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Value at Risk Analysis and Probability of Book IV Banking Shares on Indonesia Stock Exchange

Yendra Dharmadinata[1]
Student of Magister Management, MercuBuana University
Jakarta, Indonesia

Abitur Asianto[2]
Lecturer of Postgraduate, MercuBuana University
Jakarta, Indonesia

Abstract:- Book IV ***Book IV Banking Shares, consists of six banks with the largest capitalization in Indonesia. The volatility of banking stocks is estimated to have a strong impact on the Indonesian economy. This study aims to obtain the optimal model as a basis for calculating VaR (Value at Risk), which is to measure the maximum risk of each banking stock book. The research data is secondary data in the form of monthly stock prices of Bank Mandiri (BMRI), Bank BRI (BBRI), Bank BNI (BBNI), Bank BCA (BBCA), Bank CIMB-Niaga (BNGA) and Bank Pan Indonesia (PNBN). The research data ranges from June 2004 to September 2019, without including the dividend factor. ARCH / GARCH model is used to estimate the VaR value as the maximum loss over a certain period of time at a certain confidence level. The probability test is used to determine the level of stock performance. The results of the study are useful as a basis for consideration in making macroeconomic risk mitigation policies due to shocks that occur in Book IV banking stocks. Also can be used as a basis for consideration of investment decisions.***

Keywords:- *Banking shares book IV, Value-at-Risk, ARCH/GARCH, Probability.*

I. INTRODUCTION

Background of problem

The Banking Industry is one of the pillars of economic growth and national stability to improve people's lives. The main function of banking is to collect and distribute public funds aimed at supporting national development. Banking stocks traded on the Indonesia Stock Exchange (IDX) have a significant impact on the Indonesian economy. The volatility of trading shares price will have an impact towards the performance of Indonesia's domestic economy and given the close links between international stock exchanges, this influence will also have an impact on regional and international economies. So it is necessary to do research on the risks which may occur due to the volatility of banking stocks, especially for Book IV banking shares. Those shares from this sector are the shares which consist of the six banks with the largest capitalization in Indonesia.

This research data is secondary time series data in the form of monthly stock prices of BMRI, BBNI, BBRI, BBCA, BNGA and PNBN. Data was gained from www.idx.co.id [1], finance.yahoo.com [2], www.investing.com [3] and other sources. The data ranges from June 2004 to September 2019, regardless of dividend yields.

The Value at Risk (VaR) analysis of book IV banking shares has aims to measure the maximum risk which occurs in this sector. (Jorion, 2007) VaR analysis used the Autoregresive Conditional Heteroscedasticity (ARCH) and Generalized Autoregressive Conditional Heteroscedasticity (GARCH) methods

The estimation result of the maximum potential loss in a certain period and level of confidence is called Value at Risk (VaR). The VaR value shows the potential loss that will occur. The VaR method did not depend on an assumed distribution of returns. VaR measurement could be applied to all financial trading products and their derivatives. VaR estimation gives the possibility or probability that the loss will arise greater than the predetermined amount of loss. This is unique, because it cannot be found in other risk measurement methods. In VaR, changes in asset prices and their impact on the other assets still in scopes of VaR. It is possible to measure the risk reduction as a result from the portfolio diversification policy or a group of other risky products.[4]

Furthermore, a probability analysis of Book IV banking shares was carried out with aims to measure the winning probability from each share. The analysis result could be used as main consideration of implementing stock investment in this sector with the lowest possible risk. [5]

The results of this research are useful to the policy makers such as the Financial Services Authority (OJK), the Ministry of Finance, Bank Indonesia, academics, and others in an effort to implement policies to mitigate macroeconomic risk due to price volatility on book IV banking shares prices.

Based on IDX data on 2018 [6] there are 600 companies which listed on the IDX. The company's shares are grouped into 9 sectors, including: agriculture, mining, basic and chemical industries, various industries, consumer goods industry, property and real estate, transportation, utilities and infrastructure, finance, trade, services and investment [1]

From these nine industrial sectors on the IDX, the capital keep growing, and were in line with improving economic condition.

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In 2018, the capitalization of Indonesia Stock Exchange reached IDR 6,737 trillion.

