

Determinant of net interest income of commercial banks in Indonesia**R. Mahelan Prabantarikso^a, Zaenal Abidin^{b*}, Edian Fahmy^c, Mayda Tyastika^d and Amabel Nabila^e**^aAssistant Professor, Sekolah Tinggi Ilmu Ekonomi Indonesia Banking School, Jakarta, 12730, Indonesia^bAssociate Professor, Perbanas Institute, Jakarta, 12940, Indonesia^cUniversitas Pamulang, Tangerang Selatan, Banten, Indonesia^dAssistant Professor, Perbanas Institute, Jakarta, 12940, Indonesia^eAssistant Lecturer, Universitas Brawijaya, Malang, 65145, Indonesia**CHRONICLE***Article history:*

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*Keywords:**Net interest income (NII)**Commercial Banks**Credit**NPL**Vector Error Correction Model***ABSTRACT**

This study aims to identify the factors that contribute to the formation of Net interest income (NII) for commercial banks in Indonesia in the short and long-term using the Vector Error Correction Model (VECM). The results showed that in the short term all variables in each period tend to adjust to achieve long-term balance. In the short term, the variables that affect NII are credit and NPL of large and retail trade, construction credit, transportation credit and NPL warehousing and communication, as well as lending rate facility. While in the variable length figures that affect NII are credit variables and NPL large and retail trade, Credit and NPL Transportation, warehousing and communication, other credit and Third-Party Funds (Deposit) collected. The analysis of Impulse Response Function can be proven that NII most quickly achieves stability when dealing with the shocks of large trade and retail NPL. Meanwhile, in the Forecasting Variance Decomposition analysis, it can be concluded that the variable that gives the greatest contribution to NII is the amount of construction credit.

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1. Introduction

The banking industry in Indonesia continues to experience growth, seen from the value of its total assets, banking in Indonesia recorded a growth of 63% from Rp5,031 trillion in 2013 to Rp8,204 trillion as of December 2018. Meanwhile, when viewed from the source of funds (deposit) collected, Indonesian banks recorded a rapid growth of funds of 59% from Rp4,134 trillion in 2013 to Rp 6,586 trillion as of December 2018. The growth in the source of funds was also followed by the growth of the amount of credit disbursed from Rp 4,897 trillion in 2013 to Rp 7,939 trillion per December 2018 or grew 62% (Bank of Indonesia, 2018). Judging from the credit growth, the construction sector recorded the highest credit growth of 22.08% (yoy), in line with the rampant infrastructure development in various regions. The mining and quarrying sector also recorded high growth of 21.38% (yoy). Furthermore, the transportation, warehousing and communication sectors also grew high by 20.37% (yoy), primarily supported by an increase in credit in the telecommunications services subsector which grew 44.60% (yoy). Large trade and retail sector credit which is the bank's flagship sector in channeling its credit (18.43%) also recorded significant growth of 10.23% (yoy), higher than the previous year which only grew 5.24% (yoy).

Some previous studies have found that economic conditions and monetary policies for the economy will also have an impact on the profitability of banks or better known as Net Interest Income (NII). Among them is Kumar et al. (2020), Prasanto et al. (2020), Yüksel et al. (2018), and Zimmermann (2017). Macro prudential factors such as lending rate can affect bank profitability (Kumaran & Ismail, 2018; Mukolu & Adeleke, 2020; Syamni & Musnadi, Said Faisal, 2017) and micro prudential factors such as bad credit (NPL) (Tan & Floros, 2012).

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At the same time Borio et al. (2017) conducted research on how monetary policy affects bank profitability. The research was conducted on 109 International Banks headquartered in 14 developed countries for the period 1995-2012. The study found a positive link between the structure of interest rates and the profitability of banks. A subsequent study of Bikker and Vervliet (2018) that sampled banking in America found that low interest rates can certainly damage bank performance and depress bank margins. Then Kohlscheen et al. (2018) found that long-term interest rates tend to increase profitability. Research on the contribution of NII formation continues to grow and becomes an interesting topic to research in Indonesian Banking because there is a tendency to decrease NII. Currently there are a lot of research on the contribution of NII in Indonesia but very limited that includes all kinds of variables that affect NII such as the use of lending rate (macro prudential) and five types of credit and NPL as well as banking deposits or better known as micro prudential. This study aims to identify the factors that contribute to the formation of NII for Commercial Banks in Indonesia in the short and long term. The specific objectives of this study are further detailed through the analysis of the factors of the macro prudential and micro prudential variables on the NII of Commercial Banks in Indonesia if a variable experiences shocks and forecasts in the future.

