

## BUKTI KORESPONDENSI

Penulis : Jan Horas Veryady Purba (*Corresponding author*) dan Bambang Pamungkas

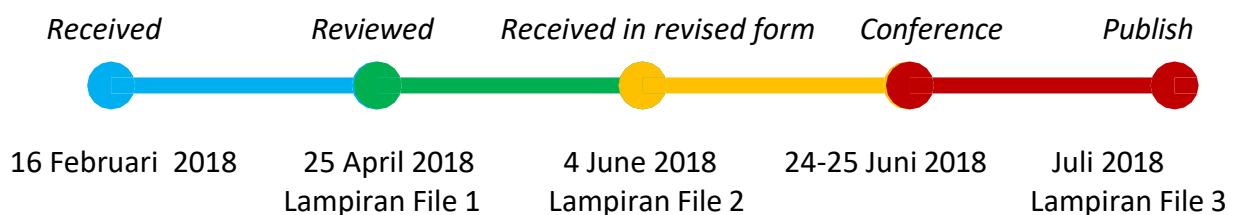
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### Kronologis Bukti Korespondensi



#### Kronologis:

1. 16 February 2018 **Received.** Pengiriman naskah via email ke Vijay Jha Conference Organizer ICBESS 2018 <[vijaykhumarjha2015@gmail.com](mailto:vijaykhumarjha2015@gmail.com)>
2. 25 April 2018, **Reviewed.** Koreksi Naskah dari Panitia ICBESS2018 (ketemu di Lombok)
3. 4 Juni 2018, **Received in revised form.** Penyerahan Hasil Revisi  
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6. Lampiran 1 : File Naskah Awal Artikel
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1. Submitted File : 16 Feb 2018 (bersamaan dengan 10<sup>th</sup> ICBESS)
2. Revisi dari Reviewer: 25 April 2018 (bersamaan dengan 10<sup>th</sup> ICBESS di Lombok)

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**MOST URGENT - REMINDER**

Dear Author,

Greetings from Academic Research Foundations (India).

I hope that you are doing well. I am glad to inform you that your paper has accepted for oral presentation for upcoming '**10th International Conference on Business, Economics and Social Sciences, 24-25 April 2018; The Jayakarta Lombok Resort, Lombok, Indonesia**' conference.

I request you to kindly arrange to send the conference registration fees at the earliest as we have extended the registration closing date.

**This Is Most Urgent Letter.**

**Thanks and looking for your kind reply,**

Yours Sincerely,  
for Academic Research Foundations,

Vijay Jha  
Conference Organizer: ICBESS-2018  
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4383/4A, Ansari Road, Darya Ganj,  
New Delhi-110002 (India)  
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The Windows taskbar at the bottom shows the system tray with a battery level of 97%, a temperature of 26°C in Berawan, and the date 03/11/2023 at 23:01.

3. Penyerahan Hasil Revisi Naskah : 4 Juni 2018, dan permohonan Jurnal ke IJER

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4. Accepted : 4 Juni 2018

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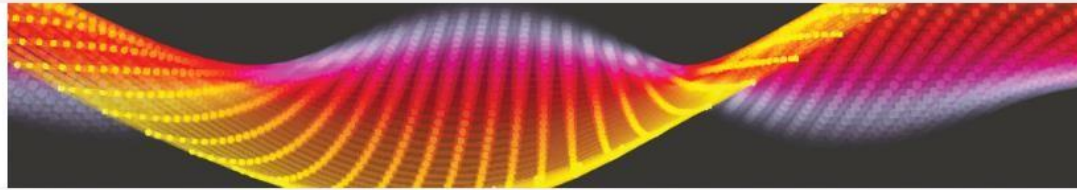
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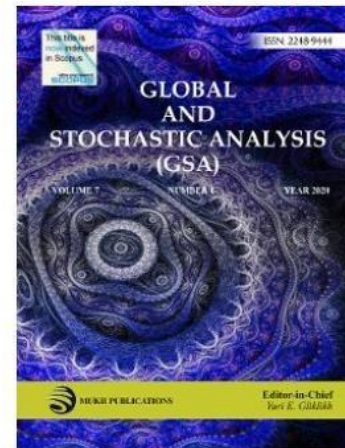
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to bcc: me

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Dear Participants,

First of all, we are very thankful to you for sending your article for the presentation in the **11th ICEBSS- 2018 conference**.

Please note that the venue for the Conference, to be held on 20th to 21st June 2018, has changed.

It will now be held in the **Ancasa Hotel & Spa, Kuala Lumpur, Malaysia**.

We request you to [send confirmation of your participation as soon as possible](#).

Thanks for your understanding !!!

Thanks & Regards

Vijay Kumar Jha  
Conference Organizer- 11 ICEBSS-2018

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# PORTFOLIO ANALYSIS WITH MARKOWITZ METHOD STUDY ON STOCKS LQ-45 IN INDONESIA

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## Abstract

Investment in the stock market can be done on various types of stocks from various industries. This helps investors to diversify their portfolios, where the essence of optimal portfolio formation is to reduce risk by diversifying stocks, placing funds on various investment alternatives to generate optimum returns. Optimal portfolio can be formed with various models, one of them using the Markowitz model. The purpose of this study is to examine stock portfolios that generate high expected returns with low risk. This research tested 6 companies selected by purposive, from LQ-45 company in IDX. With Markowitz model, two best companies can be obtained, namely BBKA and INDF. The most optimal stock proportion test is done by performing simulation analysis on some percentage of stock options in both companies. The findings of this study indicate that the most optimal investment proportion is 50% on BBKA and 50% in the company INDF. The results of this study confirm that Markowitz's method can be used to make the most optimal portfolio investment decision, resulting in high expected returns with low risk.

**Keywords:** Portfolio, Markowitz Method, Return, Risk

## INTRODUCTION

In the world of capital markets, investors have different preferences and characters in the face of risk. There is an Investor whose personality as risk seeker. This type of investor dare to take high in the hope of getting high yields as well. Investors with aggressive and speculative nature in making investment decisions. There are also Investors who are neutral to risk (risk neutrality), ie Investors who use the same yield for each level of improvement. Investors with this character make careful and flexible in making investment decisions. But there is also the

possibility of unnecessary investors (risk averter). Investors of this type only dare to spend money with low returns as well. Typical investors do not like to look for risk and mature before making investment decisions.

In terms of investing in the stock exchange Investors choose which shares can bring the largest dividends through fundamental or technical analysis process. The choice of stock is influenced by many factors such as government policy, political issues, micro and macro economic phenomena and other things. These factors pose a risk in stock selection. Rational investors always want the maximum return on investment. High returns earned on stocks are accompanied by high risk levels. In stocks, the risk is divided into two, namely systematic risk and systematic risk. Systematic or common risk also called market risk is a risk factor affecting the market as a whole. Thus, certain stock price movements will be affected by the movement of the stock market as a whole. This systematic risk can not be controlled by investors, and can not be eliminated through diversification. Meanwhile, the risk is not systematic or often called specific risk, is the risk that certain events that occur in companies or industries that then affect the stock price of the company. Investors can reduce the systematic risk of a stock investment by establishing a stock portfolio.

Although investment in the capital market promises a higher rate of return, but if the greater the return, the greater the risk faced. Therefore, investors are required to think rationally and also pay attention to how to optimize the return on minimum risk level. In order for the purpose to benefit from capital participation can make investors get optimal results. The investor must analyze the shares he/ she bought. Failure may occur if the investor gets too much information (overload information) that disorients the investor can not retrieve relevant and most needed information in analyzing the portfolio.

In stock investments in the stock market there are various types of stocks from various industries. This makes it easier for investors to diversify their portfolios, where the essence of optimal portfolio formation is to reduce risk by diversifying stocks, placing funds on various investment alternatives to generate optimum returns. Optimal portfolio can be formed with various models, one of them using the Markowitz model.

Euginia Natalia, et.al. (2014) states that Markowitz's model is used to find out: (a) which company shares are included in the optimal portfolio, (b) what proportion of funds should be invested in each stock, and (c) what the expected portfolio return rate and risk the optimal portfolio. Some optimal portfolio testing performed using the Markowitz method has proven that this model allows for optimal portfolio performance. Iyiola, et al. (2012) examines how portfolio theory helps investors to classify, estimate, and control the expected number of risks and returns in an effort to maximize Expected returns and minimize risks for expected returns. In addition to the Markowitz method, the Capital Asset Pricing Model (CAPM) is also one of theories that explains how assets are valued by the market or how to determine the rate of return that is deemed feasible for stock investments. Purwanti (2009) states that the Capital Asset Pricing Model (CAPM) is used to estimate the return of securities. While Anggraini (2014), looking at the risk side, look at the risk side, where the risk on investment can be minimized by diversifying assets to several types of stocks to form a portfolio.

The LQ45 index is a collection of 45 shares with the largest commercial transactions on the IDX. These shares are also commonly referred to as blue-chip stocks. Hartiwi Prabowo

(2013) using the CAPM and Markowitz Portfolio methods, obtained the 5 most profitable shares for investors. Meanwhile, to minimize the risk on the desired return on investing in shares can be done by diversifying or investing into more than one type of securities (forming a portfolio) (Syamsir, 2004). But the problem is how much of the proportion of funds should be invested in each share in order to obtain the desired yield with the least risk.

An efficient portfolio is the portfolio that gives the greatest return on expectations with certain risks or provides the smallest risk with a certain expectation return. An efficient portfolio can be determined by selecting a certain expectation return rate and then minimizing its risk or determining a certain level of risk and then maximizing its expected return. Portfolio analysis is used so that investors and stockholders can choose which stocks are selected to reduce portfolio risk and get the greatest return or in other words the lowest level of risk for a given rate of return. Based on the description in ata, the purpose of this study is to determine the most optimal stock portfolio, using the Markowitz method.

## **THEORY**

### **Investment**

Investing is spending a sum of money or saving money on something in the hope of one day getting financial benefits. "Investment can be interpreted as an investment activity or investment is done at the present in various assets to earn income in the future." (Warsini, 2009)

### **Portfolio Theory**

Portfolio theory is a related theory of expected portfolio returns and acceptable portfolio risk levels, and indicates how optimal portfolio formation is established. This portfolio theory is interconnected with capital market theory based on the influence of investors' decisions on the price of securities and shows the relationship that should occur between the return and the risk of securities if investors form a portfolio that fits the portfolio theory. Portfolio theory states that both risk and return should be considered with the assumption that a formal framework is available to measure both in the formation of a portfolio. In its basic form, portfolio theory begins with the assumption that the rate of return on future effects can be estimated and then determine the risk with variations in the distribution of returns. The greater the risk of investment or loan, the greater the desired rate of return to cover that risk.

