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Analysis Value At Risk In Single Asset And Portfolio By Monte Carlo Simulation

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Abstract. Value at Risk (VaR) is a defined standard for measuring market risk. VaR measures the worst expected loss under normal market conditions during a specified time interval with a level of confidence are given. VaR is a statistical approach has three components: a period of time, the confidence level and the amount of loss (or percentage loss). Simulation Monte Carlo simulation method calculates changes in the position it value using a random sample generated by pricing scenarios. In addition to using past values of risk factors, Monte Carlo simulation to produce a model for estimating the risk factors of past portfolio returns to define the distribution and parameter. Using this distribution and parameters, we can produce thousands of hypothetical scenarios for risk factors and, finally, we can determine the future prices or rates based on a hypothetical scenario. VaR can be derived from the cumulative distribution of future prices or rates for a given level of confidence. In this paper, we calculate VaR in PT Astra International Tbk., PT Telekomunikasi Tbk., And the portfolio of the two assets. PT. Astra International Tbk has a higher VaR of PT. Telekomunikasi Tbk. VaR of the portfolio has a lower yield than the VaR of each single asset.

Key-Words: *Value at Risk, Mean, Variance Efficient Portfolio, Monte Carlo Simulation*

1. Introduction

The risk of losses suffered by investors could be minimized by way of diversification or asset deployment. That is, investors are not only re-invest their funds only in one stock alone, but on several stocks, shares a collection is called the portfolio. Investors in forming the portfolio are not just incorporating a few shares, but must consider two elements inherent namely return and risk.

Previously, many financial experts assume a normal distribution of asset returns. Markowitz (1952), has compiled explicitly risks and benefits in the context of a portfolio of financial assets [1]. Another opinion as Ross (1976) using the argument the development of models of valuable assets such as the theory of Capital Asset Pricing Model (CAPM) and the theory Arbitrage Pricing Theory (APT) relating to the return of assets at risk factors more generally return asset normal distribution [2]. The problem is that the model cannot be proved empirically [3], even sometimes return assets have heavy tail distribution as introduced by [4] that the distribution of heavy tail is clearly shown in the form of financial time series. Application of the method of Value at Risk (VaR) is a part of risk management. VaR at this time widely accepted, applied and considered as a standard method of measuring risk. VaR can be defined as an estimate of the maximum loss that will be obtained during the time period (time period) specified under normal market conditions at the level of trust (confidence level) of certain [5]. Simply put, VaR want to answer the question "how much (as a percentage or a certain amount of money) investors may be losing money for the investment of time t with a confidence level (1 - α). The Investor may use VaR as one of the benchmarks can set how large the target risk.

The most important aspect in the calculation of VaR is to determine the type of methodology and assumptions in accordance with the distribution of returns. This is because the calculation of VaR is based on the distribution of return securities. Application of methods and assumptions that will deliver accurate VaR calculation to be used as a measure of risk.

There are three main methods for calculating VaR is a parametric method (called variance-covariance method also), Monte Carlo simulation method and historical simulation. The third method has the characteristic advantages and disadvantages of each. The variance-covariance method assumes that the return of the normal distribution and portfolio return is linear against the sole asset returns. Both of these factors will lead to lower estimates of the potential volatility of the asset or portfolio in the future. VaR with Monte Carlo simulation method assumes that the return distribution normal is simulated using appropriate parameters and not assuming that the portfolio return is linear against the sole asset returns. VaR with historical simulation method is ruled out assuming normally distributed returns and the linear nature of the portfolio return against the sole asset returns.

In this paper, we discuss the calculation of VaR using The Monte Carlo simulation method. This method is the most powerful method to measure VaR because it can calculate a variety of exposures and risks arrangement includes a nonlinear price risk, volatility risk, and risk models remain. This method is also flexible enough to incorporate time variation in volatility, fat tails and extreme scenarios. Simulations can awaken all the opportunities density function, not just one quantify and can be used to determine the losses exceed expectations

VaR. In estimating VaR, Monte Carlo simulation methods do simulation by generating random numbers based on the characteristics of the data that will be generated, which is then used to estimate the value of its VaR.

