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The Effect of Macroeconomic Variables on Macroprudential Indicators in Indonesia from the First Quarter of 2003 to the Fourth Quarter of 2013

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The macroprudential policy aims to mitigate the risk of financial systems to reduce the spread of negative impacts on macroeconomics. The macroprudential policy can be measured by using Financial Soundness Indicators (FSIs), including the Vector Error Correction Model (VECM) approach to analyse the influence and impact of a policy in the model. The variables in this study were modified into seven endogenous variables consisting of macroeconomic variables such as Consumer Price Index (CPI), Gross Domestic Product (GDP) growth, interest rate spread (IRS), lending interest rate (LIR) and foreign exchange reserves (DEV). Also, there were two macroprudential indicators, namely the ratio of Non-Performing Loans (NPL) and Capital Adequacy Ratio (CAR), which were divided into two models. This study aims to determine the significance and the effect of macroeconomic variables on macroprudential indicators in Indonesia during the first quarter of 2003 to the fourth quarter of 2013. Macroeconomic variables used include consumer price indices, GDP growth rate, interest rate spread, lending interest rate, and foreign exchange reserves. The result of this study indicates that the resilience of the financial system in Indonesia is maintained amid the economic slowdown/downturn. Therefore, it does not cause any systemic effect that disrupts the financial system stability.

Keywords: *Macroeconomic Variables, Macroprudential Indicator, Resilience of Financial System, Indonesia.*

Introduction

In the past two decades, there have been two major financial crises: the 1997 East Asian financial crisis and the 2008 global financial crisis. The 1997 crisis in Indonesia was preceded by the financial crisis in Thailand, affecting currency, stock exchange, and other asset prices in some countries in Asia. The global crisis of 2008, on the other hand, started from the crisis of US-based housing debt, then spread to Europe in the form of the financial crisis of several European countries, which made interest rates in almost all countries drastically declined. In both cases, the development of the crisis spread to other continents in a short time. It became a global crisis because of the deadly effect amid a globally integrated financial system and the rapid dissemination of information (Raz, Indra, Artikasih, & Citra, 2012).

The global financial crisis, stemming from subprime mortgage problems in the banking sector in the United States, not only exacerbated the performance of the financial sector in the world but also negatively impacted the development of macroeconomic indicators in some countries. This crisis provided valuable lessons on the importance of the correlation between macroeconomics and the financial sector. The crisis also showed that systemic risk could not be prevented because of the absence of market discipline and the absence of regulation and oversight of the main components of the financial system, including institutions, markets, and infrastructure (Beau, Clerc, & Mojon, 2012). Systemic risk is a risk that disrupts the activities of the financial system that can lead to negative consequences to the financial system stability as a whole and a threat to the economy in real terms (Clement, 2010). To limit the impact of these systemic risks, an international regulatory framework is created to maintain the stability of the financial system as a whole instead of merely the stability of an individual financial institution. This regulation is also known as macroprudential policy, a policy that focuses on the interaction between financial institutions, infrastructure, and business cycles (Beau, Clerc, & Mojon, 2012).

The definition of macroprudential policy, referring to Hilbers, Leone, Gill, and Evens (2000), is a policy that has the primary objective of maintaining the stability of the financial system as a whole through limiting the increase in systemic risk. According to Borio (2007), this policy aims to restrict systemic pressure or risk extensively to avoid high costs in the event of the financial system instability. Internationally, the term macroprudential was first introduced at the Basel Committee on Banking Supervision (BCBS) meeting in 1979 (Clement, 2010). At this meeting that discussed the tendency of high growth of international bank lending, the micro-economic problem was identified to be integrated with the macro-economic problem, or referred to as macro-prudential. Furthermore, the term macroprudential became very popular after the 2008 global financial crisis. In 2010, the macroprudential policy was developed after the Financial Stability Board (FSB), the International Monetary Fund (IMF), and the Bank for International Settlements (BIS) strengthened the macroprudential policy framework to prevent

systemic risks to the financial sector. A change later followed the policy in the trend of incorporating macroprudential policy in the Central Bank's mission (Amzal, 2016).

