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WHAT MOST INFLUENCE ON NON-PERFORMING LOAN IN INDONESIA? BANK ACCOUNTING PERSPECTIVE WITH MARS ANALYSIS

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Abstract

The research objective is to examine factors that affect non-performing loans at conventional private banks in Indonesia. These factors include growth in gross domestic product, interest rates, currency exchange rates, exports, credit growth, inflation, return on asset, operating costs to operating income, and the capital adequacy ratio. The sample used in this study was conventional private banks listed on the Indonesia Stock Exchange 2014-2019. Data analysis techniques using Multivariate adaptive regression spline (MARS). The study results inform that there is an influence between the predictor variables and the response variables based on functions in the model. The variables that affect non-performing loans are credit growth, exchange rates, inflation, capital adequacy ratio, return on asset, operating costs to operating income, and interest rates. In contrast, gross domestic product growth and export growth in this study do not affect non-performing loans in conventional private banks. The MARS model has informed that the most influential variable on non-performing loans is credit growth. Banking authorities need to control lending through the application of credit risk management and regulating the quality of credit loans to contribute to the results in this study.

Keywords: Non-Performing Loans; credit growth; exchange rates; capital adequacy ratio and MARS.

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INTRODUCTION

As a banking regulator in Indonesia, Bank Indonesia has determined one of the non-performing loan ratio criteria. Banks are considered to have potential difficulties that could jeopardize their business continuity when banks have a non-performing loan ratio of more than 5% (five percent) of total loans. A decline in bank credit quality is a significant cause of financial fragility in the banking services sector (Bofondi & Ropele, 2011; Ameni, Bilel, & Abdelfettah, 2017; Elmira &

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Roman, 2019). Some facts that have occurred indicate that the increase in the non-performing loan causes the banking crisis (Ali, 2016; Almazari, 2014). The Financial Services Authority (OJK) acknowledged that although the ratio of non-performing loans (NPLs) to conventional commercial banks in 2014-2019 showed an average number below 5% is still relatively safe but even urged banks to conduct supervision of credit risk below 2%. This is because regular monitoring of credit quality, with an early warning system that is able to alert authorities to potential bank pressure, is very important to ensure a healthy financial system and prevent systemic crises (Bofondi. & Ropele., 2011; Eng, 2013; Weidong, 2017; Perdana & Adriana, 2018). The banking systemic crisis is not only caused by a decrease in the quality of bank portfolios but also bias caused by macroeconomic risk factors that affect bank performance. Changjun et al. (2019) and Suryani et al. (2016) have said the increase in the NPL ratio shows signs of a decline in the banking sector's performance and decreased loan portfolio quality.

According to Weidong (2017) and Fathyah, et al. (2019) were said that bank interest rates could be interpreted as "remuneration provided by banks based on conventional principles to customers who buy or sell their products." Rising interest rates worsen the quality of loans, the higher the cost of debt, making it more difficult for debtors to repay loans. Besides, high-interest rates become a potentially unfavorable alternative for debtors (Ahmad & Bashir, 2013). Therefore, an increase in interest rates is expected to increase the NPL ratio. Linda. & Muthia (2015) and Fathyah et al. (2019) have suggested that interest rates positively affect NPL. This result is contrary to the research of Almazari (2014), which states that there is a negative influence between interest rates and NPLs. An exchange rate is a unit of value used to exchange one currency for another (Ahmad & Bashir, 2013). It will increase potential bad debt for multinational companies as they line their sum of material imported (Islam, Alam, & Hossain, 2019). Depreciation in the local currency will cause the price of imported goods to be expensive. As a result, it will pressure the merchant's letter of credit, so the risk of default can increase (Badar & Javid, 2013). The impact will further increase the risk of default that will cause bad debt.

Non-performing loans will result in bank losses, i.e., losses due to non-receipt of disbursed funds and unacceptable interest income. Banks lose the opportunity to have interest income, which results in a decrease in total revenue (Idris & Nayan, 2016; Kurniawan & Utama, 2019). The high NPL is an indication of banks' problems, which, if left unattended by banks, will negatively impact banks (Fathyah et al., 2019). (Radosław & Krzysztof, 2020) have said that the high NPL continues to receive a lot of attention in banking operations. An indication of the emergence of NPLs is a problem that simply influences bank performance because an increase in NPL ratios will also slow down credit growth. One indicator in assessing bank functions' performance is terrible loans; the higher the NPL shows the bank's health, the lower the NPL offers the bank's health is good. According to Bank Indonesia Regulation No. 15/2 / PBI / 2013, the minimum limit of non-performing loans can be seen from several internal factors that are informed in bank financial ratios such as bank size, ratio of operating costs to operating income and capital adequacy ratio (Kasmir, 2014).

Saba, Kouser, & Muhammad (2012) have analyzed NPL sensitivity to macroeconomic indicators in the US using time series data from 1984 to 2010. This study uses the NPL ratio as the dependent variable. While the independent variables used are real GDP per capita, interest rates, and total loans. This study indicates that statistically, the three variables are statistically significant, where real GDP per capita and interest rates show a negative relationship, while total loans show a positive relationship. However, mathematically only interest rates are a significant variable.

