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The Strategy of Digital in Business for Gaining Competitive Advantages after Pandemic

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Proceeding Book of
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"The Strategy of Digitalization in Business for Gaining Competitive Advantages after Pandemic"

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FOREWORD

Alhamdulillah, praise be to Allah Subhanahu Wa Ta'ala for granting us the opportunity to organize and publish the proceedings of the 4th International Conference on Business and Banking Innovations (ICOBBI) with the topic “The Strategy of Digitalization in Business for Gaining Competitive Advantages after Pandemic”. This proceeding contains several researches articles from many fields in Business & Marketing, Banking & Sharia Banking, Accounting & Financial Management, Human Resources Management, Operations Management, Investasi, Insurance & Capital Market, Strategic Management, Technology Management, and Information System.

The 4th International Conference on Business and Banking Innovations was held on 29th January 2022 by virtual (online) zoom meeting and organized by the Master Management Study Program of Universitas Hayam Wuruk Perbanas in Collaboration with five Higher Education Institutions in Indonesia and three Universities from Asia countries. Keynote speakers in this conference were: Chonlatis Darawong, P.hD (Sripatum University, Thailand), Associate Prof. Dr. Ellisha Nasrudin (University of Science, Malaysia), Dr. Sanju Kumar Singh (Postdoctoral Fellowship in Universitas Airlangga, Tribhuvan University Nepal) and Prof. Dr. Abdul Mongid, MA., P.hD (Universitas Hayam Wuruk Perbanas, Indonesia).

I would like to give high appreciation to the Rector of Universitas Hayam Wuruk Perbanas for his support at this event. Acknowledgments and thank you to all the steering and organizing committees of the ICOBBI for the extra ordinary effort during the conference until this proceeding published. Thank you very much to all presenter and delegates from various Universities. Beside it, I would like to express our gratitude to the three universities, namely Universitas 17 Agustus Surabaya, STIE YKPN Yogyakarta, Universitas Negeri Gorontalo, Universitas Surabaya and Universitas Muhammadiyah Surakarta which has been the co-host of this event.

Hopefully, the proceeding will become a reference for academics and practitioners, especially the business and banking industry to get benefit from the various results of the research field of Business and Banking associated with Information Technology. Proceedings also can be accessed online on the website http://eprints.perbanas.ac.id/

Chair of the Master Management Study Program
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Macroeconomic Stress test of Credit Risk in Indonesian Banking using Monte Carlo Simulation

(An Empirical Study on Commercial Banking in Indonesia during 2010-2020)

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ABSTRACT

The paper presents the model macroeconomic stress test credit risk for the banking system of Indonesia during 2010 to 2020. The aim of this research is to evaluate the vulnerability of the banking system through the credit risk to the country's economic shocks. The variables used are GDP, exchange rate, inflation, policy rate and total credit. Economic growth and interest rate have negative non-significant correlation to credit risk. Total credit has significant negative correlation to credit risk. Inflation has positive non-significant and exchange rate has positive significant correlation to credit risk. Stress test result showing that the forecast of NPL change is maximal at –o,83. This shows that commercial bank in Indonesia have a tendency declining the NPL value in upcoming period. According to the obtained results generally, it is still necessary for Indonesia commercial banks to increase their capital in order to cover their unexpected losses.

Keywords: *Macro Stress Test, Credit Risk, Monte Carlo Simulation*

1. INTRODUCTION

Based on banking law, bank is defined as a business entity that collects funds from the public in the form of savings and distributes them to the public in the form of credit or other forms in order to improve the standard of living of the people at large. In practice, of the total financing disbursed to the community, not all are categorized as healthy, but some of them are financing that has poor quality. Credit quality in the banking industry is important to consider due to one of the indicators for measuring bank health. Credit risk is the risk of loss due to the possibility of counterparty fail to pay its obligations. The increase in the value of credit risk is indicated by an increase in the ratio of non-performing loans as measured by the NPL ratio (Non-Performing Loan).

Based on data obtained from the average NPL level on commercial banks in Indonesia, it shows a continuous rising trend during January 2019 to January 2020 at 2.77% with a value of IDR 5,502,812,000,000,000 (www.ojk.go.id).