2. Material and Methods

2.1. Material

The study was conducted in PT. Astra International Tbk (ASII) and PT. Telekomunikasi Indonesia Tbk (TLKM), as well as a portfolio of the two companies. Software used to assist the analysis is Microsoft Excel and R. The data used for the calculation of VaR with Monte Carlo simulation method on a single asset and portfolio return data is obtained from the calculation of the closing price (closing price) daily stock of PT. Astra International Tbk (ASII) and PT. Telekomunikasi Indonesia Tbk. (TLKM) during the trading year (246 working days) which began January 2, 2014 until December 28, 2014 [10]. Return assumed independently for each period of time. Data taken from the Indonesia Stock Exchange (IDX) [11].

2.2. Method

2.2.1. Return

The return of an asset is the rate of return or the results obtained as a result of investing [6] (Ruppert, D, 2004). The return is one of the factors that motivate investors to invest because it can describe the real change in prices. Return at all, *t* is denoted by R_t (Jorion, P., 2002)[7].

$$R_t = In(1+R_t) = In\left(\frac{S_t}{S_{t-1}}\right) = In(S_t) - In(S_{t-1})$$

With S_t is the asset price all t in the absence of dividends.

2.2.2. Risk

According Kountur (2004), the risk is an uncertain situation faced by a person or a company that can give adverse impact [8]. This uncertainty is due to lack or unavailability of information about what is going to happen. Defines risk as the uncertainty of the outcome or the current situation [9]. Risk is a measure of the quantity or size empirically measure the likelihood of an event value. Risks are supporting data regarding the likelihood of occurrence.

If there is n (number of observations) return, then the expectation of return can be estimated by the sample average (mean) return:

$$\bar{R}_t = \frac{1}{n}\sum_{i=1}^{n} R_t$$

Return on average then used to estimate the variance of each period that is the standard deviation squared per period:

$$S^2 = \frac{1}{n-1}\sum_{t=1}^{n}\left(R_t - \bar{R}_t\right)^2$$

Called a variant of each period because the amount depends on the length of time when returns are measured. The root of the variance (standard deviation) is an estimate of the risk of stock prices namely:

$$S = \sqrt{\frac{\sum_{t=1}^{n}\left(R_t - \bar{R}_t\right)^2}{n-1}}$$

The annual standard deviation (annual volatility) can be estimated as follows:

$$S = \sqrt{the\,number\,of\ trading\ day\ \frac{\sum_{t=1}^{n}\left(R_t - \bar{R}_t\right)^2}{n-1}}$$

2.2.3. Portfolio

The portfolio is a combination of two or more securities was selected as the target of investment from investors at a certain time with a certain provision, for example, the proportion of the distribution of funds or capital invested. Return of the portfolio can be written by the equation:

$$R_{p,t} = \sum_{i=1}^{N} w_i R_{i,t}$$

Where
N = the number of assets in the portfolio
$R_{i,t}$ = return to the asset - i in period to - t
W_i = the amount of the composition or the proportion of assets in the portfolio to- i, with
$\sum_{i=1}^{N} w_i = 1$, Expectation value of the portfolio return is:

$$E(R_p) = \mu_p = \sum_{i=1}^{N} w_i \mu_i$$

And its variants are:

$$Var(R_p) = \sigma_p^2 = \sum_{i=1}^{N} w_i^2 \sigma_i^2 + \sum_{i=1}^{N} \sum_{j=1, j \neq i}^{N} w_i w_j \sigma_{ij} = \sum_{i=1}^{N} w_i^2 \sigma_i^2 + 2\sum_{i=1}^{N} \sum_{j<i}^{N} w_i w_j \sigma_{ij}$$

Where μ_i = expected value of the asset to-i
σ_i^2 = variety of the assets of all i σ_{ij} = covariance.

Return expectations of an expected return to be obtained by investors for making investment decisions. Expected return can be calculated using the expected value of the return.

2.2.4. Mean, Variance Efficient Portfolio (MVEP)

In the establishment of a portfolio, an investor seeks to maximize expected return of an investment with a certain level of risk. In other words, the portfolio was formed to provide the lowest risk level with a certain return expectation. Portfolios that can achieve these objectives known as an efficient portfolio. In the establishment of an efficient portfolio, investor behavior that occurs naturally in the investment decisions are investors who tend to avoid risk. Investors are risk averse is the investor when faced with two investments with the same expected return and risk is different, then it will choose investments with lower risk levels. If an investor has several options of efficient portfolio, the optimum portfolio to be chosen.

