Developing Analysis Method of Optimum Portfolio with Value at Risk – Sharia' Complian Asset Pricing Model (VaR-SCAPM) Approach

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Abstract

Capital Asset Pricing Model (CAPM) in portfolio analysis used the concept of interest rates in the calculation. Interest rates in the concept of Islam financial are forbidden as classified to usury. Therefore, an optimum portfolio analysis tool was developed by replacing the concept of interest rates to zakat rates combined with a Value at Risk analysis tool named Value at Risk– sharia' Capital Asset Pricing Model (VaR-SCAPM (Z). Its implementation in the sharia' capital market in Indonesia of January 2011 to August 2016 was obtained by three stocks of Jakarta Islamic Index (JII) of compiler the optimum portfolio of VaR-SCAPM (Z) with proportions 20.71% of KLBF, 38.95% of TLKM, and 40.34% of UNVR. As for the monthly profit rate of 1.75% and the greatest possible loss using VaR-95% of 6.65%.

Keywords: CAPM, Optimum portfolio, Value at risk, VaR–SCAPM (Z), Zakat rate.

INTRODUCTION

There are two fundamental things that always participate in an investment including Sharia' stock investment, that is return (profit level) and risk. The return and risk have a strong correlation and linear, which if the risk is high, so is the return, or vice versa (Fahmi and Hadi, 2009). Stock investment of capital market has both high risk and high-profit rate (high risk-high return). The investment of stock exchange of company may possible to bankruptcy if not careful. Therefore, risk management is necessary to prevent these problems.

Risk management can be done in 4 ways, that is accepting-risk, avoiding-risk, controlling-risk and shifting-risk (Baturapan, 2000). The controlling-risk is an effort to handle the risk by reducing the possibility of the bigger impact of bankruptcy. In capital market investment, the recommended strategy is to share differentiation by forming a portfolio. There will so many a portfolio possibility that chosen by an investor, so that requires in-depth analysis to get an optimum portfolio.

One of optimum portfolio analysis model that widely used is Capital Asset Pricing Model (CAPM). The CAPM is an analysis that using among risky stocks with market index (IHSG) and free interest rate risk (SBI) by paying attention to the value of return and risk.

The CAPM is using interest rate for its calculation, while the concept of interest rate was classified to usury and Islam firmly forbids usury, through Q.S. Al-Imran (130):

$$\text{يَٰٓأَيُّهَا ٱلَّذِينَ ءَامَنُوا۟ لَا تَأْكُلُوا۟ ٱلرِّبَوٰٓا۟ أَضْعَٰفًا مُّضَٰعَفَةً ۖ وَٱتَّقُوا۟ ٱللَّهَ لَعَلَّكُمْ تُفْلِحُونَ ۝}$$

"O you who have believed, do not consume usury, doubled and multiplied, but fear Allah that you may be successful" Q.S. Al-Imran (130).

An effort to find the pricing model that is in accordance with sharia' has been done by Timkin and Karim (1987) by eliminating the interest rates variable, Sheikh (2010) by replacing with GDP, Askhar (1987) by replacing with zakat rate and Hanif 2011) by replacing with inflation. Approaches which accordance with sharia' has known as Sharia' Complian Asset Pricing Model (SCAPM).

$$\text{وَمَآ ءَاتَيْتُم مِّن رِّبًا لِّيَرْبُوَا۟ فِىٓ أَمْوَٰلِ ٱلنَّاسِ فَلَا يَرْبُوا۟ عِندَ ٱللَّهِ ۖ وَمَآ ءَاتَيْتُم مِّن زَكَوٰةٍ تُرِيدُونَ وَجْهَ ٱللَّهِ فَأُو۟لَٰٓئِكَ هُمُ ٱلْمُضْعِفُونَ ۝}$$

"And whatever you give for interest to increase within the wealth of people will not increase with Allah. But what you give in zakah, desiring the countenance of Allah - those are the multipliers." Q.S. Ar Rum (39).

