Implementation of Value at Risk In LQ 45 Stocks in Indonesia

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ABSTRACT

Value at Risk is one measure used to measure the maximum potential loss that will be experienced in the period of a day, five days and twenty days. In this study, the methodology used is Variance Covariance models and Historical models. Object of research include 6 shares for 3 consecutive years (2012 to 2014) was recorded on LQ 45. Potential losses are measured on a confident level of 95%. And this validity model was tested by conducting back testing with Kupiec Test, where the potential maximum loss calculation results compared with a loss actually occurred. Back test measurement results indicate that the potential loss of Variance Covariance model is smaller than the Historical models, but both models are declared valid in measuring the potential maximum loss of LQ 45.

Keywords: Value at risk, Variance covariance, Historical, LQ 45, Back test, Kupiec

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Introduction

Risk is part of life. Avoid all risks will result in no achievement, no progress and no reward. Risk management is a systematic process to understand, evaluate and handle such risks to maximize the chances of goals achieved and ensure organizations, individuals and a sustainable society. In risk management there are several forms of risk, one of which is the market risk. Market risk arises because the market price moves towards the detriment of the company. One form of investment is affected by the stock market risk. The stock price is always changing prices or commonly referred to fluctuations. Stock price fluctuations closely associated with risk. The risk is a financial risk that requires risk management to minimize these risks. Risk measurement will happen requires a quantitative risk measurement methodologies, one of which is the *Value at Risk* (VaR).

Value at Risk (VaR) is a measure that can be used to assess the worst loss that might occur for an investor or an entity on its investments in securities or assets, either individually or in the form of a portfolio within a certain period with level opportunities that have been set. Models for calculating VaR is diverse, but in general the VaR measurements follow a common process that is often used by experts in the calculation of market risk. There are several methods of measuring VaR which can be grouped in a parametric approach, non-parametric and semi-parametric. Parametric approaches include 1) the variance-covariance approach, and 2) GARCH. Non-parametric approaches include 1) the historical simulation approach, 2) Monte Carlo simulation approach; and 3) simulation approach bootstrapping.

Objective of the study

The main purpose of this study is two sections. The first part, theoretical comparison of different methods of estimation of VaR. The main purpose of theoretical analysis VaR approach is to ensure that the reader build a basic knowledge of the most common VaR methodology. Although VaR is conceptually simple, its implementation in practice is not straight forward. This is because there are a myriad of different alternatives, each with their own pros and cons, which comes from the hypothesis underlying the methodology. More precisely, the study considers two methods, namely: (i) Variance-Covariance (standard Risk Metrics model) and (ii) Historical simulation. Comparison of theoretical approach emphasizes the lack of them, in cognizance that they provide a potential shortage of motivation for VaR backtesting. The second part of this work is to provide a review of empirical studies of the theory and practice of VaR backtesting as a reality check for the estimated VaR. The goal is not only to ensure the accurate estimation of VaR but also to ensure the prudent use of capital

Research methodology

Variables used in this study is the closing price (close price) six shares in three years, the period January 2012 - December 2014 are accessible on *http://www.finance.yahoo.com*, the stock Adaro Energy Tbk. (ADRO.JK), the stock Alam Sutera

Realty Tbk. (ASRI.JK), shares of Bank Rakyat Indonesia Tbk. (BBRI.JK), shares of Bank Mandiri Tbk. (BMRI.JK), shares of Tambang Batubara Bukit Asam (Persero) Tbk. (PTBA.JK), and the stock United Tractors Tbk. (UNTR.JK).

Historical data of the six stocks in the portfolio is processed and formed using the method of Markowitz, then historical data simulated by the Variance Covariance model and the Historical model. Also established a portfolio of simulation data, then look for a portfolio VaR of historical data and simulated data Variance Covariance. Then the data is tested by Kupiec's back test to know the model used is valid or not.

Result

Results of calculation of the maximum amount of potential losses undiversifed (VaR) for a period of 1 next day, 5 days and 20 days in advance for each model. In the calculation of Variance Covariance VaR model uses the assumption that the change in value of an asset within a certain period would normally distributed. If the change value does not normally distributed should be corrected by adjusting the confident interval parameter (α). Adjustments are made by using the formula Cornish-Fisher expansion. VaR indicates the maximum potential financial losses on the assets or portfolios held in the period of use with a certain confidence level. This value applies both to an individual asset or portfolio of assets. For individual asset values indicated by the VaR Undiversified, whereas for portfolio assets will be indicated by the value of VaR diversified. VaR calculation values have diversified into account the weight of the individual assets to total assets of the portfolio. The maximum loss is indicated by the value of VaR diversified but undiversified VaR value can describe the contribution loss if the stock stands out as an individual. Based on the calculation of VaR with a time horizon of one day in the future, the next 5 days and 20 days ahead overall share are presented in Table 1 below:

Table 1 Value at Risk – Variance Covariance (Undiversified) shows that the calculation of the undiversified VaR 1 day at 3.06%, VaR 5 days at 6.84% and VaR 20 days at 13.68% of the total exposure

Saham	Nilai Portofolio	EWMA α	Z Koreksi	Undiversified VaR		
				1 hr	5 hr	20 hr
ADRO	44,297,864,000	0.02523677	1.512998	1,691,432,964.42	3,782,159,087.84	7,564,318,175.68
ASRI	61,854,352,000	0.02649943	1.554928	2,548,690,193.40	5,699,044,526.02	11,398,089,052.05
BBRI	177,452,800,000	0.018204073	1.547154	4,997,871,269.59	11,175,579,901.60	22,351,159,803.21
BMRI	130,894,700,000	0.015587741	1.536795	3,135,604,636.32	7,011,425,117.37	14,022,850,234.73
PTBA	13,710,000,000	0.023795963	1.558719	508,520,567.34	1,137,086,556.52	2,274,173,113.05
UNTR	45,948,005,000	0.020752195	1.705057	1,625,809,152.93	3,635,419,784.39	7,270,839,568.78
	474,157,721,000			**14,507,928,784.00**	**32,440,714,973.75**	**64,881,429,947.49**
				3.06%	6.84%	13.68%

Based on the results of the calculation of VaR for 6 shares with a time horizon of one day it appears that the maximum amount of losses that will be incurred over the ownership of 6 shares in the coming days with a confidence level of 95% is equal Rp. 14,507,928,748.00 or by 3.06% of the total stock investment portfolio exposure, on 5 days maximum amount of losses that will be incurred over ownership of 6 shares is equal Rp. 32,440,714,973.75 or 6.84% of the total stock investment portfolio exposure, and on 20 days maximum amount of losses that will be incurred is Rp. 64,881,429,947.49 or 13,68% of total stock investment portfolio exposure.

Diversified portfolio VaR calculations to be done by calculating the weighted VaR weighting of each stock in the portfolio, with the following steps :

1. Set the number of exposures stock
2. Establish the volatility of the portfolio by value Variance Covariance Matrix
3. Assign the value of Z Score

Diversified portfolio VaR calculation is as follows :

Variance Portfolio : 0.007560787

Skewness : 1.594899

5 % Z -Score : 1.644853627

Z- Correction : 1.191400893

Exposure number : 474,157,721,000

Results on diversified overall portfolio VaR looks like Table 2 below :

Table 2 Value at Risk Variance Covariance (Diversified) shows that the calculation of diversified smaller value than undiversified

Saham	Nilai Portofolio	Weight	Vol.Port	Skewness	Z Koreksi	Diversified VaR		
						1 Hari	5 Hari	20 Hari
ADRO	44,297,864,000	9.34%	0.007560787	1.594899	1.191400893	4,271,178,870.42	9,550,646,298.32	19,101,292,596.65
ASRI	61,854,352,000	13.05%				0.90%	2.01%	4.03%
BBRI	177,452,800,000	37.42%						
BMRI	130,894,700,000	27.61%						
PTBA	13,710,000,000	2.89%						
UNTR	45,948,005,000	9.69%						
	474,157,721,000	100.00%						

Based on Table 1 and Table 2, it appears that the results of the calculation of VaR diversified Variance Covariance is smaller than the calculation results Undiversified Variance Covariance VaR portfolio, for the entire time horizon. Thus these results have proved that the risk of individual stocks can be reduced or minimized by diversification through a portfolio of stocks.

One method that can be used to calculate VaR using historical data on return stock or stock portfolio is to use the Historical Simulation models.

Ways must be taken in calculating the VaR by Historical Simulation, first performed by sorting the stock return data. Ordering starts from the value of the biggest losses to the greatest number of advantages. After it made the list with a percentile confidence level specified. In this study, the amount

of data that is used as stock returns 731 time series data (time series) with a 95% confidence level, so that 5% of the data is 36.55 rounded up to 37. With the return data sequence to 38 is used as a percentile can be calculated VaR Historical Simulation.