Optimal portfolio is selected portfolio of an investor of the many options that exist on the set of efficient portfolios. Of course, an investor selected portfolio is a portfolio that fits the investor preference towards returns and is willing to bear the risk [1].

One method of forming the optimal portfolio is the mean, variance efficient portfolios (MVEP). In MVEP investors only invest in assets any risk. Investors did not include risk-free assets in the portfolio. An asset is said to be free of risk if the returns will be accepted in the future are uncertain. One example of a risk-free asset is a government bond. In the case in Indonesia, Bank Indonesia Certificates (SBI) issued by Bank Indonesia are one example of a risk-free asset.

Mean variance efficient portfolios (MVEP) are defined as the portfolio has a minimum variance among all possible portfolios that can be formed. If we assume that investor preferences towards risk is risk averse (to avoid risk), then the portfolio has a mean variance efficient (mean, variance efficient portfolios) is a portfolio that has a minimum variance from the mean return. This would correspond to optimize weight $W = [w_1 \ldots w_2]^2$ maximum mean the return of a given variety.

More formally, the weighting vector of $\boldsymbol{w}$ will be sought in order to set up a portfolio that has the minimum variance based on two constraints, namely:

1. The initial specification of the average return μ_p, which must be achieved $\boldsymbol{w}\,\boldsymbol{\mu}$.

2. The amount of the proportion of the portfolio that is formed is equal to 1 ie ***w* 1*N*** = 1, where 1 ***N*** is a vector with dimensions N x 1.

Optimization problems can be solved by Lagrange function is:

$$L = w^T \sum w + \lambda_1 \left(\mu_P - w^T \mu\right) + \lambda_2 \left(1 - w^T 1^N\right)$$

Where *L* = function Lagrange

λ = Lagrange multiplier

In the case of a portfolio with an efficient variant, there is no restriction on the main portfolio $\left(\lambda_1 = 0\right)$, so that the weighting of mean variance efficient portfolios with a return $X \sim N_N\left(\mu, \Sigma\right)$ are :

$$w = \frac{\sum 1_N}{1_N \sum 1_N}$$

Where

$\sum^{-1}$ = inverse variance-covariance matrix

2.2.5. Diversification

Diversification related to the establishment of a portfolio. Diversification is very important for investors because it can minimize risk without reducing returns received. Risks can be diversified is no systematic risk that is part of the security risk that can be eliminated by forming a portfolio. Securities that have a smaller correlation of 1 would reduce the risk of the portfolio.

2.2.6 Value at Risk (VaR)

Value at Risk (VaR) is one form of risk measurement sufficient popular. It considers the simplicity of the concept of VaR itself, but also has the ability implementation methodologies statistical diverse and sophisticated. VaR can be defined as an estimate of the maximum loss that will be obtained during the time period (time period) specified under normal market conditions at the level of trust (confidence interval) of certain [6]. In a simple VaR want to answer the question "how much (as a percentage or a certain amount of money) investors may lose money for the investment of time ***t*** with a confidence level (1- α)". Based on the question, it can be seen that there are three important variables that large losses, period of time and a great degree of confidence.

In the portfolio, VaR is defined as the estimated maximum loss that will the portfolio experienced a certain period of time with a certain confidence level. Therefore, there is a possibility that a loss that would be suffered by the portfolio during the period of ownership will be lower than the limit established by VaR. There is a possibility that the actual losses may be even worse, so the limitations of VaR is not able to assert anything about how large the losses that actually occurred and definitively not confirm the possibility of the worst losses. VaR only declare losses that may be suffered in the bad old days were pretty bad. But investors may use VaR as one of the benchmarks can set how large the target risk.

