The Comparative Measurement of Market Risk and the Capital Charge Through Internal Model Approach: An Empirical Studi on Indonesia State-Owned Bank 2015

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Abstract

The objective of the study is to measure the capital charged by Net Open Position (NOP) of the market risk state-owned bank using internal model approach. Market risk management is a part of crucial activities for foreign exchange bank, which these is very related with bank business processes to get profit. So that the bank faces market risk that could lead to further losses if market risk can not be handled properly, then the losses incurred can be fatal to the bank capital that could cause financial loss and the bankruptcy. The adequacy of bank capital can overcome market risk if the bank suffers losses.Measurement of capital charge from market risk through Value at Risk (VaR) using Historical Simulation, Variance-Covariance and Monte-Carlo Simulation method. These method measure the foreign exchange rate volatility within the Bank's Net Open Position (NOP) on Internal Model Approach. Furthermore test the accuracy of the results of VaR models by using backtesting. The result of this study shows if there is different result in measuring VaR and Capital Charge through Historical Simulation, Variance-Covariance and Monte-Carlo simulation method because every method has different approach. Based on the result, it can be shown that Monte-Carlo Simulation becomes the best measurement because it provides detail information and appropriate measurement.

Keywords : Market Risk, Value at Risk, Capital Charge

1.Introduction

Banks are business entities that raise funds from the public in the form of savings and channel them to the public in the form of credit or other forms in order to improve the standard of living of the people (Neuberger, 2014). The business activities of the Bank are always faced with risks that are closely related to its function as a financial intermediary. Risks in the banking context is a potential events, both of which can be expected (anticipated) or unexpected (unanticipated) the negative impact on earnings and capital of the Bank (Bessis,2014). The rapid development of the external and internal environment also led to increasing complexity of risk banking activities. Therefore, to adapt in the banking business environment, the Bank is required to implement risk management (Kanchu,2013)..

Based on the Global Association of Risk Professionals (GARP) & BSMR (2005), there are several incidents that can show us how important to consider and manage the risks in order to face the unpredictable situations likes: Orange County, California. In December 1994, Orange County, a local authority in the US state of California stunned the markets by announcing that its investment pool had suffered a USD 1.6 billion loss. The loss was the result of unsupervised investment activity by the county treasurer who managed portfolio of USD 7.5 billion belonging to county schools, cities and the county itself. In August 1998 it was reported that Telekomunikasi Indonesia had incurred a net loss of USD 101 million as a result of foreign exchange losses equivalent to approximately USD 150 million. The losses resulted from foreign exchange borrowings of USD 306 million, JPY 11 billion and FRF 130 million, which had been converted into local currency, the rupiah. The devaluation of the rupiah against USD, JPY, and FRF meant that the net cost of repayment was approximately USD 150 million more than the proceeds of the loans originally received. In February 2001 it was reported that Morgan Grenfell Private Equity (MGPE) had made a loss of GBP 150 million on its holding of shares in EM. TV, a stricken German media group. MGPE had acquired the shares originally as part of a transaction to sell its stake in Formula One in return for shares in EM. TV. The shares in EM. TV subsequently fell by 90%. In September 2008 where Lehman Brothers declared bankruptcy which caused by subprime mortgage crisis in U.S. Within 2003 and 2004 the housing prices in U.S tend to increased. It caused the U.S. housing bubbled and Lehman acquired five mortgage lenders. But, unfortunately in the middle of 2007, the housing values stopped increasing – many people defaulted on their mortgage payment. This incident lead Lehman Brothers into bankruptcy. From the examples above, there are many facts that each time market was stunned by the rapidity of those unpredictable changes, which in many cases created substantial financial losses.

From the examples above, there are many facts that each time market was stunned by the rapidity of those unpredictable changes, which in many cases created substantial financial losses. So, to mitigate the potential loss the risk must be defined properly. According to Jorion (2012), in his book entitled *Value at Risk, the New Benchmark for Managing Financial Risk* said," Risk can be defined as the volatility of unexpected outcomes,

generally the value of asset or liabilities of interest. or in other words, there's difference between the expectations and potential damage within reality.