Aviliani et al., (2015) explained that macroeconomic conditions are generally seen through economic growth, inflation rates, interest rates and exchange rates. Stable macroeconomic conditions can be seen from high economic growth, low loan interest rates, and controlled inflation so it can provide a positive environment for the development of the banking business itself.

The first quarter of 2020, economic growth was recorded at only 2.97% compared to last year 5.02%. The reason of the decline in economic growth cannot be separated from the impact of handling the spread of the *Covid-19* virus that affect all aspects of life and economic activity, both in terms of production, distribution, consumption, investment, and foreign trade.

Exchange rate is one of the macroeconomic variables that can be defined as the price of one currency in the currency of another country. The exchange rate variable has a close relationship with debtors whose main business is in the import-export sector. The effect of the exchange rate on non-performing loans (NPL) occurs when the value of the domestic currency depreciates it can cause capital outflows or people's capital flight abroad because when compared to other countries' currencies, the rupiah exchange rate is too low. The increasing exchange rate of the Dollar will increase the demand for Dollars. For large bank debtors whose business activities are in dire need of the dollar exchange rate, they will experience pressure from the depreciation of the exchange rate so that it will increase the risk of default or bad credit. The increase of dollar or the weakening of rupiah will increase the risk of non-performing loans.

Inflation realization in 2020 is under the target that set by the government at 2% to 4%. The decrease of inflation in 2020 is in line with the downward trend in purchasing power demand due to *Covid19*. *Covid19* has caused the inflation trend in Indonesia to slow down as a result of a spike in layoffs, changes in work schemes, thereby suppressing demand which has an impact on supply. This causes the income of business actors and companies to decline, so it will be difficult for debtors to pay bank loan.

BI rate also known as interest rate policy in Indonesia is one of the macro variables that affect the condition of the banking sector. The BI rate is a policy made by Bank Indonesia regarding interest rates that reflects the stance of monetary policy. Bank Indonesia plays an important role in the policy of setting interest rates every year in order to maintain the country's economic stability. This policy will be implemented in monetary operations conducted by Bank Indonesia through the management of liquidity in the money market in order to achieve the operational targets of monetary policy. The determination of interest rates in Indonesia on the cost of funds and lending rates refers to the BI rate.

Commercial bank chosen as the object of study because in 2020 at the time of the pandemic, the NPL value of commercial banks was much higher than the NPF of Islamic banks. The main reason is that many Islamic banks do not yet have a corporate segment so that the NPF risk is smaller. In addition, Islamic bank financing tends to be in the non-productive or consumer sector with a lower risk character.

Using Monte Carlo simulation and calculating the risk value and expected losses for each of the macroeconomic variables, the capital required by banks to cover losses is obtained. When a common scenario is applied to bank with similar method, the authority will have certain information from stress test result. It is going to provide consistency supervisory information. Remaining the main goal of this research is to ensure that banks have sufficient capital to cope with the credit risks they face so the bank can still maintain its business continuity. The stress test is conducted by the bank and the supervisor collects the result after the test has been performed. Comprehensive study an macroeconomic stress test is done by Boss (2002).

Based on the research gap and the phenomena described above, it is necessary to conduct further research to obtain consistent results regarding macroeconomic stress tests and to determine the resilience of commercial banks to macroeconomic factors such as GDP, inflation, interest rates, and exchange rates on the quality of general banking credit. Conventional methods in Indonesia use the stress test method.

VARIABLES & MEASUREMENT

In this study, the theoretical basis used is the basic concept of macroeconomic factors, namely interest rates, GDP, inflation, exchange rates, financing growth, and the theory of credit risk. Therefore the author will present thee detail with the formulas are explained below:

1.1. Credit risk

Credit risk is the possibility of a loss resulting from a borrower's failure to repay a loan or meet contractual obligations. Credit quality is a measurement of an individual's or company's creditworthiness, or the ability to repay its debt. Credit quality is an indicator of credit risk. It refers to the risk that a lender may not receive the owed principal and interest, which results in an interruption of cash flows and increased costs for collection.

