakarta, Thesis, Faculty of Economics, Gunadarma University

Siamat, Dahlan. 2005. Management of Financial Institutions; Monetary and Banking Policy. Fifth edition. Jakarta: Faculty of Economics, University of Indonesia.

Sukarno, Mohamad. Analysis of Optimal Stock Portfolio Formation Using the Single Index Method at the Jakarta Stock Exchange. Semarang. S2 thesis, Diponegoro University.

Sunariyah. 2006. Introduction to Capital Market Knowledge. Yogyakarta: Publishing and Printing Unit of the YKPN College of Management.

Tandelilin, Eduardus. 2010. Portfolio and Investment: Theory and Application. First Edition. Yogyakarta: Kanisius

Wulandari, Sri. 2010. Optimal Stock Portfolio Analysis on the Indonesia Stock Exchange (Comparative Study Using Shares Listed in LQ-45 Shares and JII Shares). Yogyakarta, Thesis, Faculty of Economics, Yogyakarta Islamic University of Indonesia.

www.finance.yahoo.com(LQ 45 Share Price 2006-2010)

http://www.bi.go.id (List of Indonesian bank interest rates, period 2006-2010)

www.bps.go.id (Consumer Price Index 2006-2010)