2. Literature Review

Lamb et al. (2013) aimed to analyze the bank's products that contributed to the formation of the largest profit. The study used net profit as a dependent variable and as an independent variable among them were Commercial Loans; Agriculture Loans; Agriculture Operating Loans; Commercial Op Loans; Total Commercial Deposits; Agriculture Real Estate; Consumer Real Estate; Consumer Other Loans; and Equity are categorized as micro prudential factors while Gross Domestic Product, EC Unemployment rate is categorized as macro prudential. The results obtained from the study include Commercial loans, deposits and changes in consumer real estate have a significant positive effect on profit formation. The results of their next study mentioned that total securities, commercial real estate, and agriculture real estate have a significant negative effect on profit formation. The results of the study mentioned that commercial term notes have no significant effect on profit. As for other variables that are not mentioned, described has no effect on profit because it is affected by multicollinearity. Similar research was conducted by Duraj and Moci (2015) with slightly different analysis results. The difference in the results of the study lies in credit variables that negatively affect bank profits, while in Lamb et al. (2013) it is explained that not every sector given credit distribution has a negative influence on profit. Duraj and Moci's research (2015) also explained about NPL variables that have no effect on ROE because the NPL value is very high. Variable inflation is described as having a significant negative effect on ROE. Deposit and GDP variables are described to have a significant positive effect on ROE. Vejzagig and Zarafat (2014) which uses data ranging from 1995-2011 and aims to analyze the influence of macroeconomic factors on commercial bank profits in Malaysia. The ROA variable is selected to be a dependent variable. Variable Real Interest Rate; Consumer Price Index; Real GDP is chosen to be an independent variable. The results of the first study showed that Real GDP has a significant positive effect on banking profits in Malaysia. Both Real Interest Rates have no effect on banking profits in Malaysia. The three CPI have no significant negative effect on Maybank but are significant to Public Bank and Bank Leong.

Javaid et al. (2011) aims to analyze internal factors that affect bank profits in Pakistan. They used ROA variables as dependent variables while representing profit and deposit variables, total credit, total assets, and total equity as independent variables. The results explain that the variable total deposit and equity will have a significant positive effect on bank profits in Pakistan. Variable total assets have a significant negative impact on bank profits in Pakistan. As for the total variable, credit channeled will contribute to the bank's profit getting bigger if the distribution is getting bigger, but the effect is not significant. Alper and Anbar's research (2011) aims to analyze the factors that affect the profits of Commercial Banks in Turkey in terms of macroeconomics and banking specifications. The study used variable amounts of credit, deposit, real interest rates, total assets, GDP and inflation as independent variables and ROA and ROE as dependent variables. The results explain that total credit and assets have a significant negative effect on ROA and ROE and real interest rates have a positive effect on ROA and ROE. Dezfouli et al. (2014) generally aimed to identify the bank's profit from the effectiveness of liquidity management. The research, among others, explains one of the factors that is NPL that can erode profit if NPL increases. The interesting thing about their research is the importance of a bank maintaining its liquidity through increasing the amount of deposit. Attention to the high GDP contributing sector is also important as it relates to expectations of future returns. Almazari's research (2014) aims to compare the factors that affect profits from internal banks in Saudi and in Jordan. The study explained that profits at Saudi banks tend to be influenced by equity, deposit, and investment. The bank's profit in Jordania tends to be influenced by total credit, deposit, and equity. The research became interesting because it turns out that the factors that affect profit can be different in different countries. Total credit channeled by banks in Jordan affects profit because the quality of the credit provided is relatively good. This shows that the bank's ability in Jordan in managing its product assets in the form of credit has been effective. According to Haddawe and Flayyih (2020) deposit has a significant influence on profitability indicators. Savings became the largest deposit that contributed to profitability followed by deposits and current accounts that contributed the least in profitability.