One of the industrial sectors which quite dominant on IDX is the financial sector. The Shares from this sector amounted to 29.6% or IDR 1,991.7 trillion. Meanwhile, 91.1% or IDR 1,814.4 trillion in the financial sector came from the banking sub-sector. Those data was written like in Table 1 below.

Table 1. IDX Capitalized and Financial Sector Alongside Banking sub-sector

No.	Capitalization	IDR(trilion)	% to BEI	% to Fin.Sec
1	BEI Capitalization - 2018	6,737.0	100.0	n/a
2	Capitalization of Financial Sector	1,991.7	29.6	100.0
3	Capitalization of Banking sub-Sector	1,814.4	26.9	91.1
4	Capitalization of Banking Book IV	1,467.8	21.8	73.7
4.1	Bank Central Asia (BBCA)	589.5	8.8	29.6
4.2	Bank Rakyat Indonesia (BBRI)	384.6	5.7	19.3
4.3	Bank Mandiri (BMRI)	310.7	4.6	15.6
4.4	Bank Negara Indonesia 1946 (BBNI)	136.6	2.0	6.9
4.5	Bank CIMB-Niaga (BNGA)	23.1	0.3	1.2
4.6	Pan Indonesia Bank (PNBN)	23.3	0.3	1.2
5	Others (39 Banks)	346.0	5.1	19.1

source: IDX Fact Book 2018

A total of banks whose shares traded on the IDX are 45 banks. Banking Industry, is a strategic industry for the Indonesian economy. That because the intermediary function which takes on the core business of this industry has inherent systemic risk and its ability to increase the money supply (M2) through the formation of demand deposits.

Research purposes

1) Gained the nformation about risks due to the volatility of book IV banking shares prices which could affect the investors' fund decisions.
2) Analyze and measure market risk using VaR (Value at Risk). Especially with the Variance-Covariance model and Historical Simulation.
3) Ensuring those validity method by measuring risk in form of back-testing.

II. LITERATURE REVIEW

Those Shares in Banking Sub-Sector

According to www.idx.co.id, the capitalization of the IDX in August 2019 was IDR 7,271 trillion. Book IV banking shares capitalization is IDR 1,853 trillion (25.5%) on the IDX. The capitalization of each share in this sector was BBCA amounting to IDR 765.5 trillion (10.5%), BBRI amounting to IDR 543.9 trillion or 7.5% BMRI amounting to IDR 362.8 trillion (5.0%), BBNI is IDR 153.8 trillion (2.1%), and BNGA is IDR 26.9 trillion (0.4%). So the book IV banking shares were considered having a major influence on domestic, regional and global macroeconomics. This influence was confirmed by the release of Blomberg April 2019 [7] where 3 of the 10 largest banks in ASEAN came from Indonesia. Namely BBCA, BBRI and BMRI. Therefore it is important to conduct risk analysis research on these banking shares.

There are several researchs in this sector, such as [8] by the Dupont system to assess the financial performance of BBRI, BBCA, BBNI and BMRI which are included in Book IV. Meanwhile [9] found that a positive correlation between an increase in share prices and yields.

ARCH-GARCH

In time series data, there is often high volatility and inconsistent error variances. This data tends to have a heteroscedasticity impact [10]. Autoregressive Conditional Heteroscedasticity (ARCH) model used to analyze the volatility of time series data. This model explained that the volatility of data is reflected in the residual variance which did not meet the homoscedasticity assumption.

The residual variance will be constant over time. Financial risk is the deviation of results that fluctuates due to variable movements. The deviation of the fluctuating results was analyzed by the variance value (non-homogeneous variant). The Analysis of variance and forecasting (forecasting) was performed by the ARCH-GARCH model.

There are three components in these error variant of the GARCH method, which is: constant variation (α_0), the volatility of the previous period or to be called ARCH (e^2t-p) and the previous variance or called GARCH (σ^2t-q).

