Simulation Of Optimal Portfolio Using Single Index Model And Markowitz Model On Lq-45 Index Shares For 2018

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The essence of portfolio formation is to reduce risk by means of diversification, namely allocating a number of funds to various investment alternatives that are negatively correlated. To select returns in a portfolio, you can use the Single Index Model and the Markowitz Model. This study was conducted with the aim of comparing the calculation of which company portfolios can provide a good rate of return with a small risk using the Single Index and Markowitz Model based on the sector of the company. So that the results of this study can provide recommendations to investors in decision making on portfolio selection. The research was conducted on companies indexed by LQ 45 on the Indonesia Stock Exchange. The research period is to use companies indexed by LQ 45 in 2018 for two periods.

Keyword: Simulation, Single Index Model, LQ 45, Markowitz
INTRODUCTION

The Capital Market is a market that brings together parties that offer and require long-term funds, both debt securities (bonds), equity (stocks), mutual funds, derivative instruments and other instruments. The capital market is a means of funding for companies and other institutions and as a means of investing activities. The capital market facilitates various facilities and infrastructure for buying and selling long-term instruments and other related activities. The capital market is a place for trading securities that has been carried out in an organized manner. A system structured to bring together sellers and buyers of securities, through intermediaries and direct investors.

Stock Exchange is an institution that provides system facilities to bring together sellers and buyers of long-term securities between various companies with the aim of trading company securities that have been listed on the stock exchange. The number of companies currently listed on the stock exchange is 562 companies. Securities companies or often referred to as securities companies are parties that conduct business as underwriters, securities brokers or investment managers. In the Indoneisan Stock Exchange, there are currently 108 securities companies that are members and carry out their activities, both as underwriters, securities brokers and investment managers. The existence of the capital market is very helpful for economic players in finding alternative funding for business activities and investors who want to invest their funds. One of them is stock investment in companies that have been listed on the Indonesia Stock Exchange.

When a person decides to invest in financial assets such as stocks, he expects that in the future, the benefits obtained from investing activities are referred to as returns. The expected return on investment is a compensation for the opportunity cost and the risk of decreasing purchasing power due to the influence of inflation (Tandelilin, 2001). In the context of investment, returns are the returns obtained from investment returns. Returns are divided into two, namely the yield that has occurred which is calculated based on historical data and the two returns that are expected to be obtained by investors in the future. The expected returns are simply the weighted average of various historical returns. The weighing factor is the probability of each return, while the portfolio return is the weighted average of the expected single share returns (Halim, 2005).

Errors in stock selection will affect the provision of returns, so that the returns obtained from the portfolio are not as expected. To obtain the desired portfolio, investors must carry out an analysis that provides the maximum return. A rational investor will choose a portfolio that will provide the maximum return on a certain risk. A portfolio is a combination or combination or set of assets, both in the form of real assets and financial assets owned by investors. (Tandelilin, 2010) The essence of portfolio formation is to reduce risk by means of diversification, namely allocating a number of funds to various investment alternatives that are negatively correlated. To select returns in a portfolio, you can use a model Single Index and Markowitz Model.

The index model or factor model assumes that a security's yield is sensitive to changes in a variety of factors. The index model seeks to include the major economic forces that can systematically move the prices of all securities. The single index model or the one-factor model assumes that the yields between two or more securities will be correlated i.e. they will move together and have the same reaction to one factor, namely the JCI Composite Stock Price Index. (Halim, 2018)

Markowitz or multi-index models have more potential in an effort to estimate expected return, standard deviation and effect covariance more accurately than single index models. Because the actual return of securities is not only sensitive to changes in the JCI, it means that there is a possibility that more than one factor can influence it. Multi index models assume that there are other factors besides the IHSG that can influence the correlation between effects, for example the risk-free interest rate (Halim, 2005).

The LQ45 Stock Index is a stock market index on the Indonesia Stock Exchange (IDX) consisting of 45 issuers with the largest market capitalization and the highest transaction value on the regular market in the last 12 months. Issuers can only be listed on LQ45 shares if they have been listed on the IDX for at least three months, and have high financial conditions and growth prospects. Therefore, the issuers in the LQ45 stock list are often referred to as superior stocks or favorite stocks. (https://www.seputarforex.com/saham/lq_45)
research data obtained through intermediary media or indirectly in the form of books, records, existing evidence, or archives, both published and not publicly published. The data required is the closing price of shares every month, the BI Rate and the Composite Stock Price Index each month during 2018.

VARIABLES
An operational definition is a definition based on the observable characteristics of what is being defined or changing the concepts that describe observable behaviors or symptoms that can be tested and verified. Some of the indicators used in assessing the optimal portfolio are as follows:
Actual Return is a historical return that has occurred and can also be called a realize return. To get stock returns, many methods are used, such as probability returns and non-probability returns and dividends.
Expected Return is the rate of return expected by an investor Shares Variance is a measurement of the risk of return expected by investors on certain stocks.
Alpha is a linear relationship between actual stock returns and market actual returns (IHSG). This alpha is used to calculate Variance Error (ei).
Beta is the slope of the linear relationship between actual stock returns.
Variances can be calculated by the following formula:
$$\alpha_i = R_i - \beta_i x R_m$$
Calculating Stock Beta
Beta can be manually calculated using the following formula:
$$\beta_i = \frac{\text{Im}}{\text{Im}}$$
Calculating Stock Residual Variance Error
$$e_i = R_i - \alpha_i - (\beta_i x R_m)$$
Calculating Excess Return
Excess Return
$$= R_i - R_f$$
Calculating Excess Return to Beta
ERB
$$= E(R_0) - \frac{R_f}{\beta_i}$$
Sort of Excess Return to Beta
Calculating the Value of Ai and Bi for each of the ith securities as follows:
$$A_i = \frac{E(R_i) - R_f \beta_i}{\sigma e}$$
$$B_i = \frac{\beta_i}{\sigma e i}$$
Calculating the size of the proportion for each security after the securities that make up the optimal portfolio can be determined
$$Wi = \frac{Z_i}{\sum Z_i}$$

Markowitz indeks Model
By using a simple linear regression equation will be used to calculate the factors that are thought to affect stock prices. (Eka Pratiwi, Dzulkirom, & Farah Azizah, 2014). This Markowitz Index Model can be done in several steps, namely:
Calculate the return on individual stock realization
Calculate the expected return on individual stocks
Calculating Standard Deviation and Variance
Calculating Covarian
Calculating the Correlation Coefficient
Calculating the Portfolio’s Expected Return
Calculating the Standard Deviation of the Portfolio

RESULTS AND DISCUSSION

Gambaran Umum Perusahaan
Setelah dilakukan pengamatan maka sampel yang digunakan dalam penelitian ini berjumlah 37 perusahaan yang aktif melakukan perdagangan saham dalam 1 tahun terakhir. Data perusahaan tersebut dirangkum dalam Tabel 4.1 berikut:
[Table 4.1 about here.]
**Tahap Perhitungan Model Single Indeks**

Tabulasi Data diperlukan untuk mempermudah peneliti dalam mengolah data penelitian ini. Adapun data yang diolah dalam bentuk harga penutupan saham, Indeks Harga Saham Gabungan dan Suku Bunga Bank Indonesia terangkum dalam tabel-tabel di bawah ini:

1. [Table 4.2 about here.]
2. [Table 4.3 about here.]
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8. [Table 4.9 about here.]

**Actual Return**

Actual Return is a historical return that has occurred and can also be called a realize return. The formula for calculating Actual Return is as follows:

\[ R_{t,t} = \frac{P_t - P_{t-1}}{P_{t-1}} \]

1. [Table 5.0 about here.]
2. [Table 5.1 about here.]
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4. [Table 5.3 about here.]
5. [Table 5.4 about here.]
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16. [Table 5.15 about here.]

**Calculation of Expected Return, Stock and Market Variance, Calculating Stock Alpha and Beta, Calculating Variance Error**

**Calculation of Excess Return, ERB, Calculating Cut of Rate, Sorting Shares based on ERB, Determining Cut off**
Rate and Determining Shares which are included in the Optimal Portfolio

| Table 5.16 about here. | Table 5.17 about here. |
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| Table 5.18 about here. | Table 5.19 about here. |
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| Table 5.22 about here. | Table 5.23 about here. |
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From the results of calculations using the Single Index Model above, it is found that the optimal portfolio component is for property companies, all companies are optimal, this is evidenced by the calculation of Excess Return to Beta is greater than the Cut of Point value of the optimal portfolio combination, then for mining companies there is 2 that are optimal, namely INCO and PTBA, there is only one trade company that is optimal, namely UNTR, almost all of its share components are optimal except for Bank Mandiri, for Misc Ind. Companies there are SRIL and Basic Ind. BRPT, SMGR, INKP. Infrastructure companies are JSMR, PGAS and TLKM and the last combination is the consumer sector, there is only 1 company, namely KLBF.

It can be concluded that in the calculation of the optimal portfolio calculation simulation using the Single Model Index, the best taken by consumers is the property company because all companies have a very good level of return and risk in the preparation of optimal portfolios. If consumers want to combine various types of portfolios, they can combine portfolios in property companies with finance companies, or it can be with Basic Ind and Infrastructure companies, all of which provide high returns for investors.