Zerman et al (2008), explained that credit risk is one of the most important factors to see the strength of the banking sector in dealing with the possible risks faced. The greater the risk of bank credit, the bank has a large potential for failure. Therefore, Non-Performing Loans are one of the most important indicators to measure banking performance in achieving profitability.

$$NPL = \frac{non\ performing\ loans\ credit}{total\ outstanding\ loan} \text{ X } 100\% \quad (1)$$

1.2 Gross Domestic Product

GDP defines as the value of goods and services produced by a country in a certain period of time. The interpretation of the statement indicates that what will be calculated in the GDP category are products or outputs in the form of goods and services in an economy that are produced by inputs or production factors owned by the citizens of the country concerned as well as by foreign nationals living geographically in the country (Sunyoto 2014).

Gross Domestic Product is the value of goods and services produced by a country within a certain time. GDP can be measured by the following formula:

$$GDP_t = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} x100\% \qquad (2)$$

1.3 Inflation

Inflation is the process of increasing the price of goods continuously which has an impact on the decline in people's purchasing power because in real terms the level of income also decreases with the assumption that the income level of the c is constant (Mankiw, 2013). Financial risk rising when there is an unexpected increase in inflation that causes purchasing power risk. When inflation occurs, it will make cost of living higher because the cost of consumption will increase as a result of rising prices. So when inflation occurs, the income of the society and companies decreases, so it will be make the counterpart difficult to pay the bank loan.

Inflation is a condition where the price level increases continuously or can be interpreted as a value where the level of prices for goods and services has increased. Inflation can be measured by the following formula:

$$\text{Laju Inflasi} = \frac{IHKN - IHK\ n-1}{IHK\ n-1} \text{ x } 100\% \qquad (3)$$

1.4 Exchange Rate

Exchange rate can be defined as the number of units of currency that can be purchased or exchanged for one unit of foreign currency or the price of a currency expressed in another currency.

The fluctuation of the exchange rate might significantly affect the stability of the whole economy and output. An appreciation of the exchange rate can have mixed implications. On the one hand, it could weaken the competitiveness of export-oriented firms and adversely affect their ability to service their debt. On the other, it can improve the debt-servicing capacity of borrowers who borrow in foreign currency.

According to Hasad (2001), the exchange rate is the amount of domestic currency that can be reduced by a certain amount of currency of a certain country needed to obtain or obtain one unit of foreign exchange. In this case, the exchange rate is proxies by the middle rate of Bank Indonesia, which is the average sum of the buying and selling rates of exchange prevailing at the end of the quarterly reporting period, sourced from Bank Indonesia. The formula for exchange rate changes is obtained by the following formula:

$$KURS_t = \frac{KURS_t - KURS_{t-1}}{KURS_{t-1}} x100\% \qquad (4)$$

1.5 Interest Rate

According to Kasmir (2011), interest rates can be interpreted as remuneration provided by banks based on conventional principles to customers who buy or sell their products. An increase in interest rates will worsen the quality of the loan, the higher the cost of debt, making it more difficult for debtors to repay their loans. Therefore, an increase in interest rates will increase the level of NPL bank credit (Messai & Jouini, 2013).

The interest rate can be defined as the compensation paid by the borrower of funds to the lender. For borrowers, the interest rate is the cost of borrowing or the price paid for the money borrowed, which is the exchange rate of current consumption for future consumption, or the current dollar price of future rupiah. The interest rate is defined as the percentage per year charged on money borrowed or lent. BI rate data comes from the Bank Indonesia website in the form of monthly data from January 2010 to August 2020.

1.6 Total Credit

The greater the loan disbursed by the Bank, the credit growth will also increase. Good credit growth will increase the Bank's profit growth in the form of Bank interest income. Therefore, credit management must be carried out as well as possible, starting from planning the amount of credit, determining interest rates, lending procedures, credit analysis to controlling bad credit.

Before the realization is implemented, the bank must be able to assess the smoothness of loan repayments and interest payments. In addition, it is necessary to conduct research on the business feasibility of prospective debtors to determine the amount of income so that the Bank can avoid Non Performing Loan Risk. The lower the ratio, the lower the level of non performing loans that occur, this means the better the condition of the Bank.

The greater the growth of credit disbursed will determine the profits obtained. However, this does not mean that the large number of loans disbursed will provide large profits; this will have an impact on the level of Non Performing Loan. The data of total credit obtained from OJK website.

