

## Performance System of Stock Portfolio during Investment Decision Making Using Constant Correlation Model in Business Index 27 and Idx30

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### ABSTRACT

It is important to know the performance of stock portfolio during investment. Meanwhile knowing performance of stock, it will lead to make best decision in investment. Investment is an asset used by company to growth the wealth through distribution of investment result. In this research two types of stock will be observed. They are Business Index 27 and IDX30. Constant correlation model is utilized in this research to describe how sensitive the stock through observation index. It also use for seeking optimal portfolio of stock. Some of research methodology and calculation formula was conducted to solve and see performance each indexes of stock as information system of decision support system (DSS). DSS is important to support decision maker to make their decision with considering lot of information related. To make decision in investment, there are have parameters to be considered such as expected return market (ERM), risk free asset (Rf), return and risk of individual stock. Stock which has positive expected return of value will have good feasibility as investment. Stock which has positive value of return is feasible stock as investment. Stock with maximum return and minimum risk is an ideal condition. In Business Index 27, the highest ERS is TLKM about 0.213740598, and the lowest is BSDE about 0.042412331 while the order of stock rank is as follow TLKM, BBKA, ADRO, GGRM, BBRI, PTBA, BMRI, ASII, BBNI, and BSDE. The order of stock rank according to ERS value through calculation of cut off rate (Ci) and cut off point (C\*) for getting the biggest ERS value in stock selection which is enter optimal stock portfolio. According to the rank follow the order of ERS ratio value shows in IDX30, the highest ERS is TLKM about 0.213740598 and the lowest is INDF about 0.010961469, meanwhile the order of the stock rank as follow TLKM, BBKA, ADRO, GGRM, BBRI, PTBA, BMRI, ASII, BBNI, and INDF. Stock that has outlier value then it will be out from optimal stock portfolio candidate. In Business Index 27, optimal portfolio is formatted from three stocks. They are PT. Telekomunikasi Indonesia (TLKM) with proportion value 51,06%, Bank Central Asia (BBKA) with proportion value 35,7% and PT. Adaro Energy (ADRO) with proportion value 13,24%. In IDX30 listed for four stocks. They are PT. Telekomunikasi Indonesia (TLKM) with proportion value 49,02%, Bank Central Asia (BBKA) with proportion value 32,53%, PT. Adaro Energy (ADRO) with proportion value 11,67% and PT. Gudang Garam (GGRM) with proportion value 6,79%. Performance analysis shows Business Index 27 with Sharpe index 0.180353 is higher than IDX30 0.199241. Business Index 27 with Treynor index 0.011559 is lower than IDX30 0.01142. Business Index 27 with Jensen index 0.011254 is higher than IDX30 0.010999. It shows that Business Index 27 is best choice than IDX30, but portfolio volatility Business Index 27 is more sensitive than IDX30 through market changes.

**Keywords:** Decision support system, Information system, Stock portfolio performance.

### INTRODUCTION

#### RESEARCH BACKGROUND

The development of investment at the end of 2016 shows that the number still continues increase until 13.39% compared with last year. Investors expect return of investment, besides return there is risk of investment. Hence, it necessary to make best decision of investment that is considering of maximum return and small

risk. Return and risk of investment have positive trend of correlation. The greater risk is borne, the greater return to be compensated [3].

Creating optimal stock portfolio is used to maximize return and minimize risk. Risk can be reduced with combining single securities onto portfolio [3]. In this research will take case in Business Index 27 and IDX30 during three periods which is started on January 2014 up to

December 2016 approaching with constant correlation model.

After optimal portfolio created, then it will continue by return of portfolio analysis, risk of portfolio, and portfolio performance with Jensen-Sharpe and Treynor method. Both of portfolio index is compared whereas has the biggest number of return, the less of risk, and the best performance as a recommendation for investment option.

Previous research, Pratiwi and Yunita (2015) has successfully compared portfolio with single index model and constant correlation model in LQ45 Index period 2010-2015. They use risk adjusted method Sharpe, Treynor, and Jensen to measure its performance. The result of their research is portfolio with single index model creating six stock enter onto optimal portfolio, they are JSMR (32.17%), KLBF ((30,84%), TLKM (18,17%), UNVR (14.30%), ASII (94,26%), and GGRM (0.26%). At the same time optimal portfolio formation with constant correlation model will created eight stock enter optimal portfolio, they are KLBF (32.24%), JSMR (29.49%), ASII (9.85%), TLKM (7.78%), UNVR (6,49%) BBNI (4.51%), BBKA (5.97%), and BBRI (3.67%). From this fact, performance measurement of optimal portfolio which was created with single index model has better result than optimal portfolio which was conducted with constant correlation model.

Umanto Eko (2018) with title "Analysis and Performance Assessment of Optimal Stock Portfolio LQ45", has been successfully designed a simulation of optimal stock liquid portfolio LQ45 in 2002-2007 at BEI with single index method and constant correlation. The result of his research is showing optimal portfolio who has created by single index method and constant correlation model. It recommend for investor in order to allocate the biggest fund on TLKM stock. Optimal portfolio which has been created by constant correlation model has better performance.

Rifaldy and Sedana (2016) with title Optimal Stock Portfolio with Business index 27 in BEI approaching by Markowitz model. The result is 5 of 27 stocks Business Index 27 can enter optimal portfolio utilizing Markowitz model in period May-October 2015. The proportion of stocks are AKRA (55.1%), ICBP (2.4 %), LPKR (15.06 %), SCMA (21.3%) and MNCN (5.06%). From any various test of formation optimal portfolio and any difference of index

performance, it make researcher to re-testing formation of optimal portfolio and index performance in BEI. A lot of research has been done whereas stock index between syariah (such as ISSI, JII) and conventional stock in BEI (such as IHSG index, LQ45 index, Kompas100 index, and Sri Kehati) as comparison. It is also needed testing one stock index with two method of portfolio formation.