In Indonesia, macroprudential terms have been implicitly used since the beginning of the 2000 era concerning the role of Bank Indonesia in maintaining financial system stability. Indonesia's experience of the 1997-1998 financial crisis with recovery costs of about 51% of Gross Domestic Product (hereafter, GDP) provides valuable lessons on the importance of maintaining financial system stability. Therefore, since 2003, Bank Indonesia has begun to play an active role in encouraging the creation of financial system stability in Indonesia, among others, through the preparation of blueprint Financial System Stability Indonesia. Based on the blueprint, the effort to maintain financial system stability in Indonesia is made through two approaches, namely microprudential approach and macroprudential approach. The effort shows that since the beginning of the 2000 era, Bank Indonesia has implicitly calculated and realised the importance of macroprudential aspects in maintaining financial system stability (Harun, 2014).

Macroprudential supervision can be measured using systemic risk indicators. Some of them are a Non-Performing Loan (hereafter, NPL) and Capital Adequacy Ratio (hereafter, CAR). The NPL ratio is used as an indicator of financial health and is usually associated as an indicator of stress testing from financial institutions. In contrast, CAR is used as a determinant of the robustness of financial institutions against shocks in the balance sheet (Hilbers, Leone, Gill, & Evens, 2000). The NPL and CAR ratios are two of several Financial Soundness Indicators (FSIs) that represent risks in the financial system in the economy.

Macroeconomic stability is an essential requirement for financial system stability. Instability in the financial system (financial crisis), in addition to banking liquidity, also encourages the increase of non-performing loans. NPLs, moreover, can be affected by inflation, economic growth, and interest rates. The inflation rate can reflect economic stability. Intense inflationary pressures may prompt the central bank to adopt policies to raise interest rates. If the interest rates rise, then, the purchasing power of the people will decrease so that people tend to save money in the bank. In adverse economic conditions, high-interest rates can jeopardize banking activities. With high credit interest rates, the risks of default increase, as indicated by the increase in the NPL ratio (Kusumawardani & Mubin, 2019).

In terms of bank capital, the bank's CAR can also be influenced by the country's inflation rate, economic growth, and foreign exchange reserves. Foreign exchange reserves are a vital part of a country to avoid economic and financial crises, especially for a country with an open economy where international capital flows are vulnerable to shocks that propagate from other countries. Given the experience of the 1997 and 2008 crises, countries with vast foreign

exchange reserves can avoid the contagion effect of the crisis better than those with small reserves (Indrajaya, 2019).

Balogh (2012) researched some elements related to macroprudential banking supervision in Europe. Balogh further employed an empirical approach to identify macroeconomic variables that affect two macroprudential control indicators. The macroprudential surveillance indicators used are NPL and CAR ratios. In contrast, the macroeconomic variables used are Consumer Price Index (hereafter, CPI), Gross Domestic Product (hereafter, GDP) growth, state budget surplus/deficit, unemployment rate, interest rates' spread, lending interest rates, total reserves, and labour productivity. By using the analysis method of Ordinary Least Square (hereafter, OLS) panel data, the result of this research shows a strong correlation between macroeconomic trend with the banking financial health indicator in the European Banking System, marked by a strong correlation between the NPL ratio and the unemployment rate in Europe. However, The NPL rate harms GDP, state budget, and lending interest rates. Total reserve, inflation rate, and GDP, furthermore, harm the CAR ratio, whereas the state budget and labour productivity have a positive effect on CAR.

Based on the background elucidated above, the authors attempt to discern the influence of the macroeconomic variables to the two macroprudential control indicators in Indonesia. By adapting the research carried out by Balogh (2012), this study, utilized several macroeconomic variables, including the CPI, the GDP growth, interest rate spread (hereafter, IRS), lending interest rate (hereafter, LIR), and foreign exchange reserves (hereafter, DEV) and the macroprudential control indicators, i.e., NPL and CAR ratios.

In more details, there are four main objectives of this study. The first objective is to identify the significance of the macroeconomic variables (CPI, GDP growth, IRS, and LIR) influences to the NPL ratio in Indonesia from the first quarter of 2003 until the fourth quarter of 2013. The second objective is to determine the significance of the influence of the DEV, CPI, and GDP growth as macroeconomic variables to the CAR ratio in Indonesia from the first quarter of 2003 until the fourth quarter of 2013. The third objective is to analyse the influence of the macroeconomic variables including CPI, GDP growth, IRS, and LIR to the NPL ratio in Indonesia from the first quarter of 2003 until the fourth quarter of 2013. The last objective sis to examine the influence of DEV, CPI, and GDP growth to the CAR ratio in Indonesia from the first quarter of 2003 until the fourth quarter of 2013.