2. LITERATURE REVIEW

Several studies have used macroeconomic variables to estimate a banks probability of default. Most studies that connect credit risk to macroeconomic variables have used such variables to explain macroeconomic effects to credit risk. The theories of credit risk relate non-performing loans external and internal factors. There are three theories that have provided insight into how these factors influence nonperforming loans levels.

2.1 Deflation Theory

The first is deflation theory, Fisher (1933), which suggests that when the debt bubble bursts the following sequence of events occurs; debt liquidation leading to distress selling and contraction of deposit currency, as bank loans are paid off. This contraction of deposits cause a fall in the level of prices, which leads to greater fall in the net worth of business, hence precipitating bankruptcies which leads the concerns running at a loss to make a reduction in output, in trade and in employment of labor. These cycles cause complicated disturbances in the rates of interest and a fall in the money value.

2.2 Financial Theory

Financial theory" pioneered by Minsky in 1974 also known as financial instability hypothesis, attempted to provide an understanding and explanation of the characteristics of financial crisis. The theory suggests that, in prosperous times, when corporate cash flow rises beyond what is needed to pay off debt, a speculative euphoria develops, and soon thereafter debts exceed what borrowers can pay off from their incoming revenues, which in turn produces a financial crisis. As a result of such speculative borrowing bubbles, banks and lenders tighten credit availability, even to companies that can afford loans and the economy subsequently contracts.

Credit quality is determined by collectability, namely whether or not the payment of interest and principal is smooth and the ability of the debtor in terms of business conditions. Therefore, credit collectability is categorized into current, substandard, doubtful, and loss. Financial theory underpin this study in that, a hedge borrower would have a normal loan and is paying back both the principal and interest; the speculative borrower would have a watch loan; meaning loans' principal or interest is due and unpaid for 30 to 90 or have been refinanced. The primary sources of repayment are not sufficient to service the loan. The loan is past due for more than 90 days but less than 180 days. Substandard loans are nonperforming loans.

2.3 Stress Test Theory

A bank stress test is an analysis conducted under hypothetical scenarios designed to determine whether a bank has enough capital to withstand a negative economic shock. These scenarios include unfavorable situations, such as a deep recession or a financial market crash. Banking stress tests assess how banks can cope with severe economic scenarios. We look at banks' resilience, making sure they have enough capital to withstand extreme shocks and are able to support the economy. The scenario is calibrated to robustly test and challenge business models and support firms in identifying key sensitivities and vulnerabilities within their balance sheets in the context of a severe downside outcome with an intensification of the macroeconomic shocks seen in 2020. To support the process data stress test, this research use Monte Carlo simulation method. Monte Carlo simulation is a computerized mathematical technique that allows people to account for risk in quantitative analysis and decision making. Monte Carlo simulation furnishes the decision-maker with a range of possible outcomes and the probabilities they will occur for any choice of action. In other word, Monte Carlo Simulation used to estimate the possible outcomes of an uncertain event. They are most useful when it is difficult or impossible to use other approaches. In principle, Monte Carlo methods can be used to solve any problem having a probabilistic interpretation.

3. METHOD

This study presents a model for assessing a banks default risk through a multiple regression based on simultaneous estimates of the impacts macroeconomic variables such as inflation, GDP, exchange rate, and policy rate, loan growth using panel and time series data. Data spans from January 2010 to August 2020. The approach used in this research is a quantitative approach. While the type of data used is secondary data. Secondary data is obtained from literature, journals, and documents from various institutions such as the (BPS), Bank Indonesia, and OJK.

In conducting stress test analysis on the banking system, in general, the focus is on credit risk. The stress test on the banking system includes several things, including;

(1) Analysis of the influence of the variables being observed and related to the quality of bank credit,
(2) Preparing stress scenarios that will be used later in stress testing analysis,
(3) Calculating credit risk and reserves against potential losses under stress conditions in accordance with prepared scenario

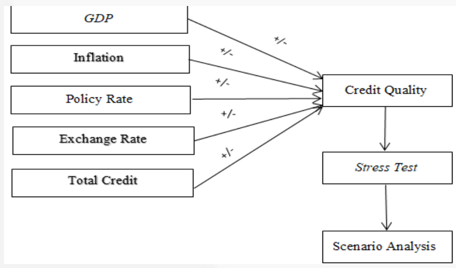


Figure 1. Stress Test Analysis Framework

Multiple regression analysis technique is used because this study uses more than one independent variable. Multiple regression analysis technique serves to determine the effect of the independent variable on the dependent variable. This research has the following equations:

$$NPL_t = \beta_0 + \beta_1 GDP_{t-1} + \beta_2 LI_{t-1} + \beta_3 BI_{t-1} + \beta_4 lKURS_{t-1} + \beta_5 lLTC + \varepsilon_t$$