The purpose of the establishment of a portfolio is to minimize risk without sacrificing returns generated through diversification. Portfolio diversification is spreading risk to selected securities. Diversification or portfolio deployment is done by entering various assets from all existing asset groups. Such as stocks, bonds, deposits, real assets and so on. Portfolio diversification can also be done by specializing in one group of assets only, for example stock. However, investors will find problems in forming a portfolio because of the large number of securities. The number of combinations of securities causes the number of portfolios.

An efficient portfolio is a portfolio that delivers maximum returns of hope with the same level of risk or portfolio that contains a minimum level of risk with equal returns of expectation. The optimal portfolio is a portfolio selected by investors from a number of efficient portfolios

according to the character of the investor. The optimal portfolio is based on the assumption that all investors are risk averse. That is to seek additional additional rate of return for additional one unit of risk is the same. An efficient portfolio is a good portfolio, but not the best one. There is only one best portfolio, the optimal portfolio. The optimal portfolio is an efficient portfolio. While an efficient portfolio is not necessarily the optimal portfolio. The optimal portfolio can be determined using risk-free assets. A risk-free asset is an asset that has a certain expected return without any risk. The risk free rate in a single index calculation usually uses the BI rate or the interest rate of Bank Indonesia Certificates (SBI) for conventional shares.

The expected return is the expected return of investors in the future and its nature has not occurred yet. With the uncertainty (uncertainty), it means investors will get a return in the future that is not yet known exactly the value. Return expectations and risk levels have a positive relationship. The greater the risk of a security, the greater the expected return, and vice versa.

One measure of risk is the standard deviation or variant that is the square of the standard deviation. The risk measured by this measure measures the risk of how much the value of each item deviates from the average. Portfolio risk can also be measured by the amount of standard deviation or variant of the value of single security returns in it.

#### LQ 45 Index

The JCI covering all listed shares (most of which are less actively traded) is deemed less appropriate as an indicator of capital market activity. Therefore, on 24 February 1997 an alternative index was introduced, the Liquid-45 Index (ILQ-45). The LQ-45 index began on 13 July 1994 and this date is the baseline day of the index with an initial value of 100 (Jogiyanto, 2009: 105). Furthermore, stock exchanges routinely monitor the progress of each of the 45 stocks included in the calculation of LQ-45 Index. Replacement of shares is done every six months, ie at the beginning of February and August. If there are any shares that do not meet the selection criteria, then the shares are excluded from the index calculation and replaced with other stocks that meet the criteria (Tandelilin, 2010: 88).

Commented [IC1]: Reference?

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### METHODOLOGY

Systematically, the phase of data analysis is done as follows:

#### 1. Variance of Shares:

$$\sigma_i^2 = \sum_{t=1}^n \frac{[R_{it} - E(R_i)]^2}{n}$$

Note :

$\sigma_i^2$  = Variance of return of share i

$R_{it}$  = Return of share i in periode t

$E(R_i)$  = Expected return share i

n = Time periode

So with the above variance formula, we can calculate the standard deviation, by:

$$\sigma_i = \sqrt{\sigma_i^2}$$

Note :

$\sigma_i^2$  = Variance of return of share i

$\sigma_i$  = Standard deviation

2. Search for covariance by entering the standard deviation that has been obtained by the formula:

$$COV_{ij} = \frac{\sum(R_{it} - E(R_i))(R_{jt} - E(R_j))}{n}$$

Note:

$COV_{ij}$  = Covariance variables i and j

$R_{it}$  = Return of stock i in period t

$E(R_i)$  = Expected return stock i

$R_{jt}$  = Return of stock j at period t

$E(R_j)$  = Expected return of stock j

n = Time periode

3. The correlation coefficient is calculated by dividing the stock covariance i and j with the result of standard deviation multiplication of shares i and j, by the formula:

$$r_{ij} = \frac{COV_{ij}}{\sigma_i \sigma_j}$$

Note:

$r_{ij}$  = The correlation coefficient of variables i and j

$COV_{ij}$  = Covariance variables i and j

$\sigma_i$  = Standard deviation i

$\sigma_j$  = Standard deviation j

4. Make a simulation and assume the proportion of funds to the stocks that have been selected with percentage as a unit  
With the condition :  $W_1 + W_2 = 1$  or 100%
5. Next look for a portfolio risk that consists of two securities, the formula used is :

$$\sigma_p = \sqrt{W_i^2 \cdot \sigma_i^2 + W_j^2 \sigma_j^2 + 2 \cdot W_i \cdot W_j \cdot (r_{ij}) \cdot \sigma_i \cdot \sigma_j}$$

Note :

$\sigma_p$  = Standard deviation portfolio

$W_i$  = Weight allocation on stock i

$W_j$  = Weight allocation on stock j

$r_{ij}$  = The correlation coefficient of variables i j

$\sigma_i$  = Standar deviasi i  
 $\sigma_j$  = Standar deviasi j

## RESULTS AND DISCUSSIONS

In this study, purposively selected 6 companies from the company LQ-45, ie BBKA (Bank BCA), BBNI (Bank BNI), BBRI (Bank BRI), INDF (PT Indofood Sukses Makmur), JSMR (PT Jasa Marga) dan TLKM (PT Telkom) on the IDX from 2012 until 2016.

The expected return and standard deviations of the above six firms are presented in Table 1 below.

**Table 1**  
**Stock Code, Expected Return (E (R<sub>i</sub>)), Standard Deviation and Variance**

No.	Stock	<i>E(R<sub>i</sub>)</i>	Standard Deviation	<i>Variance</i>
<b>1</b>	<b>BBKA</b>	<b>0,02265</b>	<b>0,01190</b>	<b>0,00014</b>
2	BBNI	0,02788	0,02575	0,00066
3	BBRI	0,02668	0,02135	0,00045
<b>4</b>	<b>INDF</b>	<b>0,01474</b>	<b>0,01187</b>	<b>0,00014</b>
5	JSMR	0,03223	0,02659	0,00070
6	TLKM	-0,00395	0,03269	0,00106

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Source: IDX, LQ-45 annual financial statements at IDX

JSMR, BBRI, BBNI have a large expected return (E (R<sub>i</sub>)), but also have big risks. TLKM has very low expected return (E (R<sub>i</sub>)) and negative material, and also has a big risk. Therefore, the four shares of this company are relatively unattractive and not an efficient investment choice.

Conversely, the company's stock that generates a relatively large expected return with the relatively smallest risk is BBKA and INDF. Therefore, both companies are selected to test the most optimal proportion of stocks.

### Covariance Analysis

Covariance is an absolute rule that shows how far two variables have a tendency to move together. In the context of portfolio management, covariance indicates the extent to which returns from both securities in the portfolio tend to move together. Covariance can take the form of positive, negative, or zero. Positive covariance means the tendency of two securities to move in the same direction, negative covariance means that the return of two securities tends to move in the opposite direction. If the securities return A rises then the return of securities B falls, and vice versa. Covariance zero indicates that the movement of two securities is independent of each other. The results showed that the covariance values tend to be near zero. This indicates that securities movements tend to be independent of each other and tend to move in opposite directions. This means the greater the benefits of risk reduction in the portfolio.



Next is to calculate the covariance between stocks forming a portfolio. The results can be seen in the following table:

**Table 2**  
**Covariance Stock Portfolio Maker**

Stock	BBCA	BBNI	BBRI	INDF	JSMR	TLKM
BBCA	0.0001	0.0001	0.0002	<b>0.0000</b>	0.0002	0.0002
BBNI	0.0001	0.0007	0.0003	0.0002	0.0006	<b>0.0000</b>
BBRI	0.0002	0.0003	0.0005	<b>-0.0001</b>	0.0004	0.0003
INDF	0.0000	0.0002	-0.0001	0.0001	0.0001	<b>0.0000</b>
JSMR	0.0002	0.0006	0.0004	0.0001	0.0007	0.0004
TLKM	0.0000	0.0002	0.0001	0.0001	0.0002	-0.0001

Source: Company annual financial report LQ-45 on IDX (data processed)

### Correlation Coefficient Analysis

The correlation coefficient is a statistical measure showing the relationship of two variables. In the context of diversification, this measure will explain the extent to which returns from one securities are related to each other. In the concept of diversification, the incorporation of two perfectly positive correlated securities (+1.0) will not provide the benefit of risk reduction. The merger of two zero-correlated securities will significantly reduce the risk of the portfolio. The more unrelated shares are included in the portfolio, the greater the benefit of risk reduction. The merger of two perfectly negative correlated (-1.0) securities will eliminate the risk of both securities. Next is to calculate the correlation coefficient between stocks forming a portfolio. The results can be seen in the following table:

**Table 3. Coefficient of Correlation of Portfolio Maker**

Stock	BBCA	BBNI	BBRI	INDF	JSMR	TLKM
BBCA	1	0.486	0.867	<b>-0.155</b>	0.771	0.474
BBNI	0.486	1	0.538	0.610	0.855	<b>-0.021</b>
BBRI	0.867	0.538	1	<b>-0.244</b>	0.718	0.469
INDF	-0.155	0.610	-0.244	1	0.451	<b>-0.089</b>
JSMR	0.771	0.855	0.718	0.451	1	0.454
TLKM	0.474	-0.021	0.469	-0.089	0.454	1

Source: Company's annual financial report LQ-45 on IDX (data processed)

The table shows that the correlation coefficient will be worth 1 if the same merged shares are correlated and it states that the same stock will not provide the benefit of risk reduction.

### Stocks That Establish Optimal Portfolio

After getting the result of covariance and correlation coefficient between each stock, then research continued by choosing two stocks that have covariance with negative value ( $0 >$  covariance) because indicating movement between two stocks have tendency is reversed in accordance with diversification principle and correlation coefficient with the value is close to negative one (-1) because it will reduce the risk significantly in accordance with the principle of hedging. After getting the result of covariance and correlation coefficient between each stock, then research continued by choosing two stocks that have covariance with negative value ( $0 >$  covariance) because indicating movement between two stocks have tendency is reversed in accordance with diversification principle and correlation coefficient with the value is close to negative one (-1) because it will reduce the risk significantly in accordance with the principle of hedging.