The difference in this study with previous research lies in the observation period, the location of the study, and the method of analysis. This study was conducted using quarterly data starting from 2003 to 2013 in Indonesia. Furthermore, this study employed the Vector Error Correction Model (hereafter, VECM) analysis method to study the impacts and influences of macroeconomic variables in Indonesia on macroprudential control indicators, namely the NPL

and CAR ratios. In addition, The VECM method was used due to its focus on scrutinizing the speed or time lag and the strength of a variable's response to the other shock variables by using the impulse response function.

Theoretical Review

Financial System Stability

According to Schinasi in Latumaerissa (2012), financial system stability is defined as the conditions under which the financial system efficiently facilitates the allocation of resources over time from depositors to investors and the allocation of overall economic resources. Financial system stability can also assess, identify, and manage financial risks besides well absorb the turmoil that occurs in the financial and economic sectors. In general, the stability of the financial system is the resilience of the financial system to economic shocks, so that the intermediary function, payment system, and risk spread are still running correctly.

There are four factors supporting the creation of financial system stability, i.e., stable macroeconomic environment, well-managed financial institutions, adequate financial institution supervision, and secure and reliable payment systems. A stable financial system will create trust and supportive environments for depositors and investors to invest in financial institutions, including ensuring the community interests, especially small customers, encouraging efficient financial intermediation functions that ultimately drive investment and economic growth, promote the operations' market, and improve the allocation of economic resources (Latumaerissa, 2012).

Primarily, the financial system stability function aims at analysing developments and assessing risks and recommending the policies necessary to maintain financial stability. To create a stable and resilient financial system, it is essential to monitor the symptoms that can cause a crisis, including regular projection of whether there is a potential risk of harm or not. Risk factors, likewise, also affect the quality of loan indicators through the ability of customers to pay their debts and affect the quality of banking capital that can affect the position of the banking sector portfolio. According to Choi (2014), there are three categories of risk factors. The cyclical indicators include GDP growth, unemployment rate and CPI inflation. On the other hand, the financial condition, including the interest rate, credit and asset prices. The last one is the external factors which include the exchange rate and foreign exchange reserves.

According to the Macroprudential Policy Department of Bank Indonesia (2014), a source of instability can be divided into two, namely endogenous and exogenous risks. Exogenous risks are risks arising outside the financial sector, such as disruption due to macroeconomic or risk of occurrence in the form of natural disasters. Endogenous risks, on the other hand, are the

risks that fall within the financial sector itself, such (Hilbers, Leone, Gill, & Evens, 2000) as credit risks, market risks, and operational risks. The monitoring and assessment of financial system resilience, additionally, are further completed by two approaches, namely macroprudential and macroprudential approaches.

Macroprudential Policy

According to Hilbers, Leone, Gill, and Evens (2000), the definition of macroprudential policy is a policy that has the primary objective of maintaining the stability of the financial system as a whole through limiting the increase in systemic risk. The systemic risk concerning the financial system is a risk that comes from within the financial system itself or spreads through the financial system. The reasons for this are solvency problems (limited liquidity reserves of financial institutions), which potentially spread negative impacts on the main activities of financial intermediation and real output; macroprudential policy reacts to average financial indicators (Dehmej & Gambacorta, 2019).

According to Borio and Shim (2007) in Harun (2014), risk restrictions on the financial system are also useful for reducing the potential for spreading the negative impact (cost) on macroeconomics. Utari, Arimurti, and Kurniati (2012) further explained that macroprudential policy achieves its objectives by preventing imbalances in the financial sector, reducing systemic risks arising from the financial system's procyclicality, and minimising risk-taking from financial institutions that have systemic implications.

Utari, Arimurti, and Kurniati (2012), moreover, stated that macroprudential policy aims to refine the financial cycle and credit cycle to prevent systemic crises and provide sufficient buffers in times of worsening economic conditions. Macroprudential policy in controlling credit mainly aims at reducing the behaviour of banking procyclicality (Brave & Lopez, 2019). Utari, Arimurti, and Kurniati (2012) further argued that macroprudential policy in credit control could be divided into policies related to capital and liquidity requirements, credit restrictions and concentration of assets, and loan eligibility criteria.