Markowitz Model

The Markowitz model is a method that can be used as an alternative by investors as a basis for making investment decisions. The basic components in calculations using the Markowitz Model are less than calculations using the Single Index Model. The following is the calculation of stock composition using the Markowitz model.

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| Table 5.30 about here. | Table 5.31 about here. |
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From calculations using the Markowitz model, it can be seen that the company that has the highest realization return of all companies is in the Mining Company, namely Aneka Tambang (ANTM) and the Basic Ind. Company, namely Indocement Tunggal Perkasa (INTP). Portfolio in this case does not directly combine one stock with another stock and not only considers the aspects of return and risk, but also considers the covariance and correlation coefficient of these stocks. The correlation coefficient is a calculation that describes the movements between stocks which are combined to determine the effect between stocks.

However, in terms of calculation for the proportion of optimal portfolio-forming stock funds using the Markowitz method, it is known that the stocks that form a high optimal portfolio are property companies by WIKA, Mining Companies...
by ANTM, INCO, PTBA, Trade Companies, all companies are optimal, and the optimal Ind. Misc Sector is ASII, the optimal finance companies are BBCA, BBRI and BMRI. The optimal Basic Ind companies are BRPT, SMGR, WSBP while the infrastructure company is PGAS and finally the Consumer companies are GGRM, ICBP, INDF and UNVR.

**CONCLUSIONS**

Based on the 45 companies that were included in the LQ 45 Index in 2018, it turned out that there were 37 companies that could be included in the criteria for the sample company because in the two periods the company was actively listing on the Indonesia Stock Exchange. According to calculations using the Single Index Model of 37 companies that form an optimal portfolio, there are 20 companies with the highest proportion in the property sector where all companies are optimal, then the finance sector almost all of the companies form an optimal portfolio except for Bank Mandiri, then underneath there is the Infrastructure sector, Basic Industry, Misc Industry, Mining, Trade, and Consumer.

If the calculation uses the Markowitz model, there are 22 companies whose portfolio formation is good. This is clearly different from the two analyzes of the calculations. The optimal portfolio formation from the calculation results of the Markowitz method is the Trade, Finance, Basic-Ind, Mining, Consumer, Property, Misc Ind and Infrastructure sectors. This proves that if the calculation or simulation uses two methods, namely the single index model method and the Markowitz method, the results are different, because in Markowitz theory there are other factors that must be considered in the formation of an optimal portfolio, not only on the Composite Stock Price Index.
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Conflict of Interest Statement: The authors declare that there is no conflict of interest.

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### TABLE 4.1 / Data perusahaan masuk LQ45 Tahun 2018

| No | Sektor     | Nama Saham  |
|----|------------|-------------|
| 1. | Property   | 1. ADHI     |
|    |            | 2. BSDE     |
|    |            | 3. PT.PP    |
|    |            | 4. WIKA     |
|    |            | 5. WSKT     |
| 2. | Mining     | 1. ADRO     |
|    |            | 2. ANTM     |
|    |            | 3. INCO     |
|    |            | 4. PTBA     |
| 3. | Trade      | 1. AKRA     |
|    |            | 2. LPPF     |
|    |            | 3. MNCN     |
|    |            | 4. SCMA     |
|    |            | 5. UNTR     |
| 4. | Misc Ind   | 1. ASII     |
|    |            | 2. SRIL     |
| 5. | Finance    | 1. BBCA     |
|    |            | 2. BBNI     |
|    |            | 3. BBRI     |
|    |            | 4. BBTN     |
|    |            | 5. BMRI     |
| 6. | Basic Ind  | 1. BRPT     |
|    |            | 2. INTP     |
|    |            | 3. SMGR     |
|    |            | 4. WSBP     |
|    |            | 5. TPIA     |
| 7. | Infrastruktur | 1. EXCL   |
|    |            | 2. INDY     |
|    |            | 3. JSMR     |
|    |            | 4. PGAS     |
|    |            | 5. TLKM     |
| 8. | Consumer   | 1. GGRM     |
|    |            | 2. HMSP     |
|    |            | 3. ICBP     |
|    |            | 4. INDF     |
|    |            | 5. KLBV     |
|    |            | 6. UNVR     |

Sumber : www.idx.go.id
### TABLE 4.2 / Data Closing Price Sektor Property

| Bulan  | Close Price |
|--------|-------------|
|        | PROPERTY    |               |
|        | ADHI BSDE PT.PP WIKI WSKT IHSG RF |               |
| Jan-18 | 2230 1820 3130 2080 2830 6650 4.25% |
| Feb-18 | 2480 1935 3100 1925 2910 6600 4.25% |
| Mar-18 | 2070 1780 2610 1680 2470 6690 4.25% |
| Apr-18 | 1880 1690 2430 1585 2210 5650 4.50% |
| Mei-18 | 1945 1705 2580 1670 2320 5650 4.75% |
| Jun-18 | 1790 1565 1995 1325 1925 5620 5.25% |
| Jul-18 | 1605 1350 2080 1550 2120 5800 5.25% |
| Agu-18 | 1490 1200 1900 1550 1895 5900 5.50% |
| Sep-18 | 1390 1155 1525 1365 1700 5650 5.75% |
| Okt-18 | 1125 1100 1330 1100 1440 5650 5.75% |
| Nov-18 | 1565 1350 1855 1505 1560 6150 6.00% |
| Des-18 | 1585 1255 1805 1655 1680 6600 6.00% |
| Jan-19 | 1630 1330 2340 1895 1975 6650 6.00% |
| Bulan   | Close Price |
|---------|-------------|
|         | MINING      |
|         | ADRO | ANTM | INCO | PTBA | IHSG | RF     |
| Jan-18  | 2450 | 915  | 3750 | 3400 | 6650 | 4.25%  |
| Feb-18  | 2350 | 955  | 3390 | 3170 | 6600 | 4.25%  |
| Mar-18  | 2130 | 775  | 2790 | 2940 | 6690 | 4.25%  |
| Apr-18  | 1835 | 845  | 3160 | 3240 | 5650 | 4.50%  |
| Mei-18  | 1885 | 865  | 3860 | 3800 | 5650 | 4.75%  |
| Jun-18  | 1790 | 890  | 4040 | 3970 | 5620 | 5.25%  |
| Jul-18  | 1905 | 915  | 4370 | 4480 | 5800 | 5.25%  |
| Agu-18  | 1865 | 5220 | 3800 | 4050 | 5900 | 5.50%  |
| Sep-18  | 1835 | 5070 | 3710 | 4320 | 5650 | 5.75%  |
| Okt-18  | 1650 | 4080 | 2920 | 4250 | 5650 | 5.75%  |
| Nov-18  | 1285 | 3690 | 3030 | 4020 | 6150 | 6.00%  |
| Des-18  | 1215 | 4590 | 3260 | 4300 | 6600 | 6.00%  |
| Jan-19  | 1390 | 1930 | 3850 | 4310 | 6650 | 6.00%  |
TABLE 4.4 / Data Closing Price Sektor Trade

| Bulan | Close Price |
|-------|-------------|
|       | TRADE       |
|       | AKRA | LPPF | MNCN | SCMA | UNTR | IHSG | RF    |
| Jan18 | 6225 | 11125 | 1525 | 710  | 38900| 6650 | 4.25% |
| Feb18 | 6100 | 10650 | 1535 | 675  | 35600| 6600 | 4.25% |
| Mar18 | 5675 | 10950 | 1415 | 630  | 32000| 6690 | 4.25% |
| Apr18 | 4900 | 10350 | 1325 | 590  | 34100| 5650 | 4.50% |
| Mei18 | 4920 | 9150  | 1200 | 560  | 35050| 5650 | 4.75% |
| Jun18 | 4300 | 8800  | 920  | 530  | 31600| 5620 | 5.25% |
| Jul18 | 4210 | 8025  | 985  | 515  | 35250| 5800 | 5.25% |
| Agu18 | 3610 | 7500  | 905  | 515  | 34400| 5900 | 5.50% |
| Sep18 | 3670 | 6925  | 805  | 515  | 33000| 5650 | 5.75% |
| Okt18 | 3460 | 4850  | 780  | 478  | 33500| 5650 | 5.75% |
| Nov18 | 3900 | 4750  | 790  | 590  | 27500| 6150 | 6.00% |
| Des18 | 4290 | 5600  | 690  | 620  | 27350| 6600 | 6.00% |
| Jan19 | 5250 | 7000  | 845  | 650  | 25725| 6650 | 6.00% |
**TABLE 4.5 / Data Closing Price Sektor Finance**