Borio et al. (2015) conducted research on how monetary policy affects bank profitability. The research was conducted on 109 International Banks headquartered in 14 developed countries for the period 1995-2012. The study found a positive link between the structure of interest rates and the profitability of banks. On the one hand, short-term interest rates and the tilt

of the yield curve are positively linked to the bank's net interest income. On the other hand, higher interest rates increase loan cost losses, are consistent with their impact on borrowing costs and possible defaults and depress non-interest income. They also found that the impact of interest rates on bank profitability is huge when interest rates are low. Therefore, the purpose of this research is to investigate the elements that influence the establishment of NII for commercial banks in Indonesia in the short and long term. The aims of this study are further defined through an examination of the effects of macroprudential and macroprudential variables on the NII of Indonesian commercial banks if a variable suffers shocks and forecasts in the future.

2. Methods

2.1 Research variables

The variables used in this study were categorized into two categories namely dependent and independent variables. Determination of dependent and independent variable types refers to Lamb (2013). The dependent variable in this study was Net Interest Income (NII). NII is an indicator used to determine the bank's ability to manage its productive assets to generate net profit. Independent variables in this study include factors-factors that affect NII Commercial Banks in Indonesia are:

1. Total loans distributed to 5 sectors of the economy from Commercial Banks in Indonesia
2. NPL for 5 economic sectors of Commercial Banks in Indonesia
3. Deposit amount collected by Commercial Banks in Indonesia
4. Lending rate facility

2.2 Research object

The population in this study is financial institutions then since commercial banks are part of financial institutions. The sample of this study is Commercial Banks in Indonesia. Commercial Banks in Indonesia were chosen as samples because to better represent the actual conditions that occur in the scope of Indonesian banks. The data is time series with monthly intervals with a period from January 2015 to March 2019.

Analytical tools

This study used vector error correction model (VECM) data analysis tool. VECM is the restricted VAR model that can be used to see relationships between nonstationary variables but has the potential to be integrated. Integration is a linear combination of non-stationary variables, where there is a potential for long-term relationships. Short-term relationships can be obtained through the error correction model. The co-integration equation will be incorporated into the model after co-integration testing on the model used (Firdaus, 2011). Most time series data have a stationary level of first difference or I (1). VECM will be used if the data obtained has a stationary degree I (1) in anticipation of loss of information. The analytical tool model used in this study is almost like Al-Tamimi (2010), and Lamb (2013) as follows:

$$\begin{aligned} \Delta NII_t = & \alpha_1 + \alpha_{NII} \Delta t-1 + \sum_{i=1}^p \alpha_{11}(i) \Delta NII_{t-1} + \sum_{i=1}^p \alpha_{13}(i) \Delta CMining_{t-1} + \sum_{i=1}^p \alpha_{15}(i) \Delta CTrading_{t-1} \\ & + \sum_{i=1}^p \alpha_{17}(i) \Delta CConstruction_{t-1} + \sum_{i=1}^p \alpha_{18}(i) \Delta CTransport_{t-1} + \sum_{i=1}^p \alpha_{19}(i) \Delta COther_{t-1} \\ & + \sum_{i=1}^p \alpha_{21}(i) \Delta NPLMining_{t-1} + \sum_{i=1}^p \alpha_{21}(i) \Delta NPLTrading_{t-1} + \sum_{i=1}^p \alpha_{21}(i) \Delta NPLConstruction_{t-1} \\ & + \sum_{i=1}^p \alpha_{20}(i) \Delta NPLTransport_{t-1} + \sum_{i=1}^p \alpha_{21}(i) \Delta NPLOther_{t-1} + \sum_{i=1}^p \alpha_{22}(i) \Delta Deposit_{t-1} \\ & + \sum_{i=1}^p \alpha_{23}(i) \Delta LendingRate_{t-1} + \varepsilon_{kp} \end{aligned}$$

Information:

Mining (mining and quarrying credits); Trade credits, large and retail); Construction (construction credit); Transportation (transportation credit, warehousing and communication); Klainnya (other credit), and to; NPL Mining (mining and quarrying); NPL Trade (trade, large and retail); NPL construction (construction); NPL Transportation (transportation, warehousing and communication); Other NPL (other loans), deposit (third party funds), Lending rate (Lending rate facility) and NII (Net Interest Income).