Nugroho et al (2017) with title the system of investment decision making through analysis of stock portfolio performance based single index model (comparison study of Syariah stock and conventional stock). The performance comparison of stock portfolio shows that JII Syariah stock has rate of return portfolio on 0.01831 (or 1.831%) higher than IDX30 conventional stock of 0.01594 (or 1.594%). Meanwhile the rate of risk portfolio JII Syariah stocks is 0.00599 (or 0.599%) lower than the conventional stock IDX30 on 0.00849 (or 0.849%). The performance of the stock portfolio based on Sharpe index values for JII Syariah into 0.17407 higher than IDX30 conventional stock at 0.12054. Treynor index value in JII Syariah is 0.00753 higher than IDX30 conventional stock at 0.00719. In addition to, Jensen index value of JII Syariah stocks is 0.01909 higher than IDX30 conventional stock at 0.01595. The result of this analysis indicates that portfolio performance of JII Syariah stocks is better than the IDX30 conventional stocks.

Novelty of research is important. In this research, has novelty which is comparing two stock index in BEI namely by Business Index 27 and IDX30 during three years (2014-2016) with constant correlation model for optimal portfolio formation and performance optimal stock measurement. This research also utilizes Sharpe, Treynor, and Jensen for each index.

## **LITERATURE REVIEW**

### **Financial Management**

The main objective of financial management is to maximize value of wealth which means to enhance company value that is objective measured by public and sustainability oriented. Value of wealth can be seen with development of common stock at market (Harmono, 2011).

### **Capital Market and Stock**

Capital market is a market of various long term financial instruments that can be traded, either in the form of debt, stock, or derivative

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instrument, et cetera. Capital market is source of funding for company or others institution (such as government) and as facilities for investment activities. So that, capital market is facilities various infrastructure of buying and selling and other activities related (Dermadji and Fakhruddin, 2006).

In capital market, in order to investor get right information then it is needed an accurate information system. System can give information with considering the user need. According to quality of financial information measurement must meet following requirements sort of accurate, relevant, and timely (Nugroho et al, 2015). Stock is legal document which shows stock ownership and has claim rights for dividend or other distribution which has been done by company through other stock ownership. Stock is paper that indicates rights of investor (party who owns the paper) for acquiring a portion of the prospect or organization wealth that issuing securities and condition who is giving chance for capital user use its rights. Stock is one of alternative that can be chosen for investment (Husnan, 2015).

The stock price index is a number that used to compare stock price changes occasionally. Whether a stock price has decreased or increased compared to a certain time. The stock index is used for analytical purposes and avoids the negative impact of the use of stock prices in rupiah (Mohamad Samsul, 2006: 179).

### IDX30 Index

IDX30 index is an index that consist of 30 stocks which is constituent chosen from LQ45 constituent index. LQ45 constituent index was chosen due to LQ45 has described stock performance with higher liquidity and big market capitalism. Though, some fund manager feels that 45 of stock is too huge number. The number of IDX30 constituent index that consist of 30 stocks have advantage is more easily replicated as a portfolio reference.

### Business Index 27

PT. Bursa Efek Indonesia has cooperation with Harian Bisnis Indonesia launched stock price index called it by Business Index 27. As independent party, Harian Bisnis Indonesia be able to maintain index independently and flexible whereas constituent index was chosen based on emiten performance with basic criteria selection, transaction historical data (technical), and accountability. This index is expected to be

one indicator market trend which is able to help investor to make buying decision, hold, or selling some stock in the field of investment on Indonesia capital market (www.viva.com, 29 Januari 2009).

make decision on their own. There are two types of DSS, first is programmed, second is not programmed. Some attribute DSS are mention as following: adaptable and flexible, high interaction, easy to use, efficient and effective, high monitor for making decision, easy to develop, support for modeling and analysis concept, support data access, and integrated with website

## RESEARCH METHODOLOGY

### Experimental Research

The research has been done with some steps. They are stock selection consistent from January 2nd 2014 to December 30th 2016, it will be continuing become constituent from Business Index 27 and IDX30. According to that the best data of stock was chosen.

After that, collecting data whatever it's needed. It is about data of stock price that enter leading stock selection, data combining of stock price index (IHSG), data rate of Bank Indonesia certificate (SBI) from January 2nd 2014 to December 30th 2016.

If some data achieved then analysis the data with each index in order to create optimal portfolio. Formation of optimal portfolio is utilized by constant correlation model (CCM). In CCM there are three procedures must be done to create optimal portfolio. They are namely by calculate of Excess Return to Standard Deviation (ERS), calculate of stock rank, determine constant correlation among stocks with determining cut off rate ( $C^*$ ), then calculate optimal weight through stock.

ERS is advantage of relative return into one unit risk which is can't be diversification measured with deviation standard. ERS ratio shows relationship among two factors who define investment (they are return and risk). Stocks will be ranked from higher value to lower. Stock which has ERS value negative will be out from candidate.