Policies related to capital and liquidity requirements may affect the cost and composition of liabilities of financial institutions through increased capital and buffer for liquidity. These policies include countercyclical capital and dynamic loan loss provisioning. Countercyclical capital policy, furthermore, can increase the cost of the capital provision in the boom period, increasing the cost of lending. This policy can also reduce the excessive movement of the credit cycle, thereby reducing the accumulation of systemic risk occurrences. In contrast, the dynamic loan loss provisioning policy requires an increase in the buffer in reserve at the time of the boom.

Analysis Model

Most of the variables used in this study were adopted from the study carried out by Balogh (2012) entitled "Macroprudential Supervision Tools in The European Banking System." In line with the objective of the research, nonetheless, to know the significance of macroeconomic variables impact and the effect on macroprudential indicators in Indonesia, the analysis model was also adapted from the research conducted by Sadeghi and Alavi (2013) using the VECM approach to analyse the influence and impact of a policy in the model.

The variables in this study were modified into seven endogenous variables consisting of macroeconomic variables, such as CPI, GDP growth, IRS, LIR, and DEV; and two macroprudential indicators, namely the ratio of the NPL and CAR, which is divided into two models. The equation model used in this research is as follows.

Model 1 was used to answer the first purpose of this study, which is to identify the significance of the influence and the impact of macroeconomic variables including the CPI, GDP growth, IRS, and LIR to the NPL as one of the macroprudential control indicators.

$$\begin{bmatrix} \Delta NPL_t \\ \Delta CPI_t \\ \Delta GDP_t \\ \Delta IRS_t \\ \Delta LIR_t \end{bmatrix} = \begin{bmatrix} \Delta NPL_{t-1} \\ \Delta CPI_{t-1} \\ \Delta GDP_{t-1} \\ \Delta IRS_{t-1} \\ \Delta LIR_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha_{NPL} \\ \alpha_{CPI} \\ \alpha_{GDP} \\ \alpha_{IRS} \\ \alpha_{LIR} \end{bmatrix} \times [\beta_{NPL}\beta_{CPI}\beta_{GDP}\beta_{IRS}\beta_{LIR}] \times \begin{bmatrix} NPL_{t-1} \\ CPI_{t-1} \\ GDP_{t-1} \\ IRS_{t-1} \\ LIR_{t-1} \end{bmatrix} \quad (1)$$

Model 2, additionally, was used to answer the second problem, which is to discern the significance of influence and the effect of macroeconomic variables, including DEV, CPI, and GDP growth toward one of the macroprudential indicators: CAR.

$$\begin{bmatrix} \Delta CAR_t \\ \Delta lnDEV_t \\ \Delta CPI_t \\ \Delta GDP_t \end{bmatrix} = r \begin{bmatrix} \Delta CAR_{t-1} \\ \Delta lnDEV_{t-1} \\ \Delta CPI_{t-1} \\ \Delta GDP_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha_{CAR} \\ \alpha_{lnDEV} \\ \alpha_{CPI} \\ \alpha_{GDP} \end{bmatrix} [\beta_{CAR}\beta_{lnDEV}\beta_{CPI}\beta_{GDP}] \begin{bmatrix} CAR_{t-1} \\ lnDEV_{t-1} \\ CPI_{t-1} \\ GDP_{t-1} \end{bmatrix} \quad (2)$$

Remarks:
NPLt = the percentage of NPL ratio of commercial banks in Indonesia in period t
CARt = percentage of CAR ratio of commercial banks in Indonesia in the period t
CPIt = percentage of Consumer Price Index in Indonesia in period t
GDPt = the percentage of GDP growth in Indonesia in period t
IRSt = percentage of interest rate spread of commercial banks in Indonesia in period t
LIRt = percentage of a lending interest rate of commercial banks in Indonesia in period t
DEVt = the number of foreign exchange reserves in Indonesia in the period t

Δ = first different notation
Γ = matrix coefficient (p×p)
α = speed of adjustment toward equilibrium
β = long-term coefficient matrix
μ = error term