Similiar with the ARCH model, for the variance to be positive, then {var (et) > 0}. This model should be made as a limitation of $\alpha_0 > 0$, α_1 and $\lambda_1 \geq 1$, and $\alpha_1 + \lambda_1 < 1$ which could be estimated by the maximum likelihood technique. The ARCH-GARCH equation could be describe as follows: [11]

$$\sigma_t^2 = \alpha_0 + \alpha_1 e_{t-1}^2 + \dots\dots + \alpha_p e_{t-p}^2 + \lambda_1 \sigma_{t-1}^2 + \dots\dots + \lambda_q \sigma_{t-q}^2$$

or

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i e_{t-1}^2 + \sum_{j=1}^{q} \lambda_j \sigma_{t-j}^2 \quad \dots\dots\dots\dots\dots\dots (1)$$

Whereas: σ^2t is the conditional variance, (0, (1, λ_1) is constant, e^2t-i is the previous period's squared error, σ_2t-j is the previous period's conditional variance, p is the lags of squared error, q is the lags of conditional variance and (i, j) are 0,1,2, ... n.The model in this equation is called the GARCH (p, q) model.

Value at Risk

A portfolio could be several single assets or a combination of several security assets. VaR is a measure from downside risk which concentrated on low probability event occurring in the lower chain of distribution. The critical value at the end of period from a portfolio was determined in advance as the worst possible end-period value of a portfolio with predetermined level of confidence "1 - c", for example, 99% or 95%. This worst value is assumed have no greater than c percent of the time. For example, suppose the estimated daily VaR value of a trading portfolio is $ 1 million at a 99% confidence level. This explains that under normal market conditions, only 1% of the time, the portfolio loss will exceed 1 million dollars. VaR describes the quantile distribution of profit and loss projected over the target horizon. The basic formula for calculating VaR is: [11]

$$VaR = \left(\sigma_{t+1} . \sqrt{b}\right) . Z_{\alpha} . W \text{ ……..……..…. (2)}$$

Note: VaR is the amount of risk, b is the investment period, Z_α is the critical point in the Z table with 95% confidence interval, W is the investment value and σt + 1 is the standard deviation in the future.

Winning Probability

Probability is the percentage of possibility that an event will occur. The percentage is between 0 and 100 percent. The greater the probability value, the more likely it will happen. If sample space is K, total of wins is W, then the relative winning frequency is W/K. If the lose total is L then the relative frequency of losses is L/K. The equation is as follows. [12]

$$\frac{W}{K} + \frac{L}{K} = 1 \text{ ……..……..…. (3)}$$

Two possible outcomes from the set of K = {win, lose}, could be formalized by defining the function of p: K → [0, 1] given by p (win) = p (lose) = 1/2.

Previous Research

Previous Research ARCH-GARCH and Value at Risk (VaR)

The GARCH type model used [13] to analyze and compare Brent and WTI in the short term for VaR forecasting. The results of these analysis show that Brent has the best performance in EGARCH (1, 1). Meanwhile, WTI, APARCH (1, 1) and GJR-GARCH (1, 1) were superior to other GARCH models.

The EVT model was applied by ([14] without terms and conditions to predict the Value at Risk and GARCH models (1,1). Combining the two procedures would give equally good results. [15] explained the existence of trading efficiency in the options market through the call option selling strategy in OTM strikes.

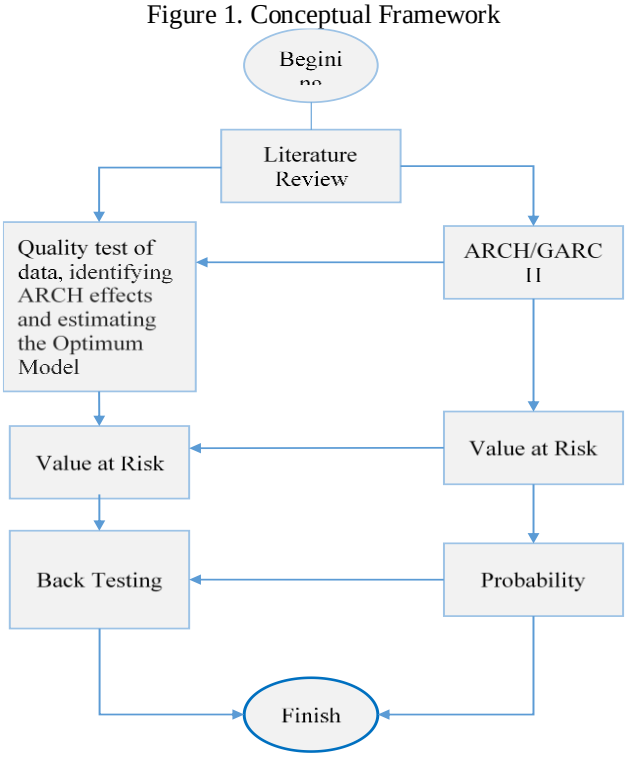
Historical Simulation methods and Monte Carlo were used by [16] on the VaR value of shares of cigarette companies such as Gudang Garam (GGRM) and HM Sampurna (HMSP), where the Monte Carlo method produces better VaR values. Meanwhile [17] with the Delta Normal (Variance-Covariance) and Historical Simulation methods, analyzing the impact of ARCH towards IGARH (1, 1) which cannot be eliminated.