Optimal portfolio will be filled by stock which has ERS value is good. Stock that has ERS ratio small then it will become optimal portfolio. Cut off rate was needed to determine limit of ERS high value. For determining cut off rate, it will

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be calculating with  $C_i$ . Cut off rate ( $C^*$ ) is  $C_i$  which is the last ERS value more bigger than  $C_i$ . If  $ERS \geq C^*$  then stock will be defined as optimal portfolio Another next step is analysis performance from each portfolio index that had been created with Sharpe, Treynor, and Jensen

method. After we know each performance then it was needed to do comparison of portfolio performance in Business Index 27 and IDX30. Conclusion will be made after found optimal portfolio.

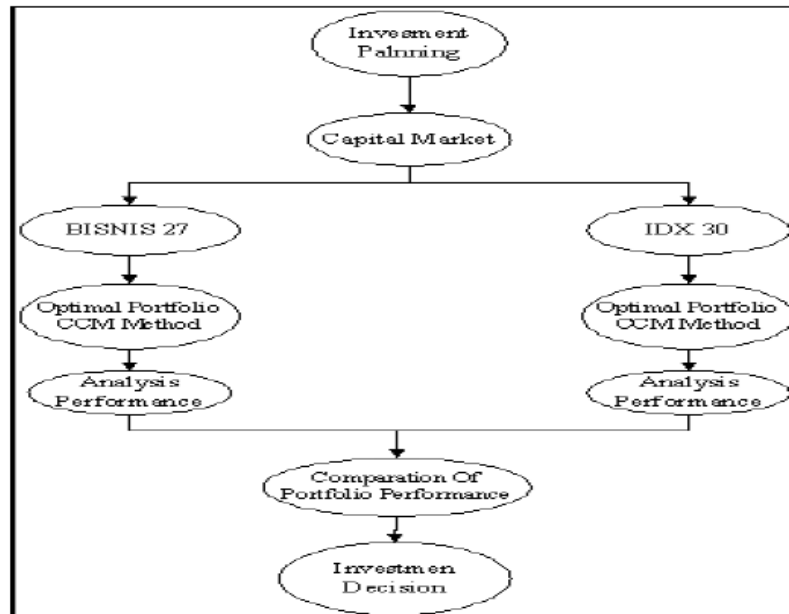


Figure1. Conceptual Framework

### Population and Sample

Population is a collection of individual that has quality and character which has been set. According to quality and character (parameter), it is able to understand as individual or observation's object at least has one the same parameter. In this research, population was defined as the whole stock which listed in BEI and had been classified into two groups. They are Business Index 27 that consists of 27 eminent, and IDX30 that consists of 30 eminent, for three years during 2014-2016. Every year

each group will be changed suddenly. In this research, sample is total population that had been selected based on chosen sample criteria continuously enter Business Index 27 and IDX30 over observation period for three years (2014-2016). From that selection of stock, the result is 21 eminent from Business Index 27 and 18 eminent from IDX30 index continuously become member of each stock index. They are become researched into sample and qualified as leading stock.

Table1. Population and Sample

No	Code	Name of Issuers	Kind of Industry	Business 27	IDX 30
1.	AALI	Astra Agro Lestari	Plantation	v	
2.	ADRO	Adaro Energy	Mining	v	v
3.	ASSI	Astra International	Automotive	v	v
4.	BBCA	Bank Central Asia	Banking	v	v
5.	BBNI	Bank Negara Indonesia	Banking	v	v
6.	BBRI	Bank Rakyat Indonesia	Banking	v	v
7.	BMRI	Bank Mandiri	Banking	v	v
8.	BSDE	Bumi Serpong Damai	Property	v	
9.	BMTR	Global Mediacom	Media	v	
10.	CPIN	Charoen Phokphand Ind.	Poultry	v	v
11.	GGRM	Gudang Garam	Cigarettes	v	v
12.	INTP	Indocement Tunggul P	Cements	v	v
13.	KLBF	Kalbe Farma	Pharmacy	v	v
14.	LPKR	Lippo Karawaci	Property	v	v
15.	MNCN	Media Nusantara Citra	Media	v	v

16.	PGAS	Perusahaan Gas Negara	Energy	v	
17.	PTBA	Tambang Batubara Bukit Asam	Mining	v	
18.	SCMA	Surya Citra Media	Media	v	

**Subject and Period of Research**

Research’s subject including stock that had been listed on BEI. Subject also listed as stock Business Index 27 and iDX30 for three years from January 2014 to December 2016.

**Data Analysis for Creating Optimal Stock Portfolio**

Data analysis for determining optimal stock portfolio has been done by using constant correlation model. Meanwhile the calculation was done by program Excel. Here, data analysis explained as below:

- Chose stock that will be filled on portfolio listed. In this step, some samples has chosen through some stock samples based on Business index 27 and IDX30 to be included for conducting optimal stock portfolio. The steps are following below:
  - list of stock to be included in IDX30 index for 2014-2016 period
  - Listed stocks to be included in Business index 27 for 2014-2016
  - From all stock that included on Business index 27 and IDX 30, stock will be selected. The criteria for selection are all stock enter both indexes in series.
- Conduct optimal portfolio with constant correlation model. Steps follow as below:
  - Determine price stock and description of IHSG and SBI
  - Calculate expected return, variance, deviation standard from individual standard of IHSG and SBI.

$$R_i = \frac{P_t - P_{t-1}}{P_{t-1}} \dots\dots\dots (1)$$

Calculate realization of return each stock

Notation: R<sub>i</sub> = stock return-i  
 P<sub>t</sub> = price stock period-t  
 P<sub>(t-1)</sub> = price stock period t-1

Return calculation each stocks above use data stock price monthly, closing price at the end of month for research period. Stock return above is total return because calculating the differences between stock price and dividend.