The general perception of the risk is that the risk will be proportional to the benefits. So the biggest risk is the risks that companies do not take. Although this perception is true, but taking risks without consideration and careful thought can be fatal (Santomero,2013). But, however those willingness to take risk are essential to the growth of the economy. Without willingness to take a risk, banks will unable to collect deposits and give loans to their customer, and finally corporate and other business people will get difficulties to fund their operational business. There will be no productivity and less economic activities which might bring into economic stagnant. That's why the knowledge about risk management which defined as the process by which various risk exposures are identified, measured, and controlled. risk management is intended to ensure the sustainability, profitability and business growth in line with the vision and mission of the company (Pyle,2009). The focus in most good risk management is the identification and handling of these risks. The objective is sustainable value on the various activities of the company. Through this knowledge, we can minimize the financial loses or even create a competitive advantage by judicious exposure to financial risks.

Many risk incidents may give the loss for the company and it will need sufficient capital to cover this loss. Risk management is the core to any banking service and hence the need for sufficient Capital Adequacy Ratio is felt. Regulation of capital assumes significant importance so as to reduce bank failures, to promote stability, safety and soundness of the banking system, to prevent systemic disaster and to ultimately reduce losses to the bank depositors (Nikhat Fatima, 2014).

Indonesia banking environment has faced the critical condition in 1998, where it can be a clear example of market risk related to foreign exchange risk that gives very bad impact for the financial performance of a bank and becomes a trigger for potential event of bankruptcy (Radelet,1999). Extreme volatility of foreign exchange in 1998 can be the root cause of many defaults of Indonesian banks. The foreign currency appreciated sharply and local currency drop and crash into the lower level, cash flow of the bank was getting worst and the value of liabilities was going to over capacity of the bank. For the internal impact of that, the bank faced the difficulties on its liquidity, and externally, the financing or loan repayment from the customer must be disturbed because both bank and customer had to earn the foreign exchange instrument in more expensive exchange rate (Nasution,2010). Based on thw description above, the research objectives to be achieved include:

1. To measure the worst expected loss under normal market conditions caused by the foreign exchange risk within Net Open Position in SOE (State-Owned Enterprise) Bank through Internal Model Approach.
2. To measure the Internal Model Approach accuracy as the approach used in measuring the risks related to Net Open Position by using Backtesting.
3. To measure the capital charged to cover the potential damage by the foreign exchanged risk within the Net Open Position (NOP) in SOE (State-Owned Enterprise) Bank through Internal Model Approach

2 Literature Review

Credit risk is the risk that customers default which fail to comply their contractual obligation to serve the debt. This default triggers a total or partial loss of any amount lent to the counterparty. Credit risk is critical since the default of small number of important customers can generate loss and lead to insolvency (Vyas and Singh, 2010). It is controlled by credit limits on nationals by the central bank. But, banks employ a number of different techniques and policies to manage credit risk in order to minimize the probability and consequences of credit loss, According to Bessis (2014) explains that credit risk is divided into default risk, migration risk,exposure risk, loss under the default, and counterparty risk.

According to OJK Regulation No. 18 /POJK.03/2016, the market risk is the risk of the position balance sheet and off-balance sheet including derivative transactions, due Overall changes in market conditions, including risk changes in option prices. BCBS define market risk as a risk of losses in on and off balance sheet positions arising from the fluctuation in the market prices (BCBS, 2011). Risks that arise due to the changes in the market value of the interest rates, exchange rate or even changes in the prices of bonds, equities and commodities. Banks are facing market risks in regards to management of balance sheet and trading operation. The following are the market risk factors (Vyas and Singh, 2010).

Risk management is defined by Schmit and Roth (1990) as "the performance of activities designed to minimize negative possible losses". Cummins et al. (1998) define risk management as "any set of actions taken by individuals or corporations in an effort to adjust the risk arising from their primary lines of business". According to Ardrey et al. (2009), risk management is a set of policies to control and monitor business transactions which can negatively impact banking operations, and to apply effective measures to identify, manage and mitigate these risks.

According to Bessis (2014), risk management includes the following four aspects (1) risk identification (2) risk mitigation (3) risk monitoring and reporting, and (4) risk measurement. Risk management in a bank can be seen from two perspectives i.e. (1) Regulatory requirements for risk management practices (2) Voluntary risk

management by banks. Under regulatory requirements, banks have been regulatory bodies. Banks also need to have a well-developed risk management process and well-defined risk appetite and risk management procedures (Talwar, 2011). To achieve appropriate risk management required a risk management procedure design and implementation of procedures for managing the business risks.