Inspired by Qudratullah (2014) who has performed an optimum portfolio analysis with the VaR-CAPM and Q.S. Ar-Rum (39) approaches, this paper will develop the SCAPM model by considering of popular risk analysis tool for financial business people, that is value at risk (VaR) combined with Sharia 'Complian Asset Pricing Model from Askhar (SCAPM (Z)) to obtain the optimum portfolio which is named Value at Risk - Sharia 'Complian Asset Pricing Model (VaR-SCAPM (Z)), as well as its implementation in capital market sharia in Indonesia.

1. Sharia Capital Market in Indonesia

On July 3, 2000, the PT Bursa Efek Indonesia in cooperation with PT Danareksa Investment Management (DIM) release stock index based on Islamic sharia, Jakarta Islamic Index (JII). This index is expected to be a benchmark for the performance of sharia-based stocks and to further develop the Islamic capital market. JII consisted of 30 selected stocks in accordance with Islamic sharia which selection by Bappepam-LK in collaboration with the Dewan Syariah Nasional (DSN) every 6 months through 2 phases, that is sharia selection and transaction volume value selection (IDX, 2010).

To determine the stocks that are allowed to enter the Sharia' index through several stages related to each other. The chart is below (Sudarsono, 2009).
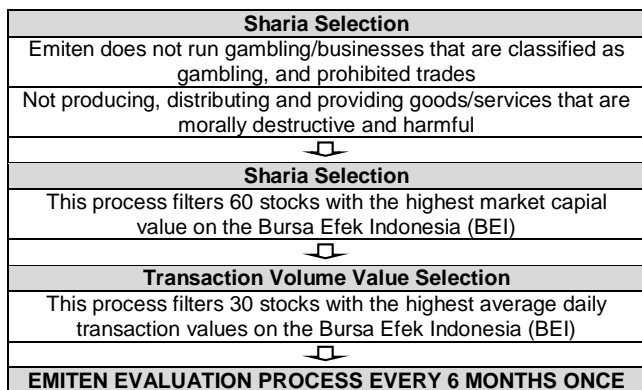
Sharia Selection
Emiten does not run gambling/businesses that are classified as gambling, and prohibited trades
Not producing, distributing and providing goods/services that are morally destructive and harmful
⬇
Sharia Selection
This process filters 60 stocks with the highest market capial value on the Bursa Efek Indonesia (BEI)
⬇
Transaction Volume Value Selection
This process filters 30 stocks with the highest average daily transaction values on the Bursa Efek Indonesia (BEI)
⬇
EMITEN EVALUATION PROCESS EVERY 6 MONTHS ONCE

Figure 1. Emiten Filtering Process of the Jakarta Islamic Index (JII).

The fundamental thing in investment decisions is the expected level of return and risk (Tandelilin, 2010). Return is the result (rate of return) obtained as a result of the investment made. In general, returns are formulated:

$$R_t = ln\left(\frac{P_t + D}{P_{t-1}}\right) = ln(P_t + D_t) - ln(P_{t-1}) \qquad (1)$$

R_t : *return* in *t* period
P_t : asset value in *t* period
D_t : deviden in *t* period
P_{t-1} : asset value in *t-1* period

If there is T observation, then the expected level of return can be formulated:

$$E(R_t) = \bar{R} = \frac{\sum_{t=1}^{T} R_t}{T} \qquad (2)$$

The risk is the level of uncertainty about the occurrence of something or does not the realization of a goal in a certain time period (Baturapan, 2000). One risk measurement tool that is often used is Value at Risk (VaR).

Value at Risk (VaR) is the biggest loss that may occur in a certain period/period that is predicted by a certain level of trust (Jorion, 2002). Mathematically, VaR can be formulated as follows:

$$VaR = P_o.\sigma.\alpha.\sqrt{t} \qquad (3)$$

P_o : asset value or initial investment value
σ : estimated volatility value
α : level of significance
t : holding period

Volatility value (σ) can be obtained from the value of the stock return standard deviation while the Z_α value can be obtained from the normal distribution table. If the data is not normally distributed, the Z_α value needs to be adjusted to Z'_α using Cornish Fisher Expansion.

$$Z'_\alpha = Z_\alpha - \frac{1}{6}((Z_\alpha)^2 - 1)\xi \qquad (4)$$

Where: ξ is a *skewness* coefficient

After the model is obtained, the next step is the examination to know the VaR model can be used or not, so it will be able to do validation test with calculated likelihood ratio (LR) value with hypothesis:

H0   : Model is Valid, and;
H1   : Model is not Valid

Test Statistics:

$$LR = -2\log[(p*)^x(1-p*)^{n-x}] + 2\log\left[\left(\left(\frac{x}{n}\right)\right)^x\left(1-\left(\frac{x}{n}\right)\right)^{n-x}\right] \qquad (5)$$

$p*$: probability of failure
n : number of observations
x : total failures

Furthermore, the LR value is compared with the Chi-Square table ($\chi 2$). If LR> Chi-Square table, Ho is rejected or the model is invalid.

2. Capital Asset Pricing Model and Sharia Complian Asset Pricing Model

The Capital Asset Pricing Model (CAPM) was first separately developed by Sharpe (1964), Lintner (1965), and Mossin (1969) so this model is known the CAPM in the form of Sharpe-Lintner-Mossin (SLM) (Jogiyanto, 2000). In general, the CAPM of a portfolio can be formulated:

$$(r_i - r_f) = \alpha_i + \beta_i(r_M - r_f) + e_i \tag{6}$$

r_i : expected stock return *i*
r_f : risk-free return
r_M : market expected return
α_i : stock intercept *i*
β_i : beta stock *i*
e_i : a stock residual *i*

The beta value of stocks is a value that measures the relative risk of a stock against market risk (IHSG). Generally written:

$$\beta_i = \frac{Covar(i,m)}{Var(m)} = \frac{\sigma_{im}}{\sigma_{mm}} \text{ and } \alpha_i = r_i - \beta_i r_M \tag{7}$$

And

CAPM still using interest rates in the calculation process. Therefore, Askhar replaced the interest rate with zakat rate ($z_R = 2,5\%/(1 - 2,5\%) = 0,0256$). So the CAPM formula in equation (6) can be written:

$$(r_i - z_R) = \alpha_i + \beta_i(r_M - z_R) \tag{8}$$

Equation (8) above is called as Sharia 'Complian Asset Pricing Model from Askhar (SCAPM (Z)).

Optimum Portfolio Analysis With VaR - SCAPM (Z)

There are 3 (three) stages that can be done in the analysis of the optimum portfolio with VaR - SCAPM (Z).

a. Selection of stock forming the optimum of portfolio

First, arrange portfolio candidate stocks based on expected return SCAPM (Z) based on beta value (Excess Return to Beta) using the equation:

$$ER_i = \left(\frac{r_i - z_R}{\beta_i}\right) \tag{9}$$

Second, calculate the *cut of rate* of SCAPM (Z) (C*) using the equation:

$$C^* = \frac{\sigma_m^2 \sum_{j=1}^i \frac{(r_j - z_R)\beta_j}{\sigma_{ej}^2}}{1 + \sigma_m^2 \sum_{j=1}^i \frac{\beta_j^2}{\sigma_{ej}^2}} \tag{10}$$

C^* : *cut of rate*
σ_m^2 : market variance
σ_{ej}^2 : unsystematic risk stock *j*

The value σ_{ej}^2 can be obtained by calculating the difference in the j-variance of the stock (σ_j^2) with its systematic risk $(\beta_j^2 \sigma_m^2)$ (Shah, 2015).

The three bands value ER_i with C^*. If $ER_i > C^*$ then the stock is included in the optimal portfolio compiler stock.

b. Determination of the proportion of stock forming the optimum portfolio

Determination of the proportion of stocks in the SCAPM (Z) model using the equation, as follows:

$$c = \frac{1}{1_p^T \Sigma^{-1}(R - z_R I_p)} \Sigma^{-1}(R - z_R I_p) \tag{11}$$

c : proportion
Σ : variant covariant matrix
I_p : matrix is 1 with size of 1 x p
R : expected return matrix
z_R : zakat rate
p : amount of portfolio-forming stock

c. Calculation of optimum portfolio return and risk (VaR) values

The portfolio return is a measurable average of the amount of return for every single security in the portfolio, that is:

$$R_{p_j} = \sum_{i=1}^p c_i r_{i_j} \tag{12}$$

R_{p_j} : portfolio return
c_i : amount of portfolio *i*
j : certain time period data with $j = 1,2,...,T$

RESULT AND DISCUSSION

Data Analysis Results

The sample used were stocks that consistently entered the JII for January 2011 - August 2016 and the Composite Stock Price Index (CSPI) as a market index. The following are the results of descriptive statistical calculation of the return value calculated based on the monthly closing price of the stock:

Table 1. Sample Descriptive Statistics.