There are three main methods for calculating VaR is a parametric method (also called variance-covariance method), Monte Carlo simulation method and historical simulation. All three methods have their own characteristics. The Variance-covariance method assumes that the return of the normal distribution and portfolio return is linear against the sole asset returns. Both of these factors will lead to lower estimates of the potential volatility of the asset or portfolio in the future. VaR with Monte Carlo simulation method assumes that the return of normal distribution and do not assume that the portfolio return is linear against the sole asset returns. VaR with historical simulation method is ruled out assuming normally distributed returns and the linear nature of the portfolio return against the sole asset returns.

Technically, VaR with a confidence level of $(1 - \alpha)$ is expressed as a form of distribution quantify to-return. VaR can be determined by the density function of the return value opportunities where front f (R) and R is the rate of return (return) assets (both single asset and portfolio). At the confidence level 1, will look for the worst possible value, R *, so the chance appearance of a return value exceeds R * is (1-.α).

$$1 - \alpha = \int_{R^*}^{\infty} f(R)dR$$

While the chance appearance of a return value less than or equal to R*, $p = P(R \leq R^*)$ is α.

$$\alpha = \int_{R^*}^{n^*} f(R)dR = P\left(R \leq R^*\right) = p$$

In other words, R * is a quantile of the distribution of returns is a critical value (cut off value) with the opportunities that have been determined. Equation (13) is flexible for all probability distributions.

If W_0 is defined as an initial investment of assets (both single asset and portfolio) then the value of the asset at the end of the time period is $W = W_0$ (1 + R). If the asset value of the lowest confidence level $(1-\alpha)$ is W * W0 1 R *, then Vary the confidence level $(1-\alpha)$ can be formulated as follows:

$$VaR_{(1-\alpha)} = W_0 R^*$$

Where : R * = quantile to - α from the distribution of returns.

In general, the R * value is negative.

2.2.7 Time Period

The time period used in measuring the level of risk depends on the type of business undertaken by an enterprise. More and more dynamic movement of factors of the market for a particular type of business, the shorter the time period used to measure the level of risk. For example, the bank will conduct monitoring of the level of risk on a daily basis, that one day, one week (five business days) to two weeks (ten business days), on the other hand, companies with real assets such as investor real estate companies may will implement a period of one month (twenty days), four months, even a year to conduct monitoring on the level of risk. Expectations of return increases linearly with time while volatility (Standard deviation) increases linearly with the square root of time, can be described as:

$$\mu(t) = \mu t \quad \text{And} \quad \sigma^2(t) = \sigma^2 t \Rightarrow \sigma(t) = \sigma\sqrt{t}$$

Time conversion rules in the calculation of VaR are expressed as "Square root of time rule", the conversion period of time in the calculation of VaR can be written as follows [10]

$$\text{VaR (t)} + \sqrt{tVaR}$$

By using the conversion rules of periods of time, then the calculation of Vary with a level of confidence $(1-\alpha)$ after a period t in Equation (14) can be expressed as follows

$$VaR_{(1-\alpha)}(t) = W_0 R^* \sqrt{t}$$

Where t is a lot of the time period.

2.2.8 Level of confidence

Level determinate of confidence in the calculation of VaR depends on the use of VaR. The confidence level is the probability that VaR will not exceed the maximum loss. Determining the level of trust is very important because it can describe how big the company is able to take a risk and price losses exceeded VaR. The greater the level of confidence is taken, the greater the risk and the allocation of capital to cover losses taken.

2.2.9 VaR by Monte Carlo Simulation Method

The use of Monte Carlo simulation methods for measuring risk has been introduced by Boyle in 1977. In estimating the value of Value at Risk (VaR) in both single asset and portfolio, Monte Carlo simulation has several types of algorithms. But in essence is doing simulation by generating random numbers based on the characteristics of the data that will be generated, which is then used to estimate the value of its VaR. VaR using The Monte Carlo simulation method assumes that the return of normal distribution.

