

# Analyzing The Determinants and Stability of Non-Performing Loans at Indonesian Private Commercial Banks

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## Analyzing The Determinants and Stability of Non-Performing Loans at Indonesian Private Commercial Banks

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### ABSTRACT

This study examines the determinants and stability of non performing loans at private commercial banks in Indonesia during 2003-2021. The determinants of NPL are influenced from both internal and external factors. The internal factors are credit growth and lending rate while the external factors are production index as proxy for GDP, exchange rate and inflation rate. Stability test is added to the analysis. This study defines stability of NPL function as the stability in regression coefficient and the stability in the intercept over time. Taking aggregate monthly NPLs of private commercial banks in Indonesia from 2003 to 2021 this study finds that loan growth has a negative impact while lending rate has a positive impact on NPL. Regarding to external or economic variables, exchange rate and inflation show a negative effect on NPL while Index production has no effect on NPL. Regarding the stability test, this study finds that the regression equation on NPL show a structural change over time. The intercept also differs over years during the study period.

**Key Words:** Non performing loans, private commercial banks, external factors, internal factors, stability test,

### 1. Introduction

Banks are understood as financial intermediaries, obtain funds from deposits and lend these out (Biondi, 2018). Due to the nature of their business, banks expose themselves to credit risk. Credit risk is the risk of default by a borrower who fails to repay the money borrowed (Rehman et al 2019). The main objective of bank lending is to make loans profitable with minimal risk. Bank Lending is not just a matter of making loan and waiting for payment, and the ability of borrower to pay the loan must be evaluated. The success of banking is assessed by its profit and asset quality while the stability of banking is needed for economic development (Barra and Zotti,

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2021). The quality of loan portfolio will affect the financial performance of bank and the success of economic development.

In Indonesia, the Financial Service Authority classifies loan quality into Pass Loan, Loan under special attention, Substandard Loan, Doubtful loan and Bad Loan. Loan is classified as pass category when the borrower is able to pay principal dan interest on time. When a borrower has installment arrears before 90 days, the loan is classified as under special attention. Substandard Loans are loans in which the principal or interest remains unpaid exceeding 90 days. The loans in Doubtful class are loans that the principal or interest remains unpaid exceeding 180 days. Bad loan means that the principal or interest remains unpaid exceeding 270 days. Non-Performing Loans (NPL) ratios are defined as the ratio of Substandard, Doubtful, and Loss combined to Total Loans.

Many factors contribute to the occurrence of NPL. Rachid (2019) divide the determinants of NPL into macroeconomic, microeconomic or bank level, and institutional factors. Key macroeconomic factors include GDP growth, unemployment rate, exchange rate, inflation, interest rate, stock price and house price. Naili and Lahrichi (2022) added public debt as a macroeconomic variable. Salem et al (2020) used Production Index as a proxy for GDP growth. Naili and Lahrichi (2022) define bank specific factors as unique features of the banking system and different policy choices of each bank. Institutional factors include Inefficient Control on Banking and legal systems that may influence market competition that deteriorate both bank and borrower financial conditions

This study includes Production Index to represent GDP, Exchange rate, and inflation rate as macroeconomic factors influencing NPL. For bank level factors, this study takes credit growth and bank lending rate. Thus, the explanatory power on NPL of macroeconomic and bank-specific factors will be investigated. This study uses aggregate data from private commercial banks in Indonesia

Based on the ownership, commercial banks in Indonesia are grouped into Government Banks, Private Banks, Foreign Banks, Foreign Banks, Joint Venture National-Foreign Banks, and Provincial Government Banks. This study selects the NPL at private commercial banks in Indonesia to represent market NPL producing since there in no government or political intervention in loan granting process by banks.

This study is motivated to reexamine the effect of these factors on NPL since there are no consistent findings in previous studies. For examples, Ahmed et al (2021) found a positive impact of loan growth on NPL while Shih-Wei et al (2022) found that loan growth had a negative impact on NPL.