Calculate expected return each stock

$$E(R_i) = \frac{\sum R_i}{N} \dots\dots\dots(2)$$

Notation: E(R<sub>i</sub>) = expected stock return-i  
 N = total analysis unit

Expected return commonly using based on historical data with arithmetic mean, that is sum of Ri during analysis period divided into sum of period. Optimal portfolio was created whenever E(R<sub>i</sub>) > 0 It will be used for next step. Though E(R<sub>i</sub>) < 0 it will be ignored because the assumption is investor will be take rational action without chose disadvantage stock.

Calculate market return and expected market return

$$R_m = \frac{IHSG_t - IHSG_{t-1}}{IHSG_{t-1}} \dots\dots\dots(3)$$

Expected market return calculated with IHSG from BEI which is taken with close price in every the end of month during research period (January 2014 to December 2016). It commonly use arithmetic mean which refers to total market return during analysis year divided into sum of N analysis unit (monthly).

$$E(R_m) = \frac{\sum R_m}{N} \dots\dots\dots(4)$$

Notation: R<sub>m</sub> = rate of market return monthly  
 IHSG = IHSG period-t  
 IHSG<sub>t-1</sub> = IHSG period t-1  
 E(R<sub>m</sub>) = expected market return  
 N= total of analysis unit

Calculate risk free return (R<sub>f</sub>)

Risk free return usually tends to interest rate Bank Indonesia certificate (SBI) monthly during analysis period. SBI is considered as assets return with free risk because it is an investment instrument short term and has guarantee for buying price on it (Bank Indonesia). R<sub>f</sub> value will be conducted from average of interest rate of SBI in analysis period.

1. Calculate correlation coefficient, deviation standard, and error standard, individual stock.
2. Calculate excess to return standard (ERS) individual stock.

$$ERS = \frac{(\bar{R}_i - R_F)}{\sigma_i} \dots\dots\dots(5)$$

Notation:

ERS = excess return to deviation standard

R<sub>i</sub> = expected return stock-i

R<sub>f</sub> = risk free return

σ<sub>i</sub> = deviation standard for stock-i

3. ERS value will be calculated from sorting maximum to minimum value.

4. Calculate cut off rate (C<sub>i</sub>)

$$C_i = \frac{\rho}{1 - \rho + i\rho} \sum_{j=1}^{j=1} \frac{\bar{R}_j - R_F}{\sigma_j} \dots\dots\dots(6)$$

Whereas:

$$\hat{\rho} = \frac{2}{(N-1)N} \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij} \dots\dots\dots(7)$$

Notation: σ = correlation coefficient (constant)

C<sub>i</sub> = Covarian stock-1

R<sub>f</sub> = risk free

R<sub>j</sub> = return stock-j

σ<sub>j</sub> = deviation standard of stock-j

Determine C\*

C\* means that the last ERS value still is greater or equal than C<sub>i</sub>. The purpose of calculating C\* is in order to make difference stock which will in and out from optimal portfolio. This action will take place from observation all value of C<sub>i</sub> and ERS value each stock. If ERS value is greater and equal than C<sub>i</sub>, then stock will enter optimal portfolio area, and vice versa (Elton Gruber, 2003). Cut off point (C\*) is the last value of ERS that is greater than C<sub>i</sub>.

Determining candidate of optimal stock

$E(R_i) - R_f/\sigma_i \geq C^*$  : inside optimal stock portfolio area

$E(R_i) - R_f/\sigma_i \leq C^*$  : outside optimal stock portfolio area

Candidate stock was conducted from ERS which is has great value or equal with ERS in C8 point.

Calculate proportion of fund which is invested in optimal portfolio

$$X_i = \frac{Z}{\sum_{j=1}^N Z_j} \dots\dots\dots(8)$$

$$Z_i = \frac{1}{(1 - \rho) \sigma_i} \left[ \frac{\bar{R}_i - R_F}{\sigma_i} - C^* \right] \dots\dots\dots(9)$$

Notation:

X<sub>i</sub> = proportion each stock-i who was chosen

Z<sub>i</sub> = relative investment each stock

**Data Analysis of Stock Portfolio Return and Risk**

Data analysis for calculating level of return and risk optimal stock portfolio which has been formatted as below.

Calculate return rate optimal stock portfolio Business Index 27 and IDX30. Expected return portfolio was calculated with equation as below.

$$R_p = \sum_{i=1}^N X_i (R_i - R_F) + R_F \dots\dots\dots(10)$$

Value of X<sub>i</sub> is proportion of fund which has invested in portfolio was calculated during optimal portfolio formation. Even though, ERS as expected return individual stock was calculated during optimal portfolio formation.

Calculate risk optimal stock portfolio Business Index 27 and IDX30. Risk of portfolio was calculated with equation below.

$$\sigma_p = \sqrt{\sum_{i=1}^N X_i^2 \sigma_i^2 + \sum_{i=1}^N \sum_{j=1, j \neq i}^N X_i X_j \sigma_{ij}} \dots\dots\dots(11)$$

Notation:

σ<sub>P2</sub>= portfolio variance

σ<sub>ij</sub> = covariance between i and j

σ<sub>i</sub> = stock covariance i (i = 1,2.....i≠j)

X<sub>i</sub> = proportion of fund securietas i

X<sub>j</sub> = proportion of fund securietas j

**Performance Analysis of Optimal Stock Portfolio Investment**

For knowing performance of optimal stock portfolio, then it was done by optimal stock portfolio performance analysis with steps below.