Khalel's (2016) aims to examine the determinants of bad credit in the Jordanian banking sector during the 2008-2012 period. So, there are two factors used to explain Non-Performing Loans (NPLs) in Jordan. These factors are bank-specific factors and macroeconomic factors. This study uses secondary data from the bank's annual report source¹⁹ namely Jordan Central Bank and the Jordan Bank Association. This study's analysis technique is multiple linear regression to obtain a comprehensive picture of the relationship between one variable with another variable. Based on hypothesis testing using the F statistical test, it was concluded that the total loan assets had a positive and significant effect. Bank Size had a positive but not significant impact, while Economic Growth had a negative but significant effect. Credit Interest Rates had a positive but not significant effect. Based on the partial test (t), it was concluded that the total assets of loan loans, bank size, economic growth, loan interest rates, inflation, and the global financial crisis had a significant positive effect.

Ahmad & Bashir (2013) analyzed the explanatory power of macroeconomic variables as a determinant of NPL. This study uses NPL ratio time series data and nine macroeconomic variables during the 1990-2011 period. The dependent variable used in²⁵ study is the NPL ratio. There are six independent variables: GDP growth, unemployment rate, interest rate, inflation rate, effective exchange rate, consumer price index, and exports. The research method used is ordinary least square. This study indicates a significant negative relationship between GDP growth, interest rates, inflation rates, exports, and industrial production with NPLs. Also, found a meaningful positive relationship between the consumer price index and NPL. However, other variables are not significant.

The study Changjun et al. (2019) has informed that both industry-specific and macroeconomic factors significantly influence NPLs. Among the industry-specific determinants, bank loan growth, net operating profit, and deposit rates negatively impact NPLs with statistical significance. In contrast, bank liquidity and lending rates have a significant positive affiliation with NPLs. Gross domestic product (GDP) growth and unemployment, among the macroeconomic variables, have a negative connection with NPLs. Whereas domestic credit and exchange rates have a significant positive association with NPLs

Fathyah et al. (2019) have conducted research on macroeconomic conditions as a major determinant of Indonesia's banking quality. The study compares the factors that influence non-performing loans in Islamic banks and conventional banks. In research with traditional bank variables use³⁵ by this previous researcher have similarities with current research. The results of his study are GDP, inflation, BI rate, CAR, LDR, BOPO, and total assets have significant to non-performing loans in conventional commercial banks. According to this study, macroeconomic conditions that need attention. The stability of macroeconomic conditions influenced the quality of bank credits. The research's impact was to inform that micro condition in this study is proxied by CAR, LDR, BOPO, and total assets can still be controlled through its internal risk management. A properly bank performance will increase the confidence of investors or other users so that it will increase the desire for investment that can be used as loan funds provided or credit given.

Mahendra & Mahardika (2019) said that funding and lending are the banks' principal activities. There are some potential problems in landing activities while the debtor had bad debt. Banks should have managed these non-performing loans because the non-performing loans are more prominent than 5%, it caused the bank to have a financial distress situation, and the long term will go bankrupt. Factors that can affect the amount of NPL are usually caused by

macroeconomics such as GDP or bank characteristics such as loan to deposit ratio and bank size. The data used in this study are secondary data obtained from the annual financial statements of banks listed on the Indonesia Stock Exchange in the 2014-2017 period. The sample obtained was 40 observations originating from the ten largest conventional banks covering the 2014-2017 period. The method used is purposive sampling. The technique used in this analysis is panel data regression and descriptive statistics. This study indicates that there is a simultaneous influence on LDR, bank size, and gross domestic product growth on NPLs. Bank size does not have a partial effect on NPL. Whereas loan to deposit ratio and gross domestic product growth has a positive influence on NPL.

Radosław & Krzysztof (2020) have analyzed the macroeconomic and microeconomic determinants of NPL. The results of their research inform that macroeconomic determinants influence the occurrence of non-performing loans. However, loan growth, in the long run, decreases non-performing loans. In small and medium enterprises (SMEs) and micro-finances, the lending program has increased during the last decade. In contrast, non-performing loans have decreased proportionately. We may investigate this fact in our future research, as this is not the focal point of this study. In the short run, NPLs increase with loan growth. Banks' profitability decreases with higher NPLs as banks need to increase the base of loan loss provisions for future losses. The government must adopt good and stable macroeconomic policies. The aim is to strengthen economic conditions and maintain an increase in gross domestic gross. The impact of this policy will affect the decline in the occurrence of non-performing loans.

Previous research also informed that the decline in credit quality and non-performing loans are related to company size. A study by Khaled (2016) and Diansyah. (2016) states that bank size affects bad credit. While research by Ari (2016), Khaled (2016) and Messai & Fathi (2013) stated that bank size does not affect non-performing loans (NPL). Diansyah. (2016) and Curak, Pepur, & Poposki (2013) say that the bank size can affect the level of NPLs; a more considerable amount of credit will be followed by more significant opportunities for banks to reduce lending rates. The lower the loan interest rates will be more competitive in providing services to customers who need credit (Dimitrova, 2013). Dewi & Ramantha (2015) believes that low credit levels can spur investment and boost the economy. Low interest rates will reduce the amount of credit default.