### Covariance Between Two Stocks

Selection of two stocks with negative covariance are (1) BBCA with INDF, (2) BBNI with TLKM, (3) BBRI with INDF, and (4) INDF with TLKM. For optimal portfolio, the value of covariance is the most closely approximated value of -1, therefore this research will select two portfolios between the two stocks with value closest to -1, the portfolio is ASII shares with TLKM shares and TLKM shares with KLBK shares.

### Correlation Coefficient Between Two Stocks

In accordance with the principle of diversification, this study chose the correlation coefficient value approaching the value of -1, the portfolio is shares of stock (1) BBCA with INDF, (2) BBNI with TLKM, (3) BBRI with INDF, and (4) INDF with TLKM .

### Analysis of Proportion of Investment Funds and Correlation Coefficient on Portfolio Risk

Shares selected for portfolio formation will be made in the form of a proportional proportion of funds simulation in order to analyze which proportion of funds will minimize portfolio risk in stock investments. This study simulated the comparison of proportion of stock investment fund from 10% to 90% with total amount of fund proportion between 2 stocks reach 100% or 1, including composition result of each individual stock risk (standard deviation), result of correlation coefficient from merging two shares and portfolio risk results obtained.

This study takes 10 stock portfolio risks with the least value in comparison to test the effect of correlation coefficient and the proportion of funds on portfolio risk

**Table 4.**  
**Correlation Coefficient and Portfolio Risk**

No	W1 Proportion	W2 Proportion	(r) Correlation	( $\sigma_p$ ) Portfolio Risk
1	30% BBCA	70% INDF	-0,155	0,00853
2	40% BBCA	60% INDF	-0,155	0,00794
<b>3</b>	<b>50% BBCA</b>	<b>50% INDF</b>	<b>-0,155</b>	<b>0,00773</b>
4	60% BBCA	40% INDF	-0,155	0,00795

5	70% BBKA	30% INDF	-0,155	0,00854
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Based on the results obtained above that the stock portfolio of BBKA-INDF with the proportion of 50% share of BBKA and 50% INDF shares with the correlation coefficient of -0.15456 is the stock portfolio selected because it has the smallest risk (0,00773 or 0.7%). The proportion of the proportion of funds taken in this portfolio affects the outcome of BBKA-INDF stock portfolio risk, as there are 9 different portfolio risk outcomes with the proportion of simulated proportion of funds, making it possible to compare the proportion of more influential funds in the portfolio.

**Commented [IC4]:** Visualize it in pictures to make it easier to understand

### CONCLUSION

For comparison of proportion of funds and correlation coefficient which resulted in the smallest portfolio risk among all such simulations are the stock portfolio of BBKA (Bank Central Asia Tbk) and INDF (Indofood Sukses Makmur Tbk.) With the proportion of 50% share of BBKA and 50% with a correlation coefficient of -0.155 resulting in a portfolio risk of 0.00773 or 0.77%. This study concludes that although the correlation coefficient of the stock portfolio of BBKA (Bank Central Asia Tbk) and INDF (Indofood Sukses Makmur Tbk.) is -0.15456, which means the level of movement of each stock is more correlated or opposite direction is not so strong. the smallest portfolio risk is derived from BBKA-INDF's stock portfolio of 0.00773 or 0.77%. The results are also influenced by the exact proportion of funds that are 50% of BBKA shares and 50% of INDF shares.

From the results obtained in this study, the influence of the proportion of funds and correlation coefficients have a tendency in affecting portfolio risk, but in accordance with the limitations of the problems listed in chapter one, that in the performance of the stock portfolio of BBKA (Bank Central Asia Tbk.) and INDF (Indofood Sukses Makmur Tbk.), investors should also measure the rate of increase of BBKA stock return and the level of stock return of INDF and vice versa, so that at the time of its operation the investor can analyze the proportion of funds invested to each stock according to fact and added with analysis of other variables including the time period in searching for expected return, the standard deviation of individual stocks respectively, variance and covariance so that the results of this study is expected to be material for a new study by further researchers. In addition to the information from the researcher, all variables that can be researched by analyzing the formulas of various experts from the academic circles include only theoretical calculations, whose results can in fact be changed if there are influences from external factors such as government policy, natural disasters, political situation and risk systematic market.

### REFERENCES

Anggraini Eka Pratiwi, Moch. Dzulkirom, dan Devi Farah Azizah. 2014. Analisis Investasi Portofolio Saham Pasar Modal Syariah Dengan Model Markowitz Dan Model Indeks

**Commented [IC5]:** Check and complete any missing references

- Tunggal (Studi Pada Saham Perusahaan yang Terdaftar dalam Jakarta Islamic Indeks di Bursa Efek Indonesia Periode Mei 2011 sampai dengan November 2013). *Jurnal Administrasi Bisnis (JAB)* Vol. 17 No. 1 Desember 2014: 1-10
- Bursa Efek Indonesia. 2017. *IDX Fact Book 2017*, BEI, Jakarta.
- Eugenia Natalia, Darminto, dan M.G. Wi Endang NP . 2014. Penentuan Portofolio Saham yang Optimal dengan Model Markowitz Sebagai Dasar Penetapan Investasi Saham (Studi pada Perusahaan Food and Beverage yang Terdaftar di Bursa Efek Indonesia Tahun 2012) . *Jurnal Administrasi Bisnis (JAB)* Vol. 9 No. 1 April 2014: 1-10
- Hartiwi Prabowo. Analisis Portofolio Saham Dengan Metode CAPM Dan Markowitz . *Binus Business Review* Vol. 4 No. 1 Mei 2013: 360-369
- Hartono, J. 2008. *Teori Portofolio dan Analisis Investasi*. Edisi 6, BPFE. Yogyakarta.
- Hasnawati, S. (2006). Penilaian Saham, Memahami Cara Berinvestasi Saham di Pasar Modal. *Jurnal Bisnis & Manajemen*. Volume 2 No. 3 Mei 2006 hal 213-237.  
[http://lemlit.unila.ac.id/file/JURNAL%20Bisnis%20dan%20Manajemen%20\(JBM\).pdf](http://lemlit.unila.ac.id/file/JURNAL%20Bisnis%20dan%20Manajemen%20(JBM).pdf). 10 Juni 2010.
- Iyiola Omisore, Munirat Yusuf and Nwifo Christopher .I. 2012. Review The Modern Portfolio Theory as an Investment Decision Tool . *Journal of Accounting and Taxation*. Vol. 4(2), pp. 19-28, March 2012 Available online at <http://www.academicjournals.org/JAT>
- Purwanti, D. (2009). Simulasi Lindung Nilai Portofolio dengan Mini LQ Futures Periode 1 Agustus, 28 November 2008. Tesis tidak dipublikasikan. Jakarta: Universitas Bina Nusantara.
- Sutrisno. 2009. Manajemen keuangan Teori, Konsep, dan Aplikasi. Ekonisia, Kampus Fakultas Ekonomi UII, Jakarta.
- Syamsir, H. (2004). Solusi Investasi di Bursa Saham Indonesia: Pendekatan Analisis Teknikal melalui Studi Kasus Riil dengan Dilengkapi Formulasi MetaStock. Jakarta: Elex Media Komputindo.
- Tandelilin, E. 2010. *Analisis Investasi dan Manajemen Portofolio*. Edisi ketujuh. Kanisius, Yogyakarta.

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# PORTFOLIO ANALYSIS WITH MARKOWITZ METHOD STUDY ON STOCKS LQ-45 IN INDONESIA

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## Abstract

Investment in the stock market can be done on various types of stocks from various industries. This helps investors to diversify their portfolios, where the essence of optimal portfolio formation is to reduce risk by diversifying stocks, placing funds on various investment alternatives to generate optimum returns. Optimal portfolio can be formed with various models, one of them using the Markowitz model. The purpose of this study is to examine stock portfolios that generate high expected returns with low risk. This research tested 6 companies selected by purposive, from LQ-45 company in IDX. With Markowitz model, two best companies can be obtained, namely BBKA and INDF. The most optimal stock proportion test is done by performing simulation analysis on some percentage of stock options in both companies. The findings of this study indicate that the most optimal investment proportion is 50% on BBKA and 50% in the company INDF. The results of this study confirm that Markowitz's method can be used to make the most optimal portfolio investment decision, resulting in high expected returns with low risk.

**Keywords:** Portfolio, Markowitz Method, Return, Risk

## INTRODUCTION

In the world of capital markets, investors have different preferences and characters in the face of risk. There is an Investor whose personality as risk seeker. This type of investor dare to take high in the hope of getting high yields as well. Investors with aggressive and speculative nature in making investment decisions. There are also Investors who are neutral to risk (risk neutrality), ie Investors who use the same yield for each level of improvement. Investors with this character make careful and flexible in making investment decisions. But there is also the



possibility of unnecessary investors (risk averter). Investors of this type only dare to spend money with low returns as well. Typical investors do not like to look for risk and mature before making investment decisions.

In terms of investing in the stock exchange Investors choose which shares can bring the largest dividends through fundamental or technical analysis process. The choice of stock is influenced by many factors such as government policy, political issues, micro and macro economic phenomena and other things. These factors pose a risk in stock selection. Rational investors always want the maximum return on investment. High returns earned on stocks are accompanied by high risk levels. In stocks, the risk is divided into two, namely systematic risk and systematic risk. Systematic or common risk also called market risk is a risk factor affecting the market as a whole. Thus, certain stock price movements will be affected by the movement of the stock market as a whole. This systematic risk can not be controlled by investors, and can not be eliminated through diversification. Meanwhile, the risk is not systematic or often called specific risk, is the risk that certain events that occur in companies or industries that then affect the stock price of the company. Investors can reduce the systematic risk of a stock investment by establishing a stock portfolio.

Although investment in the capital market promises a higher rate of return, but if the greater the return, the greater the risk faced. Therefore, investors are required to think rationally and also pay attention to how to optimize the return on minimum risk level. In order for the purpose to benefit from capital participation can make investors get optimal results. The investor must analyze the shares he/ she bought. Failure may occur if the investor gets too much information (overload information) that disorients the investor can not retrieve relevant and most needed information in analyzing the portfolio.