3. Results and Discussion

3.1 Unit root test results

Before performing a time series analysis, it should test the stationarity of the data. Test data stationarity using Dickey Fuller Augmented Test (ADF). The hypotheses that underlie data stationarity testing are:

$H_0: \delta = 0$ (data is not stationary)

$H_1: \delta \neq 0$ (data is stationary)

Here are the results of the data stationarity of one endogenous variable and 12 ex-eigenvariables.

Table 1
Data Stationary Results

variable	Stationary test at the		Stationary test on first difference	
	Probabilities ADF	information	Probabilities ADF	information
NII	0.0008	Stationary	0.0001*	Stationary
Mining and quarrying credits	0.3551	Not stationary	0.0000*	Stationary
Large trade and retail credits	0.1002	Not stationary	0.0000*	Stationary
Construction Credits	0.2169	Not stationary	0.0000*	Stationary
Transportation credits, warehousing, and communication	0.8535	Not stationary	0.0000*	Stationary
Other Credits	0.0015	Stationary	0.0005*	Stationary
NPL mining and quarrying	0.7824	Not stationary	0.0000*	Stationary
NPL large trade and retail	0.4945	Not stationary	0.0000*	Stationary
NPL Construction	0.1435	Not stationary	0.0000*	Stationary
NPL Transportation, warehousing, and communication	0.7226	Not stationary	0.0000*	Stationary
Other NPL	0.7076	Not stationary	0.0000*	Stationary
Lending Facility	0.4986	Not stationary	0.0000*	Stationary
Deposit	0.0968	Not stationary	0.0000*	Stationary

Based on Table 1 after all variables became stationary after performing the first difference ($\alpha = 0,05$) and it can be interpreted that all variables are stationary in the first differentiation. Therefore, integrated first order or I (1).

Cointegration test

Based on the cointegration test using Johansen, the results show that at lag 1 the value of trace statistics and maximum eigenvalue at $r = 1$ is greater than the critical value with a significance level of 5%. This means that the null hypothesis which states that there is no cointegration is rejected and the alternative hypothesis which states that there is cointegration that cannot be rejected. So that among the twelve variables in this study, there is at least one cointegration at the 5% significance level.

Table 2
Number of Integrated Equations

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.934891	608.1809	on	on
At most 1 *	0.899916	477.0598	334.9837	0.0000
At most 2 *	0.815847	366.5758	285.1425	0.0000
At most 3 *	0.718649	285.3603	239.2354	0.0001
At most 4 *	0.663283	224.4889	197.3709	0.0011
At most 5 *	0.620339	172.2403	159.5297	0.0084
At most 6 *	0.528097	125.7534	125.6154	0.0490
At most 7	0.380497	89.70630	95.75366	0.1212
At most 8	0.353616	66.72212	69.81889	0.0861
At most 9	0.267567	45.77680	47.85613	0.0774
At most 10 *	0.249038	30.83042	29.79707	0.0379
At most 11 *	0.190797	17.08323	15.49471	0.0286
At most 12 *	0.134281	6.921351	3.841466	0.0085

Note: the sign (*) indicates an integrated equation and (**) indicates p-values 5 percent.

VECM model estimation

After obtaining the co-integration relationship between the twelve research variables, the next stage forms the VECM model. If there is a co-integration relationship between the research variables, then the estimation is done with VECM. VECM estimation results for short and long term can be seen in Table 3 and Table 4.

Table 3
Short-Term Influence

variable	coefficient	T Statistics
CointEq1	2.6442	3.6089
D (C. Mining (-1))	-1.5875	-1.0628
D (C. Trading (-1))	22.4697	3.5095
D (C. Construction (-1))	10.2973	2.2782
D (C. Transportation (-1))	-11.0412	-3.0777
D (C. Other (-1))	3.9304	0.4738
D (NPL. Mining (-1))	0.3340	0.4535
D (NPL. Trading (-1))	8.6686	3.3838
D (NPL. Construction (-1))	2.1074	1.3084
D (NPL. Transportation (-1))	2.6601	2.4029
D (NPL. Others (-1))	-2.8648	-1.6181
D (Lending Facility (-1))	0.6961	3.1737
F (Deposit (-1))	11.7700	1.0672
F (NII (-1))	-0.8155	-4.1263

Note: italic print shows significant at a real rate of 5 percent.