| Bulan | Close Price | FINANCE |
|-------|-------------|---------|
|       | BBCA | BBNI | BBRI | BBTN | BMRI | IHSG | RF |
| Jan18 | 22725 | 9400 | 3700 | 3660 | 8150 | 6650 | 4.25% |
| Feb18 | 23175 | 9725 | 3780 | 3740 | 8300 | 6600 | 4.25% |
| Mar18 | 23300 | 8675 | 3600 | 3800 | 7675 | 6690 | 4.25% |
| Apr18 | 22100 | 8050 | 3220 | 3110 | 7125 | 5650 | 4.50% |
| Mei18 | 22700 | 8475 | 3080 | 3050 | 7050 | 5650 | 4.75% |
| Jun18 | 21475 | 7050 | 2840 | 2450 | 6850 | 5620 | 5.25% |
| Jul18 | 23275 | 7400 | 3070 | 2360 | 6650 | 5800 | 5.25% |
| Agu18 | 24800 | 7800 | 3180 | 2750 | 6900 | 5900 | 5.50% |
| Sep18 | 24150 | 7400 | 3150 | 2630 | 6725 | 5650 | 5.75% |
| Okt18 | 23650 | 7325 | 3150 | 2120 | 6850 | 5650 | 5.75% |
| Nov18 | 26050 | 8500 | 3620 | 2670 | 7400 | 6150 | 6.00% |
| Des18 | 26000 | 8800 | 3660 | 2540 | 7375 | 6600 | 6.00% |
| Jan19 | 28175 | 9075 | 3850 | 2740 | 7450 | 6650 | 6.00% |
### TABLE 4.6 / Data Closing Price Sektor Basic Industri

| Bulan | Close Price |
|-------|-------------|
|       | BASIC-IND   |
|       | BRPT | INTP | SMGR | SSBP | INKP | TPIA | IHSG | RF |
| Jan18 | 2640 | 4470 | 11150 | 474 | 9275 | 4525 | 6650 | 4.25% |
| Feb18 | 2620 | 4320 | 11125 | 480 | 10750 | 4150 | 6600 | 4.25% |
| Mar18 | 2310 | 3530 | 10350 | 414 | 11000 | 4225 | 6690 | 4.25% |
| Apr18 | 2470 | 3410 | 9650 | 404 | 12200 | 4050 | 5650 | 4.50% |
| Mei18 | 2120 | 3740 | 8400 | 402 | 14700 | 5850 | 5650 | 4.75% |
| Jun18 | 1980 | 3420 | 7125 | 366 | 18800 | 5800 | 5620 | 5.25% |
| Jul18 | 1815 | 3600 | 7600 | 428 | 19200 | 5000 | 5800 | 5.25% |
| Agu18 | 1715 | 3270 | 9450 | 390 | 19100 | 5500 | 5900 | 5.50% |
| Sep18 | 1840 | 2800 | 9925 | 358 | 17250 | 4920 | 5650 | 5.75% |
| Okt18 | 1875 | 2240 | 9000 | 318 | 12725 | 4510 | 5650 | 5.75% |
| Nov18 | 2110 | 1800 | 12025 | 350 | 10800 | 5225 | 6150 | 6.00% |
| Des18 | 2390 | 1585 | 11500 | 376 | 11350 | 5225 | 6600 | 6.00% |
| Jan19 | 2610 | 2130 | 12675 | 384 | 12000 | 5575 | 6650 | 6.00% |
### TABLE 4.7 / Data Closing Price Sektor Misc - Industry

| Bulan  | Close Price |
|--------|-------------|
|        | **MISC – IND** |
|        | ASII | SRIL | IHSG | RF  |
| Jan-18 | 8500 | 382  | 6650 | 4.25% |
| Feb-18 | 8075 | 336  | 6600 | 4.25% |
| Mar-18 | 7300 | 334  | 6690 | 4.25% |
| Apr-18 | 7150 | 342  | 5650 | 4.50% |
| Mei-18 | 6900 | 344  | 5650 | 4.75% |
| Jun-18 | 6600 | 344  | 5620 | 5.25% |
| Jul-18 | 7150 | 342  | 5800 | 5.25% |
| Agu-18 | 7250 | 344  | 5900 | 5.50% |
| Sep-18 | 7350 | 344  | 5650 | 5.75% |
| Okt-18 | 7900 | 362  | 5650 | 5.75% |
| Nov-18 | 8550 | 360  | 6150 | 6.00% |
| Des-18 | 8225 | 358  | 6600 | 6.00% |
| Jan-19 | 8450 | 340  | 6650 | 6.00% |
#### TABLE 4.8 / Data Closing Price Sektor Infrastruktur

| Bulan | EXCL | INDY | JSMR | PGAS | TLKM | IHSG | RF   |
|-------|------|------|------|------|------|------|------|
| Jan18 | 2950 | 4470 | 5700 | 2810 | 2990 | 6650 | 4.25% |
| Feb18 | 2950 | 4220 | 5250 | 2870 | 4000 | 6600 | 4.25% |
| Mar18 | 2520 | 2520 | 4580 | 2200 | 2600 | 6690 | 4.25% |
| Apr18 | 2120 | 2410 | 4270 | 1965 | 2520 | 5650 | 4.50% |
| Mei18 | 2100 | 2740 | 4450 | 2070 | 2520 | 5650 | 4.75% |
| Jun18 | 2320 | 2420 | 4780 | 1995 | 2750 | 5620 | 5.25% |
| Jul18 | 2750 | 2800 | 4850 | 1700 | 2570 | 5800 | 5.25% |
| Agu18 | 2150 | 2270 | 4520 | 2140 | 2480 | 5900 | 5.50% |
| Sep18 | 2750 | 2800 | 4470 | 2250 | 2640 | 5650 | 5.75% |
| Okt18 | 2540 | 2260 | 4150 | 2220 | 2550 | 5650 | 5.75% |
| Nov18 | 1950 | 1800 | 4120 | 1955 | 2680 | 6150 | 6.00% |
| Des18 | 1875 | 1585 | 4250 | 2120 | 2750 | 6600 | 6.00% |
| Jan19 | 2170 | 2720 | 4920 | 2570 | 2900 | 6650 | 6.00% |
## TABLE 4.9 / Data Closing Price Sektor Consumer

| Bulan  | Close Price |
|--------|-------------|
|        | GGRM  | HMSP  | ICBP  | INDF  | KLBF  | UNVR  | IHSG  | RF    |
| Jan18  | 81000 | 4900  | 8725  | 7750  | 1885  | 54400 | 6650  | 4.25% |
| Feb18  | 79750 | 4820  | 8975  | 7575  | 1800  | 52900 | 6600  | 4.25% |
| Mar18  | 72475 | 2960  | 8275  | 7200  | 1500  | 49525 | 6690  | 4.25% |
| Apr18  | 62225 | 2540  | 8675  | 6975  | 1505  | 48250 | 5650  | 4.50% |
| Mei18  | 68500 | 2750  | 8700  | 7075  | 1270  | 45800 | 5650  | 4.75% |
| Jun18  | 87250 | 2580  | 8725  | 4650  | 1220  | 48100 | 5620  | 5.25% |
| Jul18  | 75150 | 2840  | 8675  | 4250  | 1295  | 42250 | 5800  | 5.25% |
| Agu18  | 72000 | 2820  | 8525  | 4275  | 1345  | 42350 | 5900  | 5.50% |
| Sep18  | 74050 | 2850  | 8925  | 5900  | 1380  | 47025 | 5650  | 5.75% |
| Okt18  | 72200 | 2720  | 8550  | 5975  | 1370  | 42225 | 5650  | 5.75% |
| Nov18  | 82000 | 2680  | 10450 | 6800  | 1325  | 42250 | 6150  | 6.00% |
| Des18  | 82625 | 2710  | 10150 | 7450  | 1320  | 45400 | 6600  | 6.00% |
| Jan19  | 82650 | 2820  | 10775 | 7750  | 1600  | 50000 | 6650  | 6.00% |
### TABLE 5.0 / Actual Return Perusahaan Property

| Bulan | Actual Return |   |   |   |   |   |
|-------|---------------|---|---|---|---|---|
|       | PROPERTY      | IHSG | RF |
|       | ADHI | BSDE | PT.PP | WIKA | WSKT |   |   |
| Jan18 | 0,1121 | 0,0632 | - | 0,0096 | - | 0,0283 | -0,0075 | 0,0035 |
| Feb18 | -0,1653 | - | 0,0801 | - | 0,1581 | - | 0,1273 | - | 0,0136 | 0,0035 |
| Mar18 | -0,0918 | - | 0,0506 | - | 0,0690 | - | 0,0565 | - | 0,1053 | -0,1555 | 0,0035 |
| Apr18 | 0,0346 | 0,0089 | 0,0617 | 0,0536 | 0,0498 |   |   |   |   | 0,0038 |
| Mei18 | -0,0797 | - | 0,0821 | 0,2267 | - | 0,2066 | - | 0,1703 |   | -0,0053 | 0,0040 |
| Jun18 | -0,1034 | 0,1374 | 0,0426 | 0,1698 | 0,1013 |   |   |   |   | 0,0320 | 0,0044 |
| Jul18 | -0,0717 | - | 0,1111 | 0,0865 | - | 0 | - | 0,1061 |   | 0,0172 | 0,0044 |
| Agu18 | -0,0671 | - | 0,0375 | 0,1974 | - | 0,1194 | - | 0,1029 |   | -0,0424 | 0,0046 |
| Sep18 | -0,1906 | - | 0,0476 | 0,1279 | 0,1941 | - | 0,1529 | - |   | 0 | 0,0048 |
| Okt18 | 0,3911 | 0,2273 | 0,3947 | 0,3682 | 0,0833 |   |   |   |   | 0,0885 | 0,0048 |
| Nov18 | 0,0128 | 0,0704 | 0,0270 | 0,0997 | 0,0769 |   |   |   |   | 0,0732 | 0,0050 |
| Des18 | 0,0284 | 0,0598 | 0,2964 | 0,1450 | 0,1756 |   |   |   |   | 0,0076 | 0,0050 |
### TABLE 5.1 / Actual Return Perusahaan Mining