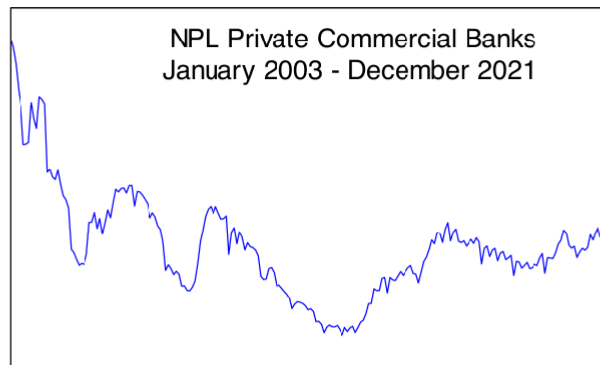
Macroeconomic condition had a negative effect on NPL (Anita et al, 2022; Foglia, 2022 and Khan et al, 2018) but it has a positive effect on NPL (Gashi et al 2022). A study conducted by Ahmed et al (2021) and Robert & Koori (2022) found that lending rate had a positive effect on NPL while Lalisho (2022) found that it had a negative effect. Khan et al (2018) found a positive influence of Inflation rate while Anita et al (2022) found a negative effect of Inflation on NPL.

A positive influence of exchange rate on NPL was found by Khan et al (2018) and Ahmed et al (2021) while no influence was found by Anita et al (2022).

This paper differs from previous studies. In addition to investigate the determinants of NPL, this paper also investigates the stability of NPL. Since the regression model used in this study involves time series data, a structural change may happen in the relationship between NPL and its determinants.

The behavior of NPLs during the 2003-2021 study period is displayed in Figure 1. The trend of NPLs over time at private commercial banks in Indonesia shows unstable behaviour. This fact motivates this study to investigate whether NPL at private commercial banks is stable.

Figure 1  
NPL Trend at Private Commercial Banks in Indonesia



### Problem Formulation

The following questions will be answered in this study

- (1) Are NPLs at private commercial banks partially and simultaneously affected by credit or loan growth, lending rate, GDP, inflation rate, and exchange rate
- (2) Does the structure of NPL function at private commercial banks in Indonesia change over time

### <sup>1</sup> Limitations of the study

This study only focuses on the determinants of NPL at private commercial banks in Indonesia. This study does not include government banks since there are possible government intervention in loan granting process. NPL at private commercial banks will more reflect market generating process of NPL. Instead of using individual bank data, this study uses aggregate data from all private commercial banks combined. There are many variables that can be grouped to internal and external factors. This study only includes loan growth and lending rate as internal factors. For external factors, this study includes production index as proxy for GDP, exchange rate, and inflation rate.

### <sup>1</sup> Objectives

The first objective of this study is to investigate whether NPLs at private commercial banks in Indonesia are sensitive to such internal factors as loan growth and lending rate as well as by external factors. The second objective is to investigate the stability of NPL function at private commercial banks in Indonesia either in the regression slope coefficients or in the intercept. In particular this study will be able to determine whether the intercepts during pandemic years differ.

### **Contribution**

This study is expected to benefit management, regulator as well as academic literatures.

An increasing portion of NPLs in assets of banks reflects greater risks facing banks. NPL affects both the bank liquidity as well as the bank profitability since NPL does not generate revenue for banks. Bank management should control the level of NPL by monitoring factors affecting the occurrence of NPL in their banks. This study helps the management to identify these factors.

Banks in Indonesia plays an important role in economy. Banking regulator should identify the causes of the occurrence on NPL for the objective to mitigate it. Lowering NPL is necessary to restore public confidence in Indonesian banking system and foster financial stability. This study gives information to the regulator the behaviour of NPL at private commercial banks as well as factors affecting the NPL.

This empirical study on NPL will also give significant contribution to existing literature since this study differs from previous studies in several aspects. This study adds stability test to the NPL function particularly for NPL at private commercial banks in Indonesia. This study shows new findings using data from private banks in Indonesia on the determinants of NPL. The findings in this study can become reference for future study particularly on Indonesian banking

## **2. Literature Review**

### **2.1. Information asymmetry, adverse selection and moral hazard theories**

Atoi (2018) summarized three theories as the traditional causes of loan default: information asymmetry, adverse selection and moral hazard theories. Information asymmetry theory states that it is difficult to differentiate between good and bad borrowers and this situation leads to adverse selection and moral hazard problems. The adverse selection theory is based on the assumption that banks are facing difficulty to select credit-worthy borrowers from a pool of loan seekers with different credit risk exposures ex-ante. Thus, banks are more likely to lend to high-risk borrowers who are prone to loan default. The moral hazard exists where the borrower of bank credit takes action that adversely affects the returns to the bank. A bank that makes loans is subject to a moral hazard problem with respect to screening borrowers. The theory is based on the assumption that the likelihood of borrowers engaging in activities that will guarantee repayment of bank credit extended to them cannot be determined ex-post by banks.