Based on Table 3, the estimation model for VECM is obtained in the short term as follows:

$$\begin{aligned} \Delta Y_t = & -0,8155 D(Y(-1)) - 1,5875D(X1(-1)) + 22,4697 D(X2(-1)) + 10,2973D(X3(-1)) - 11,0412 D(X4(-1)) \\ & + 3,9304 D(X5(-1)) + 0,3340 D(X6(-1)) + 8,6686 D(X7(-1)) + 2,1074 D(X8(-1)) \\ & + 2,6601 D(X9(-1)) - 2,8648 D(X10(-1)) + 0,6961D(X11(-1)) + 11,7700 D(X12(-1)) \\ & + 2,6442, \end{aligned}$$

In the short-term variable credit and NPL trade large and retail, Construction Credit, Credit and NPL Transportation, warehousing and communication, Lending rate facility, and NII in the previous time had a significant effect on NII variables at the present time. While the variable credit and NPL mining and quarrying, Credit and other NPL, NPL Construction, and Deposit Collected is insignificant so it has no effect on NII.

The amount of large trade and retail credits positively affects NII by 22.4697% which means that every large trade and retail credit increases by 1%, which will cause NII to increase by 22,469% in the short term.

Large and retail trade NPL has a positive influence on NII of 8.6686% which means that every large trade and retail NPL increases by 1%, which will cause NII to increase by 8.6686% in the short term.

Construction Credit has a positive influence on NII of 10.2973% which means that each Construction Credit increases by 1%, which will cause NII to increase by 10.2973% in the short term.

Transportation, warehousing, and communication loans negatively affect NII by -11.0412% which means that every Transportation, warehousing, and communication Credit increases by 1%, which will cause NII to decrease by 11.0412% in the short term.

NPL Transportation, warehousing and communication positively influenced NII by 2.6601% which means that every NPL of Transportation, warehousing and communication increased by 1%, it will cause NII to increase by 2.6601% in the short term.

Lending rate Facility has a positive influence on NII of 0.6961% which means that each Lending Facility increases by 1%, which will cause NII to increase by 0.6961% in the short term.

The above results are consistent with Dezfouli et al. (2014) they explained about one of the factors that npl that can erode profit if NPL increases.

The above results are also consistent with Borio et al. (2017) that there is a positive relationship between the lending rate facility structure and the bank's profitability. On the one hand, short-term interest rates and the tilt of the yield curve are positively linked to net interest income. But it's different from the results of Almazari (2014) which states that the Deposit affects NII but from the above research results for the short-term influence of Deposit to three commercial banks does not affect NII.

Table 4
Long-Term Influence

variable	coefficient	T Statistics
D (C. Mining (-1))	1	1.2132
D (C. Trading (-1))	-10.8193	-10.4398
D (C. Construction (-1))	1.3744	1.7839
D (C. Transportation (-1))	1.9409	3.6545
D (C. other (-1))	-6.9311	-5.4452
D (NPL. Mining (-1))	-0.0913	-0.9287
D (NPL. Trading (-1))	1.6711	4.4113
D (NPL. Construction (-1))	0.3389	1.8162
D (NPL. Transportation (-1))	0.7609	4.7505
D (NPL. Others (-1))	-0.4254	-1.2746
D (Lending rate Facility (-1))	-0.0057	-0.1894
D (Deposit -1)	-10.6852	-6.0887
D (NII (-1))	0.1257	3.9195

Note: italic print shows significant at a real rate of 5 percent.

In the long term it explains that credit variables and NPLs of large and retail trade, Transportation Credit and NPL, warehousing and communication, Other Loans, Deposit (Third Party Funds) are collected and NII has a significant impact on NII in the long run. In the long run the amount of large trade and retail loans negatively affects NII by -10.8193% which means that every large trade and retail credit increases by 1%, it will cause NII to decrease by 10.8193%.

Large trade and retail NPL positively influenced NII by 1.6711% which means that every large trade and retail NPL increases by 1%, which will cause NII to increase by 1.6711% in the long run.

In the long run, the amount of Transportation Credit, warehousing and communication has a positive influence on NII of 1.9409% which means that every Transportation, warehousing, and communication Credit increases by 1%, which will cause NII to increase by 1.9409%.

In the long term NPL Transportation, warehousing and communication positively influenced NII by 0.7609% which means that every NPL of Transportation, warehousing and communication increased by 1%, it will cause NII to increase by 0.7609%.