2.2.10 VaR by Monte Carlo Simulation Method in a Single Asset

VaR with Monte Carlo simulation method on a single asset assumes that the asset returns were normally distributed. In general, a simple algorithm calculation of VaR using Monte Carlo simulation on a single asset is as follows:

1. Determining the value of the parameters of a single asset returns. Return assumed to follow a normal distribution with mean μ and variance σ^2 .
2. Simulating the return value of generating random single asset returns with the parameters obtained in step (1) for n pieces forming the empirical distribution of returns the simulation results.
3. Finding the estimated maximum loss at a level of trust $(1-\alpha)$, as to - quantify value of the empirical distribution of returns obtained in step (2), denoted with R *.
4. Calculate the VaR confidence level $(1-\alpha)$, as in the time period t

$$VaR_{(1-\alpha)}(t) = W_0 R^* \sqrt{t}$$

Where W_0 = Initial investment funds or portfolios of assets

R*= Value to -α quantify of the distribution of returns
t = time period
Values obtained VaR is the maximum loss that would be suffered by a single asset ..

5. Repeating steps (2) to step (4) of m thus reflecting the various possible values of VaR single asset that is VaR_1, VaR_2, ..., VaR_m.
6. Calculating the average results of step (5) to stabilize because of the VaR generated by each of the different simulations.

2.2.11 VaR by Monte Carlo Simulation Method in Portfolio

VaR with Monte Carlo simulation method assumes that the portfolio return the assets forming the portfolio of the multivariate normal distribution. Algorithm Simple calculation of VaR using Monte Carlo simulation on the portfolio was as follows:

1. Determine the parameter values for the variables (in this case is the return of assets) as well as the correlations between variables. Return the assets forming the portfolio assumed to follow a multivariate normal distribution, so that the required parameters include the mean return of the assets forming the portfolio and the variance-covariance matrix.
2. Simulate the return value to randomly generate a return of assets multivariate normal distribution with the parameters obtained in step (1) as n.
3. The return value of each asset at time t is R_1, and R_2 t, t produced in step (2) is used to calculate the portfolio return at time *t* is :
   $$RP_t = w_1 R_{1t} + w_2 R_{2t}$$
   With :
   Rp_t = portfolio return at time t
   w_1 = the amount or proportion of asset composition 1st
   w_2 = the amount of the composition or the proportion of the assets of the 2nd
4. Looking at the estimated maximum loss level of confidence that is
   as the value of quantifying to α of the empirical distribution of portfolio return obtained in step (3) is denoted by R *.
5. Calculate the VaR confidence level$(1-\alpha)$, in the time period t day as:
   $$VaR_{(1-\alpha)}(t) = W_0 R^* \sqrt{t}$$
   Values obtained VaR is the maximum loss which will be suffered portfolio.
6. Repeating steps (2) through step (5) of m so as to reflect various possible values of portfolio VaR is VaR_1, VaR_2, ..., VaR_m.
7. Calculating the average results from step (6) to stabilize because of the VaR generated by each of the different simulations.

3. Results and Discussion

3.1. Normality test

Return assumed normal distribution. Prior to the calculation of VaR, first tested the assumption of normality of data for PT. Astra International Tbk

(ASII) and PT. Telekomunikasi Indonesia Tbk (TLKM) respectively, using the Kolmogorov-Smirnov test to determine whether the right of return ASII and TLKM follow a normal distribution [3].

Hypothesis
H_0: return data follow a normal distribution
H_1: return data do not follow a normal distribution
Statistical Test:

$$D = \sup_x |S(x) - F_\alpha(x)|$$

The significance level α = 5%
Test criteria
H_0 is rejected if D> D * (α) or p-value < α

Value D * (0.05), which is obtained from Table Kolmogorov-Smirnov amounted 0.0869. From the calculation of extreme values of Kolmogorov-Smirnov (D) return ASII is at 0.0457 with a p-value of 0.6857.

Values D <D * (0:05) and p-value> 0.05 which means that H0 is accepted. So we can conclude that the return data PT. Astra International Tbk follows a normal distribution.

Extreme values of Kolmogorov-Smirnov (D) return TLKM amounted to 0.0821 with a value of p Value-at 0.07357.

Values D <D * (0:05) and the p-value> 0.05 means H_0 is accepted. So we can conclude that the return data PT. Telekomunikasi Indonesia Tbk follows a normal distribution.

3.2 Confidence and a Period of Time

The confidence level used in the calculation of Monte Carlo VaR on this single assets is 95%. The time period is 1 day.