Analysis of previous research Methods and Win Probability

So far, the research on probability of winning shares in banking sub-sector has not been found, but there are several previous research on probability of winning using a run test. [12] to analyzed the probability of winning selling options on WTI using the runs test method and the proportion test explained that FOTM strikes had a better probability of winning than strike at the money (ATM) [18] were explained that random shares price changes in the Nigerian stocks exchange were efficient in a weak form. [19] analyzing the probability with the proportion test method concluded that company performance in corporate governance practices did not have a significant difference. [20] made a dissertation by proportion test to analyze the impact of variable input on occupant behavior in the optimization process.

Conceptual Framework

Figure 1. Conceptual Framework



Based on the conceptual framework above, the steps in implementing the research as follows:

1) Doing literature study
2) Examine data, identifying ARCH effects and estimating the Optimum Model
3) Value at Risk calculation
4) Probability Analysis
5) Back Testing

III. RESEARCH METHODOLOGY

Research data

The research data was include in secondary data of time series on monthly stock returns of Bank Mandiri (BMRI), Bank Rakyat Indonesia (BBRI), Bank Negara Indonesia 1946 (BBNI), Bank Central Asia (BBCA) and Bank CIMB-Niaga (BNGA), during period June 2004 to August 2019. Data sources were www.idx.co.id, www.finance.yahoo.com, www.investing.com. This research was conducted in Jakarta by analysis used the software Eviews 10, Microsoft Excel and Microsoft word.

ARCH-GARCH and VaR Methods

The stages of this method used as follows.

1) Data Quality Test

- Stationarity test

The data stationarity test that was used was the Augmented Dickey Fuller (ADF) model. ADF test was done by comparing the ADF statistical value with its critical value. It was assumed to be 5%. The data was declared stationary if the ADF test statistics were greater than the critical value.

- Normality test

To find out whether the data has been normally distributed, therefore the normality test were carried out. Namely by comparing the Jarque-Bera value with its Critcal Value. If the Jarque-Bera value was greater than the Critical Value (probability) > 5%, meaning the data is normal and it does conversely.

- Heteroscedasticity Test

Heteroscedaticity test used to test whether in regression model had difference in variance from the residuals of one observation to another. If there are the differences in variance, it could be concluded that symptoms of heteroscedasticity will be found. The identification of the heteroscedasticity effect was carried out by the White test (White Heteroscedasticity Test).

2) ARCH/GARCH model

In heteroscedasticity data, the variance value will change from time to time. This change could be measured by ARCH / GARCH (Auto Regresive Conditional Heteroscedasticity/Generalized Auto Conditional Heteroscedasticity) proposed by [21]. The measurement using ARCH/GARCH assumed that current variance value had an impact from its previous value or what to be called as conditional variance.

3) The identification of heteroscedasticity effects was statistically descriptive

Skewness values less than 0 indicated heteroscedasticity. Kurtosis values greater than 3 and probability values less than 0.05 indicate abnormal data distribution and heteroscedasticity.

4) Optimal Model Estimation.

Each variable was analyzed by ARCH-GARCH to overcome the ARCH effect, then the optimal model was selected. The lower the Akaike info criterion (AIC) and Schwarz criterion (SIC) scores, the more optimal the model will be. The probability that the z-stat value was higher than the z table and lower than the 0.05 level indicates that the variable was significant.

5) Value at Risk (VaR)

VaR is an estimate of the risk at a certain level of confidence, how much the portfolio will lose over a certain time horizon. This research used 2 VaR approaches, namely Variance-Covarianve and Historical Simulation. The VaR equation could be seen as follows [11]

$$VaR = \left(\sigma_{t+1} . \sqrt{b}\right) . Z_{\alpha} . W \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Note: VaR is the amount of risk, b is the investment period, Zα is the critical point in the Z table with 95% confidence interval, W is the investment value and σt + 1 is the standard deviation in the future.