Research Method

Operational Definition of Variables

The NPL ratio represents the number of nonperforming loans experienced by commercial banks, calculated in terms of a percent against the total volume of loans granted. NPLs, furthermore, are credited with substandard quality, are doubtful, and perform at a loss. The data used are quarterly data during the first quarter of 2003 to the fourth quarter of 2013, obtained from Indonesian Banking Statistics (hereafter, SPI) issued by Bank Indonesia in percent units. CAR, on the other hand, aims to ensure that the bank can absorb losses arising from the activities undertaken. If the CAR value is high, then the bank can finance its operational activities and contribute substantially to profitability. The data used are quarterly data during the first quarter of 2003 to the fourth quarter of 2013, obtained from the SPI issued by Bank Indonesia in percent units. CPI calculations, moreover, are performed to measure inflation and record changes in the purchase price at the consumer level (purchasing cost) of a fixed group of goods and services (fixed basket) that are generally consumed by the community. The data used are quarterly data during the first quarter of 2003 to the fourth quarter of 2013, obtained from the International Financial Statistics (hereafter, IFS) issued by the International Monetary Fund (IMF) in percentages.

GDP growth represents the rate of GDP growth at current prices showing the rate of real development of the aggregate income for each year compared with the previous year. The data used are quarterly data during the first quarter of 2003 to the fourth quarter of 2013, obtained from the Organization for Economic Cooperation and Development (hereafter, OECD Stats) in percent units. IRS, besides, is the difference between the loan interest rate (credit) imposed by banks on loans to the private sector with the value of deposit rates paid by commercial banks for savings or deposits. The data used are quarterly data during the first quarter of 2003 to the fourth quarter of 2013, obtained from the SPI issued by Bank Indonesia in percent units.

LIR is an interest given to borrowers who are differentiated by borrower's credit-worthiness and financing purposes. The data used are quarterly data during the first quarter of 2003 to the fourth quarter of 2013, periods obtained from the SPI issued by Bank Indonesia in percent units. DEV, moreover, represents foreign currency deposits by the monetary authority to finance the balance of payments (BoP) imbalances and maintain economic resilience and

exchange rates. The maintenance of foreign exchange reserves means the ability of a country to ensure the safe payment of international trade and foreign debt will increase. The data used are quarterly data during the first quarter of 2003 to the fourth quarter of 2013, observation period obtained from the IFS issued by the International Monetary Fund (hereafter, IMF) in a million USD. To equate the unit to become a percentage, the data of foreign exchange reserves in this study is transformed into natural logarithm (ln).

Analysis Method

The method used in this study was the Vector Error Correction Model (VECM) method to reconcile the behaviour of short-run economic variables with long-term economic variables (Gujarati, Porter, & Gunasekar, 2013). VECM is a form of Vector Auto Regression (VAR) designed for use in non-stationary data series and is known to have cointegration correlations. According to Enders (2004), the vital concept in VECM is the long-term balance of time series data which is often called cointegration. In VECM, short-term correlations among variables in the system are influenced by deviations from long-term equilibrium. The shared mathematical model of VECM can be described as follows.

$$\Delta \boldsymbol{Y_t} = \boldsymbol{\alpha\beta Y_{t-1}} + \boldsymbol{r_i \Delta Y_{t-1}} + \cdots + \boldsymbol{r_{p-i} \Delta Y_{t-p+1}} + \boldsymbol{u_t} \qquad (3)$$

Remarks:
Yt = vector of observed variables
ΔYt = Yt – Yt-1 α = adjustment matrix
Γi = regression coefficient matrix β = cointegration vector

Before estimating the VECM model, some initial testing was required. First was the stationary test. The stationary test was performed on all variables to avoid spurious regression problems. Unit root testing was done by the Augmented Dickey-Fuller (ADF) method by comparing the value of ADF statistic with Mackinnon Critical Value 5%. The second was the optimal lag length determination, which is useful to eliminate the problem of autocorrelation and heteroscedasticity in a VAR system. Also, an optimal lag determination is beneficial to show how long the reaction is of a variable to other variables. Third was cointegration testing, which was performed to obtain a long-term correlation between the variables that have met the requirements during the integration process, that is where all variables have been stationary on the same degree. Cointegrated variables will show that these variables have the same stochastic trend and then have the same direction of movement in the long run.