In stock investments in the stock market there are various types of stocks from various industries. This makes it easier for investors to diversify their portfolios, where the essence of optimal portfolio formation is to reduce risk by diversifying stocks, placing funds on various investment alternatives to generate optimum returns. Optimal portfolio can be formed with various models, one of them using the Markowitz model.

Euginia Natalia, et.al. (2014) states that Markowitz's model is used to find out: (a) which company shares are included in the optimal portfolio, (b) what proportion of funds should be invested in each stock, and (c) what the expected portfolio return rate and risk the optimal portfolio. Some optimal portfolio testing performed using the Markowitz method has proven that this model allows for optimal portfolio performance. Iyiola, et al. (2012) examines how portfolio theory helps investors to classify, estimate, and control the expected number of risks and returns in an effort to maximize Expected returns and minimize risks for expected returns. In addition to the Markowitz method, the Capital Asset Pricing Model (CAPM) is also one of theories that explains how assets are valued by the market or how to determine the rate of return that is deemed feasible for stock investments. Purwanti (2009) states that the Capital Asset Pricing Model (CAPM) is used to estimate the return of securities. While Anggraini (2014), looking at the risk side, look at the risk side, where the risk on investment can be minimized by diversifying assets to several types of stocks to form a portfolio.

The LQ45 index is a collection of 45 shares with the largest commercial transactions on the IDX. These shares are also commonly referred to as blue-chip stocks. Hartiwi Prabowo

(2013) using the CAPM and Markowitz Portfolio methods, obtained the 5 most profitable shares for investors. Meanwhile, to minimize the risk on the desired return on investing in shares can be done by diversifying or investing into more than one type of securities (forming a portfolio) (Syamsir, 2004). But the problem is how much of the proportion of funds should be invested in each share in order to obtain the desired yield with the least risk.

An efficient portfolio is the portfolio that gives the greatest return on expectations with certain risks or provides the smallest risk with a certain expectation return. An efficient portfolio can be determined by selecting a certain expectation return rate and then minimizing its risk or determining a certain level of risk and then maximizing its expected return. Portfolio analysis is used so that investors and stockholders can choose which stocks are selected to reduce portfolio risk and get the greatest return or in other words the lowest level of risk for a given rate of return. Based on the description in ata, the purpose of this study is to determine the most optimal stock portfolio, using the Markowitz method.

## **THEORY**

### **Investment**

Investing is spending a sum of money or saving money on something in the hope of one day getting financial benefits. "Investment can be interpreted as an investment activity or investment is done at the present in various assets to earn income in the future." (Warsini, 2009)

### **Portfolio Theory**

Portfolio theory is a related theory of expected portfolio returns and acceptable portfolio risk levels, and indicates how optimal portfolio formation is established. This portfolio theory is interconnected with capital market theory based on the influence of investors' decisions on the price of securities and shows the relationship that should occur between the return and the risk of securities if investors form a portfolio that fits the portfolio theory. Portfolio theory states that both risk and return should be considered with the assumption that a formal framework is available to measure both in the formation of a portfolio. In its basic form, portfolio theory begins with the assumption that the rate of return on future effects can be estimated and then determine the risk with variations in the distribution of returns. The greater the risk of investment or loan, the greater the desired rate of return to cover that risk.

The purpose of the establishment of a portfolio is to minimize risk without sacrificing returns generated through diversification. Portfolio diversification is spreading risk to selected securities. Diversification or portfolio deployment is done by entering various assets from all existing asset groups. Such as stocks, bonds, deposits, real assets and so on. Portfolio diversification can also be done by specializing in one group of assets only, for example stock. However, investors will find problems in forming a portfolio because of the large number of securities. The number of combinations of securities causes the number of portfolios.

An efficient portfolio is a portfolio that delivers maximum returns of hope with the same level of risk or portfolio that contains a minimum level of risk with equal returns of expectation. The optimal portfolio is a portfolio selected by investors from a number of efficient portfolios

according to the character of the investor. The optimal portfolio is based on the assumption that all investors are risk averse. That is to seek additional additional rate of return for additional one unit of risk is the same. An efficient portfolio is a good portfolio, but not the best one. There is only one best portfolio, the optimal portfolio. The optimal portfolio is an efficient portfolio. While an efficient portfolio is not necessarily the optimal portfolio. The optimal portfolio can be determined using risk-free assets. A risk-free asset is an asset that has a certain expected return without any risk. The risk free rate in a single index calculation usually uses the BI rate or the interest rate of Bank Indonesia Certificates (SBI) for conventional shares.

The expected return is the expected return of investors in the future and its nature has not occurred yet. With the uncertainty (uncertainty), it means investors will get a return in the future that is not yet known exactly the value. Return expectations and risk levels have a positive relationship. The greater the risk of a security, the greater the expected return, and vice versa.

One measure of risk is the standard deviation or variant that is the square of the standard deviation. The risk measured by this measure measures the risk of how much the value of each item deviates from the average. Portfolio risk can also be measured by the amount of standard deviation or variant of the value of single security returns in it.

#### LQ 45 Index

Referring to Jogiyanto's opinion (2009: 101), the JCI covering all listed shares (most of which are less actively traded) is deemed less appropriate as an indicator of capital market activity. Therefore, on 24 February 1997 an alternative index was introduced, the Liquid-45 Index (LQ-45). The LQ-45 index began on 13 July 1994 and this date is the baseline day of the index with an initial value of 100 (Jogiyanto, 2009: 105). Furthermore, stock exchanges routinely monitor the progress of each of the 45 stocks included in the calculation of LQ-45 Index. Replacement of shares is done every six months, ie at the beginning of February and August. If there are any shares that do not meet the selection criteria, then the shares are excluded from the index calculation and replaced with other stocks that meet the criteria (Tandelilin, 2010: 88).

Commented [JHP1]: Jogiyanto, 2009  
References have been added

#### Markowitz Method

Markowitz's portfolio method is also called the Mean-Varian Model, which emphasizes the effort to maximize return (mean) expectations and minimize the uncertainty/risk (variance) for selecting and preparing an optimal portfolio. This means that it can be said that the optimum portfolio selection approach is based on its preference for return and risk exposure of each investment option.

Establishing a portfolio with this model provides an advantage whereby every investor can take advantage of all the information provided on the market. The assumptions underlying the formation of the portfolio use Markowitz's theory, the time spent in the study is only one period, the investor bases the calculation on the return value of exposure and portfolio risk, no loans and risk-free savings, and no transaction cost calculation (Hartono, 2010 : 312)

Commented [JHP2]: Markowitz Method has been added

Commented [JHP3]: Reference: Hartono, 2010

## METHODOLOGY

Systematically, the phase of data analysis is done as follows:

1. Variance of Shares:

$$\sigma_i^2 = \sum_{t=1}^n \frac{[R_{it} - E(R_i)]^2}{n}$$

Note :

$\sigma_i^2$  = Variance of return of share i

$R_{it}$  = Return of share i in periode t

$E(R_i)$  = Expected return share i

n = Time periode

So with the above variance formula, we can calculate the standard deviation, by:

$$\sigma_i = \sqrt{\sigma_i^2}$$

Note :

$\sigma_i^2$  = Variance of return of share i

$\sigma_i$  = Standard deviation

2. Search for covariance by entering the standard deviation that has been obtained by the formula:

$$COV_{ij} = \frac{\sum (R_{it} - E(R_i))(R_{jt} - E(R_j))}{n}$$

Note:

$COV_{ij}$  = Covariance variables i and j

$R_{it}$  = Return of stock i in period t

$E(R_i)$  = Expected return stock i

$R_{jt}$  = Return of stock j at period t

$E(R_j)$  = Expected return of stock j

n = Time periode

3. The correlation coefficient is calculated by dividing the stock covariance i and j with the result of standard deviation multiplication of shares i and j, by the formula:

$$r_{ij} = \frac{COV_{ij}}{\sigma_i \sigma_j}$$

Note:

$r_{ij}$  = The correlation coefficient of variables i and j

$COV_{ij}$  = Covariance variables i and j

$\sigma_i$  = Standard deviation i

$\sigma_j$  = Standard deviation j

4. Make a simulation and assume the proportion of funds to the stocks that have been selected with percentage as a unit  
With the condition :  $W_1 + W_2 = 1$  or 100%
5. Next look for a portfolio risk that consists of two securities, the formula used is :

$$\sigma_p = \sqrt{W_i^2 \cdot \sigma_i^2 + W_j^2 \sigma_j^2 + 2 \cdot W_i \cdot W_j \cdot (r_{ij}) \cdot \sigma_i \cdot \sigma_j}$$

Note :

$\sigma_p$  = Standard deviation portfolio

$W_i$  = Weight allocation on stock i

$W_j$  = Weight allocation on stock j

$r_{ij}$  = The correlation coefficient of variables i j

$\sigma_i$  = Standar deviasi i

$\sigma_j$  = Standar deviasi j

## RESULTS AND DISCUSSIONS

In this study, purposively selected 6 companies from the company LQ-45, ie BBKA (Bank BCA), BBNI (Bank BNI), BBRI (Bank BRI), INDF (PT Indofood Sukses Makmur), JSMR (PT Jasa Marga) dan TLKM (PT Telkom) on the IDX from 2012 until 2016.

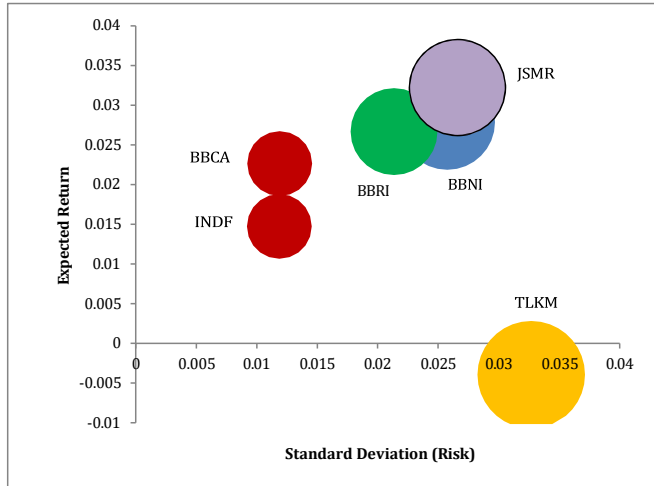
The expected return and standard deviations of the above six firms are presented in Table 1 below.