Banking operating income consists of interest income and other operating income. The ratio of operating costs to operating income (BOPO) can be interpreted as operating income received by the bank due to its efforts to streamline operational costs. If bank revenues are created, the NPL level will be deficient. Research conducted by Barus & Erik (2016) states that BOPO has a positive effect on NPL. However, research conducted by Jasmansyah & Sriyanto (2013) mentioned that BOPO has a negative impact on NPL. Therefore, this study examines the factors that influence the Non-Performing Loan (NPL). The factors tested in this study are the growth of gross domestic product (GDP), interest rates, exchange rates, export growth, credit growth, inflation, return on assets (ROA), operating costs to operating income (BOPO), and capital adequacy ratio (CAR). Based on the description of this phenomenon, the purpose of the study is to examine the effect of GDP growth, interest rates, currency exchange rates, exports, loan growth, inflation, ROA, operating costs to operating income (BOPO), capital adequacy ratio to non-performing loans (NPL) at conventional private banks in Indonesia in 2014-2019.

GDP is defined as the total value of goods and services produced in a specific area and at a particular time (usually per year). These variables are consistent with overall economic activity. It is hoped that the quality of the aggregate portfolio depends on economic activity. If the economy

is unstable, then the economic activity will deteriorate and impact the decline in community income so that it will also affect customers' ability to repay loans. This factor causes a decrease in the quality of the portfolio (Yesica & Irene, 2015). Slow growth rates (in developing countries) explain the stagnant economic situation, causing developing countries to be unable to control price stability and achieve the desired level of economic growth (Badar & Javid, 2013). GDP growth shows an increase in the income of individuals and companies alike, therefore when GDP increases, the purchasing power of the customer will increase and financing through credit will decrease so that it has the potential to reduce the occurrence of non-performing loans (Badar & Javid, 2013; Kristiani & Sri, 2018).

H₁: Gross domestic product growth effects on non-performing loans

The interest rate is the service costs incurred by the borrower of funds to the fund owner, and the interest rate can also be defined as the return of borrowed money (Badar & Javid, 2013; Kristiani & Sri, 2018). Increasing bank interest rates can improve loan portfolios (Ari, 2016; Yesica & Irene, 2015). Previous research stated that an increase in interest rates would enhance the quality of credit, meaning that interest rates can conduct market selection for credit customers who are capable and have collateral to repay loans and interest (Bofondi & Ropele, 2011; Fathyah et al. 2019; and Kristiani & Sri, 2018). Debtors (borrowers of funds) who are trusted and have profitable quality loan portfolios tend not to be concerned about the increase in credit caused by market fluctuations. Quality borrowed funds (credible) will have the ability to pay off debts on time; the impact is that it can reduce non-performing loans.

H₂: Interest rates effect on non-performing loans

The exchange rate is a digital currency, commonly referred to as the reference currency of Messai & Fathi (2013). Kristiani & Sri (2018) and Warue (2013) explain that the depreciation of the local currency provides the potential for non-performing loans in foreign currency loans. Besides, the weakening of the exchange rate tends to reduce consumers' purchasing power on consumer goods products so that the cash inflows that will be used to finance debts that are due are also low. The impact is the possibility of non-performing loans is also getting more significant. Depreciation of the local currency will also affect imported goods which will put pressure on letters of credit (LC) issued by commercial banks for traders (importers) which will result in an increase in defaults or non-performing loans (Badar & Javid, 2013; Kristiani & Sri, 2018).

H₃: Exchange rates effect on non-performing loans

Export is transporting goods or commodities from one country to another Yesica & Irene (2015). Companies with small to medium scale businesses as the primary strategy to compete at the international level often use this process. Exports are an essential part of national income for countries with an open economy. Export growth positively affects export-oriented sectors and indirectly affects the economy (Yahaya & Oni, 2016). Conditions with profitable export growth will affect improvements in the quality of credit payments for export and import companies so that they will be able to reduce the occurrence of credit woes. The Indonesian Financial Stability Review April 2019 stated that there were concerns about the continued decline in exports. This condition could cause a decline in exporters' financial performance and impact the reduced ability

to meet its debts to banks. If the exporter's ability to meet his obligations decreases, it will have an impact on increasing the non-performing loans.

H4: Export growth effects on non-performing loans

Economic warming because demand growth is higher than the potential output can be attributed to increased credit, especially consumer credit. During the expansion period, the banking sector tended to have overly optimistic expectations of customers' ability to pay and were careless in giving credit to high-risk groups. As a result, the accumulation of loans can become bad credit in contractive economic times (Utari, Trinil, & Ina, 2012). Besides, rapid credit expansion is considered to be one of the most important causes of non-performing loans, provided that behind the credit expansion policy, banks are willing to reduce the quality of their clients (Akinlo, 2014; Wooldridge, 2013). Low-quality debtors have a greater risk. Therefore, it can increase non-performing loans (Ozili, 2019).

H5: Credit growth effects on non-performing loans

Inflation is a condition experienced by a country where the price of goods rises continuously. Inflation is excess demand exists for goods and services in the economy. The effect of inflation on non-performing loans (NPL) is significant (Ali, 2016; Barus & Erik., 2016; Diansyah., 2016). This result is also supported by research by Muthia (2015) and Fathyah et al. (2019). Inflation implies that money cannot function as a fair and correct calculation unit. Inflation is also a condition where a decline in the value of a country's currency and an increase in the price of goods occur systematically. Messai & Fathi (2013) said that financial risk also arises due to inflation. If there is an unexpected increase in inflation, it will cause purchasing power risk. Purchasing power risk is the real value of money lent plus interest payments to be smaller than expected (Johannes, 2014). The relationship between inflation and bad credit occurs in changes in people's purchasing power, which will decrease because the level of real income also decreases if inflation occurs.