Investment performance measurement of optimal portfolio with Sharpe (Reward to variability/RVAR) is like equation below.

$$S_{pi} = \frac{ER_{pi} - ER_f}{SD_{pi}} \dots\dots\dots(12)$$

Notation: S<sub>pi</sub>= sharpe portfolio index

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$ER_{pi}$  = average return portfolio

$ER_f$  = average return free risk

$SD_{pi}$  = deviation standard portfolio

Basically index formula was utilized to calculate trend of slope that connected portfolio with risk. This is stated as  $(ER_{pi} - ER_f) / SD_{pi}$ . Hence, the biggest slope, the greater Sharpe index. This is able to conclude that portfolio performance is good (Halim, 2015).

Calculate optimal stock portfolio investment performance in Business Index 27 and IDX30 with Jensen index. Calculate Jensen index as below.

$$J_{pi} = (ER_{pi} - ER_f) - (ER_m - ER_f)\beta_{pi} \quad \dots\dots(13)$$

Notation:  $J_{pi}$  = Jensen index portfolio

$ER_{pi}$  = return rate portfolio

$ER_m$  = return rate market

$ER_f$  = return free risk

$\beta_{pi}$  = coefficient Beta portfolio

### RESULT AND DISCUSSION

Sample was chosen from stock which has good and stable performance. Indicator was used to select this stock and noted continuously in Business Index 27 and IDX30 during three periods for 2014-2016. 21 Stocks were chosen from Business Index 27, they are AALI, ADRO, ASSI, BBKA, BBNI, BBRI, BMRI, BSDE, BMTR, CPIN, GGRM, INTP, KLBF, LPKR, MNCN, PGAS, PTBA, SCMA, SMGR, TLKM, and UNTR. 18 stocks were selected from IDX30 consistently had noted in both index. They are ADRO, ASSI, BBKA, BBNI, BBRI, BMRI, CPIN, GGRM, ICBP, INDFINTP, KLBF, LPKR, MNCN, SMGR, TLKM, UNTR, and UNVR.

#### Expected Return Market(ERM)

#### Creating Optimal Stock Portfolio

#### Excess Return to Deviation Standard (ERS) Stock Index IDX30

**Table2.** Rank of Business Index 27 according to ERS Value

No	Emiten	E(R <sub>i</sub> )	E(R <sub>i</sub> ) - R <sub>f</sub>	σ <sub>i</sub>	E(R <sub>i</sub> ) - R <sub>f</sub> /σ <sub>i</sub>	Rank
					( ERS)	
20	TLKM	0,017641	0,012037	0,056318	0,213740598	1
4	BBKA	0,014045	0,008441	0,050869	0,165942723	2
2	ADRO	0,022495	0,016891	0,11196	0,150870731	3
11	GGRM	0,013253	0,00865	0,067053	0,1143137161	4
6	BBRI	0,012533	0,00693	0,075748	0,091484742	5
17	PTBA	0,017614	0,012011	0,136268	0,088141746	6

Return market (R<sub>m</sub>) and expected return market (ER<sub>m</sub>) was needed for raw material to format optimal portfolio with constant correlation model and assess stock performance. Then, we resume it on recapitulation stock price combining index (IHSG) as closing at January 2014 to December 2016. From data calculating during research, it got result expected return of market (ER<sub>m</sub>) about 0.005746 with deviation standard (σ) is 0.033507 and variance (σ<sup>2</sup>) about 0.001123.

#### Risk Free Asset (Rf)

Risk free asset is an assumption from interest rate Bank Indonesia Certificate (SBI), for knowing the value of risk free asset (R<sub>f</sub>). It can be gotten from interest rate of SBI. In this research, it can be calculated. The average of risk free asset (R<sub>f</sub>) is about 0.00573 or 0.573\$ per month.

#### Return and Risk of Individual Stock

Level of individual stock return is determined by the changes of closing each stock every month. After that, stock return value will be used for calculate expected return and individual stock of risk. From table above shows Business Index 27 has positive return. Here are the result ADRO, TLKM, PTBA, GGRM, BBKA, BBRI, BMRI, BBNI, ASII, BSDE, SCMA, KLBF, MNCN. Meanwhile Business Index 27 has negative return value are CPIN, AALI, LPKR, INTP, PGAS, SMGR, UNTR, BMTR. Stock which has positive expected return of value will have good feasibility as investment.

IDX30 stocks have positive return of value. Here are based on return ranking, ADRO, TLKM, GGRM, BBKA, BBRI, BMRI, UNVR, BBNI, ASII, INDF, KLBF, MNCN, ICBP. Meanwhile IDX30 has negative value are CPIN, LPKR, INTP, SMGR, UNTR. Stock which has positive value of return is feasible stock as investment. Rank of stock according to ERS ratio in Business Index 27 shows at table below.