In the long run, the amount of other loans negatively affects NII by -6.9311% which means that every Other Credit increases by 1%, it will cause NII to decrease by 6.9311%.

In the long term, third party funds collected negatively affect NII by -10.6852% which means that each Third-Party Fund collected has increased by 1%, it will cause NII to decrease by 10.6852%. There are differences with the results of Borio et al. (2017) which states there is a positive relationship between the structure of lending rate facility and bank profitability (NII) because this paper shows there is no significant relationship of lending rate with NII. On the contrary, the long-term influence of the Deposit has an influence on NII Consistent with the results of Almazari (2014).

Table 5

Short-Term Model Goodness Test

R-squared	0.867455
Adj. R-squared	0.811223

From the estimation model that has been obtained it is known that the value of goodness model is R^2 Adjusted by 81.12% (Table 5). It can be interpreted that twelve independent variables can describe dependent variables by 81.12% and the remaining 18.88% described by other factors outside the model.

Impulse response function (IRF)

IRF analysis will explain the impact of shocks on one variable on other variables, which in this analysis is not only short-term but can be analyzed for some time in the future as long-term information. In this study, the IRF test was conducted to show the NII response when the independent variable experienced shocks. The effect of shocks from the independent variables on NII can be measured from current events as well as events in the future. The IRF test also represents how long it takes for NII to return to its original state after one of the independent variables has experienced a drastic increase or decrease in value. IRF test results can be seen in Fig. 1 to Fig. 12.

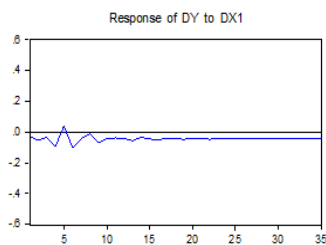


Fig. 1. Response of DY to DX1

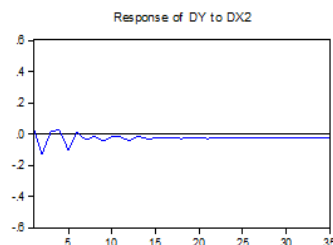


Fig. 2. Response of DY to DX2

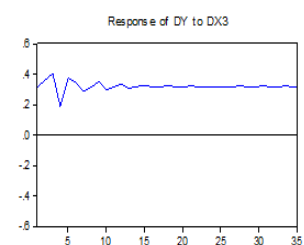


Fig. 3. Response of DY to DX3

Fig. 1 indicates that the response given by the variable NII (Y) due to a shock in the variable Number of mining and quarrying loans (X1) NII responded negatively from the beginning of the month. In the 5th month NII responded positively and reached its maximum point. The response achieved stability in the 18th period, which was -0.045326 percent of the initial value before the shock.

Fig. 2 shows that the response given by the variable NII (Y) due to a shock to the variable Amount of large trade and retail credits (X2), NII responded negatively from the 2nd month, the following month NII responded positively and began to reach the maximum in the 4th month. The response achieved stability in the 15th period, which was -0.026798 percent of the initial value before the shock.

Fig. 3 shows that the response given by the NII variable (Y) due to a shock to the Construction Credit Amount (X3) variable NII responded positively. The response achieved stability in the 16th period, amounting to 0.316957 percent of the initial value before the shock.