| Bulan | Actual Return | IHSG | RF |
|-------|---------------|------|----|
|       | MINING        |      |    |
|       | ADRO  | ANTM  | INCO | PTBA |      |
| Jan18 | -0.0408 | 0.0437 | -0.0960 | -0.0676 | -0.0075 | 0.0035 |
| Feb18 | -0.0936 | -0.1885 | 0.1770 | 0.0726 | 0.0136 | 0.0035 |
| Mar18 | -0.1385 | 0.0903 | 0.1326 | 0.1020 | -0.1555 | 0.0035 |
| Apr18 | 0.0272 | 0.0237 | 0.2215 | 0.1728 | 0.0038 |
| Mei18 | -0.0504 | 0.0289 | 0.0466 | 0.0447 | -0.0053 | 0.0040 |
| Jun18 | 0.0642 | 0.0281 | 0.0817 | 0.1285 | 0.0320 | 0.0044 |
| Jul18 | -0.0210 | 4.7049 | -0.1304 | -0.0960 | 0.0172 | 0.0044 |
| Agu18 | -0.0161 | -0.0287 | -0.0237 | 0.0667 | -0.0424 | 0.0046 |
| Sep18 | -0.1008 | -0.1953 | -0.2129 | -0.0162 | 0 | 0.0048 |
| Okt18 | -0.2212 | -0.0956 | 0.0377 | -0.0541 | 0.0885 | 0.0048 |
| Nov18 | -0.0545 | 0.2439 | 0.0759 | 0.0697 | 0.0732 | 0.0050 |
| Des18 | 0.1440 | -0.5795 | 0.1810 | 0.0023 | 0.0076 | 0.0050 |
TABLE 5.2 / Actual Return Trade

| Bulan | Actual Return | IHSG | RF  |
|-------|---------------|------|-----|
|       | TRADE         |      |     |
|       | AKRA          | LPPF | MNCN| SCMA| UNTR|
| Jan18 | -             | 0.0201 | - | 0.0066 | - | 0.0493 | - | 0.0848 | - | 0.0075 | 0.0035 |
| Feb18 | -             | 0.0697 | 0.0282 | - | 0.0782 | 0.0067 | - | 0.1011 | - | 0.0136 | 0.0035 |
| Mar18 | -             | 0.1366 | 0.0548 | - | 0.0636 | - | 0.0635 | 0.0656 | - | 0.1555 | 0.0035 |
| Apr18 | 0.0041        | - | 0.1159 | - | 0.0943 | 0.0508 | - | 0.0279 | - | 0.0038 |
| Mei18 | -             | 0.1260 | - | 0.0383 | - | 0.2333 | - | 0.0984 | - | 0.0053 | 0.0040 |
| Jun18 | -             | 0.0209 | - | 0.0881 | - | 0.0707 | 0.0283 | 0.1155 | 0.0320 | 0.0044 |
| Jul18 | 0.1425        | - | 0.0654 | - | 0.0812 | - | 0.0241 | - | 0.0172 | 0.0044 |
| Agu18 | 0.0166        | - | 0.0767 | - | 0.1105 | 0.0407 | - | 0.0424 | - | 0.0046 |
| Sep18 | -             | 0.0572 | - | 0.2996 | - | 0.0311 | 0.0718 | 0.0152 | 0 | 0.0048 |
| Okt18 | -             | 0.1272 | 0.0206 | - | 0.0128 | 0.0234 | 0.1791 | - | 0.0885 | 0.0048 |
| Nov18 | 0.1000        | - | 0.1789 | - | 0.1266 | - | 0.0508 | 0.0055 | 0.0732 | 0.0050 |
| Des18 | 0.2238        | 0.2500 | 0.2246 | 0.0484 | - | 0.0594 | - | 0.0076 | - | 0.0050 |
| Bulan | Actual Return | FINANCE | IHSG | RF |
|-------|----------------|---------|------|----|
|       |                | BCCA | BNI | BBRI | BBTN | BMRI |      |
| Jan18 | 0,0198          | 0,0346 | 0,0216 | 0,0219 | 0,0184 | -   | 0,0075 | 0,0035 |
| Feb18 | 0,0054          | -    | 0,1080 | 0,0476 | 0,0160 | -   | 0,0753 | 0,0136 | 0,0035 |
| Mar18 | 0,0515          | -    | 0,0720 | 0,1056 | 0,1816 | -   | 0,0717 | -      | 0,1555 | 0,0035 |
| Apr18 | 0,0271          | 0,0528 | -    | 0,0435 | 0,0193 | 0,0105 | -   | 0 |
| Mei18 | 0,0540          | -    | 0,1681 | 0,0779 | 0,1967 | 0,0284 | -   | 0,0053 | 0,0040 |
| Jun18 | 0,0838          | 0,0496 | 0,0810 | -    | 0,0367 | -   | 0,0292 | 0,0320 | 0,0044 |
| Jul18 | 0,0655          | 0,0541 | 0,0358 | 0,1653 | 0,0376 | -   | 0,0172 | 0,0444 |
| Agu18 | 0,0262          | 0,0513 | 0,0094 | 0,0436 | 0,0254 | -   | 0,0424 | -      | 0,0046 |
| Sep18 | 0,0207          | -    | 0,0101 | 0,1939 | 0,0186 | -   | 0 |
| Okt18 | 0,1015          | 0,1604 | 0,1492 | 0,2594 | 0,0803 | 0,0885 | 0,0048 |
| Nov18 | 0,0019          | 0,0353 | 0,0110 | 0,0487 | 0,0034 | -   | 0,0732 | 0,0050 |
| Des18 | 0,0837          | 0,0313 | 0,0519 | 0,0787 | 0,0102 | 0,0076 | 0,0050 |
### TABLE 5.4 / Actual Return MISC-IND

| Bulan | Actual Return | IHSG | RF |
|-------|---------------|------|----|
|       | MISC - IND    |      |    |
|       | ASII | SRIL |      |    |
| Jan18 | -0,0500 | -0,1204 | -0,0075 | 0,0035 |
| Feb18 | -0,0960 | -0,0060 | 0,0136 | 0,0035 |
| Mar18 | -0,0205 | 0,0240 | -0,1555 | 0,0035 |
| Apr18 | -0,0350 | 0,0058 | 0 | 0,0038 |
| Mei18 | -0,0435 | 0 | -0,0053 | 0,0040 |
| Jun18 | 0,0833 | -0,0058 | 0,0320 | 0,0044 |
| Jul18 | 0,0140 | 0,0058 | 0,0172 | 0,0044 |
| Agu18 | 0,0138 | 0 | -0,0424 | 0,0046 |
| Sep18 | 0,0748 | 0,0523 | 0 | 0,0048 |
| Okt18 | 0,0823 | -0,0055 | 0,0885 | 0,0048 |
| Nov18 | -0,0380 | -0,0056 | 0,0732 | 0,0050 |
| Des18 | 0,0274 | -0,0503 | 0,0076 | 0,0050 |
### TABLE 5.5 / Actual Return Basic-Ind Tahun 2018

| Bulan | BRPT  | INTP  | SMGR  | WSBP  | INKP  | TPIA  | IHSG  | RF    |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Jan   | 0.0076| 0.0336| 0.0022| 0.0127| 0.1590| -     | 0.0829| 0.0075|
| Feb   | 0.1183| -     | 0.0697| 0.1375| 0.0233| 0.0181| 0.0136| 0.0035|
| Mar   | 0.0693| 0.0340| 0.0676| 0.0242| 0.1091| -     | 0.0414| 0.1555|
| Apr   | 0.1417| 0.0968| 0.1295| 0.0050| 0.2049| 0.4444| 0     | 0.0038|
| Mei   | 0.0660| 0.0856| 0.1518| 0.0896| 0.2789| -     | 0.0085| 0.0053|
| Jun   | 0.0833| 0.0526| 0.0667| 0.1694| 0.0213| -     | 0.1379| 0.0320|
| Jul   | 0.0551| 0.0917| 0.2434| 0.0052| 0.1000| 0.0172| 0.0044|
| Agu   | 0.0729| 0.1437| 0.0503| 0.0821| 0.0969| 0.1055| 0     | 0.0424|
| Sep   | 0.0190| 0.2000| 0.0932| 0.1117| 0.2623| 0.0833| 0     | 0.0048|
| Okt   | 0.1253| 0.1964| 0.3361| 0.1006| 0.1513| 0.1585| 0.0885| 0.0048|
| Nov   | 0.1327| 0.1194| 0.0437| 0.0743| 0.0509| 0     | 0.0732| 0.0050|
| Des   | 0.0921| 0.3438| 0.1022| 0.0213| 0.0573| 0.0670| 0.0076| 0.0050|
### TABLE 5.6 / Actual Return Perusahaan Infrastruktur