The calculation of the maximum loss over the 6 stocks done by using return data similar to that used in the calculation of Variance Covariance VaR. Historical Simulation VaR calculation results of the top ten stocks are presented in Table 3 below:

Table 3 Value at Risk - Historical model at 1 day, 5 days and 20 days

Saham	Eksposure	Percentile 5%	Value at Risk		
			1 Hari	5 Hari	20 Hari
ADRO	44,297,864,000	0.041964	1,858,924,384.56	4,156,681,288.90	8,313,362,577.81
ASRI	61,854,352,000	0.041385	2,559,855,728.13	5,724,011,420.70	11,448,022,841.40
BBRI	177,452,800,000	0.041243	7,318,678,472.15	16,365,062,569.19	32,730,125,138.39
BMRI	130,894,700,000	0.040822	5,343,382,726.13	11,948,167,005.43	23,896,334,010.85
PTBA	13,710,000,000	0.040521	555,545,616.43	1,242,237,762.94	2,484,475,525.88
UNTR	45,948,005,000	0.040410	1,856,737,669.60	4,151,791,645.60	8,303,583,291.20
Total	474,157,721,000	0.246345	19,493,124,597.00	43,587,951,692.77	87,175,903,385.53
			4.11%	9.19%	18.39%

In testing conducted on models backtesting Variance Covariance and Historical Simulation models to determine the validity of the magnitude of the potential loss of the 6 stocks examined. The model used is Kupiec Test using test data as much as 252 Data 1 last year that since December 25, 2013 until December 30, 2014 Results of tests performed using either a model of Variance Covariance and using models Historical Simulation apparently showing the two models is valid to measure potential losses a maximum of 6 stocks on an individual basis as presented in Table 4 below.

Table 4 The Result of Back Test from Variance Covariance and Historical VaR

No.	Saham	Tingkat Kegagalan		6<N<21	Keterangan
		Var-Covar	Historical		
1	ADRO	16	12	<21	VALID
2	ASRI	8	5	<21	VALID
3	BBRI	14	8	<21	VALID
4	BMRI	11	6	<21	VALID
5	PTBA	8	5	<21	VALID
6	UNTR	14	11	<21	VALID

Based on the results of testing the validity of the VaR model at the top turns failure rate (failure) generated by the model Variance-Covariance whole is greater than the Historical Simulation for undiversified VaR stocks individually.

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Discussion

Based on data in Table 1, it can be concluded that with a 95% confidence level, the maximum potential loss which occurred on December 30, 2014 at ADRO shares that have exposure value of Rp 44.297.864.000 is Rp 1,691,432,964.42 for VaR 1 day, Rp 3,782,159,087.84 for the 5-day VaR and VaR Rp 7,564,318,175.68 for 20 days.

In other words, only a 5% chance that the losses will happen tomorrow because it has the exposure value of Rp 44.297864 billion will exceed USD 1,691,432,964.42 for 1-day VaR, VaR Rp 3,782,159,087.84 for 5 days, and for Rp 7,564,318,175.68 for 20 days VaR. The same explanation applies to the five other stocks.

Once known VaR for each stock then Undiversified VaR can be calculated by adding the entire portfolio VaR value of each share. Of the amount of Rp 474 157 721 000 portfolio, the portfolio VaR for 1 day ahead of Rp 14,507,928,780.00 value of VAR for 5 days ahead of Rp 32.44.714.973,75 and VaR for 20 days ahead of Rp 64,881,429,947.49

Based on Table 2, it can be concluded that the number of exposures Rp 474 157 721 000, the investor will suffer a loss of Rp 4,271,178,870.42 for the 1-day VaR, Rp 9,550,646,298.32 for VAR 5 days and Rp 19,101,292,596.65 for a 20-day VaR with a 95% chance of needed funds to sustain losses

of Rp 4,271,178,870.42 for the 1-day VaR, Rp 9,550,646,298.32 for VAR 5 days and Rp 19,101,292,596.65 for 20 days VaR.

On Table 3 above, it can be concluded that the value losses on ADRO shares with Rp 44.297864 billion exposure value is Rp 1,858,924,384.56 for the 1-day VaR, VaR Rp 4,156,681,288.90 for 5 days, and Rp 8,313,362,577.81 for 20 days VaR. The same explanation applies to the five other stocks.

Of the amount of Rp 474 157 721 000 portfolio, the portfolio VaR for 1 day ahead of Rp 19,493,124,597.00 value of VAR for 5 days ahead of Rp 43,587,951,692.77 and the VaR for 20 days ahead of Rp 87,175,903,385.53

Conclusion

Based on the results of research that has been done on LQ 45 related to market risk, it can be concluded as follows:

1. Measurement risk market on investment stock is good for individually or in portfolio Variance Covariance models with turns produce values big be compared with using the Historical models. Differences especially happen on calculation for undiversified VaR. While on diversified VaR calculation shows that the compared resultcan be smaller than undiversified VaR calculation. This already prove that value at risk stock individually can reduce by diversified VaR.

2. Result of examination to the validity of a model based back test, shows that both model, variance covariance models and historical models turned out to be valid for be used as tool measure potential loss maximum on investment stock.

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