6) Winning Probability

Method probability analysis is intended to calculate the winning probability based on how many positive yields were gained from each book IV bank share. This stage of analysis needs to be done to find out winning probability from each share. The results of the analysis were expected to be considered in selecting stocks which contained a high of winning probability.

IV. RESULTS AND DISCUSSION

Descriptive Statistics

The average total monthly return on the six shares from Banking Book IV analyzed during period of June 2004 to September 2019 was in the range of 10.27%. The shares with the lowest yield were Bank CIMB-Niaga (BNGA) with shares at 1.36% and the highest average yield was achieved by Bank Central Asia (BBCA) at 2.16%. The highest yield in the monthly period was achieved by Bank Negara Indonesia 1946 (BBNI) shares that achieved 81.29% in April 2009 and the lowest maximum yield was achieved by shares of Bank Central Asia (BBCA) of 31.91% in March 2009. While the largest loss was achieved by Bank Rakyat Indonesia (BBRI) around -76.51% in October 2008 and the lowest loss was achieved by Bank Central Asia (BBCA) of 15.38% in January 2009.

Table 2. Descriptive Statistics

Shares	Return on Banking Book IV shares (Jun'04 - Sep'19)					Standar Deviasi	Skewness	Jarque-Bera (prob)
	Average	Maximum	Period	Minimum	Period			
BBCA	0.021654	0.319149	Mar'09	(0.153846)	Jan'09	0.071773	0.482840	0.000004
BBRI	0.017297	0.380952	Apr'09	(0.765152)	Oct'08	0.113960	(1.583869)	0.000000
BMRI	0.015663	0.358799	Dec'08	(0.538950)	Oct'08	0.103393	(0.623396)	0.000000
BBNI	0.018470	0.812909	Apr'09	(0.473913)	Oct'08	0.128964	1.883506	0.000000
BNGA	0.013642	0.733333	Apr'09	(0.346535)	Oct'08	0.123206	1.514086	0.000000
PNBN	0.016031	0.354839	Apr'09	(0.309211)	Oct'08	0.118185	0.194490	0.522810
Total	0.102757	2.959981		(2.587607)	Oct'08	0.659481	1.867657	

ARCH-GARCH Method and Value at Risk

Data Stationarity Test

The stationarity test was related to the consistency of time series data movement. Time series data were said to be non-stationary if the mean and variance values vary over time. From these stationary test result, it shows that the t-statistical values on the ADF all have values above the critical value. The data will be declared stationary if the t-statistic of the ADF value was greater than the critical value.

Table 3. ADF Stationery Test

Shares	ADF (t-statistik)	Critical Value 5%	Notes
BBCA	(12.070410)	(2.877363)	Stasioner
BBRI	(14.408360)	(2.877274)	Stasioner
BMRI	(13.904400)	(2.877274)	Stasioner
BBNI	(11.461410)	(2.877274)	Stasioner
BNGA	(12.920650)	(2.877274)	Stasioner
PNBN	(13.985660)	(2.877274)	Stasioner

Data Normality Test

The normality test aims to explore perhaps the yield data distribution on the six Bank on Book IV Banking shares were normally distributed or not (Skewed). According to the normality test result it could be concluded that based on the yield of five shares from Book IV Banking such as BBCA, BBRI, BMRI, BBNI, and BNGA, shares whose data are not normally distributed / skewed. Meanwhile, PNBN shares were distributed normally. In the Variance-Covariance Method, data which normally distributed and not normal (Skewed) required a different formula. As for data results that are not normally distributed, the α´ calculation used the Cornish Fisher Expansion formula to find out the correction value for Z.

Table 4. Normality Test (Jarque Bera)

No.	Shares	Jarque-Bera(prob)	Critical Value 5%	Notes
1	BBCA	0.000004	0.050000	Not Normal
2	BBRI	0.000000	0.050000	Not Normal
3	BMRI	0.000000	0.050000	Not Normal
4	BBNI	0.000000	0.050000	Not Normal
5	BNGA	0.000000	0.050000	Not Normal
6	PNBN	0.522810	0.050000	Normal

Identification of ARCH Effects (Heteroscedasticity)

After the stationarity test and normality test were carried out, next the heteroscedasticity test was then carried out. This test aimed to ensure that there was no data fluctuates greatly. From the results of these heteroscedasticity test, it turns out that the stocks of BBCA, BBRI, BMRI, BBNI, BNGA and PNBN all have a probability value of F-statistic lower than the critical value of 0.05 (5%). Thus, data on all book IV banking shares were heteroscedasticity. Which means, it has a variance that is not constant with time.