The cointegration correlation in a system of equations indicates that in the system, there is an error correction model which describes the dynamics in the short term consistently with the long-term correlation. The fourth was the VECM estimation to indicate the correlation between

one variable and other variables both in the long term and short term. In the short term, only one independent variable affects the dependent variable, while the other is considered constant (*ceteris paribus*). In the long run, all independent variables together affect the dependent variable. The fifth was impulse response analysis performed to see the response of an endogenous variable to the shock of other variables in the model. The impulse response also describes the rate of shock from one variable to another variable over a while so the effect of the shock of a variable on another variable can be seen, until the effect is lost or returned to the equilibrium point. The sixth was variance decomposition that provided information on the proportion of movement of the effect of the shock on a variable to the shock of another variable in the current period and the period to come. This test can be used to find out how significant is the contribution of each variable in the model to the endogenous variable being observed.

Results and Discussion

In the long run, only the CPI, GDP growth, and IRS significantly affect the NPL ratio. In the short term, only the CPI, GDP growth, and IRS variables significantly affect the NPL ratio.

The Coefficient of Error Correction Term (hereafter, ECT) shown by the CointEq1 value in Table 1 is the variable speed of adjustment in case of a shock. Negative and significant ECT values show a correction of the movement of a variable toward a long-term equilibrium. This means that the rate of change in the NPL ratio to achieve a new equilibrium condition after the shock caused by changes in the macroeconomic indicator value is 68% over a period (quarter). The relatively large ECT value indicates that the time required by the NPL ratio variable to achieve faster equilibrium.

Table 1. VECM Estimation Results Model 1 (NPL)

Long Term			
Var	**Coeff.**	**t-stat**	**Explanation**
C	-38.081	-	-
NPL(-1)	1.000	-	-
CPI(-1)	0.492	5.205	Significant
GDP(-1)	-1.192	-2.922	Significant
IRS(-1)	0.457	1.917	Significant
LIR(-1)	0.128	0.455	Not significant
Short Term			
Var	**Coeff.**	**t-stat**	**Explanation**
CointEq1	-0.680	-4.653	Significant
D(CPI(-1))	0.469	3.434	Significant
D(GDP(-1))	0.687	-2.304	Significant
D(IRS(-1))	0.392	1.820	Significant
D(LIR(-1))	-0.170	-0.369	Not significant
R-squared	0.723		
F-stat	3.392		

Source: Processed data

Exp: t-table 5% = 2.023; t-table 10% = 1.685;
F-table 5% = 2.61; F-table 10% = 2.09

Based on the F test, the parameter test results on the VECM model estimation in the long term, all significant variables are used as estimators. This is proven by the F-statistic score (3.392182), which is higher than F-table (2.61) at 5% of significance level.

Table 2. VECM Estimation Results Model 2 (CAR)

Long Term			
Var	**Coeff.**	**t-stat**	**Explanation**
C	1411.05	-	-
CAR(-1)	1.00000	-	-
lnDEV(-1)	-125.86	-4.737	Significant
CPI(-1)	-4.562	-2.539	Significant
GDP(-1)	61.419	4.038	Significant
Short Term			
Var	**Coeff.**	**t-stat**	**Explanation**
CointEq1	-0.037	-1.951	Significant
D(lnDEV(-1))	0.471	0.127	Insignificant
D(CPI(-1))	0.034	0.202	Insignificant
D(GDP(-1))	1.708	1.627	Insignificant
R-squared	0.795		
F-stat	2.645		

Source: Processed data

Exp: t-table 5% = 2.021; t-table 10% = 1.684;
F-table 5% = 2.84; F-table 10% = 2.23

In the long run, variables of DEV, CPI, and GDP growth significantly affect CAR ratios. In the short term, variables of DEV, CPI, and GDP growth are not significant in influencing CAR ratios.

The ECT shown by the CointEq1 value in Table 2 represents the variable speed of adjustment in case of a shock. Negative and significant ECT values show a correction of the movement of a variable toward a long-term equilibrium. This means that the rate of change in the CAR value to achieve a new equilibrium condition after the shock caused by the change in the macroeconomic indicator value is 3% over a period (quarter). The small value of ECT indicates that the CAR variable requires a longer time to achieve a balance. Based on the F test, the parameter test results on the VECM model estimation in the long term, all significant variables are used as estimators. This is proven by the value of F-statistics (2.645867) higher than F-table (2.23) at the level of significance of 10%.

The Influence of Macroeconomic Variables on Macroprudential Indicators (Non-Performing Loan Ratios) in Indonesia

The global economic and financial crisis of 2008 is an example of a linkage between monetary and macroprudential policies. Especially in the United States, a systemic crisis that originated

from imbalances in the financial sector in the event of excessive lending in the property sector and the fall in asset prices, have an impact on the global economic slowdown. Monetary authorities of various countries respond to this condition by adopting a loose monetary policy through the application of low-interest rates and quantitative easing to the market.