**Table 1**  
**Stock Code, Expected Return (E (Ri)), Standard Deviation and Variance**

No.	Stock	<i>E(Ri)</i>	Standard Deviation	<i>Variance</i>
<b>1</b>	<b>BBKA</b>	<b>0,02265</b>	<b>0,01190</b>	<b>0,00014</b>
2	BBNI	0,02788	0,02575	0,00066
3	BBRI	0,02668	0,02135	0,00045
<b>4</b>	<b>INDF</b>	<b>0,01474</b>	<b>0,01187</b>	<b>0,00014</b>
5	JSMR	0,03223	0,02659	0,00070
6	TLKM	-0,00395	0,03269	0,00106

Source: IDX, LQ-45 annual financial statements at IDX

The meaning of the table above can be seen more easily by describing the coordinate relationship between Expected return (E (Ri)) with risk (standard deviation), as presented in Figure 1.



**Figure 1: Expected Return Correlation (E(Ri)) and Risk**

**Commented [JHP4]:** Graphically, the relationship between Expected return and Risk is presented in Figure 1

JSMR, BBRI, BBNI have a large expected return (E (Ri)), but also have big risks. TLKM has very low expected return (E (Ri)) and negative material, and also has a big risk. Therefore, the four shares of this company are relatively unattractive and not an efficient investment choice.

Conversely, the company's stock that generates a relatively large expected return with the relatively smallest risk is BBKA and INDF. Therefore, both companies are selected to test the most optimal proportion of stocks.

### Covariance Analysis

Covariance is an absolute rule that shows how far two variables have a tendency to move together. In the context of portfolio management, covariance indicates the extent to which returns from both securities in the portfolio tend to move together. Covariance can take the form of positive, negative, or zero. Positive covariance means the tendency of two securities to move in the same direction, negative covariance means that the return of two securities tends to move in the opposite direction. If the securities return A rises then the return of securities B falls, and vice versa. Covariance zero indicates that the movement of two securities is independent of each other. The results showed that the covariance values tend to be near zero. This indicates that securities movements tend to be independent of each other and tend to move in opposite directions. This means the greater the benefits of risk reduction in the portfolio.

Next is to calculate the covariance between stocks forming a portfolio. The results can be seen in the following table:

**Table 2**



**Covariance Stock Portfolio Maker**

Stock	BBCA	BBNI	BBRI	INDF	JSMR	TLKM
BBCA	0.0001	0.0001	0.0002	<b>0.0000</b>	0.0002	0.0002
BBNI	0.0001	0.0007	0.0003	0.0002	0.0006	<b>0.0000</b>
BBRI	0.0002	0.0003	0.0005	<b>-0.0001</b>	0.0004	0.0003
INDF	0.0000	0.0002	-0.0001	0.0001	0.0001	<b>0.0000</b>
JSMR	0.0002	0.0006	0.0004	0.0001	0.0007	0.0004
TLKM	0.0000	0.0002	0.0001	0.0001	0.0002	-0.0001

Source: Company annual financial report LQ-45 on IDX (data processed)

### Correlation Coefficient Analysis

The correlation coefficient is a statistical measure showing the relationship of two variables. In the context of diversification, this measure will explain the extent to which returns from one securities are related to each other. In the concept of diversification, the incorporation of two perfectly positive correlated securities (+1.0) will not provide the benefit of risk reduction. The merger of two zero-correlated securities will significantly reduce the risk of the portfolio. The more unrelated shares are included in the portfolio, the greater the benefit of risk reduction. The merger of two perfectly negative correlated (-1.0) securities will eliminate the risk of both securities. Next is to calculate the correlation coefficient between stocks forming a portfolio. The results can be seen in the following table:

**Table 3. Coefficient of Correlation of Portfolio Maker**

Stock	BBCA	BBNI	BBRI	INDF	JSMR	TLKM
BBCA	1	0.486	0.867	<b>-0.155</b>	0.771	0.474
BBNI	0.486	1	0.538	0.610	0.855	<b>-0.021</b>
BBRI	0.867	0.538	1	<b>-0.244</b>	0.718	0.469
INDF	-0.155	0.610	-0.244	1	0.451	<b>-0.089</b>
JSMR	0.771	0.855	0.718	0.451	1	0.454
TLKM	0.474	-0.021	0.469	-0.089	0.454	1

Source: Company's annual financial report LQ-45 on IDX (data processed)

The table shows that the correlation coefficient will be worth 1 if the same merged shares are correlated and it states that the same stock will not provide the benefit of risk reduction.

### Stocks That Establish Optimal Portfolio

After getting the result of covariance and correlation coefficient between each stock, then research continued by choosing two stocks that have covariance with negative value (>0 covariance) because indicating movement between two stocks have tendency is reversed in accordance with diversification principle and correlation coefficient with the value is close to negative one (-1) because it will reduce the risk significantly in accordance with the principle

of hedging. After getting the result of covariance and correlation coefficient between each stock, then research continued by choosing two stocks that have covariance with negative value ( $0 >$  covariance) because indicating movement between two stocks have tendency is reversed in accordance with diversification principle and correlation coefficient with the value is close to negative one (-1) because it will reduce the risk significantly in accordance with the principle of hedging.

### Covariance Between Two Stocks

Selection of two stocks with negative covariance are (1) BBCA with INDF, (2) BBNI with TLKM, (3) BBRI with INDF, and (4) INDF with TLKM. For optimal portfolio, the value of covariance is the most closely approximated value of -1, therefore this research will select two portfolios between the two stocks with value closest to -1, the portfolio is ASII shares with TLKM shares and TLKM shares with KLBF shares.

### Correlation Coefficient Between Two Stocks

In accordance with the principle of diversification, this study chose the correlation coefficient value approaching the value of -1, the portfolio is shares of stock (1) BBCA with INDF, (2) BBNI with TLKM, (3) BBRI with INDF, and (4) INDF with TLKM .

### Analysis of Proportion of Investment Funds and Correlation Coefficient on Portfolio Risk

Shares selected for portfolio formation will be made in the form of a proportional proportion of funds simulation in order to analyze which proportion of funds will minimize portfolio risk in stock investments. This study simulated the comparison of proportion of stock investment fund from 10% to 90% with total amount of fund proportion between 2 stocks reach 100% or 1, including composition result of each individual stock risk (standard deviation), result of correlation coefficient from merging two shares and portfolio risk results obtained.

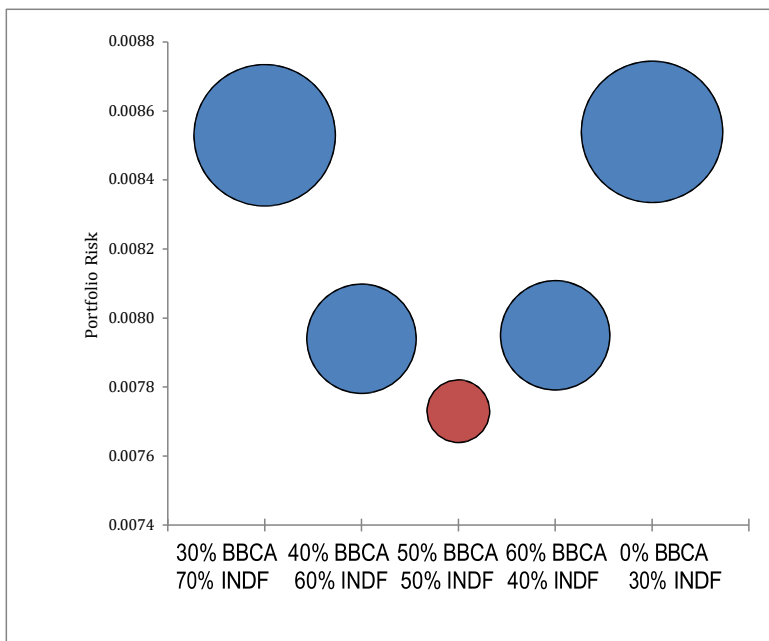
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Based on the results obtained above that the stock portfolio of BBCA-INDF with the proportion of 50% share of BBCA and 50% INDF shares with the correlation coefficient of -0.15456 is the stock portfolio selected because it has the smallest risk (0,00773 or 0.7%). The

proportion of the proportion of funds taken in this portfolio affects the outcome of BBKA-INDF stock portfolio risk, as there are 9 different portfolio risk outcomes with the proportion of simulated proportion of funds, making it possible to compare the proportion of more influential funds in the portfolio.



**Figure 2: Proportion of the most optimal stock on BBKA and INDF**

**CONCLUSION**

For comparison of proportion of funds and correlation coefficient which resulted in the smallest portfolio risk among all such simulations are the stock portfolio of BBKA (Bank Central Asia Tbk) and INDF (Indofood Sukses Makmur Tbk.) With the proportion of 50% share of BBKA and 50% with a correlation coefficient of -0.155 resulting in a portfolio risk of 0.00773 or 0.77%. This study concludes that although the correlation coefficient of the stock portfolio of BBKA (Bank Central Asia Tbk) and INDF (Indofood Sukses Makmur Tbk.) is -0.15456, which means the level of movement of each stock is more correlated or opposite direction is not so strong. the smallest portfolio risk is derived from BBKA-INDF's stock portfolio of 0.00773 or 0.77%. The results are also influenced by the exact proportion of funds that are 50% of BBKA shares and 50% of INDF shares.

**Commented [JHP5]:** The proportion of the most optimal stock on BBKA and INDF is presented in figure 2

From the results obtained in this study, the influence of the proportion of funds and correlation coefficients have a tendency in affecting portfolio risk, but in accordance with the limitations of the problems listed in chapter one, that in the performance of the stock portfolio of BBKA (Bank Central Asia Tbk.) and INDF (Indofood Sukses Makmur Tbk.), investors should also measure the rate of increase of BBKA stock return and the level of stock return of INDF and vice versa, so that at the time of its operation the investor can analyze the proportion of funds invested to each stock according to fact and added with analysis of other variables including the time period in searching for expected return, the standard deviation of individual stocks respectively, variance and covariance so that the results of this study is expected to be material for a new study by further researchers. In addition to the information from the researcher, all variables that can be researched by analyzing the formulas of various experts from the academic circles include only theoretical calculations, whose results can in fact be changed if there are influences from external factors such as government policy, natural disasters, political situation and risk systematic market.