H6: Inflation effects on non-performing loans.

ROA of a company can be assessed from the company's total assets compared to the total net profit. Saba et al. (2012) and Fathyah et al. (2019) states that banks with large assets can generate greater profits if followed by their operational activities. One of the bank's operational actions is lending. Yahaya & Oni (2016); Idris & Nayan (2016) states that the greater the assets or assets owned by banks, the greater the volume of credit channeled by banks. Larger credit volumes provide opportunities for banks to reduce spread rates, which will reduce lending rates so that banks will be more competitive in providing services to customers who need credit. Low-interest rates can spur investment and drive the economic sector. Lower loan interest rates also facilitate smoother credit payments so that they will be able to reduce the occurrence of non-performing loans (Barus & Erik., 2016)

H7: Return on asset effects on non-performing loans

Operational costs of operating income are operating expenses compared to operating income. Operating expenses include interest and other operating expenses. Operating income includes interest income and other operating income. Jusmansyah & Sriyanto (2013) operating income operating cost is a ratio to measure bank efficiency in carrying out its operational activities. This ratio can occur because if operating expenses are higher than operating income, it means that

operational costs incurred are not efficient to make banks in bad condition. The lower the operating cost ratio to the bank, the more efficient it is, because the bank can manage operational costs and possible. It can be concluded that BOPO positively affects non-performing loans (Barus & Erik., 2016). This finding is supported by research conducted by Fathyah et al. (2019). With the efficiency of banking institutions, especially cost efficiency, it will obtain an optimal level of profits, increase the number of funds disbursed, more competitive costs, improved services to customers, security, and the banking system (Yesica & Irene, 2015). With reasonable cost efficiency, the smaller the operating cost to operating income ratio, the smaller the problematic conditions, or vice versa. Messai & Fathi (2013) and Fathyah et al. (2019) said in their research that operating costs operating income ratio influenced non-performing loans.

H₈: Operating costs operating income ratio effects on non-performing loans

Banks must meet the minimum capital adequacy requirements. The capital adequacy ratio aims to ensure that banks can absorb losses arising from the activities carried out. The regulatory rate set by Bank Indonesia is a minimum ratio of 8%. The bank's amount of capital will provide benefits to reduce the risk of a default occurring borne by the bank. Capital is the most crucial thing in bank operations. The higher the capital adequacy ratio than the more significant the banks' ability to fund credit risk is incurred (Barus & Erik., 2016). This policy is done to reduce the high level of non-performing loans (NPLs) that occur due to credit problems; banks provide funds for business development needs and accommodate the risk of losing funds. Diansyah. (2016) and Fathyah et al. (2019) said that when an increase in bank capital or an increase in the number of risk-weighted assets (RWA), non-performing loans will also decrease.

H₉: Capital adequacy ratio effects on non-performing loans

Several studies that have been illustrated above aim to examine factors that affect non-performing loans at conventional private banks in Indonesia using multiple linear regression. These factors include growth in gross domestic product, interest rates, currency exchange rates, export growth, credit growth, inflation, return on asset, operating costs to operating income, and the capital adequacy ratio. A significant contribution to this research is to make the Multivariate Adaptive Regression Spline (MARS) method. This alternative method can answer the problems that often occur in economic data using multiple regression. MARS is one of the nonparametric regressions which does not require parametric conditions. MARS friendly to financial data that usually occur cases of autocorrelation and normality.

RESEARCH METHODS

The population used in this study is banking companies listed on the Indonesia Stock Exchange (IDX) for the period 2014-2019. In comparison, the technique used for sampling in this study is purposive sampling. The sample's criteria are conventional private banks companies listed on the Indonesia Stock Exchange (IDX) during the 2014-2019 observation period and published financial statements for 2014-2019. The variables used in this study consisted of two types, namely the response variable and the predictor variable. The response variable (Y) is a non-performing loan_NPL. Predictor variable (X) consists of: gross domestic product_ GDP growth (X1), interest

rate (X2), the currency exchange rate (X3), export growth (X4), credit growth (X6), inflation (X6), return on assets_ROA (X7), operating income to operating costs_Operation expenses to operation income (X8), and capital adequacy ratio CAR (X9). Data analysis techniques using Multivariate adaptive regression spline (MARS). MARS is a complex combination of truncated spline and RPR (Friedman, 1991).

MARS can be used in regression modeling that involves continuous and category responses, whereas truncated spline is generally used only on constant responses. MARS parameter estimation uses LS optimization and builds a model with a stepwise, stepwise, stepwise algorithm. Forward stepwise create the model by adding spline function bases (knots, interactions) until a model with the maximum number of function bases is obtained. Backward stepwise is used to get the appropriate model by selecting the function base whose contribution is most significant to the model's alleged response generated by forwarding stepwise based on minimum GCV value. Variable definitions and measurement were Non Performing Loans are measured by dividing bad debt (loans) with total loans. GDP is estimated using the result of reducing the real GDP in n period with GDP real in the n-1 period divided by real GDP n-1 period. Interest rates are deducted from the interest rates published by Bank Indonesia.