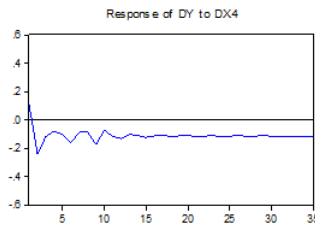


Fig. 4. Response of DY to DX4

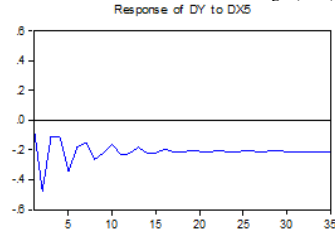


Fig. 5. Response of DY to DX5

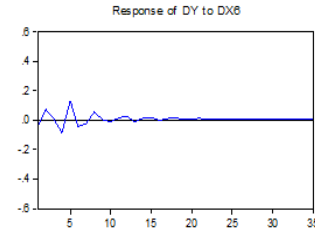


Fig. 6. Response of DY to DX6

Fig. 4 indicates that the response given by the variable NII (Y) due to the shock in the variable Amount of Transportation Credit, warehousing, and communication (X4). NII responds negatively from the 2nd month. The response achieved stability in the 19th period, which was -0.111099 percent of the initial value before the shock. Fig. 5 shows the response NII received was from a shock that occurred to the Number of Other Credits (X5) that NII responded negatively to. Starting from the 2nd month the value is volatile until the 15th month and begins to achieve stability in the 16th month of -0.194698 percent. Fig. 6 describes NII's response to the shocks that occurred in the mining and quarrying NPL (X6) which were responded negatively from the beginning of the month by NII. However, NII response got a positive score in the 2nd to 3rd month. The NII response was volatile until the 18th month and reached a stability point in the 19th month of 0.005322.

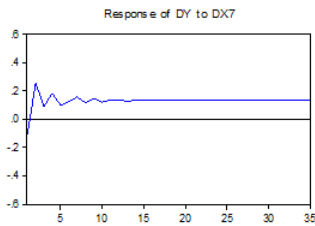


Fig. 7. Response of DY to DX7

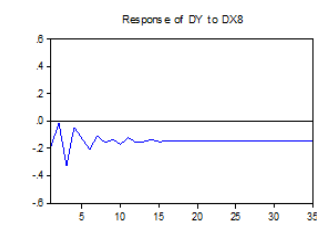


Fig. 8. Response of DY to DX8

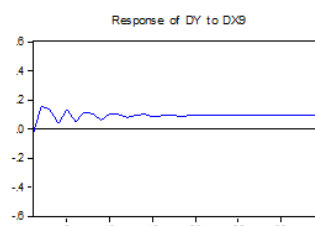


Fig. 9. Response of DY to DX9

In Fig. 7 NII's response to the shocks that occur in large trade and retail NPLs (X7) tends to be volatile because the response is positive starting in the 2nd month and in the 2nd month it is the maximum point achieved. The response achieved stability in the 14th period, which amounted to 0.136793 percent of the initial value before the shock.

In Fig. 8, response subsequently received NII from the shock that occurred in NPL Construction (X8) which was responded negatively by NII. Starting from the 2nd month the value is volatile until the 15th month and reaches a minimum point in the 3rd month and reaches the start of stability in the 16th month of -0.146703.

In Fig. 9, NII's response to shocks occurring in NPL Transportation, warehousing, and communication (X9) tends to be volatile. In the 2nd month the NII response reached its maximum point. The response began to stabilize on the 16th month of 0.093399.

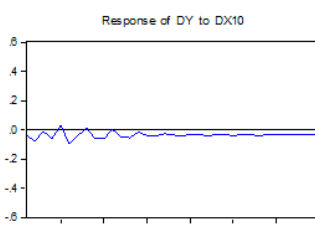


Fig. 10. Response of DY to DX10

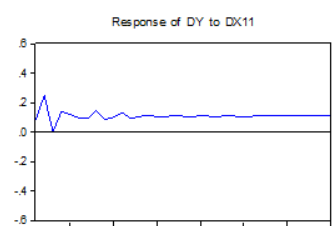


Fig. 11. Response of DY to DX11

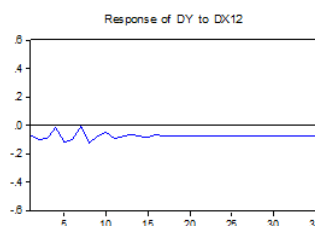


Fig. 12. Response of DY to DX12

Fig. 10 describes NII response to shocks that occurred in other NPL (X10) that were responded negatively from the beginning of the month by NII. However, the NII response received a positive score in the 5th month and the 8th month. Furthermore, the NII response was negative and reached a stability point in the 21st month of -0.032898.

Fig. 11 shows the NII response to the shock that occurred Lending rate Facility (X11). NII responds positively starting from the beginning of the month and reaching its maximum point in the 2nd month. Then the response began to reach the point of stability in the 27th month of 0.109898.

In Fig. 12, response subsequently received by NII from the shock that occurred in the Deposit (X12) which was negatively responded by NII. Starting from the 2nd month the value is volatile until the 19th month and reaches the minimum point in the 8th month and begins to achieve stability in the 17th month of -0.075729.