## REFERENCES

- Anggraini Eka Pratiwi, Moch. Dzulkhirom, dan Devi Farah Azizah. 2014. Analisis Investasi Portofolio Saham Pasar Modal Syariah Dengan Model Markowitz Dan Model Indeks Tunggal (Studi Pada Saham Perusahaan yang Terdaftar dalam Jakarta Islamic Indeks di Bursa Efek Indonesia Periode Mei 2011 sampai dengan November 2013). *Jurnal Administrasi Bisnis (JAB)* Vol. 17 No. 1 Desember 2014: 1-10
- Bursa Efek Indonesia. 2017. *IDX Fact Book 2017*, BEI, Jakarta.
- Euginia Natalia, Darminto, dan M.G. Wi Endang NP . 2014. Penentuan Portofolio Saham yang Optimal dengan Model Markowitz Sebagai Dasar Penetapan Investasi Saham (Studi pada Perusahaan Food and Beverage yang Terdaftar di Bursa Efek Indonesia Tahun 2012) . *Jurnal Administrasi Bisnis (JAB)* Vol. 9 No. 1 April 2014: 1-10
- Hartiwi Prabowo. Analisis Portofolio Saham Dengan Metode CAPM Dan Markowitz . *Binus Business Review* Vol. 4 No. 1 Mei 2013: 360-369
- Hartono, J. 2008. *Teori Portofolio dan Analisis Investasi*. Edisi 6, BPFE. Yogyakarta.
- Hartono, J. 2010. *Dasar-dasar Teori Portofolio dan Analisa Sekuritas*. Edisi 7, BPFE, Yogyakarta.
- Hasnawati, S. (2006). Penilaian Saham, Memahami Cara Berinvestasi Saham di Pasar Modal. *Jurnal Bisnis & Manajemen*. Volume 2 No. 3 Mei 2006 hal 213-237.  
[http://lemlit.unila.ac.id/file/JURNAL%20Bisnis%20dan%20Manajemen%20\(JBM\).pdf](http://lemlit.unila.ac.id/file/JURNAL%20Bisnis%20dan%20Manajemen%20(JBM).pdf). 10 Juni 2010.
- Iyiola Omisore, Munirat Yusuf and Nwufu Christopher .I. 2012. Review The Modern Portfolio Theory as an Investment Decision Tool . *Journal of Accounting and Taxation*. Vol. 4(2), pp. 19-28, March 2012 Available online at <http://www.academicjournals.org/JAT>
- Purwanti, D. (2009). Simulasi Lindung Nilai Portofolio dengan Mini LQ Futures Periode 1 Agustus, 28 November 2008. Tesis tidak dipublikasikan. Jakarta: Universitas Bina Nusantara.

Commented [JHP6]: New references have been added

- Sutrisno. 2009. Manajemen keuangan Teori, Konsep, dan Aplikasi. Ekonisia, Kampus Fakultas Ekonomi UII, Jakarta.
- Syamsir, H. (2004). Solusi Investasi di Bursa Saham Indonesia: Pendekatan Analisis Teknikal melalui Studi Kasus Riil dengan Dilengkapi Formulasi MetaStock. Jakarta: Elex Media Komputindo.
- Tandelilin, E. 2010. *Analisis Investasi dan Manajemen Portofolio*. Edisi ketujuh. Kanisius, Yogyakarta.

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## PORTFOLIO ANALYSIS WITH MARKOWITZ METHOD STUDY ON STOCKS LQ-45 IN INDONESIA

JAN HORAS VERYADY PURBA AND BAMBANG PAMUNGKAS

**Abstract.** Investment in the stock market can be done on various types of stocks from various industries. This helps investors to diversify their portfolios, where the essence of optimal portfolio formation is to reduce risk by diversifying stocks, placing funds on various investment alternatives to generate optimum returns. Optimal portfolio can be formed with various models, one of them using the Markowitz model. The purpose of this study is to examine stock portfolios that generate high expected returns with low risk. This research tested 6 companies selected by purposive, from LQ-45 company in IDX. With Markowitz model, two best companies can be obtained, namely BBCA and INDF. The most optimal stock proportion test is done by performing simulation analysis on some percentage of stock options in both companies. The findings of this study indicate that the most optimal investment proportion is 50% on BBCA and 50% in the company INDF. The results of this study confirm that Markowitz's method can be used to make the most optimal portfolio investment decision, resulting in high expected returns with low risk.

### Introduction

In the world of capital markets, investors have different preferences and characters in the face of risk. There is an Investor whose personality as risk seeker. This type of investor dare to take high in the hope of getting high yields as well. Investors with aggressive and speculative nature in making investment decisions. There are also Investors who are neutral to risk (risk neutrality), ie Investors who use the same yield for each level of improvement. Investors with this character make careful and flexible in making investment decisions. But there is also the possibility of unnecessary investors (risk averter). Investors of this type only dare to spend money with low returns as well. Typical investors do not like to look for risk and mature before making investment decisions.

In terms of investing in the stock exchange Investors choose which shares can bring the largest dividends through fundamental or technical analysis process. The choice of stock is influenced by many factors such as government policy, political issues, micro and macro economic phenomena and other things. These factors pose a

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<sup>1</sup>**Keywords:** Portfolio, Markowitz Method, Return, Risk

risk in stock selection. Rational investors always want the maximum return on investment. High returns earned on stocks are accompanied by high risk levels. In stocks, the risk is divided into two, namely systematic risk and systematic risk. Systematic or common risk also called market risk is a risk factor affecting the market as a whole. Thus, certain stock price movements will be affected by the movement of the stock market as a whole. This systematic risk can not be controlled by investors, and can not be eliminated through diversification. Meanwhile, the risk is not systematic or often called specific risk, is the risk that certain events that occur in companies or industries that then affect the stock price of the company. Investors can reduce the systematic risk of a stock investment by establishing a stock portfolio.

Although investment in the capital market promises a higher rate of return, but if the greater the return, the greater the risk faced. Therefore, investors are required to think rationally and also pay attention to how to optimize the return on minimum risk level. In order for the purpose to benefit from capital participation can make investors get optimal results. The investor must analyze the shares he/ she bought. Failure may occur if the investor gets too much information (overload information) that disorients the investor can not retrieve relevant and most needed information in analyzing the portfolio.

In stock investments in the stock market there are various types of stocks from various industries. This makes it easier for investors to diversify their portfolios, where the essence of optimal portfolio formation is to reduce risk by diversifying stocks, placing funds on various investment alternatives to generate optimum returns. Optimal portfolio can be formed with various models, one of them using the Markowitz model.

Euginia Natalia, et.al. (2014) states that Markowitz's model is used to find out: (a) which company shares are included in the optimal portfolio, (b) what proportion of funds should be invested in each stock, and (c) what the expected portfolio return rate and risk the optimal portfolio. Some optimal portfolio testing performed using the Markowitz method has proven that this model allows for optimal portfolio performance. Iyiola, et al. (2012) examines how portfolio theory helps investors to classify, estimate, and control the expected number of risks and returns in an effort to maximize Expected returns and minimize risks for expected returns. In addition to the Markowitz method, the Capital Asset Pricing Model (CAPM) is also one of theories that explains how assets are valued by the market or how to determine the rate of return that is deemed feasible for stock investments. Purwanti (2009) states that the Capital Asset Pricing Model (CAPM) is used to estimate the return of securities. While Anggraini (2014), looking at the risk side, look at the risk side, where the risk on investment can be minimized by diversifying assets to several types of stocks to form a portfolio.

The LQ45 index is a collection of 45 shares with the largest commercial transactions on the IDX. These shares are also commonly referred to as blue-chip stocks. Hartiwi Prabowo (2013) using the CAPM and Markowitz Portfolio methods, obtained the 5 most profitable shares for investors. Meanwhile, to minimize the risk on the desired return on investing in shares can be done by diversifying or investing



into more than one type of securities (forming a portfolio) (Syamsir, 2004). But the problem is how much of the proportion of funds should be invested in each share in order to obtain the desired yield with the least risk.

An efficient portfolio is the portfolio that gives the greatest return on expectations with certain risks or provides the smallest risk with a certain expectation return. An efficient portfolio can be determined by selecting a certain expectation return rate and then minimizing its risk or determining a certain level of risk and then maximizing its expected return. Portfolio analysis is used so that investors and stockholders can choose which stocks are selected to reduce portfolio risk and get the greatest return or in other words the lowest level of risk for a given rate of return. Based on the description in ata, the purpose of this study is to determine the most optimal stock portfolio, using the Markowitz method.

## Theory

### Investment

Investing is spending a sum of money or saving money on something in the hope of one day getting financial benefits. "Investment can be interpreted as an investment activity or investment is done at the present in various assets to earn income in the future." (Warsini, 2009)

### Portfolio Theory

Portfolio theory is a related theory of expected portfolio returns and acceptable portfolio risk levels, and indicates how optimal portfolio formation is established. This portfolio theory is interconnected with capital market theory based on the influence of investors' decisions on the price of securities and shows the relationship that should occur between the return and the risk of securities if investors form a portfolio that fits the portfolio theory. Portfolio theory states that both risk and return should be considered with the assumption that a formal framework is available to measure both in the formation of a portfolio. In its basic form, portfolio theory begins with the assumption that the rate of return on future effects can be estimated and then determine the risk with variations in the distribution of returns. The greater the risk of investment or loan, the greater the desired rate of return to cover that risk.

The purpose of the establishment of a portfolio is to minimize risk without sacrificing returns generated through diversification. Portfolio diversification is spreading risk to selected securities. Diversification or portfolio deployment is done by entering various assets from all existing asset groups. Such as stocks, bonds, deposits, real assets and so on. Portfolio diversification can also be done by specializing in one group of assets only, for example stock. However, investors will find problems in forming a portfolio because of the large number of securities. The number of combinations of securities causes the number of portfolios.

An efficient portfolio is a portfolio that delivers maximum returns of hope with the same level of risk or portfolio that contains a minimum level of risk with equal

returns of expectation. The optimal portfolio is a portfolio selected by investors from a number of efficient portfolios according to the character of the investor. The optimal portfolio is based on the assumption that all investors are risk averse. That is to seek additional additional rate of return for additional one unit of risk is the same. An efficient portfolio is a good portfolio, but not the best one. There is only one best portfolio, the optimal portfolio. The optimal portfolio is an efficient portfolio. While an efficient portfolio is not necessarily the optimal portfolio. The optimal portfolio can be determined using risk-free assets. A risk-free asset is an asset that has a certain expected return without any risk. The risk free rate in a single index calculation usually uses the BI rate or the interest rate of Bank Indonesia Certificates (SBI) for conventional shares.