No.	Code	Emiten Name	Return	Std. Deviation
0	IHSG	Indeks Harga Saham Gabungan	0,006760	0,039732
1	AALI	Astra Agro Lestari tbk	-0,00158	0,100381
2	ASII	Astra International tbk	0,009917	0,070979
3	ASRI	Alam Sutera Realty tbk	0,011283	0,130333
4	INTP	Indocement Tunggal Prakarsa tbk	0,006982	0,083858
5	KLBF	Kalbe Farma tbk	0,018471	0,066475
6	LPKR	Lippo Karawaci tbk	0,011407	0,108240
7	LSIP	PP London Sumatera tbk	-0,00324	0,135254
8	SMGR	Semen Gresik (Persero) tbk	0,005955	0,078381
9	TLKM	Telekomunikasi Indonesia tbk	0,017871	0,060054
10	UNTR	United Tractors tbk	0,001258	0,082408
11	UNVR	Unilever Indonesia tbk	0,018347	0,064613

Based on table 1 above, there are 9 (nine) stocks that have positive return values, from the highest in a row: KLBF, UNVR, TLKM, LPKR, ASRI, ASII, INTP, SMGR, and UNTR. While there are 2 (two) stocks that have negative return values, namely AALI and LSIP (both stocks are not involved in the next process).

Of the remaining 9 (nine) stocks, the intercept value and beta are calculated using equation (7), followed by calculating the expected stock return using a modification of equation (8), obtained:

Table 2. Intercept Value, Beta, and Stock Expected Return.

No	Code	Emiten Name	β_i	α_i	r_i
2	ASII	Astra International tbk	1,2237	0,0016	0,009440
3	ASRI	Alam Sutera Realty tbk	2,0322	-0,0025	0,009078
4	INTP	Indocement Tunggal Prakarsa tbk	0,9963	0,0002	0,006990
5	KLBF	Kalbe Farma tbk	0,9258	0,0122	0,018630
6	LPKR	Lippo Karawaci tbk	1,3066	0,0026	0,010752
8	SMGR	Semen Gresik (Persero) tbk	1,3391	-0,0031	0,005231
9	TLKM	Telekomunikasi Indonesia tbk	0,5437	0,0142	0,018847
10	UNTR	United Tractors tbk	0,8996	-0,0048	0,001473
11	UNVR	Unilever Indonesia tbk	0,1683	0,0172	0,020124

The next step is calculating the expected return of SCAPM (Z) based on the value of beta (Excess Return to Beta) and the *cut of rate* of SCAPM (Z) in the context in selecting the optimum stock forming portfolio.

Table 3. Results of Stock Selection Forming Optimum Portfolios.

No	Code	Emiten Name	ER_i	C^*	Evidence
2	ASII	Astra International tbk	0,005968		-
3	ASRI	Alam Sutera Realty tbk	0,003416		-
4	INTP	Indocement Tunggal Prakarsa tbk	0,004872		-
5	KLBF	Kalbe Farma tbk	0,017815		√
6	LPKR	Lippo Karawaci tbk	0,006594	0,006455	√
8	SMGR	Semen Gresik (Persero) tbk	0,00231		-
9	TLKM	Telekomunikasi Indonesia tbk	0,030736		√
10	UNTR	United Tractors tbk	-0,00074		-
11	UNVR	Unilever Indonesia tbk	0,106906		√

Envidence: if $ER_i > C^*$ is marked √ means including the optimum portfolio candidate.

Based on table 3, there are 4 (four) stocks as a portfolio candidates, it is KLBF, LPKR, TLKM, and UNVR. The following table is the fourth covariance variant matrix of the stocks.

Table 4. Covariance Variants Matrix of Optimum Portfolio Candidates.