Table 5. Heteroskedasticity Test (White)

Shares	Prob F-Statistic (White)	Critical Value 5%	Notes
BBCA	0.000625	0.050000	Heteroskedastisitas
BBRI	0.000000	0.050000	Heteroskedastisitas
BMRI	0.000025	0.050000	Heteroskedastisitas
BBNI	0.000017	0.050000	Heteroskedastisitas
BNGA	0.000000	0.050000	Heteroskedastisitas
PNBN	0.004254	0.050000	Heteroskedastisitas

Calculation of α with Cornish Fisher Expansion

After doing these validity test (normality test) yield data for each share it is known that the data is not normally distributed. Thus, an adjustment should be made to the " α" value. It seems that the skewness value consists of positive values and negative values. Negative Skewness Value, meaning that the data distribution curve was sloping to the left. Meanwhile, if the skewness value was positive, the curve will point to the right. If the data was not normally distributed, the skewness value was zero. With confidence level of 95%, and the Z value was obtained at 1.644854.

Table 6. Calculation from Z-correction, Skewness and α'

Shares	Z-Score (α)	Skewness	Z-Corection (α')
BBCA	1.644854	0.482840	1.507603134
BBRI	1.644854	(1.583869)	2.095080558
BMRI	1.644854	(0.623396)	1.822058955
BBNI	1.644854	1.883506	1.109453393
BNGA	1.644854	1.514086	1.214463779
PNBN	1.644854	0.194490	1.589568769

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Calculation from Standard Deviation and Optimum Model of ARCH/GARCH

Referring to the previous Table 5, the yield data has heteroscedasticity, so it is important to estimate the yield volatility using the ARCH / GARCH optimum model approach. The determination of the ARCH / GARCH model in Table 7 was carried out by estimating the process mean equation by the ARCH / GARCH method. After the Estimate Equation process in Eviews, constants will be obtained for the variance process equation alongside with Z-statistics and probability, the Akaike Info Criterion (AIC) value and the Schwarz Info Criterion (SIC) value.

To get the best/optimal ARCH / GARCH model, various variants were carried out. With loglikelihood, AIC, and SIC criteria. If the AIC and SIC values was conflict, then the highest log-likelihood value will be taken as the optimal model.

Table 7. Estimation of Volatility from Book IV Banking Shares

No.	Shares	ARCH/GARCH Model	Mean Coefficient	Variance Coefficient			Conditional Variance	Std Dev (Volatilitas)
			C	C	Vrbl-1	Vrbl-2	(σ^2)	(σ)
1	BBCA	ARCH(1)	0.021179	0.003958	0.217787	0.000000	0.005183	0.071993
2	BBRI	GARCH(1)	0.017440	0.006201	0.521310	0.000000	0.013128	0.114577
3	BMRI	GARCH(2)	0.016377	0.002960	0.038712	0.686610	0.010893	0.104370
4	BBNI	GARCH(1)	0.019893	0.002257	0.866735	0.000000	0.007130	0.084439
5	BNGA	ARCH(1)	0.009655	0.012815	0.203436	0.000000	0.015941	0.126258
6	PNBN	GARCH(1)	0.016494	0.004236	0.696893	0.000000	0.014150	0.118954

VaR calculation - Variance Covariance

After knowing the correction value of Z (alpha prime), the maximum risk value (VaR) of the six banking shares in book IV could be calculated. Based on the VaR calculation with a time horizon of 1 month, the maximum amount of losses faced by investors was obtained for each share.

From Table 8, it is known that the biggest risk for these shares comes from BBRI shares, which is IDR 238,755,380.- While the lowest maximum risk was obtained from BBCA shares which is IDR 108,536,872.