The expected return is the expected return of investors in the future and its nature has not occurred yet. With the uncertainty (uncertainty), it means investors will get a return in the future that is not yet known exactly the value. Return expectations and risk levels have a positive relationship. The greater the risk of a security, the greater the expected return, and vice versa.

One measure of risk is the standard deviation or variant that is the square of the standard deviation. The risk measured by this measure measures the risk of how much the value of each item deviates from the average. Portfolio risk can also be measured by the amount of standard deviation or variant of the value of single security returns in it.

### **LQ 45 Index**

Referring to Jogiyanto's opinion (2009: 101), the JCI covering all listed shares (most of which are less actively traded) is deemed less appropriate as an indicator of capital market activity. Therefore, on 24 February 1997 an alternative index was introduced, the Liquid-45 Index (ILQ-45). The LQ-45 index began on 13 July 1994 and this date is the baseline day of the index with an initial value of 100 (Jogiyanto, 2009: 105). Furthermore, stock exchanges routinely monitor the progress of each of the 45 stocks included in the calculation of LQ-45 Index. Replacement of shares is done every six months, ie at the beginning of February and August. If there are any shares that do not meet the selection criteria, then the shares are excluded from the index calculation and replaced with other stocks that meet the criteria (Tandelilin, 2010: 88).

### **Markowitz Method**

Markowitz's portfolio method is also called the Mean-Varian Model, which emphasizes the effort to maximize return (mean) expectations and minimize the uncertainty/risk (variance) for selecting and preparing an optimal portfolio. This means that it can be said that the optimum portfolio selection approach is based on its preference for return and risk exposure of each investment option.

Establishing a portfolio with this model provides an advantage whereby every investor can take advantage of all the information provided on the market. The assumptions underlying the formation of the portfolio use Markowitz's theory, the

time spent in the study is only one period, the investor bases the calculation on the return value of exposure and portfolio risk, no loans and risk-free savings, and no transaction cost calculation (Hartono, 2010 : 312)

### Methodology

Systematically, the phase of data analysis is done as follows:

#### 1. Variance of Shares:

$$\sigma_i^2 = \sum_{t=1}^n \frac{[R_{it} - E(R_i)]^2}{n}$$

Note :

$\sigma_i^2$  = Variance of return of share i  
 $R_{it}$  = Return of share i in periode t  
 $E(R_i)$  = Expected return share i  
 $n$  = Time periode

So with the above variance formula, we can calculate the standard deviation, by:

$$\sigma_i = \sqrt{\sigma_i^2}$$

Note :

$\sigma_i^2$  = Variance of return of share i  
 $\sigma_i$  = Standard deviation

#### 2. Search for covariance by entering the standard deviation that has been obtained by the formula:

$$COV_{ij} = \frac{\sum (R_{it} - E(R_i))(R_{jt} - E(R_j))}{n}$$

Note:

$COV_{ij}$  = Covariance variables i and j  
 $R_{it}$  = Return of stock i in period t  
 $E(R_i)$  = Expected return stock i  
 $R_{jt}$  = Return of stock j at period t  
 $E(R_j)$  = Expected return of stock j  
 $n$  = Time periode

#### 3. The correlation coefficient is calculated by dividing the stock covariance i and j with the result of standard deviation multiplication of shares i and j, by the formula:

$$r_{ij} = \frac{COV_{ij}}{\sigma_i \sigma_j}$$

Note:

$r_{ij}$  = The correlation coefficient of variables i and j

$COV_{ij}$  = Covariance variables i and j

$\sigma_i$  = Standard deviation i

$\sigma_j$  = Standard deviation j

4. Make a simulation and assume the proportion of funds to the stocks that have been selected with percentage as a unit  
With the condition :  $W_1 + W_2 = 1$  or 100%
5. Next look for a portfolio risk that consists of two securities, the formula used is :

$$\sigma_p = \sqrt{W_i^2 \cdot \sigma_i^2 + W_j^2 \sigma_j^2 + 2 \cdot W_i \cdot W_j \cdot (r_{ij}) \cdot \sigma_i \cdot \sigma_j}$$

Note :

$\sigma_p$  = Standard deviation portfolio

$W_i$  = Weight allocation on stock i

$W_j$  = Weight allocation on stock j

$r_{ij}$  = The correlation coefficient of variables i j

$\sigma_i$  = Standar deviasi i

$\sigma_j$  = Standar deviasi j

### Results and Discussions

In this study, purposively selected 6 companies from the company LQ-45, ie BBKA (Bank BCA), BBNI (Bank BNI), BBRI (Bank BRI), INDF (PT Indofood Sukses Makmur), JSMR (PT Jasa Marga) dan TLKM (PT Telkom) on the IDX from 2012 until 2016.

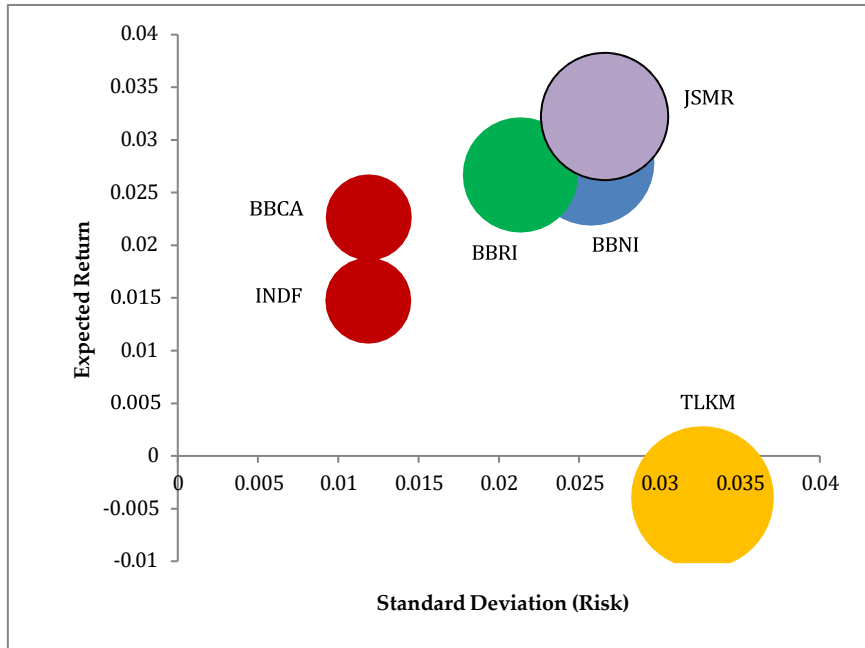
The expected return and standard deviations of the above six firms are presented in Table 1 below.

**Table 1**  
**Stock Code, Expected Return (E (Ri)), Standard Deviation and Variance**

No.	Stock	$E(R_i)$	Standard Deviation	Variance
1	BBKA	0,02265	0,01190	0,00014
2	BBNI	0,02788	0,02575	0,00066
3	BBRI	0,02668	0,02135	0,00045
4	INDF	0,01474	0,01187	0,00014
5	JSMR	0,03223	0,02659	0,00070
6	TLKM	-0,00395	0,03269	0,00106

Source: IDX, LQ-45 annual financial statements at IDX

The meaning of the table above can be seen more easily by describing the coordinate relationship between Expected return (E (Ri)) with risk (standard deviation), as presented in Figure 1.



**Figure 1: Expected Return Correlation (E(Ri)) and Risk**

JSMR, BBRI, BBNI have a large expected return (E (Ri)), but also have big risks. TLKM has very low expected return (E (Ri)) and negative material, and also has a big risk. Therefore, the four shares of this company are relatively unattractive and not an efficient investment choice.

Conversely, the company's stock that generates a relatively large expected return with the relatively smallest risk is BBCA and INDF. Therefore, both companies are selected to test the most optimal proportion of stocks.

**Covariance Analysis**

Covariance is an absolute rule that shows how far two variables have a tendency to move together. In the context of portfolio management, covariance indicates the extent to which returns from both securities in the portfolio tend to move together. Covariance can take the form of positive, negative, or zero. Positive covariance means the tendency of two securities to move in the same direction, negative covariance means that the return of two securities tends to move in the opposite direction. If the securities return A rises then the return of securities B falls, and vice versa. Covariance zero indicates that the movement of two securities is independent of each other. The results showed that the covariance values tend to be near zero. This indicates that securities movements tend to be independent of each other and tend to move in opposite directions. This means the greater the benefits of risk reduction in the portfolio.

Next is to calculate the covariance between stocks forming a portfolio. The results can be seen in the following table:

**Table 2. Covariance Stock Portfolio Maker**

Stock	BBCA	BBNI	BBRI	INDF	JSMR	TLKM
BBCA	0.0001	0.0001	0.0002	<b>0.0000</b>	0.0002	0.0002
BBNI	0.0001	0.0007	0.0003	0.0002	0.0006	<b>0.0000</b>
BBRI	0.0002	0.0003	0.0005	<b>-0.0001</b>	0.0004	0.0003
INDF	0.0000	0.0002	-0.0001	0.0001	0.0001	<b>0.0000</b>
JSMR	0.0002	0.0006	0.0004	0.0001	0.0007	0.0004
TLKM	0.0000	0.0002	0.0001	0.0001	0.0002	-0.0001

*Source:* Company annual financial report LQ-45 on IDX (data processed)

### Correlation Coefficient Analysis

The correlation coefficient is a statistical measure showing the relationship of two variables. In the context of diversification, this measure will explain the extent to which returns from one securities are related to each other. In the concept of diversification, the incorporation of two perfectly positive correlated securities (+1.0) will not provide the benefit of risk reduction. The merger of two zero-correlated securities will significantly reduce the risk of the portfolio. The more unrelated shares are included in the portfolio, the greater the benefit of risk reduction. The merger of two perfectly negative correlated (-1.0) securities will eliminate the risk of both securities. Next is to calculate the correlation coefficient between stocks forming a portfolio. The results can be seen in the following table:

**Table 3. Coefficient of Correlation of Portfolio Maker**

Stock	BBCA	BBNI	BBRI	INDF	JSMR	TLKM
BBCA	1	0.486	0.867	<b>-0.155</b>	0.771	0.474
BBNI	0.486	1	0.538	0.610	0.855	<b>-0.021</b>
BBRI	0.867	0.538	1	<b>-0.244</b>	0.718	0.469
INDF	-0.155	0.610	-0.244	1	0.451	<b>-0.089</b>
JSMR	0.771	0.855	0.718	0.451	1	0.454
TLKM	0.474	-0.021	0.469	-0.089	0.454	1

*Source:* Company's annual financial report LQ-45 on IDX (data processed)

The table shows that the correlation coefficient will be worth 1 if the same merged shares are correlated and it states that the same stock will not provide the benefit of risk reduction.