The rupiah's exchange rate is measured using the median price of the rupiah's exchange rate to the US dollar. Export growth is a percentage increase in total exports in a certain period compared to the previous period. Credit growth is calculated by reducing full credit in n period by total credit in the n-1 period and then divided by total credit in the n-1 period. Inflation is measured using consumer price index data that calculates by the average change in prices of goods and services consumed by the public at a specific time (CPI). All data from the calculation of interest rates, exchange rates, and inflation are regressed to see the level of sensitivity by looking at the value of the beta coefficient (β). ROA is measured by calculated of the total assets compared to total net income. Operating cost to operating income ratio is calculated by comparing operational costs with operating income. In contrast, the capital adequacy ratio (CAR) is measured by the amount of bank capital divided by weighted average risk assets. The Bank central regulation has stated that CAR minimum is 8%

RESULT AND DISCUSSION

Result

Table 1 has informed that the variable data on interest rates, exchange rates, export growth, credit growth, inflation, return on assets (ROA), operating cost operating income ratio and capital adequacy ratio (CAR) are homogeneous. The mean value indicates this > standard deviation. Homogeneous data on these variables prove that the data have characteristics that tend to be constant. There are no extreme data that go up or down significantly to cause data to be unfavorable. Simultaneously, the other variable data, namely gross domestic product and export growth variables, are heterogeneous.

The minimum value of NPL data is 0,12%. This number shows that from January 2014 to December 2019, the lowest NPL obtained by conventional private banks occurred in January 2017, while the highest value of NPL data of 3.38% occurred in November 2019. Based on this statement, traditional private banks are still meet the NPL ratio requirement below 5%. The minimum value of GDP of -17,4% occurred in March 2015, the highest GDP in September 2019

was 2,01%, and the average in 2014-2019 was 0,71%. A standard deviation was higher than the average value indicates that the distribution of variable data is increased between the highest GDP and the lowest GDP. This number indicates that the data GDP is not useful for testing the MARS model.

Table 1. Descriptive Analyze

Variable	Minimum	Maximum	Mean	SD	N
NPL	0.0012	0,0338	0,0148	0,0112	413
GDP	-0,0174 0,0575	0,0201 0,0775	0,0071	0,0740	413
Interest rate			0,0680	0,0060	413
Exchange rate Rupiah	-0,0051	0,0591	0,0163	0,0065	413
Export growth	-0,1375	0,1779	0,0071	0,0735	413
Credit growth	0,0656	0,1146	0,0890	0,0245	413
Inflation	0,0293	0,0836	0,0403	0,0021	413
ROA	0,0004	0,1605	0,0526	0,0231	413
Operating Costs					
Operating Income	0,6558	0,9811	0,6843	0,0283	413
CAR	0,0810	0,2734	0,1748	0,1635	413

Source: Statistical data processed

The minimum BI rate data is 5,75% determined by Bank Indonesia from February 2016 to December 2016. This number indicates that the cost of debt in February 2016 is the lowest and the maximum value of interest rate of 7,75% set by Bank Indonesia in November and December 2018. It shows that the highest cost of debt during the study period was in November and December 2018. The average interest rate is 6,80%. A standard deviation of 0,64% shows no large gap, so the interest rate data is useful for the MARS model because the information is evenly distributed.

The minimum value of the rupiah exchange rate data is -0,51%, this shows that during the period January 2014 to December 2019 the lowest exchange rate of -0,51% obtained by conventional private banks occurred in 2018, while the highest value of the exchange rate data was 5,91% occurred in November 2016. The average exchange rate was 1,63 %, and the standard deviation was 0,65%. A standard deviation smaller than the average value indicates that the variable data distribution is little between the highest exchange rate and the lowest exchange rate. This deviation indicates that the data exchange rate is good enough to test the MARS model because it is spread evenly. The minimum value of export growth of -13,75% occurred in June 2015, the highest export growth in July 2018 17,79% average in 2014-2019 was 0,71% and standard deviation 7,35%. A standard deviation was higher than the average value indicates that the distribution of variable data increases between the highest export growth and the lowest export growth. This deviation suggests that data export growth is not useful for testing the MARS model.

The minimum value of credit growth of 6.56% occurred in October 2019, indicating that in January 2019, credit growth disbursed by Conventional private banks as a whole experienced the worst decline during the study period. In comparison, the highest credit growth of 11,46% occurred in April 2018, and the average credit growth 8,90% in the 2014-2019 period. The

minimum of the inflation value was 2,93% occurred in February 2019. This value indicates that in 2019, consumers' purchasing power increased because the amount of money circulating in the community and the number of goods available were still able to boost economic growth. While the highest inflation was growth, 8,36% occurred in March 2014. It caused the bank more to have potential non-performing loans. The minimum value of ROA of 0,04% occurred in June 2016, while the maximum ROA of 16,05% in February 2018. The average amount of ROA of 5,26% with a standard deviation of 2,31% indicates data to be useful for MARS because the data distribution is evenly distributed.

The minimum value of BOPO is 65,58% in March 2017, while the highest is 98,11% in January 2018. The average BOPO value of 68,43% with a standard deviation of 2,83% indicates no large gap. The data can be said to be suitable for MARS Model because the data is evenly distributed. The minimum CAR value is 8,10% in June 2013, while the maximum CAR value is 27,34% December 2018. The maximum amount means the bank's ability to finance all assets that contain risks such as lending, securities, investments, and bills to other banks using their capital is very strong or good. The average CAR value is 17,48%, with a standard deviation of 16,35%, indicating that the data to be useful for MARS because the data distribution is evenly distributed.