Indonesia, affected by the crisis, also responded by lowering the benchmark interest rate in line with the weakening of economic growth. The loose monetary policy adopted and the start of the flow of foreign funds into Indonesia as a result of the weakening of developed countries' economies, helped speed up the recovery of Indonesia's economic growth. The improved economic growth conditions, more substantial exchange rates, and low-interest rates provide room for increased credit growth. On the macroprudential side, to accelerate credit growth, Bank Indonesia encourages banks to conduct intermediation while maintaining liquidity and capital adequacy.

CPI is the percentage used to analyse the rate of inflation. Based on the results of impulse response analysis, the NPL variable gives a negative response to CPI variable shock, which means the increase of inflation (CPI), causing a decrease of banking NPL ratio. This is in line with Balogh's (2012) study, which stated that inflation (CPI) is shown to harm the NPL ratio in developing countries. The Fisher Effect Theory (Mankiw, 2006) explained that a rise in nominal interest rates causes rising inflation. An increase in inflation followed by an increase in lending rates may lead to a debtor's ability to pay credit instalments to be weak, which could risk becoming a bad credit. This condition leads to the NPL ratio of commercial banks that are assured to increase. However, the result of impulse response in this research shows that the NPL ratio responded negatively to the significant inflation shock despite the less favourable domestic economic condition. However, the risk in the banking industry was still maintained. According to the Macroprudential Policy Department of Bank Indonesia (2014), this condition is inseparable from banking efforts in improving the quality of risk management and adjusting credit growth amid the slowdown in the domestic economy.

In terms of economic growth, the NPL variable gives a positive response to the shock of GDP growth variable, which means the increase of GDP growth leads to the increase of banking NPL ratio. On the contrary, the decrease in GDP growth led to a decrease in the banking NPL ratio. These empirical findings, however, are not per previous theories and research, especially with the one conducted by Balogh (2012) who expected negative results. Balogh (2012) further argued that when the economic slowdown occurs, customers find it challenging to pay off their debts and the probability of default or bank NPLs will definitely increase.

In line with the results of the impulse response analysis of this study, which states that the decline in GDP is directly proportional to the decline in NPL ratio, the Macroprudential Policy Department of Bank Indonesia (2014) also asserted that the credit risk of the banking industry

is reflected in the NPL ratio showing a decline amid the economic slowdown. This is because although some disturbances have the potential to encourage the rise of NPLs in the banking industry such as higher fuel prices, rising inflation, and falling commodity prices, the banking industry can overcome these disruptions by improving the quality of prudence in disbursing credit and implementing more effective risk management.

The research results on the positive correlation between economic growth and NPL ratio are also supported by Choi (2014), whose study concluded that the banking sector tends to behave proclitically (following economic circumstances). At a time when the economy is on the rise, banks find it easier to lend. According to Choi (2014), it is like sowing excessive credit risk seeds that can undermine financial system stability later in the day when a recession occurs.

Interest rate spread is the difference between loan interest rates and deposit interest rate. Based on the results of impulse response analysis, the NPL variable gives a positive response to the interest rate spread variable shock, which means an increase in the interest rate spread which leads to an increase in the ratio of banking NPLs. This finding is in line with Balogh's (2012) case studies of EU countries expecting a positive correlation between the interest rate spread and NPL ratio. Choi's (2014) study with the Macau-PRC regional case study also further confirmed that higher interest rates impose higher funding costs for borrowers, and high debt burdens increase the likelihood of default (default). According to the Macroprudential Policy Department of Bank Indonesia (2014), an increase in inflation responded by an increase in interest rates, which led to increased production costs and other overheads. This increase in cost has, in turn, resulted in a decline in the performance of the real sector (corporate and household), which is also one of the factors that potentially increase credit risk. According to the analysis of variance decomposition, the interest rate shock has a considerable impact on the ratio of NPLs in Indonesia that is equal to 22.7%. Choi (2014) also confirmed that fluctuations in interest rates pose the most prominent risks to the quality of banking assets in Macau. Almost the same as the discussion of interest rates above, based on the results of impulse response analysis, the NPL variable gives a positive response to the loan interest rate shock which means the increase in the loan interest rate causes the increase of banking NPL ratio. The loan interest rate is the interest rate set by the bank to the debtor as the loan interest rate for the debtor and the incentive for the bank to lend. According to the Macroprudential Policy Department of Bank Indonesia (2014), when there is an imbalance in Indonesia's financial sector, the central bank will implement tight monetary policy through an increase in the BI Rate. The increase in the BI Rate has had a significant impact on the increase in the lending rate of the banking industry, which has the potential to increase its lending rate in banks and other debt instruments. Based on the result of VECM analysis, the loan interest rate variable is not significant in influencing NPL ratio. Similarly, according to the results of variance decomposition analysis, the variable lending rate contributes a relatively small shock compared to other variables that