Table 8. VaR (Variance-Covariance Method) of 1 month

Shares	Standar Deviation (Volatilitas - σ)	Z-Koreksi (α')	√t (1month)	Value at Risk* (Undiversified)
BBCA	0.071993	1.507603	1.000000	(108,536,872)
BBRI	0.113960	2.095081	1.000000	(238,755,380)
BMRI	0.104370	1.822059	1.000000	(190,168,293)
BBNI	0.119118	1.109453	1.000000	(132,155,869)
BNGA	0.126258	1.214464	1.000000	(153,335,768)
PNBN	0.118954	1.589569	1.000000	(189,085,591)

*asumtion, initial Investment for each Bank's Shares =IDR.1.000.000.000,-

VaR estimation of book IV banking shares with a time horizon of 3 months results in the maximum amount of loss faced by investors for each share. In Table 9, it is known that the greatest risk for six stocks came from BBRI shares amounting to IDR 413,536,495 and the lowest maximum risk for PNBN shares is IDR 107,716,842.

Table 9. VaR (Variance-Covariance Method) of 3 months

Shares	Standar Deviation (Volatilitas - σ)	Z-Koreksi (α')	√t (3months)	Value at Risk* (Undiversified)
BBCA	0.071993	1.507603	1.732051	(187,991,398)
BBRI	0.071993	2.095081	1.732051	(261,247,218)
BMRI	0.113960	1.822059	1.732051	(359,646,254)
BBNI	0.104370	1.109453	1.732051	(200,560,508)
BNGA	0.119118	1.214464	1.732051	(250,566,286)
PNBN	0.126258	0.522810	1.732051	(114,330,859)

*asumtion, initial Investment for each Bank's Shares =IDR.1.000.000.000,-

VaR calculations - Historical Simulation

One method that could be used to calculate VaR was historical data on stock returns using the Historical Simulation method. The first steps in estimate the VaR value with Historical Simulation were done by sorting the stock yield data. The order starts from the largest loss value to the largest profit. After that, a list of percentage was generated with a certain level of confidence. In this research, total data of stock returns which used was 183 times series with confidence level of 95%. So 5% of data was 9.15. Rounded to 10. With the 10th data sequence used as a percentile, the VaR Historical Simulation value could be counted. The maximum loss estimation for the six bank in book IV banking shares was carried out by the same yield data used in the Variance-Covariance VaR calculation. Completing the previous explanation of percentile values, the next explanation that regarding the Value at Risk calculation for 1 month time horizon, the largest value came from PNBN shares amounted to IDR 177,740,000 and the lowest was from BBCA shared of IDR 91,660,000.

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Table 10. VaR (Historical Simulation Method)– for 1 month

Shares	Exposure *	Percentile	√t	Value at Risk
BBCA	1,000,000,000	(0.091660)	1.000000	(91,660,000)
BBRI	1,000,000,000	(0.129210)	1.000000	(129,210,000)
BMRI	1,000,000,000	(0.110470)	1.000000	(110,470,000)
BBNI	1,000,000,000	(0.157960)	1.000000	(157,960,000)
BNGA	1,000,000,000	(0.144800)	1.000000	(144,800,000)
PNBN	1,000,000,000	(0.176740)	1.000000	(176,740,000)

* asumtion

Table 11 VaR (Historical Simulation Method) for 3 months

Shares	Exposure *	Percentile	√t	Value at Risk
BBCA	1,000,000,000	(0.091660)	1.732051	(158,759,795)
BBRI	1,000,000,000	(0.129210)	1.732051	(223,798,310)
BMRI	1,000,000,000	(0.110470)	1.732051	(191,339,674)
BBNI	1,000,000,000	(0.157960)	1.732051	(273,594,776)
BNGA	1,000,000,000	(0.144800)	1.732051	(250,800,985)
PNBN	1,000,000,000	(0.176740)	1.732051	(306,122,694)

* asumtion

Probability Method

BBCA's winning probability is better than the other five shares

The monthly return on book IV banking shares was illustrated from monthly data for each share. If the monthly yield was positive, it was given a numerical notation of 1 (one). If the monthly yield was negative then its assigned a numeric notation of 0 (zero). Number 1 and number 0 were binominal numbers whichthen carried out by descriptive statistical analysis. The results from these descriptive analysis of the win-loss monthly returns on book IV banking shares were described like in the Table below.