| Bulan | INFRASTRUKTUR | IHSG | RF |
|-------|----------------|------|----|
|       | EXCL | INDY | JSMR | PGAS | TLKM |     |    |
| Jan-18 | 0,0000 | - | 0,0789 | - | 0,0214 | 0,3378 | - | 0,0075 | 0,0035 |
| Feb-18 | 0,1458 | 0,4028 | 0,1276 | - | 0,2334 | 0,3500 | - | 0,0136 | 0,0035 |
| Mar-18 | 0,1587 | 0,0437 | 0,0677 | 0,1068 | - | 0,308 | - | 0,1555 | 0,0035 |
| Apr-18 | - | 0,0094 | 0,1369 | 0,0422 | 0,0534 | 0 | 0 | 0 | 0,0038 |
| Mei-18 | 0,1048 | - | 0,1168 | 0,0742 | - | 0,0362 | 0,0913 | - | 0,0053 | 0,0040 |
| Jun-18 | 0,1853 | 0,1570 | 0,0146 | - | 0,1479 | 0,0655 | 0,0320 | 0,0044 |
| Jul-18 | - | 0,2182 | 0,1893 | 0,0680 | 0,2588 | - | 0,0350 | 0,0172 | 0,0044 |
| Agu-18 | 0,2791 | 0,2335 | - | 0,0111 | 0,0514 | 0,0645 | - | 0,0424 | 0,0046 |
| Sep-18 | - | 0,0764 | 0,1929 | 0,0716 | - | 0,0133 | 0,0341 | - | 0,0048 |
| Okt-18 | 0,2323 | 0,2035 | 0,0072 | 0,1194 | 0,0510 | 0,085 | 0,0048 |
| Nov-18 | - | 0,0385 | 0,1194 | 0,0316 | 0,0844 | 0,0261 | 0,0732 | 0,0050 |
| Des-18 | 0,1573 | 0,7161 | 0,1576 | 0,2123 | 0,0545 | 0,0076 | 0,0050 |
### TABLE 5.7 / Actual Return Perusahaan Consumer

| Bulan   | CONSUMER | IHSG | RF   |
|---------|----------|------|------|
|         | GGRM | HMSP | ICBP | INDF | KLBF | UNVR |      |      |
| Jan-18  | 0,0154| 0,0163| 0,0287| 0,0226| 0,0451| 0,0276| -    | 0,0035|
| Feb-18  | 0,0912| 0,3859| 0,0780| 0,0495| 0,1667| 0,0638| -    | 0,0136| 0,0425|
| Mar-18  | 0,1414| 0,1419| 0,0483| 0,0313| 0,0033| 0,0257| -    | 0,1555| 0,0425|
| Apr-18  | 0,1008| 0,0827| 0,0029| 0,0143| -    | 0,1561| 0,0508| 0    | 0,0450|
| Mei-18  | 0,2737| 0,0618| 0,0029| 0,3428| 0,0394| 0,0502| -    | 0,0053| 0,0475|
| Jun-18  | 0,1387| 0,1008| 0,0057| 0,0860| 0,0615| 0,1216| 0    | 0,0320| 0,0525|
| Jul-18  | 0,0419| 0,0070| 0,0173| 0,0059| 0,0386| 0,0024| 0,0172| 0,0525|
| Agu-18  | 0,0285| 0,0106| 0,0469| 0,3801| 0,0260| 0,1104| -    | 0,0424| 0,0550|
| Sep-18  | 0,0250| 0,0456| 0,0420| 0,0127| 0,0072| 0,1021| 0    | 0,0575|
| Okt-18  | 0,1357| 0,0147| 0,2222| 0,1381| 0,0328| 0,0006| 0,0885| 0,0575|
| Nov-18  | 0,0076| 0,0112| 0,0287| 0,0956| 0,0038| 0,0746| 0,0732| 0,0600|
| Des-18  | 0,0003| 0,0406| 0,0616| 0,0403| 0,2121| 0,1013| 0,0076| 0,0600|
### TABLE 5.8 / Perusahaan Property

|       | ADHI  | BSDE  | PT.PP  | WIKA  | WSKT  |
|-------|-------|-------|--------|-------|-------|
| $E(R)$ | -0.0159 | -0.0215 | -0.0089 | 0.0048 | -0.0228 |
| $\sigma^2$ | 0.0219539 | 0.0091103 | 0.0327595 | 0.0264597 | 0.0132645 |
| $\alpha$ | -0.0179045 | -0.0222574 | -0.011234 | 0.0021839 | -0.0243561 |
| $\beta$ | 1.1285 | 0.4387 | 1.3119 | 1.4740 | 0.8732 |
| $\sigma_{\epsilon_i}^2$ | -0.0179045 | -0.0222574 | -0.011234 | 0.0021839 | -0.0243561 |
| $ER$ | 0.1086 | 0.0596 | -0.0131 | -0.0781 | 0.0247 |
| Rata-rata $ER$ |          |          |          |       | 0.0204 |
| $\xi$ | 0.0180 | 0.0464 | 0.0155 | 0.0138 | 0.0233 |
| $ERB$ |          |          |          |       |       |
| $Ai$ | -0.0202045 | -0.0097633 | -0.014739 | 0.0032189 | -0.0212676 |
| $Bi$ | 0.0177763 | 0.0106783 | 0.0081365 | 0.0003454 | 0.0254542 |
| $Ci$ | -0.0198516 | -0.0096602 | -0.01462 | 0.0032178 | -0.0207397 |
| $C^*$ | 0.0032178 |          |          |       |       |
### TABLE 5.9 / Perusahaan Mining

|            | ADRO | ANTM | INCO | PTBA |
|------------|------|------|------|------|
| E(R)       | -0.0418 | 0.3397 | 0.0114 | 0.0234 |
| $\sigma^2$ | 0.0082987 | 1.770252 | 0.018111 | 0.006983 |
| $\alpha$  | -0.041854 | 0.336856 | 0.011904 | 0.024104 |
| $\beta$   | 0.0400 | 1.5662 | -0.2741 | -0.4201 |
| $\sigma_{ei}^2$ | -0.041854 | 0.336856 | 0.011904 | 0.024104 |
| ER         | -0.0444 | 0.0402 | -0.0995 | -0.0712 |
| ERB        | -1.0919 | -0.0279 | 0.1596 | 0.1041 |
| Ai         | -0.0017 | 0.5276 | -0.0033 | -0.0101 |
| Bi         | -0.0016 | -4.0643 | 0.0009 | 0.0056 |
| Ci         | -0.0017 | -0.1722 | -0.0033 | -0.0101 |
| C*         | -0.001679 | | | |
### TABLE 5.11 / Perusahaan Finance

|         | BBCA   | BBNI   | BBRI   | BBTN   | BMRI   |
|---------|--------|--------|--------|--------|--------|
| E(R)    | 0.0194 | 0.0007 | 0.0055 | -0.0149| -0.0066|
| $\sigma^2$ | 0.002662626 | 0.007097 | 0.00454 | 0.017845 | 0.00178 |
| $\alpha$ | 0.018401111 | -0.0007 | 0.00406 | -0.01727 | -0.00735 |
| $\beta$ | 0.5446 | 0.7864 | 0.8319 | 1.3043 | 0.4414 |
| $\sigma_{\hat{c}}^2$ | 0.018401111 | -0.0007 | 0.00406 | -0.01727 | -0.00735 |
| ER      | 0.0163 | 0.0310 | 0.0181 | 0.0183 | 0.0149 |
| Rata-rata ER | 0.0197 |        |        |        |        |
| ERB     | 0.0362 | 0.0251 | 0.0237 | 0.0151 | 0.0447 |
| Ai      | 0.010022056 | -0.00055 | 0.003378 | -0.02253 | -0.00325 |
| Bi      | 0.009356274 | 1.98E-05 | 0.000696 | 0.019741 | 0.001211 |
| C*      | 0.009929156 |        |        |        |        |