are only equal to 7.04%. This is because the banking industry in Indonesia has only adjusted the loan interest rate increase between five to six months since the BI Rate increase.

Influence of Macroeconomic Variables on Macroprudential Indicators (Capital Adequacy Ratio) in Indonesia

Based on the results of the impulse response analysis, CAR variables provide a negative response to the shock of foreign exchange reserves, which means an increase in foreign reserves causes a decrease in the banking CAR ratio. On the contrary, the decline in foreign reserves led to an increase in the banking CAR ratio. This finding is in line with Balogh's (2012) study, which stated that there is a negative correlation between foreign exchange reserves and the quality of banking capital in the EU. Foreign exchange reserves are useful to support the resilience of the external sector and to maintain the sustainability of Indonesia's economic growth. The declining position of Indonesia's foreign reserves is supported by an increase in expenditures for official foreign debt payments and the use of foreign exchange to stabilise the rupiah. Although Indonesia's foreign exchange reserves had been unsteady amid the dynamics of the global economy, the resilience of the banking industry continued to show positive performance with the Bank's capital ratio maintained at a reasonably high level.

Shocks that occurred in the consumer price index responded positively by the CAR ratio, which means the increase in inflation (CPI) led to an increase in the ratio of banking CAR. The positive inflation and CAR ratios in this study are not in line with Balogh's (2012) analysis, which argued that there is a negative correlation between the inflation rate and the bank's capital ratio in the EU. According to Babihuga (2007), through case studies in 96 countries, the bank's capital ratios depend on what happens to bank earnings when inflation is high. Countries with smaller financial systems tend to hold more capital. In the event of an economic slowdown, banks will increase their capital ratios by adjusting the denominator (i.e. by reducing portfolio assets) to maintain macroprudential regulatory requirements. Ejoh and Iwara (2014) claim that the effect of inflation is asserted on the aspect of banking capital depends on the attitude of banks in anticipating the occurrence of inflation. If the bank anticipates an increase in inflation and adjusts interest rates, it will have a positive impact on profitability related to the banking capital aspect.

Under the result of impulse response analysis, the CAR variable gives a negative response to the shock of GDP growth which means the increase of GDP growth causes the decrease of CAR ratio of banking. Conversely, the decline in GDP growth increases the banking CAR ratio. The results of this study are in line with the research conducted by Balogh (2012), which stated that there is a negative correlation between economic growth and capital quality of banking in the EU. According to the Macroprudential Policy Department of Bank Indonesia (2014), the strength of banking capital reflected in the value of CAR increased amid the

pressure of Indonesia's economic slowdown. The high CAR value of the banking industry shows that banks still have the room for business expansion while also having considerable potential to mitigate risks arising from business activities of the bank and changes in economic and business conditions. In line with the analysis done by Babihuga (2007), the banking system tends to have higher capital ratios when economic conditions are declining. This situation occurs because the banking industry takes precautions to ensure its security during economic slowdown by holding more capital as a precaution against the possibility of write-offs and provisioning.

Conclusion

The result of this study indicates that the resilience of the financial system in Indonesia is maintained amid an economic slowdown/downturn. Therefore, the economic downturn does not cause systemic effects that disrupt the stability of the financial system. Foreign exchange reserves and GDP growth harm CAR ratios, while inflation (CPI) has a positive impact on CAR ratios. This fact shows that, despite the rise in inflation, the declining foreign exchange reserves, and the slowing economic growth in Indonesia amid the dynamics of the global economy, the resilience of the banking industry capital still indicates a positive performance. This positive sentiment is useful to minimise risks arising from the business activities of banks and changes in macroeconomic conditions.

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