Measuring VAR through Internal Model Approach

The VAR measurement is purposed to define the worst potential loss that might be occurred caused by the fluctuation of foreign exchange rate within the Net Open Position hold by the bank. It will be measured by using Internal Model Approach method which consist of Historical Simulation Method, Variance-Covariance Method and Monte Carlo simulation.

VAR Portfolio

To generate the VaR portfolio, we need to find the portfolio standard deviation. It will be generated by following the steps below;

1. Prepare the matrix correlation among the observed variables over the simulated returns. The matrix correlation is purposed to determine how two securities move in relation to each other. Perfect positive correlation (+1) shows that as one security move, the other security will move in the same direction. Otherwise, if the correlation is perfectly negative means that if one security move, the other security will move in opposite direction. Hence, if the correlation is 0, the movements of the securities have no correlation; they are completely random.

2. Prepare the covariance matrix. The covariance will be generated by using formula below;

$$Cov(r_1 r_2) = \rho_{1.2} \sigma_1 \sigma_2$$

3. Find the portfolio variance and standard deviation.

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

$$= \sum_{i=1}^{N} w_i^2 \sigma_i^2 + 2 \sum_{i=1}^{N} \sum_{j<1}^{N} w_i w_{ji} \sigma_{ij}$$

As the number of assets increase, it is more convenient to use matrix notation.

$$\sigma_p^2 = \begin{bmatrix} w_1 & w_2 & \cdots & w_N \end{bmatrix} \begin{bmatrix} \sigma_{11} & \sigma_{12} & \sigma_{13} \cdots & \cdots & \sigma_{1N} \\ \vdots & & & & \\ \sigma_{N1} & \sigma_{N2} & \sigma_{N3} \cdots & \cdots & \sigma_{N} \end{bmatrix} \begin{bmatrix} w_1 \\ \vdots \\ w_N \end{bmatrix})$$

$$\sigma = \sqrt{\sigma^2}$$

4. Measure the risk portfolio and VaR portfolio with 99% confidence level

$$VaR = \sigma_{portfolio} \text{ x total asset x } 2.33$$

Backtesting VAR

Backtesting VAR numbers provides valuable feedback to users about the accuracy of their models. It will verify the VAR measurements by comparing the historical VAR with the subsequent returns. This model verification is an integral component of the risk management process.

Computing the Capital Charged

Capital Charge is a bank-owned capital expenses for reserved as re-investment costs as well as provisions for risk coverage. In addition, capital charge can also be interpreted as the minimum capital that must be deposited by the bank as part of the investment which is multiplied by the cost of the paid-up capital. Below is the formula to generate the capital charge (BCBS,2011);

$$Capital\ Charge = VAR\ x\ \sqrt{t}\ x\ multiplicative\ factor$$

As explained earlier, according to Basel Committee for Banking Supervision, the holding period for capital charge should be 10 trading days or 2 calendar weeks, and the multiplicative factor used is 3 (Bank Indonesia, 2015).

3. Methods

Population and Sampling

The population used in this study is PT. Bank Tabungan Negara (Persero) Tbk, thus the sampling used is the Net Open Position (NOP) in Bank BNI, BRI, BTN and Bank Mandiri which consists of several foreign currencies (USD, EUR, JPY, SGD) and considered as part of bank's capital. The Net Open Position (NOP) will be defined from Bank BNI, BRI, BTN and Bank Mandiri financial report on 31st December 2015.

Types and Sources of Data

The data used in this study is secondary data. Secondary data is data which obtained indirectly through an intermediary, like media or data collector. Here, we obtained the data from internet which consists of 250 business days of foreign exchange historical rate in Bank Indonesia within period 23th December 2014 until 31st December

2015.

Data Analysis Method

The obtained data will be processed by using VAR approach through Historical Simulation Method, Variance-Covariance Method, and Monte Carlo simulation method. It will be done by Microsoft Office Excel program which can simplify the risk measurement process related to the volatility of foreign exchange rate.