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7	BMRI	0,010465	0,004861	0,068001	0,071489809	7
3	ASII	0,00996	0,004357	0,073393	0,059358856	8
5	BBNI	0,010074	0,004471	0,079885	0,055962764	9
8	BSDE	0,009129	0,003525	0,083118	0,042412331	10
15	MNCN	0,003908	-0,0017	0,152126	-0,011143096	11
18	SCMA	0,004477	-0,00113	0,077191	-0,014587652	12
13	KLBF	0,004061	-0,00154	0,061381	-0,025124464	13
10	CPIN	-0,00162	-0,00722	0,117913	-0,061238567	14
1	AALI	-0,00178	-0,00739	0,104866	-0,070445258	15
14	LPKR	-0,00327	-0,00888	0,097648	-0,09090222	16
16	PGAS	-0,01004	-0,01565	0,113175	-0,138246248	17
9	BMTR	-0,02016	-0,02576	0,151072	-0,170503596	18
12	INTP	-0,0079	-0,0135	0,075054	-0,179862956	19
19	SMGR	-0,01026	-0,01587	0,065515	-0,242196376	20
21	UNTR	-0,01722	-0,02283	0,082664	-0,276130031	21

From table of ranking above shows the rank of ERS ratio value. In that table the highest ERS is TLKM about 0.213740598, and the lowest is BSDE about 0.042412331 while the order of stock rank is as follow TLKM, BBKA, ADRO, GGRM, BBRI, PTBA, BMRI, ASII, BBNI, and BSDE. The order of stock rank according to ERS value through calculation of cut off rate (Ci) and cut off point (C\*) for getting the biggest ERS value in stock selection which is enter optimal stock portfolio. The rank of IDX30 according to ERS value shows as table below.

The next step is calculate cut off rate (Ci) that will be calculated with constant correlation value whereas before calculating Ci at first, it must be figure out constant correlation coefficient ( $\rho$ ). After constant correlation coefficient was found then calculating Ci. This calculation is needed as basic fundamental of determining cut off point (C\*) which will be constraint of stock that will enter optimal stock portfolio. By entering data that has been completed in previous step, then it will get result for calculating Ci value from each index as follow.

**Calculate Cut off Rate (Ci) and Determine Cut off Point (C\*)**

**Table3.** Rank of IDX30 Based on ERS

No.	Emiten	$E(R_i)$	$E(R_i) - R_f$	$\sigma_i$	$E(R_i) - R_f/\sigma_i$ (ERS)	Rank
16	TLKM	0,017641	0,012037	0,056318	0,213740598	1
3	BBKA	0,014045	0,008441	0,050869	0,165942723	2
1	ADRO	0,022495	0,016891	0,11196	0,150870731	3
8	GGRM	0,013253	0,00865	0,067053	0,1143137161	4
5	BBRI	0,012533	0,00693	0,075748	0,091484742	5
18	UNVR	0,010194	0,00459	0,054963	0,083517577	6
6	BMRI	0,010465	0,004861	0,068001	0,071489809	7
2	ASII	0,00996	0,004357	0,073393	0,059358856	8
4	BBNI	0,010074	0,004471	0,079885	0,055962764	9
10	INDF	0,006442	0,000839	0,0765	0,010961469	10
14	MNCN	0,003908	-0,0017	0,152126	-0,011143096	11
12	KLBF	0,004061	-0,00154	0,061381	-0,025124464	12
9	ICBP	0,0006	-0,005	0,109519	-0,04568795	13
7	CPIN	-0,00162	-0,00722	0,117913	-0,061238567	14
13	LPKR	-0,00327	-0,00888	0,097648	-0,09090222	15
11	INTP	-0,0079	-0,0135	0,075054	-0,179862956	16
15	SMGR	-0,01026	-0,01587	0,065515	-0,242196376	17
17	UNTR	-0,01722	-0,02283	0,082664	-0,276130031	18

According to the rank follow the order of ERS ratio value shows the highest ERS is TLKM

about 0.213740598 and the lowest is INDF about 0.010961469, meanwhile the order of the



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stock rank as follow TLKM, BBCA, ADRO, GGRM, BBRI, PTBA, BMRI, ASII, BBNI, and INDF. Stock that has outlier value then it will be out from optimal stock portfolio candidate. This

is able to cause Business Index 27 is just 10 stocks number who has positive ERS ratio, as same as IDX30. This rank is needed for calculate cut off rate (Ci).

**Table 4.**Table of Ci value in Business Index 27

No.	Stock	ERS	$\rho/(1 - \rho + i\rho)$	$\sum E(R_j) - R_f / \sigma_j$	Ci	Ket.
1	TLKM	0,213799785	0,39291298	0,21379979	0,084005	Enter
2	BBCA	0,166008251	0,28208006	0,37980804	0,107136	Enter
3	ADRO	0,150900504	0,22001751	0,53070854	0,116765	Enter
4	GGRM	0,114137161	0,18033963	0,6448457	0,116291	Out
5	BBRI	0,091528748	0,15278622	0,73637445	0,112508	Out
6	PTBA	0,088166207	0,13253647	0,82454066	0,109282	Out
7	BMRI	0,071538827	0,11702623	0,89607948	0,104865	Out
8	ASII	0,059404274	0,10476588	0,95548376	0,100102	Out
9	BBNI	0,056004491	0,09483084	1,01148825	0,09592	Out
10	BSDE	0,042452435	0,08661689	1,05394068	0,091289	Out

**Table 5.**Table of Ci in IDX30 Index

No	Stock	ERS	$\rho/(1 - \rho + i\rho)$	$\sum E(R_j) - R_f / \sigma_j$	Ci	Ket.
1	TLKM	0,213799785	0,330987979	0,213799785	0,070765	Enter
2	BBCA	0,166008251	0,248678414	0,379808036	0,09445	Enter
3	ADRO	0,150900504	0,19915329	0,53070854	0,105692	Enter
4	GGRM	0,114137161	0,166078258	0,644845701	0,107095	Enter
5	BBRI	0,091528748	0,142424625	0,736374449	0,104878	Out
6	UNVR	0,083578224	0,124668728	0,819952673	0,102222	Out
7	BMRI	0,071538827	0,110849288	0,8914915	0,098821	Out
8	ASII	0,059404274	0,099787873	0,950895774	0,094888	Out
9	BBNI	0,056004491	0,090733746	1,006900265	0,09136	Out
10	INDF	0,011005042	0,083185971	1,017905307	0,084675	Out