Variance decomposition

Variance decomposition aims to measure the magnitude of the contribution or composition of the influence of each independent variable on its dependent variables. Based on Fig. 13, the diversity began to appear in the first period. Construction credit variables contribute the most diversity to NII, followed next by other credit variables, npl construction and NPL trading. This indicates that future changes in NII will be influenced by the four variables that have the largest variety of contributions. The above results are consistent with Dezfouli et al. (2014) they explain the impact of NPL that can erode profit (NII) if NPL increases.

The above results are also consistent with Borio et al. (2017) that there is a positive relationship between the structure of the interest rate (lending rate facility) and bank profitability. On the one hand, short-term interest rates and the slope of the yield curve are positively related to net interest income. But it is different from the research results of Almazari (2014) which state that third party funds affect NII but from the research results above for the short-term effect of deposit, commercial banks do not affect NII.

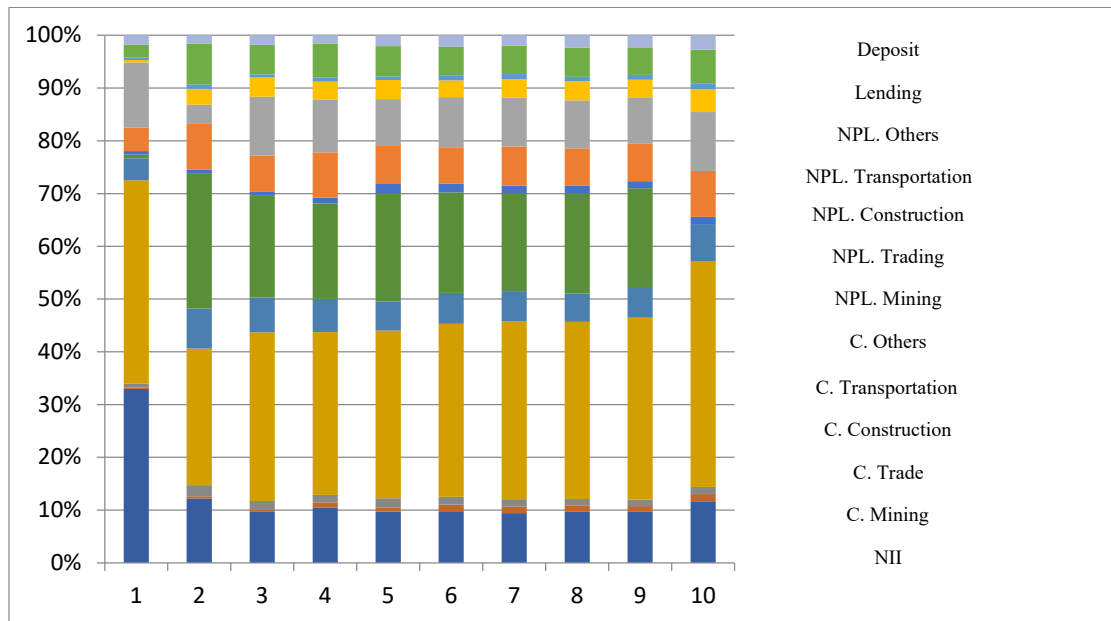


Fig. 13. Variance Decomposition of NII

Variance Decomposition analysis of NII variables in Fig. 13 above shows that the variable that contributes the most to NII for the next 10 periods is the Total Construction Credit with an average per period of 32,858%, then variable Amount of Other Credit with an average per period of 17.78%, variable NII with an average per period of 12.33%, NPL Construction with an average per period of 9.168% and NPL. Trade with an average per period of 7.143%.

4. Conclusion

Using Johansen's Cointegration Test, the cointegration test has shown that all variables in each short-term period tend to adjust to each other to achieve long-term balance. While in the short-term variable that affects NII is credit and NPL large trade and retail, Construction Credit, Credit and NPL Transportation, warehousing, and communication, as well as Lending rate Facility. While in the long term the variables that affect NII are variable credit and NPL large and retail trade, Credit and NPL Transportation, warehousing and communication, Other Credit and Deposit. The analysis of Impulse Response Function can be proven that NII most quickly achieves stability when dealing with the shocks of large trade and retail NPL. In the analysis of Forecasting Variance Decomposition, it can be concluded that the variable that contributes the most to NII is the number of credit constructions.

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