The test results using multiple linear regression inform that the parametric requirements are not met. This statistic can be seen in the table as follows:

Table 2. Statistics Test

Statistical Test	Statistical Test Value	Remark
Nilai Adj-Rsquare	29,11%	Quite low
F test I	P value = 0,249	Model not fit
Normality	P value = 0,001	Case occurred
Autocorrelation	P value (run Test) = 0.0	Case occurred
Multicollinertity	All VIF value < 10	No case
Heteroscedasticity	All P-value (t-test results of residual abs regression with independent variable) > 0/05	No case

Source: Statistical data processed

Table 2 informs that the multiple linear regression model cannot be held accountable because the parametric requirements are not met: normality and autocorrelation. The low Adj-square value reinforces this model, and the amount of the model suitability test is not significant. One alternative method that can provide multiple linear regression limitations is the multivariate adaptive regression spline (MARS) method. Friedman (1991) was the first researcher who developed the MARS model. The model aims to solve the case of continuous unresponsive data. The patterns' model is of nonparametric relationships between continuous response variable with several predictor variables. Friedman (1991) obtained an estimation of MARS parameters using Least Square (LS) optimization and built a model with a stepwise algorithm consisting of forwarding stepwise and backward stepwise. Forward stepwise make the model by adding spline function bases (knots, interactions) until a model with the maximum number of function bases is obtained. Backward stepwise is used to get the appropriate model by selecting the function base whose contribution is most significant to the model's alleged response generated by forwarding stepwise based on minimum GCV value.

The best effect test results using multivariate adaptive regression spline (MARS) with a combination of BF, MI and MO obtained the smallest GCV and MSE values obtained at a combination of BF = 12 predictor variables, MI = 3 and MO = 10 with GCV = 11,072 and MSE = 13,901. The best model formed based on a combination of BF, MI, and MO and the smallest GCV and MSE values as follows:

$$Y = 0,039 + 0,847 * BF1 + 0,078 * BF2 + 86,517 * BF7 - 112,031 * BF9 - 165,736 * BF10 + 774,814 * BF11 + 603,212 * BF12 + 7,531 * BF16 + 159,411 * BF17 - 79,116 * BF19 - 5,008 * BF20 - 1,390 * BF21 - 19,907 * BF22 - 411,031 * BF23 - 429,219 * BF24 + 211,420 * BF28 + 0,759 * BF32.$$

Table 3 has informed that using $\alpha = 0,05$; then obtained $F_{table} = 1,873$ because $F_{count} > F_{table}$ rejects H_0 , which indicates that the research model with MARS is appropriate. It can also be interpreted that the independent variable can explain the dependent variable. The adjusted R-Squared value is 0,417 or 41,7% which means that the influence of GDP, exchange rate, export value, credit growth, inflation, ROA, BOPO, CAR can explain the NPL of 41,7% and also means there are other factors of 58, 3% is not included in the model.

Table 3. F-test

Source of Variance	Degree of Freedom	Sum of Square	Adjusted. R Square	F test
Regression	9	28,902	0,417	
Residual	403	10,103		151.016
Sum	412			

Source: Statistical data processed

Table 4. Relative Variable Importance

Variable	Importance	- GCV	Conclusion	Ranking of Effect
Credit growth	100,00	0,379	Accepted	1
Interest rate	79,013	0,307	Accepted	2
Inflation	77,905	0,268	Accepted	3
ROA	74,117	0,193	Accepted	4
CAR	58,098	0,116	Accepted	5
Operating Costs	36,182	0,054	Accepted	6
Operating Income				
Exchange rate	16,613	0,041	Accepted	7

Source: MARS data processed

Table 4 has informed the variables that affect NPL: credit growth, interest rates, inflation, ROA, CAR, operating cost to operating income, and exchange rates. It means the hypothesis that credit growth, interest rates, inflation, ROA, CAR, Operating Cost to Operating Income, and exchange rates affect non-performing loans were accepted. The more excellent CGV score showed the

highest-ranking of the variables that most influence the NPL. It is indicated by the inclusion of these variables in the relative variable importance table. The comparative variable importance results have shown that the most influential non-performing loans were credit growth.

Discussion

Table 4 has informed relative variable importance, so discussing will start from the most important that has affected non-performing loans.

Effect of Credit Growth on Non-Performing Loans

Hypothesis results inform that credit growth has the most substantial influence on non-performing loans (NPL). This result can be seen from the importance value in Table 3 of 100,00 with a GCV of 0,379. The penetration of conventional private banks in lending to the consumption and working capital sectors is very aggressive in the study period. This action causes banks to be less careful in giving credit to the public. The highest credit growth of 11.46% occurred in April 2018, and the average credit growth was high 8,90% (see Table 1). Excessive credit growth can be threatening macroeconomic stability. Significantly credit consumption and working capital (investment) could trigger aggregate demand growth above the potential output in the economy heats up. In turn, it will have an impact on increasing non-performing loans because debtors have difficulty paying off their maturity debts. At the same time, during credit expansion, banks tend to have overly optimistic expectations of delivering their customers.

Consequently, in this situation, banks are less careful in credit lending to high-risk groups of customers. Further impact, credit growth will be to increase potential credit impairment losses (CKPN). Also, rapid, and aggressive credit expansion is considered the critical cause of non-performing loans. Banks are willing to reduce the quality of collateral assessments, business feasibility, and customer portfolios behind the credit expansion policy, a measurable evaluation material in providing credit by a bank. Many debtors with low creditworthiness portfolios are approved to give credit that causes non-performing loans. The results of this study are supported by Utari et al. (2012), Ozili (2019), and Radosław & Krzysztof (2020).