With the following explanation:

NPL = Credit risk
GDP = Economic growth
BI = Policy Rate
INF = Inflation
KURS = Exchange Rate

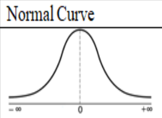
Heteroskedasticity Test: ARCH			
F-statistic	0.143025	Prob. F(1,124)	0.7059
Obs*R-squared	0.145165	Prob. Chi-Square(1)	0.7032

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.128226	Prob. F(2,119)	0.8798
Obs*R-squared	0.273104	Prob. Chi-Square(2)	0.8724

lLTC = Total Credit
α = Regression equation Constanta
β1,2,3,4,5 = Regression coefficient
ε = Error term

The stress test in this study uses a stress test scenario with Monte Carlo simulation that will be explained as follows:

1. Using a linear regression model
2. Determine the regression coefficient and standard error in line with the distribution assumptions.
3. Determine the value of variables such as mean, standard deviation and distribution assumptions. All data are assumed to be normally distributed.
4. Entering regression efficiency data, variable values and distributions into the Monte Carl Simulation with the help of the Oracle Monte Carlo Simulation tool.
5. Determine the number of trials and the assumption of a level of confidence of 500,000 times with a level of confidence of 95%

NPL SIMULATION			
Varieable	Regression	History Data	Assumption of Distribution
c			
GDP	β1*GDP*	$\bar{X}$ GDP	Normal Curve
Inflation	β2INF	$\bar{X}$ INFLASI	
BI Rate	β3RATE	$\bar{X}$ RATE	
Exchange Rate	β4KURS	$\bar{X}$ KURS	
Total Credit	β5LTC	$\bar{X}$ LTC	

6. Simulation implementation
7. Downloading simulation result data
8. Analyze data
9. Draw conclusions

The next step is to predict the macro economy in 2022 using data from GDP, inflation, interest rates, exchange rates, loan growth in 2022 using the standard deviation and average data from 2011 to 2020 with the following description:

Table 1. NPL Simulation

4. RESULTS

The first step is doing some statistics test to knowing whether the data is fit or not by using classic assumption using Heteroskedasticity Test, Variance Inflation Factors, normality test, and autocorrelation test. After the data is fit and fulfil the criteria of that test, then it is continued to doing t-test and F test.

This research using data D (data differential) in order to obtaining the realistic result remaining the impact of NPL in nowadays is caused by the variables in prior year.

The following tables are the result of several statistics process:

Table 2. Result of Heteroskedasticity and Autocorrelation

Based on Heteroskedasticity test and Serial Correlation LM test, the value of Prob. F is more than 0.05, means the data is homogens and fulfilling the criteria so the data can be process further. After obtaining the result of autocorrelation and Heteroskedasticity test, the next step is testing whether the data has the similarity between the independent variables in the regression model because the similarity that occurs between the independent variables indicates a very strong correlation. While the good regression model can be defined there is no correlation between the independent variables. If there is a correlation, it indicates a multicollinearity problem.

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
D(EGRW)	3.48E-09	1.042.845	1.038.250
D(LKYD)	0.000193	1.804.780	1.040.552
D(LKURS)	1.48E-05	1.094.815	1.059.742
D(RATE)	1.10E-07	1.038.550	1.030.835
D(INFLASI)	1.84E-08	1.030.045	1.028.876

Table 3. Multicolleniarity Test Result

Table 3. shows that the hat the value of centered VIF < 10, so the model is not multicollinearity.