4. Result and Discussion

Measuring Value at Risk

To begin the measurement process, it was started by figuring the mean and standard deviation of the return on exchange rate. The exchange rate was based on Bank Indonesia's currencies exchange from December 2014 until December 2015, which in total there was 250 data. The return was generated by using excel natural logarithm formula. As the result, the mean and standard deviation measurement for each currency is figured on table below;

Table 1. Mean and Standard Deviation

Mean	0,004420%	0,004348%	0,039904%	0,012952%
Std. Deviation	0,832689%	0,820885%	0,672396%	0,446664%
Variance	0,006934%	0,006739%	0,004521%	0,001995%

source: data processed

These means and standard deviation will be used as basis variable on the VaR measurement in several method by computing this component into the simulation to measure the risk on foreign exchange that reflected by Net Open Position of the Banks above. The Measurement of VaR can be developed by using Historical Data Method, Variance-Covariance Method and Monte Carlo Simulation Method.

As the result of this study in measuring market risk and capital charge of Net Open Position (NOP) on 31st Decemeber 2015 by using VaR approach through Historical Simulation. Variance-Covariance Simulation and Monte Carlo simulation in BNI, BRI, BTN and Bank Mandiri we may take some conclusions as follows:

1. The VaR measurement through Historical Simulation. Variance-Covariance Simulation and Monte Carlo simulation with 99% confidence level at one day time horizon with the current portfolio they had (USD. EUR. JPY and SGD which in total and the bank maximum loss will show in table below:

Table 2. VAR Result Conclusion

Bank	NOP	VaR on NOP		
		Historical Method	Variance-Covariance Method	Monte Carlo Method
BNI	1.030.496.000.000	16.643.120.264	18.891.507.406	18.891.507.406,28
BRI	1.778.591.000.000	27.034.583.200	25.918.845.449	25.826.202.743,32
BTN	239.986.000.000	3.896.976.299	4.431.449.458	4.409.371.641,18
Bank Mandiri	2.957.761.000.000	44.957.967.200	42.596.902.054	42.596.902.054

source: data processed

2. Backtesting was done to verify whether the actual losses are in line with projected losses by comparing the historical VaR forecasts with their portfolio returns during 250 observation days from 30th December 2014 until 31st December 2015. The test results show there are exceptions have been found from the VaR calculations and categorized into yellow zone in Basel Penalty Zone. As the impact. the bank will get penalty by adding the increment k as show in table below

Table 3. Backtesting Conclusion

Bank	Historical Method		Var-Covar Method		Monte Carlo Simulation	
	Exception	Value of Z	Exception	Value of Z	Exception	Value of Z
BNI	6	2,2247	5	1,5891	5	1,5891
BRI	5	1,5891	5	1,5891	5	1,5891
BTN	6	2,2247	5	1,5891	5	1,5891
Bank Mandiri	5	1,5891	5	1,5891	5	1,5891

source: data processed

3. According to the hypothetical testing. this number of exceptions was caused by bad luck where the markets were particularly volatile or correlations changed. As the impact. this test also shows if the VaR model used in the study was correct and allowed to be used by the bank.

4. To measure the capital charge. the increment k used by the bank is 3.00 + incremental k with 10 days holding period. As the result. the capital charge by the bank on foreign exchange risk for NOP on 31st December 2015 was :

Table 4. Capital Charge Result Conclusion

Bank	NOP	Capital Charge		
		Historical Method	Var-Covar Method	Monte Carlo Simulation
BNI	1.030.496.000.000	184.205.585.931	203.845.264.059	203.116.652.249
BRI	1.778.591.000.000	272.512.097.325	245.887.757.827	245.008.871.947
BTN	239.986.000.000	43.131.623.829	47.645.810.326	47.408.435.283
Bank Mandiri	2.957.761.000.000	397.724.063.597	459.633.874.668	457.990.987.986

source: data processed

5. Conclusion

From the total NOP at Bank BNI, BRI, BTN and Bank Mandiri for the amount of money that held in NOP. Bank BNI, BRI, BTN and Bank Mandiri need to cover the potential loss for the capital charge over the market risk. As the impact, the banks need to provide reserve capital to cover the potential loss to occur. But the exceptions are caused by bad luck. the bank supervisors give flexibility to adjust the rules regarding to penalty in turbulent times.

The result of this study shows if there is different result in measuring VaR and Capital Charge through Historical Simulation, Variance-Covariance and Monte-Carlo simulation method because every method has different approach. Based on the result, it can be shown that Monte-Carlo Simulation becomes the best measurement because it provides detail information and appropriate measurement.

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