Effect of Interest Rates on Non-Performing Loans

The results of Table 3 inform that interest rates affect the non-performing loans with the importance of 40,76 and -GCV 0,064. The highest interest rate set by Bank Indonesia during 2014-2019 is 7,75%, with a mean of 6,80%, which is still relatively high (Table 1). High-interest rates on loans will cause the debtor's burden, especially in the type of consumer, and working capital loans will increase. The increase in debtor burden causes the debtor's credit payment quality to decrease, causing non-performing loans. High-interest expense is a risk for customers to pay in installments or pay off the loan. The interest rate is the service costs incurred by the borrower of funds to the fund owner. The interest rate can also be defined as the cost of credit or loans (Badar & Javid, 2013; Kristiani & Sri, 2018). However, increasing bank interest rates can increase banks' spread income, but banks will potentially experience an increased risk of default by customers. The results of this study were supported by Bofondi & Ropele (2011); Kristiani & Sri (2018) and Fathyah et al. (2019) stated that credit interest rates affect non-performing loans.

Influence of Inflation on Non-Performing Loans

The results in Table 3 inform that inflation does not affect non-performing loans because this variable also does not fall into the category of relative variable importance. Table 1 discloses that the highest inflation occurred in 2014 of 8.36%, and the lowest inflation was 2.93% in 2019, but during 2014-2019, the average inflation was 4.03%. This inflation is due to inflation that occurred in that period was still classified as low inflation (< 10%). It has affected the financial stability of banks, especially non-performing loans. The policy of Bank Indonesia is to continue to oversee the banking sector to implement the precautionary principle in providing credit. The prudential regulation is needed to reduce banks' risks due to the uncertainty factor due to the period of credit granted. Besides, Bank Indonesia established policies to focus on maintaining and overseeing the implementation of the intermediation function in each bank so that credit can be channeled under credit assessments, monitoring usage, and credit guarantees (Kasmir, 2014). If the two Bank Indonesia policies can be done well by the banks, then an increase in inflation that requires interest rates to rise will not affect non-performing loans' potential. This rise is since customers ⁴⁵ve monitored the bank's ability to pay the credit, both in stock and crisis conditions, so that the ratio of non-performing loans is maintained and stable. The results of this study were supported by Fathyah et al. (2019), Ari (2016), and Akinlo (2014).

Effect of ROA on Non-Performing Loans

Table 3 shows that the importance variable ROA value is 65.441, and the -CGV value is 0.087, so it can be concluded that ROA affects NPL. Table 1 informs that the highest ROA during the 2014-2019 period was 16.05%, with an average of 2.31%. ROA of a company can be assessed from the company's total assets compared to the total net profit. Saba et al. (2012) state that banks with large assets can generate greater profits if followed by their operational activities. One of the bank's operational actions is lending. Yahaya & Oni (2016); Idris & Nayan (2016) states that the greater the assets or assets owned by banks, the greater the volume of credit channeled by banks. Larger credit volumes provide opportunities for banks to reduce spread rates, which will reduce lending rates so that banks will be more competitive in providing services to customers who need credit. Low-interest rates can spur investment and drive the economic sector. Low loan interest rates also facilitate smoother credit payments so that they will be able to reduce the occurrence of non-performing loans (Barus & Erik., 2016). This study's results are also supported by Yahaya & Oni (2016) and Idris & Nayan (2016), stating that return on assets affects non-performing loans.

³⁴

Effect of Capital Adequacy Ratio (CAR) on Non-Performing Loans

The importance value ⁴²6,875 and -GCV of 0.145 shows that CAR affects the NPL. Under Bank Indonesia regulations, banks are required to meet the minimum CAR requirement of 8%. Table 1 informs that the highest CAR during the 2014-2019 period was 27.34%, with an average of 17.48%, which means banks' performance was good because value average of CAR is greater than CAR requirements. The bank's capital adequacy ratio is intended to assure that banks in carrying out operations must have minimal capital support to anticipate the risk of loss. These risks include those caused by low credit quality and generating non-performing loans—the greater the capital adequacy ratio, the more significant banks' ability to fund credit risk. This study supports Ari (2016); Fathyah et al. (2019), which states that the capital adequacy ratio affects the non-performing loans. Previous research also noted that the higher the capital adequacy ratio, the

greater banks' ability to fund credit risk (Barus & Erik., 2016). Diansyah. (2016) and Fathyah et al. (2019) said that when an increase in bank capital or an increase in the number of risk-weighted assets (ATMR), non-performing loans will also decrease.

Effect of Operating Costs Operating Income on Non-Performing Loans

Operational Costs Operational Income (BOPO) is Operational Cost compared to Operating Income. Operational costs include interest and other operational expenses—operating income, including interest income and other operating income. Jasmansyah & Sriyanto (2013) operating income operating cost (BOPO) is a ratio to measure bank efficiency in carrying out its operational activities. This ratio can occur because if operating expenses are higher than operating income, operating costs are not efficient to make banks in bad condition. Table 1 informs that during the 2014-2019 period, the lowest BOPO was 65.58%, and the highest was 98.11%, with an average of 68.43%. The higher the operating cost ratio (BOPO) to the bank, the more inefficient it is because the bank cannot manage operational costs as well as possible. This BOPO ratio indicates that the higher the BOPO means the lower efficiency of the bank's management. It can be concluded that BOPO affects NPL. This result is supported by Fathyah et al. (2019), Barus & Erik. (2016) and Messai & Fathi (2013), which states that BOPO influences non-performing loans.