Descriptive Statistics Result

	INFLASI	LKYD	EGRW	NPL	RATE	LKURS
Mean	4,54	6,53	4,32	0,0262	5,88	9,37
Median	4,047	6,572	5,04	0,0267	5,75	9,479
Maximum	8,363	6,756	5,58	0,0354	7,750	9,66
Minimum	1,323	6,14	-5,325	0,0176	4,00	9,05
Std. Dev.	1,75	0,17	2,56	0,004	1,026	0,189

Table 4. Descriptive Statistics

Based on the descriptive statistics above, it shows that the mean value of each variable is greater than the standard deviation. This is showing that during the research period are good, because the criteria of good data are when the value of standard deviation lowers than the mean value. The lower the standard deviation, the closer the data range to the average and less variation.

The highest NPL value was 3,54%. While the lowest NPL was 1,76%. The highest economic growth was 5.588000 in February to May 2010, while the lowest economic growth was -5.325000 in September to December 2019. The highest inflation rate was 8.363000 in November 2014, while the lowest inflation rate was 1,323 in February 2019. The highest interest rate was 7.750 in December 2015, while the lowest interest rate was 4,000 in April 2012. The highest LKURS was 9.663452 in March 2020, while the lowest LKURS was 9.051227 in July 2011.

REGRESSION ANALYSIS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000710	9.96E-05	7.127.056	0.0000
D(EGRW)	-4.56E-05	5.90E-05	-0.774200	0.4403
D(LKYD)	-0.164116	0.013902	-1.180.486	0.0000
D(LKURS)	0.008813	0.003844	2.292.615	0.0236
D(RATE)	-0.000121	0.000332	-0.365702	0.7152
D(INFLATION)	2.70E-06	0.000135	0.019912	0.9841
R-squared	0.542661	Mean dependent var		-2.01E-05
Adjusted R-squared	0.523763	S.D. dependent var		0.001215

Table 5. Regression Result

F-statistic	Prob(F-stat)	Note
2.871.484	0.000000	Significant

Table 6. F test result

Table 6 F-test shows that the value of Prob (F-statistic) < 0.05, means the variables economic growth (GDP), inflation (INFL), interest rate, and (RATE) exchange rate (LKURS), and total credit (LTCR) are significantly effect on NPL and regression model is fit. Based on the result above, the value of R square is 0,54 or 54%. Means that the contribution of that variables are influencing credit risk as 54% and the rest is influence by others variable that did not observe in this research.

Explanation:

GDP per capita growth rate has a negative and non-significant relationship with credit risk at 5% significant level. A plausible interpretation of these results is that an increase in the GDP per capita growth will lead to a decrease in credit risk of banks since there will be improved economic conditions of both households and corporate hence they will be able to repay their borrowed amounts owing to the improved economy.

Total credit has a significant and negative correlation to credit risk. If the values of total credit increase, the value of NPL will decrease. a probably interpretation leads to The greater the total credit, the smaller the NPL ratio. This statement can be elaborate as if giving credit without any prior analysis will be very dangerous for the bank. As a result, if the analysis is wrong, then the credit disbursed will be difficult. If the disbursement is congestion, then the steps taken to save the credit is to increase the distribution of credit. The disbursement of credit is increasing it will cover the value of bad debt because the analysis of disbursement will be more advance. In accordance if only the business prospect is good in future. So the bank will inject the business process so that the business can run well and the borrowed can repay the bank loan.

Exchange rate has a positive significant to credit risk at 5% significant level. A plausible explanation of these results is that most of the borrowers of money / loan holders borrow in local currency hence the exchange rates between the local currency and the US dollar effect the credit risk. The increase in the exchange rate will affect the performance of bank debtors, the weak exchange rate of the rupiah against the United States dollar means that the income of the public will also decrease. Therefore banks will experience credit risk problems. This result in line with the Gitonga, 2014.

The policy rate does not have a strong influence enough to credit risk. A probable interpretation of these results is that increase in the policy rate not always lead increase in the credit risk. This is because high interest does not make the debtors hard to pay the bank loan if the business process and business prospect good. So the debtors can pay the bank loan well.

From table 5 it show that inflation rate is positive non-significant with credit risk at 5% significant level. This implies that Non-performing loans are not responsive to changes in inflation. A probably interpretation of these results is that inflation leads to more profitability as more money chases few goods. Most borrowers are business people who seem to pass over the cost of inflation to consumers. For instance, when fuel prices go up, road transport players raise fare to consumers of their services. Thus business people retain their ability to repay their loans.