**Note:** The table includes various financial metrics for different companies, such as expected returns (E(R)), variances ($\sigma^2$), and beta ($\beta$) values. The last row indicates the average expected return (rata-rata ER) and the region (ERB) for each company.
TABLE 5.12 / Perusahaan Misc-Ind

|        | ASII         | SIRIL         |
|--------|--------------|---------------|
| E(R)   | 0,0010       | -0,0088       |
| $\sigma^2$ | 0,003093828  | 0,0016342     |
| $\alpha$ | 0,000632332  | -0,008619     |
| $\beta$  | 0,2331       | -0,0999       |
| $\sigma^2_{ei}$ | 0,000632332 | -0,008619     |
| ER      | -0,0535      | -0,1240       |
| Rata-rata ER | -0,0888    |               |
| ERB     | -0,3807      | 0,8884        |
| Ai      | 0,00014742   | 0,000861      |
| Bi      | -1,05033E-06 | 8,361E-05     |
| Ci      | 0,00014742   | 0,0008609     |
| C*      | 0,000860931  |               |
### TABLE 5.13 / Perusahaan Basic-Ind

| BRPT | INTP | SMGR | WSBP | INKP | TPIA |
|------|------|------|------|------|------|
| E(R) | 0.0033 | -0.0495 | 0.0201 | -0.0134 | 0.0324 | 0.0274 |
| $\sigma^2$ | 0.008384 | 0.02216 | 0.020387 | 0.00812 | 0.021028 | 0.02285279 |
| $\alpha$ | 0.003145 | -0.04894 | 0.018254 | -0.01445 | 0.033496 | 0.026359346 |
| $\beta$ | 0.0674 | -0.3131 | 1.0177 | 0.5991 | -0.6022 | 0.5662 |
| $\sigma^2_e$ | 0.003145 | -0.04894 | 0.018254 | -0.01445 | 0.033496 | 0.026359346 |
| ER | -0.0111 | -0.0371 | -0.0058 | 0.0091 | 0.1555 | -0.0864 |
| Rata-rata ER | 0.0221 |
| ERB | 0.3281 | -0.0707 | 0.0217 | 0.0369 | -0.0367 | 0.0391 |
| Ai | 0.000212 | 0.015322 | 0.018577 | -0.00866 | -0.02017 | 0.014924255 |
| Bi | 3.01E-05 | -0.0339 | 0.01533 | 0.005652 | -0.03055 | 0.017783783 |
| Ci | 0.000212 | 0.015859 | 0.018297 | -0.00861 | -0.02081 | 0.014663 |
| C* | 0.018297 |
### TABLE 5.14 / Perusahaan Infrastruktur

|                | EXCL | INDY | JSMR | PGAS | TLKM |
|----------------|------|------|------|------|------|
| $E(R)$         | -0,0127 | -0,0067 | -0,0093 | 0,0021 | 0,0092 |
| $\sigma^2$    | 0,02511823 | 0,076653 | 0,005777 | 0,019049 | 0,021831 |
| $\alpha$      | -0,0123116 | -0,00555 | -0,00985 | 0,001691 | 0,009237 |
| $\beta$       | -0,2312 | -0,6618 | 0,2898 | 0,2006 | -0,0444 |
| $\sigma_{\epsilon}^2$ | -0,0123116 | -0,00555 | -0,00985 | 0,001691 | 0,009237 |
| $\text{ER}$   | -0,0035 | -0,0559 | -0,0789 | 0,2526 | 0,9996 |
| Rata-rata $\text{ER}$ | 0,2228 | | | | |
| $\text{ERB}$  | -0,9635 | -0,3366 | 0,7688 | 1,1102 | -5,0200 |
| $\text{Ai}$   | 0,00284643 | 0,003673 | -0,00286 | 0,000339 | -0,00041 |
| $\text{Bi}$   | -0,0001573 | -9,1E-05 | 0,000126 | 2,58E-06 | -1,7E-05 |
| $\text{Ci}$   | 0,00284688 | 0,003673 | -0,00285 | 0,000339 | -0,00041 |
| $C^*$          | 0,00367314 | | | | |
TABLE 5.15 / Perusahaan Consumer

|        | BRPT  | INTP  | SMGR  | WSBP  | INKP  | TPIA  |
|--------|-------|-------|-------|-------|-------|-------|
| E(R)   | 0,0078| -0,0356| 0,0201| 0,0129| -0,0091| -0,0043|
| \sigma^2| 0,01282| 0,014928| 0,005224| 0,025128| 0,008903| 0,005299532|
| \alpha | 0,006635| -0,03652| 0,019866| 0,012613| -0,00904| -0,004385395|
| \beta  | 0,6241| 0,5028| 0,1551| 0,1632| -0,0513| 0,0213|
| \sigma^2_\epsilon | 0,006635| -0,03652| 0,019866| 0,012613| -0,00904| -0,004385|
| \theta | -0,0579| -0,0588| -0,0138| -0,0051| -0,0876| -0,0701|
| Rata-rata ER | -0,0567| -0,1127| -0,3654| -0,3471| 1,1047| -2,5392|
| ERB    | -0,0908| -0,1127| -0,3654| -0,3471| 1,1047| -2,5392|
| A_i    | 0,004141| -0,01836| 0,00308| 0,002059| 0,000464| -0,000097849|
| B_i    | -0,00048| -0,01183| -0,00108| -0,00046| 7,4E-05| -0,000007574|
| C_i    | 0,004143| -0,01858| 0,003084| 0,00206| 0,000464| -0,000098|
| C^*    | 0,004143|

Rata-rata ER = \frac{\sum E(R)}{n}

\beta = \frac{\sum \alpha \beta_i}{\sum \alpha^2}

\sigma^2_\epsilon = \sum \sigma^2_i - \sum \alpha \beta_i \sigma^2_\epsilon

\theta = \sum \alpha \sigma^2_\epsilon - \sum \alpha \beta_i \sigma^2_\epsilon

E(R) = \sum \theta_i + \sum \beta_i \beta_i \alpha_i

\alpha_i = \frac{\sum \beta_i \alpha_i}{\sum \beta_i^2}

\sigma^2_i = \sum \sigma^2_i - \sum \alpha_i \beta_i \sigma^2_i
### TABLE 5.16 / Perusahaan Property

| Emiten | ERB | Ci   | C*    | Kesimpulan | Zi  | Wi   | rER  | rER2 |
|--------|-----|------|-------|------------|-----|------|------|------|
| ADHI   | 0.0179045 | 1.1285 | -0.01790 | 0.0180 | -0.0198516 | 0.003218 | Optimal | -0.9338 | -0.2913 | 0.005031 |
| BSEC   | 0.022374 | 0.4387 | 0.002234 | 0.0644 | -0.0096623 | 0.003218 | Optimal | -1.8509 | -0.2654 | 0.008067 |
| PT PP  | 0.012346 | 1.3119 | -0.01123 | 0.0153 | -0.016196 | 0.003218 | Optimal | -1.4394 | -0.4478 | 0.007897 |
| WSWT   | 0.021239 | 1.6744 | 0.02118 | 0.0138 | 0.031279 | 0.003218 | Optimal | -1.4403 | -0.2277 | 0.004886 |

| Emiten | ERB | Ci   | C*    | Kesimpulan | Zi  | Wi   | rER  | rER2 |
|--------|-----|------|-------|------------|-----|------|------|------|
| MAX    | 0.0032178 | -1 | 1.291 | -1 | 0.026492 | 2.056867 | 0.026492 |

- E(Rm): 0.0318
- SIM: 0.0033
- rER: 0.0031
- rER2: 0.0034
### TABLE 5.17 / Perusahaan Mining

| Emiten | $\alpha$ | $\beta$ | $\sigma^2_{\epsilon}$ | $\sigma^2_{\mu}$ | $\sigma^2_{\epsilon}$ | $\epsilon_{\mu}$ | $\epsilon_{\mu}$ | $\epsilon_{\mu}$ | $\epsilon_{\mu}$ |
|--------|---------|---------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| ADRO   | -0.041854 | 0.0400  | -0.04185  | 0.0400  | -0.04185  | -1.0919  | -0.0017  | -1.0432  | -0.2251  |
| ANTM   | 0.186655  | 1.5662  | 0.18668  | -0.0279  | -0.1722  | -0.0017  | -0.1220  | 0.0076  | 0.008869  |
| INCO   | 0.025064  | 0.2741  | 0.02509  | -0.0339  | -0.0033  | -0.0017  | Optimal  | -0.1220  | 0.008869  |
| PTBA   | 0.0241059 | 0.4201  | 0.02410  | -0.0316  | -0.0033  | -0.0017  | Optimal  | -1.8434  | 0.005988  |

### E(Rm) Maximum

| $\sigma^2_{\epsilon}$ | $\sigma^2_{\mu}$ | $\sigma^2_{\epsilon}$ |
|-------------------------|-------------------------|-------------------------|
| 0.0043  | 0.03590  | 0.00340  |
| 0.037840 | 0.037440  | 0.037440  |
### TABLE 5.18 / Perusahaan Trade

| Emiten | $\alpha$ | $\beta$ | $\epsilon_p$ | ERF | CI | Kesimpulan | Zi | We | E(Rm) | $\beta_p$ | $\sigma_p$ |
|--------|---------|--------|-------------|-----|---|------------|---|----|------|---------|----------|
| AKRA   | -0,0031 | 0,9201 | -0,00010    | -0,04479 | 0,0135 | - | 5,5939 | 0,3320 | -0,0314 | -0,3868 | -0,0001 |
| LPPF   | -0,00774 | 0,5123 | -0,007974 | -0,07506 | 0,0115 | - | 1,6874 | 0,0644 | -0,0326 | -0,0362 | -0,0006 |
| MNCN   | -0,00416 | 0,4812 | -0,00460 | -0,09902 | 0,0114 | 0,0155 | 1,0701 | 0,0699 | -0,0325 | -0,0347 | -0,0010 |
| SCMA   | -0,00586 | 0,8389 | -0,00506 | -0,05044 | 0,0114 | 0,0155 | 9,5723 | 0,5567 | -0,0304 | -0,4429 | -0,0030 |
| UNTR   | -0,00881 | 0,5261 | -0,02881 | 1,195862 | 0,0155 | 0,0155 | 24,3866 | 1,1637 | -0,0407 | -0,7307 | -0,0407 |