Table 12. Winning Probability of Book IV Banking Shares

Shares	Win	Loss	Total	Prob.Win	Prob.Loss
BBCA	109	74	183	60	40
BBRI	105	78	183	57	43
BBNI	104	79	183	57	43
BMRI	100	83	183	55	45
PNBN	97	86	183	53	47
BNGA	80	103	183	44	56

The monthly yield analysis which shown in Table 12 above it was described that BBCA has the highest winning probability (109 wins, 74 losses or a winning percentage of 60%) compared to the other five shares. The results of the analysis towards winning probability on book IV banking shares could be used as an input for decision makers in selecting which stocks to invest.

Back Testing

Aimed to examine whether the VaR estimation model that carried out was accurated/valid or not, or need backtesting [22]. One of the back-testing models was done by using the Kupiec Test. Which is by comparing the test results between the actual data and the predicted VaR value [23]. Back testing from variance-covariance method and Historical simulation aimed to determine potential losses validation on six shares studied. The method that have been used was Kupiec Test that generally the level of failure was in stage of $6 < N < 21$ as for $T = 256$ so the VaR model could be said enough valid to measure those potential losses.

The test results, both Variance-Covariance method and Historical Simulation method, shows that the two models were declared valid in measuring the maximum potential loss of those six shares from the (individual) book IV banking shares as presented in these Table 13 below.

Table 13. Validity Test of VaR Model (Kupiec Test)

Shares	Failure level		6 < N < 21	Notes
	Var-Covar	Historical		
BBCA	7	9	< 21	Valid
BBRI	2	10	< 21	Valid
BMRI	3	9	< 21	Valid
BBNI	13	6	< 21	Valid
BNGA	7	9	< 21	Valid
PNBN	4	9	< 21	Valid

Based on validity of the VaR model above, it turns out that the failure rate earned by Historical Simulation method that generally greater than the Variance Covariance method. These failure rates of both methods could still within the required tolerance limits (<21). Thus, the VaR model from both Historical Simulation method and Variance-Covariance method was declared valid.

V. CONCLUSION

Conclusion

According to these results which have been carried out on Book IV Banking shares on Indonesia Stock Exchange, it could be stated that:

1) Changes in the value of shares in the stock market were carried out by random-walk. So, it will difficult to predicted because they were impact by several risk factors that came from outside the company. For example, government policies and changes in national and international macroeconomic variables. Besides that, changes in share prices were also influenced by company policies and other activities. Such as dividend policy, company performance and other corporate actions.
2) Measurement of market risk on individual stock investment with VaR, Variance-Covarian generally produced a greater value than Historical-Simulation method.
3) VaR calculation model has been examined for its validity (back testing with the Kupiec Test) which aims to find out the validity of potential losses. Thus the VaR model, both Variance-Covariance method and Historical Simulation method were declared valid.

Suggestion

1) For prospective investors of six shares from book IV banking shares, it is advisable to apply the Value at Risk (VaR) model in measuring market risk, because the results of risk measurement using the existing model that could be predicted the certainty within a certain period of

time. So, it will make it easier for the decision maker to create investment decisions.

2) As for future researchers, it is suggested to carry out further research on risk analysis by Value at Risk approach, the Variance-Covariance Method, the Historical Simulation Method and Monte Carlo Method and not only in the banking shares sub-sector, but also in other industrial sectors. Whether it's on the Indonesia Stock Exchange or the International Stock Exchange. Because this research was limited only in the scope of book IV banking shares investment and single asset. Further research was suggested to carry out further research, both on single asset and portfolio.
3) In observing stock price movements, it is basically known as fundamental analysis and technical analysis. Fundamental analysis used to decide what stocks to buy. While technical analysis is used for when is the right time to buy. This research discusses stock price movements in fundamental analysis to determine which stocks are recommended to buy. In book IV banking shares, it is advisable to invest in BBCA shares. For further research, the researchers could explore fundamental analysis from various aspects. For example, macroeconomic aspects (GNP, GDP, inflation, interest rates and others) and other micro aspects, such as corporate financial statements (balance sheet, profit and loss, and cash flow statements).
4) As for regulators as well as bank top management, the implemented of maximum risk calculation method (VaR Model) for banking sector could be use the VaR calculation model (Varian-Covariance, Historical Simulation and Monte Carlo Method). In order to enrich the examine over the maximum risk exposure faced by banks, it is also an implementation of the Stess testing policy.

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