5. STRESS TEST

The stress test in this study used a Montecarlo simulation with 500,000 trials, using Crystalball software by Oracle. The probability variables used are economic growth (GDP), inflation (INFL), interest rate, and (RATE) exchange rate (LKURS), and total credit (LTCR) assuming the data is normally distributed.

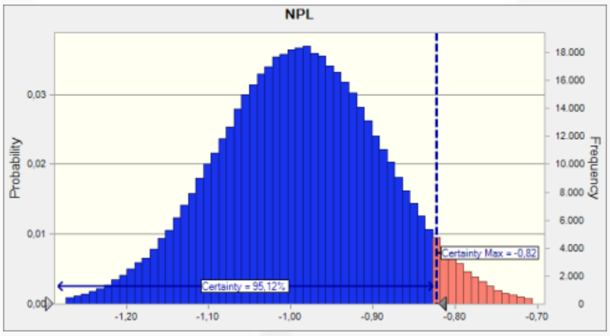


Figure 2. Forecast Change of NPL

Figure 2 saying that the change of NPL in short term have is in -0,83 in the level of certainty at 95%. This is show that the value of NPL in short team will maximally decrease in level 0,83 in future period. This shows that commercial bank in Indonesia have a tendency declining the NPL value in upcoming period. The result is in line with the fact that the value of NPL decreasing in level 3%.

However, Indonesia commercial bank is still necessary to anticipate the high probability of default, including by strengthening capital structure so bank be able to cover the potential risk of loss.

5. CONCLUSIONS

The regression result show economic growth and interest rate have negative non-significant correlation to credit risk. Total credit has significant negative correlation to credit risk. Inflation has positive non-significant and exchange rate has positive significant correlation to credit risk. Stress test result showing that the forecast of NPL change is maximal at –o,83. This shows that commercial bank in Indonesia have a tendency declining the NPL value in upcoming period. According to the obtained results generally, it is still necessary for Indonesia commercial banks to increase their capital in order to cover their unexpected losses.

AUTHORS’ CONTRIBUTIONS

The expected contributions of this study theoretically, as a scientific reference related to factors that affect NPL and stress tests with Montecarlo simulation. Practically as a reference for banks in financing risk management and for the government in formulating policies related to factors that affect NPL and stress tests using Montecarlo simulation.

ACKNOWLEDGMENTS

This study has many limitations including variables, theories, data, analytical methods, and simple stress tests that have not yet measured the resilience of bank capital. Suggestions, criticisms and constructive input are needed for further improvement. The study findings will enable managers and investors make timely decisions on how to avoid risk, transfer risks, risk reduction (mitigating risk) or retain the risk in a bid to maximize returns. On the policy front the study findings are also important to the government, regulatory bodies and to the commercial banks themselves. It will help the regulators to know exactly how credit risk is affected by macroeconomic variables and how to strengthen the financial industry in terms of policies.

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REFERENCES

[1] Boss, M. (2002). A macroeconomic credit risk model for stress testing the Austrian credit portfolio. *Financial Stability Report*, 4, 64-82.

[2] Mankiw, N. Gregory. (2000). *Teori Makro Ekonomi. Edisi Keempat*. Jakarta: Erlangga.

[3] Messai, Ahlem, S, & Fathi, Jouni. (2013). Micro and Macro Determinants of Non performing Loans. *International Journal of Economics and Financial Issues* Vol.3 No.4, pp. 852-860

[4] Minksy, H. P., 1974. The Modeling of Financial Instability: An introduction. Modeling and Simulation. *Proceedings of the Fifth Annual Pittsburgh Conference*,, pp. 15-20.

[5] J.E. Gentle, in International Encyclopedia of Education (Third Edition), 2010

[6] Poetry, Zakiyah Dwi and Sanrego, Yulizar D. (2011). "The Influence of Macro and Micro Variables on the NPL of Conventional Banking and NPF of Islamic Banking". TAZKIA, Islamic Finance & Business Review. Vol. 6 No.2 August - December 2011

[7] Washington, Gitonga Kariuki. (2014). Effect of Macroeconomic Variables On Credit Risk In The Kenyan Banking System. *International Journal of Business and Commerce* Vol. 3 No. 9, pp. 01-26

[8] Zeman, J., & Jurca, P. (2008). Macro stress testing of the Slovak banking sector. *National bank*

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www.bi.go.id