3.3 VaR calculations PT. Astra International Tbk (ASII)

Based on the test assumptions and calculations, the return of normal distribution ASII
Where : $\mu = 0.0019915702$ and $\sigma^2 = 0.0005937142$ denoted by return ASII ~ N (0.0019915702, 0.0005937142). This parameter is used for simulation Monte Carlo VaR.

VaR is always different in each simulation. This is caused by the difference of random data generated. But basically the results do not differ greatly between one another because the return generated with the same parameters. One way to reduce this problem is to run a lot of simulations and then taking the average value.

At the 95% confidence level with twenty five repetitions, resulting in the average value of VaR, which amounted -2987122134 (sign - showing a loss). This means there is a 95 % confidence that the losses that will be suffered by investors will not exceed Rp. 29,871,221.34 within one day after the date of December 28, 2007 or with other editors can be said there is a possibility that a loss of 5% investment in PT. Astra International Tbk amounting to Rp. 29,871,221.34 or more.

3.4 VaR calculations PT. Telekomunikasi Indonesia Tbk. (TLKM)

Based on the test assumptions and calculations, the return of normal distribution TLKM with parameters $\mu = -0.00008266022$ and $\sigma^2 = 0.000396501$ denoted by return TLKM ~ N (-0.00008266022, 0.000396501). This parameter is used for simulation Monte Carlo VaR.

If the initial funds are invested in a portfolio consisting of two assets, namely ASII and TLKM Rp. 1,000,000,000.00, then the confidence level of 95% with twenty-five repetitions, resulting in the average value of the Vary -226 545 321 (sign - showing a loss). This can mean there is a conviction of 95% of that loss to be suffered by investors will not exceed Rp. 22,654,532.10

Within one day after the date of December 28, 2007 or by other editors can be said there is a possibility that a loss of 5% investment in PT. Telekomunikasi Indonesia Tbk amounting to Rp. 22,654,532.10 or more.

3.5 VaR calculations with Monte Carlo Simulation Method in Portfolio Consisting of Two Assets

3.5.1 Multivariate Normal Test

Prior to the calculation of VaR, first tested the assumption of normality of data to determine whether the right of return on assets forming the portfolio follows the multivariate normal distribution.

Tests were carried out with the Kolmogorov-Smirnov test the hypothesis
H0: Distance mahalanobis chi-square distribution with degrees of freedom p = 2
H1: Distance mahalanobis not chi-square distribution with degrees of freedom p = 2
Statistical Test:

$$D = \sup_x \left| S(x) - F_\alpha(x) \right|$$

The significance level $\alpha = 5\%$
Test criteria: H_0 if D> D * (α) or p-value < α
Value D * (0.05), which is obtained from Table Kolmogorov-Smirnov amounted
0.0869. Extreme values of Kolmogorov-Smirnov (D) at the output is at 0.0696 with a p-value of 0.1861. Values D <D * (0:05) and the p-value> 0.05 which means that H_0 is accepted. So mahalanobis distance chi-square distribution, so that the sample (return on assets forming the portfolio) can be assumed to come from a bivariate normal population.

3.5.2 Confidence and a Period of Time

The confidence level used in Monte Carlo VaR calculation on the two asset portfolios is 95 %. The time period is 1 day.

3.5.3 Correlation and Parameters

Correlations were formed from the merger of assets and TLKM is ASII 0.4242234. It can be seen that the correlation between ASII and TLKM below 1, so expected effect of diversification to reduce risk.

The parameters used for the simulation of Monte Carlo VaR in the portfolio are mean vector and variance-covariance matrix, which amounted:

$$\mu = \begin{bmatrix} 0,002092502 \\ -0,00007966122 \end{bmatrix} \text{ And } \sum = \begin{bmatrix} 0.0006337162 & 0.0002153156 \\ -0.0002153156 & 0.0004065061 \end{bmatrix}$$

3.5.4 Weights or Proportion Portfolio

Weights or proportions given in each of the assets obtained from the calculation using mean, variance efficient portfolios (MVEP).