The next step is determining value of cut off point (C\*) whereas cut of point is defined as the biggest value of Ci meanwhile ERS value is also the same position (is bigger than) Ci about 0.116765 in Business Index 27 and 0.107095 in IDX30. Stocks that formatted optimal portfolio are stocks with the biggest ERS value or equal with ERS in C\* point. After that, it will follow by comparing stocks that have ERS positive value and C\*. Optimal stock portfolio with ERS who has bigger value than C\* in each stocks index in Business Index 27 are PT. Telekomunikasi Indonesia (TLKM), Bank Central Asia (BBCA) dan PT. Anadaro Energy (ADRO). In IDX30 have four result, PT. Telekomunikasi Indonesia (TLKM), and Bank

Central Asia (BBCA), PT. Anadaro Energy (ADRO), and PT. Gudang Garam (GGRM) are entered optimal stock portfolio.

**Optimal Stock Portfolio and Stock Proportion**

Optimal stock portfolio in every index has been determined. Business Index 27 has three stocks, here are TLKM, BBCA dan ADRO, meanwhile IDX30 has two stocks, they are TLKM and BBCA. After all of the things done, the next to be done is determine proportion of fund to invest in each stock in order to get return portfolio and optimal portfolio risk. The value of proportion can be shown as below.

**Table6.**Table of Stock Proportion in Business Index 27

No.	Emitent	$E(R_i) - R_f / \sigma_i$	$1/(1 - \rho) * \sigma_i$	$z_i$	$x_i$
1	TLKM	0,21374	29,24829501	3,79523	51,06%
2	BBCA	0,16594	32,38162671	2,65404	35,70%
3	ADRO	0,15087	14,71250884	0,98411	13,24%
				7,43338	100,00%

Table above shows proportion of optimal stock portfolio for Business Index 27. They are

consists of three stocks, here PT. Telekomunikasi Indonesia (TLKM ) with stock

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proportion 51,06%, Bank Central Asia (BBCA) with stock proportion 35,7% and PT. Adaro Energy (ADRO) with proportion 13,24%.

**Table 7.** Table of Stock Portfolio Proportion in IDX30

No.	Emitent	$E(R_i) - R_f/\sigma_i$	$1/(1 - \rho)*\sigma_i$	$z_i$	$x_i$
1	TLKM	0,21374	26,5410181	3,16692	49,02%
2	BBCA	0,16594	29,3843228	2,10167	32,53%
3	ADRO	0,15087	13,3506915	0,75367	11,67%
4	GGRM	0,11409	22,291911	0,43845	6,79%
				6,46071	100,00%

Table above shows stock proportion in optimal portfolio for IDX30. It is consists of of four stock of result. They are PT. Telekomunikasi Indonesia (TLKM ) with proportion about 49,02%, Bank Central Asia (BBCA) with proportion about 32,53%, PT. Adaro Energy (ADRO) with proportion about 11,67% , and PT. Gudang Garam (GGRM) with proportion about 6,79%.

### Return and Risk Portfolio Analysis

For creating optimal portfolio to maximize

**Table 8.** Table of Portfolio Return in Business Index 27

No.	Emitent	$E(R_i)$	$R_f$	$x_i$	$x_i * E(R_i) - R_f$
1	TLKM	0,0176408	0,0056033	0,510566	0,00614593
2	BBCA	0,0140446	0,0056033	0,357043	0,003013905
3	ADRO	0,0224948	0,0056033	0,13239	0,002236269
				Total	0,011396104
				Rf	0,005603333
				$E(R_p)$	0,016999

**Table 9.** Table of Portfolio Return in IDX30

No.	Emitent	$E(R_i)$	$R_f$	$x_i$	$x_i * E(R_i) - R_f$
1	TLKM	0,017640812	0,00560333	0,490181	0,005900544
2	BBCA	0,014044619	0,00560333	0,325301	0,00274596
3	ADRO	0,022494798	0,00560333	0,116654	0,001970462
4	GGRM	0,013253249	0,00560333	0,067864	0,00051915
				Total	0,01136116
				Rf	0,005603333
				$E(R_p)$	0,016739

According to both of table above, it shows that expected return portfolio ( $E(R_p)$ ) for Business Index 27 about 0.016739. Meanwhile expected return portfolio value of IDX30 is about 0.016739.

### Risk Analysis of Optimal Stock Portfolio

**Table 10.** Table of Risk Portfolio in Business Index 27

No.	Emiten	$x_i$	$\sigma_i$	$x_i^2 \sigma_i^2$	$\sum \sum x_i x_j \sigma_i \sigma_j$
1	TLKM	0,490181	0,003172	0,000762	0,000817
2	BBCA	0,325301	0,002588	0,000274	0,000673
3	ADRO	0,116654	0,012535	0,000171	0,000577
			Total	0,001207	0,002067

$$\sigma_p^2 = \sum x_i^2 \sigma_i^2 + \sum \sum x_i x_j \sigma_i \sigma_j$$

Meanwhile optimal portfolio in IDX30 was shown as follow.

return and minimum risk, so that formatting optimal stock portfolio with constant correlation model above is needed to be done. After optimal portfolio and proportion of stock in each index was completed, then calculating return and risk of portfolio.