### Stocks That Establish Optimal Portfolio

After getting the result of covariance and correlation coefficient between each stock, then research continued by choosing two stocks that have covariance with negative value ( $0 > \text{covariance}$ ) because indicating movement between two stocks have tendency is reversed in accordance with diversification principle and correlation

coefficient with the value is close to negative one (-1) because it will reduce the risk significantly in accordance with the principle of hedging. After getting the result of covariance and correlation coefficient between each stock, then research continued by choosing two stocks that have covariance with negative value ( $0 >$  covariance) because indicating movement between two stocks have tendency is reversed in accordance with diversification principle and correlation coefficient with the value is close to negative one (-1) because it will reduce the risk significantly in accordance with the principle of hedging.

### Covariance Between Two Stocks

Selection of two stocks with negative covariance are (1) BBCA with INDF, (2) BBNI with TLKM, (3) BBRI with INDF, and (4) INDF with TLKM. For optimal portfolio, the value of covariance is the most closely approximated value of -1, therefore this research will select two portfolios between the two stocks with value closest to -1, the portfolio is ASII shares with TLKM shares and TLKM shares with KLBK shares.

### Correlation Coefficient Between Two Stocks

In accordance with the principle of diversification, this study chose the correlation coefficient value approaching the value of -1, the portfolio is shares of stock (1) BBCA with INDF, (2) BBNI with TLKM, (3) BBRI with INDF, and (4) INDF with TLKM .

### Analysis of Proportion of Investment Funds and Correlation Coefficient on Portfolio Risk

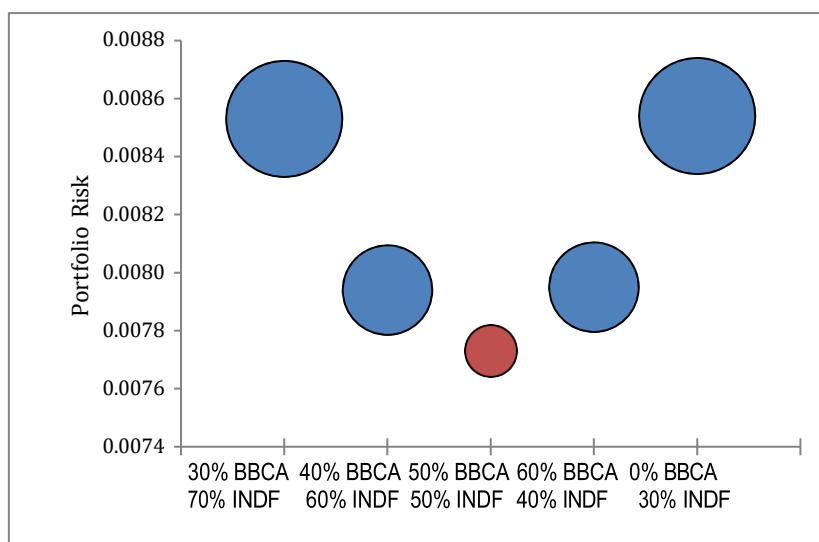
Shares selected for portfolio formation will be made in the form of a proportional proportion of funds simulation in order to analyze which proportion of funds will minimize portfolio risk in stock investments. This study simulated the comparison of proportion of stock investment fund from 10% to 90% with total amount of fund proportion between 2 stocks reach 100% or 1, including composition result of each individual stock risk (standard deviation), result of correlation coefficient from merging two shares and portfolio risk results obtained.

This study takes 10 stock portfolio risks with the least value in comparison to test the effect of correlation coefficient and the proportion of funds on portfolio risk

**Table 4.**  
**Correlation Coefficient and Portfolio Risk**

No	W1 Proportion	W2 Proportion	(r) Correlation	( $\sigma_p$ ) Portfolio Risk
1	30% BBCA	70% INDF	-0,155	0,00853
2	40% BBCA	60% INDF	-0,155	0,00794
3	<b>50% BBCA</b>	<b>50% INDF</b>	<b>-0,155</b>	<b>0,00773</b>
4	60% BBCA	40% INDF	-0,155	0,00795
5	70% BBCA	30% INDF	-0,155	0,00854

Based on the results obtained above that the stock portfolio of BBCA-INDF with the proportion of 50% share of BBCA and 50% INDF shares with the correlation coefficient of  $-0.15456$  is the stock portfolio selected because it has the smallest risk (0,00773 or 0.7%). The proportion of the proportion of funds taken in this portfolio affects the outcome of BBCA-INDF stock portfolio risk, as there are 9 different portfolio risk outcomes with the proportion of simulated proportion of funds, making it possible to compare the proportion of more influential funds in the portfolio.



**Figure 2: Proportion of the most optimal stock on BBCA and INDF**

### Conclusion

For comparison of proportion of funds and correlation coefficient which resulted in the smallest portfolio risk among all such simulations are the stock portfolio of BBCA (Bank Central Asia Tbk) and INDF (Indofood Sukses Makmur Tbk.) With the proportion of 50% share of BBCA and 50% with a correlation coefficient of  $-0.155$  resulting in a portfolio risk of 0.00773 or 0.77%. This study concludes that although the correlation coefficient of the stock portfolio of BBCA (Bank Central Asia Tbk) and INDF (Indofood Sukses Makmur Tbk.) is  $-0.15456$ , which means the level of movement of each stock is more correlated or opposite direction is not so strong. the smallest portfolio risk is derived from BBCA-INDF's stock portfolio of 0.00773 or 0.77%. The results are also influenced by the exact proportion of funds that are 50% of BBCA shares and 50% of INDF shares.

From the results obtained in this study, the influence of the proportion of funds and correlation coefficients have a tendency in affecting portfolio risk, but in accordance with the limitations of the problems listed in chapter one, that in the performance of the stock portfolio of BBCA (Bank Central Asia Tbk.) and INDF (Indofood Sukses Makmur Tbk.), investors should also measure the rate of increase of BBCA stock return and the level of stock return of INDF and vice versa, so that at the time of its operation the investor can analyze the proportion of funds invested to each



stock according to fact and added with analysis of other variables including the time period in searching for expected return, the standard deviation of individual stocks respectively, variance and covariance so that the results of this study is expected to be material for a new study by further researchers. In addition to the information from the researcher, all variables that can be researched by analyzing the formulas of various experts from the academic circles include only theoretical calculations, whose results can in fact be changed if there are influences from external factors such as government policy, natural disasters, political situation and risk systematic market.

### References

- Anggraini Eka Pratiwi, Moch. Dzulkirom, dan Devi Farah Azizah. 2014. Analisis Investasi Portofolio Saham Pasar Modal Syariah Dengan Model Markowitz Dan Model Indeks Tunggal (Studi Pada Saham Perusahaan yang Terdaftar dalam Jakarta Islamic Indeks di Bursa Efek Indonesia Periode Mei 2011 sampai dengan November 2013). *Jurnal Administrasi Bisnis (JAB)* Vol. 17 No. 1 Desember 2014: 1-10
- Bursa Efek Indonesia. 2017. *IDX Fact Book 2017*, BEI, Jakarta.
- Euginia Natalia, Darminto, dan M.G. Wi Endang NP. 2014. Penentuan Portofolio Saham yang Optimal dengan Model Markowitz Sebagai Dasar Penetapan Investasi Saham (Studi pada Perusahaan Food and Beverage yang Terdaftar di Bursa Efek Indonesia Tahun 2012). *Jurnal Administrasi Bisnis (JAB)* Vol. 9 No. 1 April 2014: 1-10
- Hartiwi Prabowo. Analisis Portofolio Saham Dengan Metode CAPM Dan Markowitz. *Binus Business Review* Vol. 4 No. 1 Mei 2013: 360-369
- Hartono, J. 2008. *Teori Portofolio dan Analisis Investasi*. Edisi 6, BPFE. Yogyakarta.
- Hartono, J. 2010. *Dasar-dasar Teori Portofolio dan Analisa Sekuritas*. Edisi 7, BPFE, Yogyakarta.
- Hasnawati, S. (2006). Penilaian Saham, Memahami Cara Berinvestasi Saham di Pasar Modal. *Jurnal Bisnis & Manajemen*. Volume 2 No. 3 Mei 2006 hal 213-237.  
[http://lemlit.unila.ac.id/file/JURNAL%20Bisnis%20dan%20Manajemen%20\(JBM\).pdf](http://lemlit.unila.ac.id/file/JURNAL%20Bisnis%20dan%20Manajemen%20(JBM).pdf) df. 10 Juni 2010.
- Iyiola Omisore, Munirat Yusuf and Nwifo Christopher .I. 2012. Review The Modern Portfolio Theory as an Investment Decision Tool. *Journal of Accounting and Taxation*. Vol. 4(2), pp. 19-28, March 2012 Available online at <http://www.academicjournals.org/IAT>
- Purwanti, D. (2009). Simulasi Lindung Nilai Portofolio dengan Mini LQ Futures Periode 1 Agustus, 28 November 2008. Tesis tidak dipublikasikan. Jakarta: Universitas Bina Nusantara.
- Sutrisno. 2009. Manajemen keuangan Teori, Konsep, dan Aplikasi. Ekonisia, Kampus Fakultas Ekonomi UII, Jakarta.
- Syamsir, H. (2004). Solusi Investasi di Bursa Saham Indonesia: Pendekatan Analisis Teknikal melalui Studi Kasus Riil dengan Dilengkapi Formulasi MetaStock. Jakarta: Elex Media Komputindo.
- Tandelilin, E. 2010. *Analisis Investasi dan Manajemen Portofolio*. Edisi ketujuh. Kanisius, Yogyakarta.