The calculations are as follows:

$$\sum^{-1} = \begin{bmatrix} 1924.301 & -1019.252 \\ -1019.252 & 2999.859 \end{bmatrix}$$

$$1_N = \begin{bmatrix} 1 \\ 1 \end{bmatrix} \quad 1_N^T = \begin{bmatrix} 1 & 1 \end{bmatrix}$$

By using Equation (13)

$$w = \frac{\sum 1_N}{1_N \sum 1_N}$$

w1 = weight or proportion ASII
w2 = weights or proportions TLKM

Based on the calculation of weight or proportions given in each asset in the amount of 31% for PT. Astra International Tbk. (ASII) and 69% of PT. Telekomunikasi Indonesia Tbk (TLKM). The Assumed proportion of portfolios remains during the period of ownership.

3.6 The calculation of VaR Portfolio

If the initial funds are invested in a portfolio consisting of two assets, namely ASII and TLKM Rp. 1,000,000,000.00, then at the 95% confidence level with twenty five repetitions, produces an average VaR of -30,308,619 (sign - showing a loss). This means there is a 95 % confidence that the losses that will be suffered by investors will not exceed Rp. 30,308,619.00 within one day after the date of December 28, 2007 or with other editors can be said there is a possibility of 5% that the investment losses on a portfolio consisting of shares and TLKM ASII Rp. 30,308,619.00 or more.

VaR is lower than the portfolio VaR single asset. The lower value of the shows the effects of diversification. Diversification can occur due to the effect of mutual offset between assets. If one asset at a disadvantage, while others saw their assets, then the benefits of the asset can only be used to cover losses of other assets. This diversification effect due to the low correlation between assets. Diversification effects will be of great value (which means it can be lowered portfolio risk further) if the correlation between assets lower.

4. Conclusion

Based on the issues raised in this study, it can be concluded as follows

1. The difference in the value of the Value at Risk (VaR) on each test due to differences the results of each simulation run. But the result is not much different between one another as simulated with the same parameters. Therefore, to stabilize the result of the average value taken.
2. The calculation of VaR single asset, the value of risks to be borne by PT. Astra International Tbk is greater than the value of the risk will be borne by PT. Telekomunikasi Indonesia Tbk.
3. Based on the Monte Carlo VaR calculated either on a single asset and portfolio, resulting VaR at 95% confidence level of Rp. 38,991,032.00 for PT. Astra International Tbk, Rp. 32,744,534.00 for PT. Telekomunikasi Indonesia Tbk and Rp. 30,308,619.00 for the portfolio. The greater the level of confidence is taken, the greater the risks involved and the allocation of capital used to cover such losses.
4. VaR of the portfolio is lower than the VaR of each asset. This is due to the diversification effect which occurs between the compensating effect of the asset so that it can lower the risk value. Diversification effects will be of great value if the correlation between low asset.

References

[1] Markowitz, 1952. Portfolio Selection. *The Journal of Finance*. Vol. 7 (Mar. 1952). Pp. 77-91
[2] Ross, S. A., (1976), The Arbitrage Theory of Capital Asset Pricing, *Journal of Economic Theory*, **13**: 341 – 360
[3] Breadley, B. O. and Taqqu, M. S., (2001), *Financial Risk and Heavy Tails,* Svectlor T., Rachev, editor, North Holland. 63 p.
[4] Murphy, K. M., and Welch, F., (1990), Empirical Age-Earning Profiles, *Journal of Labour Economic* **8**(2), 202-229
[5] Abdurrakhman, (2007). *Textbook Introduction to Financial Statistics*, Jakarta: University of Gajah Mada, Yogyakarta.
[6] Ruppert, D. (2004), *Statistics and Finance: An Introduction,* Springer, New York..
[7] Jorion, Phillipe, (2002). *Value at Risk: The New Benchmark for Managing Financial Risk,* The McGraw-Hill Companies, Inc,
[8] Kountur. 2004. *Manajemen Risiko Operasional*. PPM, Jakarta
[9] Jogiyanto, (2003). *Portfolio Theory and Investment Analysis*, 3rd Edition, BPFE, Yogyakarta.
[10] Financial Statements and Consolidated PT. Astra Intenational Tbk and Subsidiaries December 31, 2006 and 2007, URL: www.idx.co.id, accessed on May 27, 2008.
[11] Financial Statements and Consolidated PT. Telekomunikasi Indonesia Tbk and Subsidiaries December 31, 2006 and 2007, URL: www.idx.co.id, accessed on May 27, 2008.