	KLBF	LPKR	TLKM	UNVR
KLBF	0,0043	0,0022	0,0013	0,0007
LPKR	0,0022	0,0114	0,0003	0,0017
TLKM	0,0013	0,0003	0,0035	0,0002
UNVR	0,0007	0,0017	0,0002	0,0041

Using equation (11), the proportion of the four stocks in the optimum portfolio is obtained below:

Table 5. Proportion of Optimum Portfolio Forming Stocks in Phase 1.

Code	Proportion
KLBF	22,90%
LPKR	-3,89%
TLKM	38,88%
UNVR	42,11%

It appears that there is 1 (one) stock, namely LPKR has a negative proportion. So LPKR stock must be removed from the optimum portfolio candidates, leaving 3 (three) stocks, that is KLBF, TLKM, and UNVR.

Table 6. Proportion of Optimum Portfolio Forming Stocks Phase 2.

Code	Proportion
KLBF	20,71%
TLKM	38,95%
UNVR	40,34%

Furthermore, the portfolio descriptive statistics can be calculated and the results of the normality test.

Table 7. Descriptive Portfolio Statistics.

Portfolio Forming Stock	Return	Std. Deviation	Kurtosis	Skewnes
KLBF, TLKM, UNVR	0,0173	0,0404	0,5637	-0,4775

Table 8. Portfolio Normality Test Results.

Kolmogorov-Smirnov[a]			Shapiro-Wilk			Evidence
Statistic	df	Sig.	Statistic	df	Sig.	
,066	68	,200*	,972	68	,136	Normal

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Because SCAPM portfolio data (Z) is normally distributed, VaR calculation at a confidence level of 95% can use the value of $Z_\alpha = 1{,}645$. So that the VaR-95% can be calculated for the next 1 (one) month is 0.066508 and 0.115194 for the next 3 (three) months.

After the VaR value is calculated, validation of the VaR value is carried out. Here are the results:

Table 9. Validation Test Results VaR-95%.

T	n	x	LR	Evidence
1	68	3	0,05149283	Valid Value
3	68	0	-	*Over Estimate*

It appears that the VaR value is valid for 1 (one) month ahead but is not valid (overestimate) for 3 (three) forwards.

Based on the data analysis above during January 2011 - August 2016 there were 11 (eleven) stocks that were consistently included in the JII list, that is AALI, ASII, ASRI, INTP, KLBF, LPKR, LSIP, SMGR, TLKM, UNTR, and UNVR. But 2 (two) stocks, AALI and LSIP have negative return values. Then of the remaining 9 (nine) stocks, only 4 (four) stocks were selected as optimum SCAPM (Z) portfolio candidates, it is KLBF, LPKR, TLKM, and UNVR. However, there is 1 (one) stock that has a negative proportion as LPKR.

Of the 3 (three) remaining stocks, KLBF, TLKM, and UNVR, the proportion of each stock to form an optimal SCAPM (Z) portfolio is 20.71%, 38.95%, and 40.34% respectively with a monthly return at 1.75% and VaR-95% at 6.65%. This mean that if a person invests Rp. 100,000,000,- then he allocated Rp. 20,710,000,- bought KLBF stock, Rp. 38,950,000,- bought TLKM stock and Rp. 40,340,000,- bought stock of UNVR with a profit rate of Rp. 1,750,000./month and the biggest loss that may Rp.6,650,000.-.

CONCLUSIONS

The development of the optimum portfolio analysis with the Value at Risk – Sharia Complian Asset Pricing Model (VaR - SCAPM (Z)) approach can be done with 3 (three) stages: first, the selection of portfolio forming stock candidates by comparing the expected return of SCAPM (Z) with SCAPM (Z) cut of rate value. Second, the determination of the proportion of stocks that form the optimum portfolio. And third, calculating the value of return and portfolio risk by using the Value at Risk (VaR).

For the period of January 2011 - August 2016 3 (three) stocks of Jakarta Islamic Index (JII) were obtained, the compilers of VaR - SCAPM (Z) optimum portfolio, KLBF, TLKM, and UNVR with consecutive proportions of 20.71%, 38.95% and 40.34%. The monthly profit rate is 1.75% and the biggest possible loss is using VaR-95% of 6.65%

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