The minimum value of the rupiah exchange rate data is -0,51%, this shows that during the period January 2014 to December 2019 the lowest exchange rate of -0,51% obtained by conventional private banks occurred in 2018, while the highest value of the exchange rate data was 5,91% occurred in November 2016. The average exchange rate was 3,63 %, and the standard deviation was 0,65%.

Effects of Rupiah Exchange Rates with Foreign Currencies on Non-Performing Loans

Variable exchange rates of rupiah with foreign currencies affect non-performing loans because they have an essential value of 87,876 with a GCV of 0.321. Table 1 informs that during the 2014-2019 period, the lowest exchange rate was -0,51%, and the highest was 5,91%, with an average of 1,63%, which means exchange rates of rupiah with foreign currencies was weak. Exchange rates are digital currencies, commonly referred to as reference currencies (Messai & Fathi, 2013). Warue (2013) explains that depreciation of the local currency provides the potential for non-performing loans in foreign currency loans, specifically loans used to purchase production goods to increase investment and expand businesses that purchase using foreign currencies. Besides, the weakening of the exchange rate tends to reduce consumers' purchasing power on consumer goods products so that the cash inflows that will be used to finance debts that are due are also low. The impact is the possibility of non-performing loans is also getting more significant. Depreciation of the local currency will also affect imported goods that will pressure letters of credit (LC) issued by commercial banks for traders (importers). This action will increase non-performing loans (Badar & Javid, 2013; Kristiani & Sri, 2018). The results of this study were supported by Mahendra & Mahardika (2019), Messai & Fathi (2013), Kristiani & Sri (2018), and Warue (2013), which stated that the exchange rate affects non-performing loans.

Effect of Gross Domestic Product on Non-Performing Loans

Table 3 informs that gross domestic product (GDP) does not affect non-performing loans because this variable is not included in the categorical relative importance. Table 1 reports that the minimum value of GDP of -17,4%, the highest GDP was 2,01%, and average in 2014-2019 was

0,7%, which means GDP in Indonesia growth slowdown. GDP does not affect NPL because GDP growth as a benchmark for Indonesia's economic growth is based on two sources, namely aggregate demand and aggregate supply. Aggregate demand is seen from the large public consumption level, private and non-private investments that need credit consumption and investment. The number of goods and services produced, while the creation of goods and services requires substantial financial support, one of which is sourced from bank loans, theoretically influences GDP. The role of credit, in this case, is very appropriate because the investment will require large financing. However, GDP is also determined by aggregate demand and other factors, such as supporting the availability of labor, natural resources and technology, and physical infrastructure that are generally well-owned by Indonesia. These resources will affect the investments that require financing from banks that are relatively small and will not affect the bad debt or non-performing loan. This study's results are not in line with the results of the survey of Yesica & Irene (2015).

Effect of Export Growth on Non-Performing Loans

Table 1 informs that during the 2014-2019 period, the lowest export growth was -0,13%, and the highest was 17.79%, with an average of 4,1%. Table 3 informs that export growth also influences non-performing loans with the importance of 80.765 and -GCV 0.213. Shipping goods or products from Indonesia to other countries is a form of positive economic growth in the real sector (Yesica & Irene, 2015). Test results inform export growth that does not affect NPL. Export is the process of transportation of goods from one country to another. Exports have become an essential part of national income from the state. The effect of slowing and relatively small export growth during the 2014-2019 average was only 0,71% (Table 1) is due to the small portion of export credit in the business of channeling credit bank in Indonesia. The share of credit export extended until the end of December 2019 was only 1.67% of all loans provided by banks (Indonesian Banking Statistics, 2020). This percentage indicates that most of the loans disbursed by commercial banks were not for export purposes. Therefore, credit that lends to export growth has only a very small (not significant) effect on non-performing loans. These results support the findings of research conducted by Ossamah (2017).

CONCLUSIONS

The results of this study indicate several factors that can affect NPL. The MARS model test concluded that from the nine factors examined: Gross domestic product (GDP) growth, interest rates, exchange rates, export growth, credit growth, inflation, return on assets (ROA), operating costs operating income and capital adequacy ratio (CAR), the results obtained GDP growth and export growth variables do not affect non-performing loans, while interest rates, exchange rates, credit growth, inflation, return on asset, operating costs operating income and capital adequacy ratio affect non-performing loans. The seven influential variables based on the GCV value can be concluded that credit growth is the factor that most influences non-performing loans.

This study's limitation was using the sensitivity measurement of gross domestic product, export, and inflation data, so the data used may not reflect the actual conditions. Suggestions for further research to conduct more in-depth analysis by adding other variables such as government

policies, write-offs of credit impairment losses (CKPN) and political costs, and a more extended observation period to obtain more accurate research results. Subsequent studies can use other statistical tests that aim to see the model's consistency in this study. Besides, long panel data will further strengthen findings and strengthen variables that affect the non-performing loan. Research implication is that banking authorities need to exercise credit control by applying risk management to loans and regulating the quality of profitable bank earning assets. Banks also need to improve the quality of credit guarantees that can be sold quickly so that banks' collateral assets can be used to reduce the risk of non-performing loans.

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