Maximum | 0,0015 | 27,8629 | 1,0000 | -0,0256 | 0,7802 | -0,0256 |

**E(Rm)** | 0,0018

**SIM=E(Rp)** | -0,01010

**$\sigma_p$** | 0,0040

**$\mu$** | 0,0004
### TABLE 5.19 / Perusahaan Finance

| Emiten | \( a \) | \( \beta \) | \( \sigma^2 \) | EMI | Cl | C* | Kesimpulan | Zi | Wi | \( \sigma^2_{wi} \) | \( \beta_{wi} \) | \( \sigma^2_{\beta wi} \) |
|--------|--------|--------|--------|------|----|----|------------|----|----|---------------|--------|---------------|
| BBCA   | 0.024801 | 0.5446 | 0.02480 | 0.04129 | 0.0009 | 0.0009 | Optimal | 0.7773 | 0.0053 | 0.0031 | 0.00250 | 0.0020 |
| BBNI   | -0.0007 | 1.7864 | -0.0007 | 0.02506 | -0.0006 | 0.0009 | Optimal | -16.902 | -0.1145 | 0.0031 | -0.0009 | 0.0021 |
| BBRI   | 0.000493 | 0.6319 | 0.00049 | 0.02499 | 0.0004 | 0.0009 | Optimal | 16.323 | 0.0101 | 0.0031 | 0.0029 | 0.0021 |
| BBTN   | -0.01727 | 1.3043 | -0.01727 | 0.0251 | -0.0221 | 0.0009 | Optimal | -3.914 | -0.0024 | 0.0030 | -0.0035 | 0.0004 |
| BMRI   | -0.00735 | 0.4414 | -0.00735 | -2.68071 | -0.0002 | 0.0009 | - | 161.5079 | 1.0502 | -0.0038 | 0.4822 | -0.0068 |

Maximum: 147,8174 | 1.0000 | 0.0077 | 0.0077

- \( E(R_m) \) = 0.0018
- \( SIM-E(R_p) \) = -0.0070
- \( \sigma^2 \) = 0.0034
- \( \sigma^2_{\beta} \) = -0.0072
TABLE 5.20 / Perusahaan Misc-Ind

| Emiten | α  | β   | σ * | ERB | C  | C*  | Kesimpulan | Zi  | Wi  | 𝐄(𝐸𝑟) | 𝑆𝑖 | 𝑆𝑖 * |
|--------|----|-----|-----|-----|----|-----|------------|-----|-----|-------|----|-------|
| ASHI   | 0.000632 | 0.2333 | 0.00063 | 0.2006822 | 0.000001 | 0.000001 | -140.4096 | 1.0791 | 0.0007 | 0.2516 | 0.0007 |
| SIRIL  | -0.00862 | -0.9999 | -0.00862 | 0.0804046 | 0.000001 | 0.000001 | Optimal   | 10.2650 | -0.0791 | 0.0007 | 0.0079 | 0.0077 |
| Maximum| 0.000001 | -130.1138 | 1.0000 | 0.0014 | 0.2595 | 0.0014 |

E(Rm) | 0.0018 | SIM=E(Rp) | 0.00183 | 0.00340 | 0.0016 |
### TABLE 2.21 / Perusahaan Basic Ind

| Emiten | a | E(R) | \( \sigma_a \) | E(R) | C* | a | Wi | \( \sigma_w \) | Zi | Wi | \( \sigma_w \) |
|--------|---|------|-------------|------|----|---|----|-------------|----|----|-------------|
| BRPT   | 0,0034538 | 0,0674 | 0,00305 | 0,0264 | 0,0031 | 0,3281 | 0,0002 | 0,0183 | Optimal | 6,6408 | 0,0493 |
| INTP   | 0,04999308 | -0,3133 | -0,0449 | -0,0154 | -0,0131 | -0,0449 | -0,0043 | 0,0002 | 0,0183 |
| SMGR   | 0,00644642 | 0,0891 | -0,0144 | -0,1527 | -0,0186 | -0,0186 | -0,1527 | -0,0706 | Optimal | 66,5408 | 0,4773 |
| WSBP   | 0,03995984 | 0,0123 | 0,0135 | 0,1407 | 0,0135 | 0,1407 | 0,1407 | 0,0183 | Optimal | 66,5408 | 0,4773 |
| TPAA   | 0,02659564 | 0,0623 | 0,0260 | -0,2098 | 0,0141 | 0,0141 | -0,2098 | 0,0183 |
| Maximum | 0,0183 | 134,6512 | 1,0000 | 0,0000 | 0,8035 |

\[ E(R_m) = 0,0018 \]
\[ SIM = E(R_p) = 0,00337 \]
\[ 0,00340 \]
\[ 0,0041 \]
### TABLE 5.22 / Perusahaan Infrastruktur

| Emiten  | $\alpha$  | $\beta$  | $\sigma^2_y$ | EOB | Cl | $C^*$ Kesimpulan | Zi | Wi | $\delta_0$ | $\delta_1$ | $\delta_{eff}$ |
|----------|-----------|---------|-------------|-----|---|-----------------|---|----|----------|----------|-------------|
| EXCL     | -0.01231  | -0.2312 | 0.01230     | 0.96347 | 0.0028 | 0.0037 | - | 18.8620 | -0.3629 | 0.0045 | 0.0849 | 0.0045 |
| INDI     | -0.02555  | -0.6638 | 0.00555     | 0.38637 | 0.0037 | 0.0037 | - | 40.5791 | -0.8107 | 0.0045 | 0.3966 | 0.0045 |
| JSNR     | -0.07965  | 0.2898  | 0.00965     | 0.76876 | 0.0029 | 0.0037 | Optimal | 22.8900 | -0.4495 | 0.0044 | -0.1232 | 0.0044 |
| PGAS     | 0.00185   | 0.3098  | 0.01088     | 1.12316 | 0.0037 | 0.0037 | Optimal | 211.2918 | 2.6286 | 0.0044 | 0.5363 | 0.0044 |
| TUMN     | 0.00023   | -0.0644 | 0.00024     | 0.15507 | 0.0037 | 0.0037 | Optimal | 115.3512 | 2.1044 | 0.0034 | 0.3172 | 0.0034 |

| Maximum  | 0.0627    | 30.5540 | 0.0037       | 0.0109 | 0.0560 | 0.2578 |

| $E(R_m)$ | 0.0018    |
| $SIM=E(R_p)$ | 0.01965 |
| $\sigma^2_y$ | 0.00340 |
| $\sigma^2_{eff}$ | 0.0213 |
### TABLE 5.23 / Perusahaan Consumer

| Emiten | $\alpha$ | $\beta$ | $\sigma^2$ | SMB | HML | Keimpulan | Zi | Wi | $\sigma_z$ | $\sigma_w$ |
|--------|--------|--------|----------|-----|-----|-----------|----|----|----------|----------|
| GGRM   | 0.006635 | 0.6241 | 0.00664 | -0.0074 | 0.0041 | 0.0041 | $-8.9286$ | $0.1061$ | $0.0007$ | $0.0007$ |
| HMSP   | -0.00662 | 0.5028 | 0.00664 | -0.1136 | -0.0386 | 0.0441 | -0.0885 | 0.2951 | 0.0007 | 0.0007 |
| KCBP   | 0.006666 | 0.1951 | 0.00667 | -2.8158 | 0.0061 | 0.0041 | -22.3554 | 0.0446 | 0.0007 | 0.0007 |
| INDF   | 0.026615 | 0.1952 | 0.02661 | 4.4937 | 0.0021 | 0.0041 | 5.1857 | 0.6554 | 0.0007 | 0.0007 |
| LKDF   | -0.00684 | 0.1511 | 0.00684 | 0.04683 | 0.0014 | 0.0041 | 0.04683 | 0.0014 | 0.0007 | 0.0007 |
| UNVR   | -0.00667 | 0.1223 | 0.00667 | 0.0061 | 0.0014 | 0.0041 | 0.0061 | 0.4092 | 0.0007 | 0.0007 |

| Maximum | $E(R_m)$ | $SIM$ | $E(R_p)$ | $\sigma_m$ | $\sigma_p$ |
|---------|----------|-------|----------|-----------|-----------|
| 0.0441  | 0.0018   | 0.0162 | 0.00340  | 0.0159    | 0.0158    |