### Return Analysis for Optimal Stock

For knowing expected return stock portfolio at Business Index 27 and IDX30, then return calculation portfolio of optimal stock was done. The results are as following.

In addition, meanwhile portfolio return must be known, then also the same condition with knowing risk portfolio. Both of them are used to make decision of investment. Table below is shown the result of risk portfolio.

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$$= 0,003273$$

$$\sigma_p = 0,057214$$

Risk of Portfolio in Business Index 27 is 0,057214

**Table 11.**Table of Risk Portfolio in IDX30

No.	Emiten	$x_i$	$\sigma_i^2$	$Xi^2\sigma_i^2$	$\sum\sum XiXj \sigma_i \sigma_j$
1	TLKM	0,49018105	0,003171736	0,000762	0,00094
2	BBCA	0,325301127	0,002587622	0,000274	0,00075
3	ADRO	0,116654291	0,01254	0,000171	0,00064
4	GGRM	0,067863531	0,00450	2,07E-05	0,00026
			Jumlah	0,00123	0,00259

$$\sigma_p^2 = Xi^2\sigma_i^2 + \sum\sum XiXj \sigma_i \sigma_j$$

$$= 0,00381$$

$$\sigma_p = 0,061765$$

Risk of Portfolio in IDX30 is 0,061765

Expected return portfolio (ERp) and risk portfolio ( $\sigma_p$ ) each stock index is comparing one another as follow.

**Table 12.**Table of Return and Risk Portfolio

No.	Parameter	Saham Bisnis 27		Saham IDX30
1	Return Portfolio (ERp)	0,016999	>	0,016739
2	Risk Portfolio ( $\sigma_p$ )	0,057214	<	0,061765

According table above, it shows that coefficient expected return portfolio (ERp) in Business Index 27 is bigger than expected return portfolio IDX30. Level of risk portfolio in Business index 27 is lower than IDX30. This value shows expected return of Business Index 27 0.016999 is bigger than IDX30 0.016739 with level of risk portfolio Business index 27 0.057124 is lower than IDX30 0.061765.

**Performance Analysis of Optimal Stock Portfolio**

Data which is used for this research is historical data, then there is no certainty to say that performance of stock is good in the future will guarantee for next couple of years. Nevertheless, it described level of persistent and consistent for long term condition through stock performance that happened in the past. It is

utilized for signal and see potential of stock in the future. Performance will be done by Sharpe, Treynor, and Jensen index.

Sharpe index (RVAR) is portfolio performance measurement based on excess return of stock through level interest rate of asset with free risk. It is compared with standard deviation and return of portfolio. Treynor index (RVOL) is measure portfolio performance according to excess return of portfolio stock through level of interest rate of asset with free risk. It will be compared with beta portfolio that shows volatility of portfolio through market return. Meanwhile Jensen index is measure portfolio performance based on excess return portfolio and market through asset with free risk. Sharpe, Treynor, and Jensen from portfolio of stock Business Index 27 and IDX30 are showing below.

**Table 13.**Table of Sharpe, Treynor, and Jensen Index

No	MetodePenilaian	BISNIS-27		IDX30
1	Indeks Sharpe	0,199241	>	0,180353
2	Indeks Treynor	0,01142	<	0,01159
3	Indeks Jansen	0,011254	>	0,010999

According to table above, is showing comparison of portfolio performance between Business Index 27 and IDX30 in Sharpe, Treynor, and Jensen Index. The result of

analysis Sharpe and Jensen index, performance of portfolio Business index 27 is better than IDX30. Meanwhile, in Treynor index IDX30 has higher value than Business Index 27.

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Business Index 27 with Sharpe index 0.18547 is higher than performance of IDX30. Business Index 27 with Treynor index 0.01142 is lower than IDX30. Business Index 27 with Treynor index 0.011254 is higher than IDX30. Overall, Business Index 27 performance is better than IDX30, but Business Index 27 is more sensitive in market return changes.

### CONCLUSION

- Optimal portfolio is conducted with constant correlation model in Business Index 27 and IDX30 during period 2014-2016. In Business Index 27, optimal portfolio is formatted from three stocks. They are PT. Telekomunikasi Indonesia (TLKM) with proportion value 51,06%, Bank Central Asia (BBCA) with proportion value 35,7% and PT. Adaro Energy (ADRO) with proportion value 13,24%. In IDX30 listed for four stocks. They are PT. Telekomunikasi Indonesia (TLKM) with proportion value 49,02%, Bank Central Asia (BBCA) with proportion value 32,53%, PT. Adaro Energy (ADRO) with proportion value 11,67% and PT. Gudang Garam (GGRM) with proportion value 6,79%.
- Return and risk analysis of portfolio shows that expected return portfolio in Business Index 27 0.016999 is higher than IDX30 0.016739. Risk portfolio of stock in Business Index 27 0.0507214 is lower than IDX30 0.061765. Optimal portfolio in Business Index 27 has level of return higher than IDX30, and level of risk lower than IDX30. The more higher level of return and the more lower level of risk is an ideal condition and very expected for investor. Business Index 27 is good choice than IDX30 for ideal condition.
- Performance analysis shows Business Index 27 with Sharpe index 0.180353 higher than IDX30 0.199241. Business Index 27 with Treynor index 0.011559 lower than IDX30 0.01142. Business Index 27 with Jensen index 0.011254 higher than IDX30 0.010999. It shows that Business Index 27 is best choice than IDX30, but portfolio volatility Business Index 27 is more sensitive than IDX30 through market changes.

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