**Perusahaan Consumer**

| Emiten | $\alpha$ | $\beta$ | $\sigma^2$ | SMB | HML | Keimpulan | Zi | Wi | $\sigma_z$ | $\sigma_w$ |
|--------|--------|--------|----------|-----|-----|-----------|----|----|----------|----------|
| GGRM   | 0.006635 | 0.6241 | 0.00664 | -0.0074 | 0.0041 | 0.0041 | $-8.9286$ | $0.1061$ | $0.0007$ | $0.0007$ |
| HMSP   | -0.00662 | 0.5028 | 0.00664 | -0.1136 | -0.0386 | 0.0441 | -0.0885 | 0.2951 | 0.0007 | 0.0007 |
| KCBP   | 0.006666 | 0.1951 | 0.00667 | -2.8158 | 0.0061 | 0.0041 | -22.3554 | 0.0446 | 0.0007 | 0.0007 |
| INDF   | 0.026615 | 0.1952 | 0.02661 | 4.4937 | 0.0021 | 0.0041 | 5.1857 | 0.6554 | 0.0007 | 0.0007 |
| LKDF   | -0.00684 | 0.1511 | 0.00684 | 0.04683 | 0.0014 | 0.0041 | 0.04683 | 0.0014 | 0.0007 | 0.0007 |
| UNVR   | -0.00667 | 0.1223 | 0.00667 | 0.0061 | 0.0014 | 0.0041 | 0.0061 | 0.4092 | 0.0007 | 0.0007 |

| Maximum | $E(R_m)$ | $SIM$ | $E(R_p)$ | $\sigma_m$ | $\sigma_p$ |
|---------|----------|-------|----------|-----------|-----------|
| 0.0441  | 0.0018   | 0.0162 | 0.00340  | 0.0159    | 0.0158    |
### TABLE 5.24 / Emiten Perusahaan Property

| Emiten | E(Ri)  | \( \sigma^2 \) | Cov | \( \rho \) | E(Rp)  | \( \sigma_p^2 \) | Wi  |
|---------|--------|----------------|-----|---------|--------|----------------|-----|
| ADHI    | -0.0684| 0.0865         | 0.0849 | 0.9672 | 0.01992| 0.2909        | -0.2913 |
| BSDE    | -0.0930| 0.0759         | 0.0865 | 0.9231 | 0.02467| 0.30171       | -0.2654 |
| PTPP    | -0.0602| 0.0986         | 0.1014 | 0.9683 | 0.02696| 0.31715       | -0.4478 |
| WIKA    | -0.0462| 0.0947         | 0.0879 | 0.9574 | -0.10306| 0.29786       | 2.2291   |
| WSKT    | -0.0585| 0.0758         | 0.0802 | 0.9141 | 0.01313| 0.29063       | -0.2246 |
### TABLE 5.25 / Perusahaan Trade

| Emiten | E(Ri)  | $\sigma^2$ | Cov | $\rho$ | E(Rp)  | $\sigma_p^2$ | Wi  |
|--------|--------|-----------|-----|--------|--------|-------------|-----|
| AKRA   | -0.0705| 0.0795    | 0.0795 | 0.9302 | -0.0218 | 0.2865      | 0.3100 |
| LPPF   | -0.0554| 0.0783    | 0.0717 | 0.8701 | -0.0052 | 0.2822      | 0.0944 |
| MNCN   | -0.0991| 0.0739    | 0.0727 | 0.9121 | -0.0059 | 0.2781      | 0.0599 |
| SCMA   | -0.0437| 0.0733    | 0.0676 | 0.8716 | -0.0234 | 0.2741      | 0.5357 |
| UNTR   | -0.0929| 0.0700    | 0.0697 | 0.8624 | -0.1267 | 0.2790      | 1.3637 |
### TABLE 5.26 / Perusahaan Mining

| Emiten | $E(R_i)$ | $\sigma^2$ | Cov | $\rho$ | $E(R_p)$ | $\sigma_{p^2}$ | Wi |
|--------|----------|------------|-----|--------|----------|----------------|----|
| ADRO   | -0.0801  | 0.0668     | 0.0939 | 0.2523 | 0.01803  | 0.99003        | -0.2251 |
| ANTM   | 0.2466   | 1.7648     | 0.0433 | 0.1027 | 0.00648  | 0.99097        | 0.0263  |
| INCO   | -0.0283  | 0.0860     | 0.0810 | 0.9494 | -0.02264 | 0.28881        | 0.8010  |
| PTBA   | 0.0401   | 0.0721     | 0.0691 | 0.9188 | 0.01597  | 0.27567        | 0.3978  |
TABLE 5.27 / Perusahaan Finance

| Emiten | E(Ri) | $\sigma^2_i$ | Cov | $\rho$ | E(Rp) | $\sigma_p^2$ | Wi  |
|--------|-------|--------------|-----|-------|-------|-------------|-----|
| BBCA   | -0.0552 | 0.0759       | 0.0803 | 0.9821 | -0.00029 | 0.28021 | 0.0053 |
| BBNI   | -0.0500 | 0.0751       | 0.0786 | 0.9860 | -0.00572 | 0.27684 | -0.1143 |
| BBRI   | -0.0297 | 0.0721       | 0.0795 | 0.9484 | -0.00057 | 0.28483 | 0.0191 |
| BBN    | -0.0703 | 0.0831       | 0.0752 | 0.9270 | -0.00018 | 0.28005 | -0.0026 |
| BMRI   | -0.0472 | 0.0675       | 0.0766 | 0.9882 | -0.05152 | 0.27306 | 1.0926 |
TABLE 5.28 / Perusahaan Misc-Ind

| Emiten | E(Ri) | $\sigma^2$ | Cov | $\rho$ | E(Rp) | $\sigma_p^2$ | Wi  |
|--------|-------|------------|-----|--------|-------|-------------|-----|
| ASII   | -0.0675 | 0.0732     | 0.0758 | 0.9780 | -0.0728 | 0.2729       | 1.0791 |
| SRIL   | -0.0757 | 0.0700     | 0.0758 | 0.9780 | 0.0060  | 0.2729       | -0.0791 |
TABLE 5.29 / Perusahaan Basic Ind

| Emiten | $E(R_i)$ | $\sigma_i^2$ | Cov | $\rho$ | $E(R_p)$ | $\sigma_p^2$ | Wi |
|--------|----------|--------------|-----|-------|---------|-------------|----|
| BRPT   | -0.0669  | 0.0787       | 0.0516 | 0.6924 | -0.00330 | 0.28077     | 0.0493 |
| INTP   | 0.0933   | 0.0601       | 0.0507 | 0.6317 | -0.00039 | 0.28833     | -0.0042 |
| SMGR   | -0.0358  | 0.0915       | 0.0772 | 0.8956 | -0.01768 | 0.28902     | 0.4942 |
| WSBP   | -0.0272  | 0.0691       | 0.0730 | 0.8363 | -0.01298 | 0.29132     | 0.4773 |
| INKP   | -0.0387  | 0.0940       | 0.0864 | 0.8415 | 0.00064  | 0.31401     | -0.0166 |
| TPIA   | -0.0464  | 0.0956       | 0.0749 | 0.7969 | 0.00203  | 0.30122     | -0.0438 |
| Emiten | E(Ri) | $\sigma^2$ | Cov | $\rho$ | E(Rp) | $\sigma_p^2$ | Wi  |
|--------|-------|----------|-----|-------|-------|---------------|-----|
| EXCL   | -0.0591 | 0.0887 | 0.1033 | 0.8542 | 0.0214 | 0.3452 | -0.3629 |
| INDY   | -0.0598 | 0.1404 | 0.0901 | 0.8167 | 0.0485 | 0.3339 | -0.8107 |
| JSMR   | -0.0749 | 0.0739 | 0.0789 | 0.9086 | 0.0337 | 0.2895 | -0.4495 |
| PGAS   | -0.0471 | 0.0869 | 0.0813 | 0.8673 | -0.1236 | 0.3007 | 2.6230 |
| TLKM   | -0.0040 | 0.0860 | 0.0772 | 0.8153 | 0.0093 | 0.3028 | -2.3141 |
TABLE 5.31 / Perusahaan Consumer

| Emiten | E(Ri)  | $\sigma_i^2$ | Cov  | $\rho$ | E(Rp) | $\sigma_p^2$ | Wi  |
|--------|--------|-------------|------|--------|-------|-------------|-----|
| GGRM   | -0.0330| 0.0804      | 0.0727 | 0.8631 | -0.0035 | 0.2849      | 0.1061 |
| HMSP   | -0.0668| 0.0752      | 0.0748 | 0.9010 | 0.0013  | 0.2824      | -0.0191 |
| ICBP   | -0.0515| 0.0781      | 0.0825 | 0.8817 | -0.0136 | 0.3005      | 0.2649 |
| INDF   | -0.0538| 0.0955      | 0.0782 | 0.8467 | -0.0372 | 0.2989      | 0.6914 |
| KLBF   | -0.0658| 0.0762      | 0.0772 | 0.9473 | 0.0029  | 0.2797      | -0.0433 |
| UNVR   | -0.0715| 0.0743      | 0.0780 | 0.9319 | -0.0035 | 0.2842      | 0.0486 |