## 2.2. Credit Default Theory

According to Sy (2022) a credit default is caused by both delinquency and insolvency. Loan delinquency is a situation where a borrower does not have cash flow to meet the loan obligation by the due date. Unanticipated adverse developments in the borrower condition can cause delinquency. There are many factors, internal and external, that cause borrowers to have insufficient cash flow for meeting their debt obligations. Insolvency is a situation where the value of assets is less than liabilities. This study uses the term credit default as delinquency.

## 2.3. Factors Affecting Non-Performing Loans and Hypotheses

### 2.3.1. Credit Growth

Credit or loan growth is a good indicator of the banking stability. An excessive loan growth can cause bank instability since it leads to high credit risk (Pasaribu and Mindosa, 2021). High loan growth assumes greater risk since credit analysis is less rigorous as bank officers have less time for analyzing loan request. Excessive lending by commercial banks is often identified as an important determinant of NPLs

**The hypothesis is that credit growth positively affects on NPL**

### 2.3.2. Growth in GDP

GDP is a measure of economic health for a country. The higher the GDP means the higher the income of people. According to Foglia (2022), an increase in GDP indicates a higher income for households and higher profitability for businesses. The higher the GDP the higher the demand for goods and services and the higher the sales revenue of business. Improved financial conditions for businesses and households imply a higher ability of borrowers to repay their debt. The growth in the income level increases loan repayment capacity of the borrower (Khan et al, 2018). Therefore, the higher the GDP, the lower the NPL

**The hypothesis is that Growth in GDP affects negatively on NPL**

### 2.3.3. Inflation Rate

Inflation refers to the sustained increase in the general prices of goods and services in an economy over time. Inflation may pass through nominal interest rates as lenders adjust rates to maintain their real returns. The increase in lending rate is additional burden on borrowers causing NPL to increase. According to Ari et al (2019), The relationship between inflation and NPLs is theoretically ambiguous. Inflation may make it easier for borrower to service debt by reducing its real value, the inflation may also lead to higher nominal interest rates which raise burden on borrower. High inflation may also be associated with macroeconomic instability that exacerbates NPLs. This study believes that inflation may make it easier for borrower to service debt by reducing its real value.

**The hypothesis is that inflation rate affects negatively on NPL**

### 2.3.4. Exchange Rate

The exchange rate used in this study is the price of USD in terms Indonesia home currency or IDR.



An increase in exchange rate, that is a depreciation <sup>3</sup> in home currency will result in costly imported goods which put a pressure to finance letter of credits issued to traders by commercial banks, and thus increasing the risk of default, and vice versa (Anita et al 2022). The weaker the IDR, the higher the cost of imported goods. Therefore, the weaker the IDR, the higher the NPL

**The hypothesis is that exchange rate affects positively on NPL**

#### **2.3.5. Lending Rate**

The sign for interest rate on loan is expected to be positive since an increase in interest rate on loan will decrease the ability of borrower to repay debt. The increase in interest rates reduces the borrower's repayment capacity, therefore, causes an increase in non-performing loans. When banks increase interest rate, there is an additional burden on borrowers resulting in increased defaults (Robert and Koori, 2022).

**The hypothesis is that lending rate affects positively on NPL**

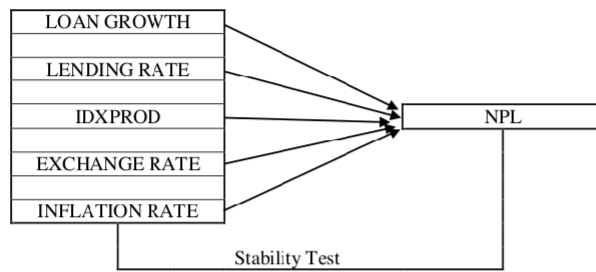
#### **2.4. The stability of NPL function**

The instability of regression function over time may be caused by <sup>6</sup> differences in the intercept or by the differences in the slope coefficients or both. The Chow test is used to test whether the regression parameters differ over subperiods. The differences in the intercept over time such as from year to year can be examined using two models explained in Brooks (2019). The first model is the Least Square Dummy Variables (LSDV) and the second model is the time fixed effect model produced by panel data regression with time effect instead of crosssection effect

#### **2.5. Research Framework**

The framework of this study is depicted in Figure 2 below:

Figure 2. Research Framework



The regression model used in this study:

$$NPL_t = \alpha + \beta_1 LOANGRW_t + \beta_2 LRATE_t + \beta_3 IDXPORD_t + \beta_4 XRATE_t + \beta_5 INF_t + \varepsilon_t$$

Where:

$NPL_t$  = Current NPL

$LOANGRW_t$  = Loan Growth

$LRATE_t$  = Lending Rate

$IDXPORD_t$  = Index of Industrial Production

$XRATE_t$  = IDR Exchange Rate

$INF_t$  = Inflation Rate

$\varepsilon_t$  = Residuals

$\alpha, \beta_1, \beta_2, \beta_3, \beta_4, \text{ and } \beta_5$  = Regression Parameters

$t$  = Month

### 3. Research Method

### 3.1. Data and Sources

This study uses time series data on monthly NPLs at private commercial banks in Indonesia from 2003 to 2021 or 228 observations. Data on NPL are available at Indonesian Banking Statistics issued by Bank Indonesia, the Indonesia central bank. This study defines NPL as <sup>11</sup>the ratio of Non-Performing Loans to Total Loans, that is;

$$NPL = \frac{\text{Substandard Loans} + \text{Doubtful Loans} + \text{Bad (Loss) Loans}}{\text{Total Loans}}$$

Since monthly GDP data are not available, this study uses <sup>9</sup>monthly Production Index data issued by Central Bureau of Statistics as a proxy for GDP. Monthly <sup>9</sup>industrial production index (IPI) has been used as a proxy of monthly economic activity (Stanger, 2020) to represent GDP. Monthly inflation rate data are available at Central Statistical Bureau

Monthly lending rate data are available at both Indonesian Banking Statistics and Central Bureau of Statistics. Data on bank loans are available at Indonesian Banking Statistics. The growth in loan or credit growth is defined as monthly credit growth calculated by the following formula:

$$\text{Credit Growth} = \frac{\text{Credit in Month}_t - \text{Credit in Month}_{t-1}}{\text{Credit in Month}_{t-1}}$$

### 3.2. Analytical tools

To answer the research questions, this study will use regression-based model. The regression model has been presented in previous section. Using this model allows this study to answer whether credit growth, lending rate, production index as a proxy for GDP, exchange rate and inflation rate influence current NPL at private commercial banks in Indonesia. For answering the second question, this study will use stability test to see whether there is a structural change in the regression equation. The intercept for individual year can be obtained either by adding dummy variables of by applying time fixed effect using panel data regression.

### 3.3. Examining the Partial effect of independent variable on NPL

Testing hypotheses about the partial regression coefficient will use the t-test. This test has the null and alternative hypotheses as follows:

$$H_0: \beta_t = 0 \text{ and } H_a: \beta_t \neq 0$$

The null hypothesis  $H_0$  states that, each independent variable has no linear effect on NPL with all other variables held constant. The alternative hypothesis  $H_a$  states that  $X_i$  has a linear effect on NPL with all other variables held constant. The decision is that  $H_0$  will be rejected if the corresponding p-value is lower than 0.10

### 3.4. Examining the simultaneous effect of all independent variable on NPL

Testing hypotheses about the simultaneous influence of all independent variable on NPL will use the F-test. This test has the null and alternative hypotheses as follows:

$$H_0 : \beta_1 = \beta_2 = \dots = \beta_k = 0$$

$H_a$  : Not all slope coefficients are simultaneously zero

This  $H_0$  is a joint hypothesis that all  $\beta$ s are simultaneously equal to zero. The decision is that  $H_0$  will be rejected if the p-value of F statistic is lower than 0.10

### 3.5. Stability Test

#### 3.5.1. The stability of intercept

To find the intercept for every year, this study will use two models as explained in Brooks (2019). The first model is the Least Square Dummy Variables (LSDV) and the second model is the time fixed effect model produced by panel data regression with time effect instead of crosssection effect.

According to Brooks (2014) the least square dummy variable (LSDV) regression approach is:

$$Y_{it} = \beta X_{it} + \mu_1 D1_i + \mu_2 D2_i + \dots + \mu_N DN_i + v_{it}$$

Applying this model, the regression intercepts would vary from year to year

This time-fixed effect model is written as

$$Y_{it} = \alpha + \beta X_{it} + \lambda_t + v_{it}$$

Where  $\lambda_t$  is an intercept that varies over time and constant cross-sectionally

To accommodate the time effect, this study applies time effect panel data regression. Applying the Chow and Hausman tests, this study finds what the appropriate model among common effect, fixed effect and random effect. If the fixed or random effect model is selected means that the intercepts are different among years or the regression on NPL is not stable.

### 3.5.2. The stability of regression structure

The Chow test will be applied to see whether the regression structure differs over time. The test procedure follows Biu and Nwakuya (2022). This study divides the entire period from 2003 to 2021 or 228 months into two subperiods, each with 114 months. This test is formulated as follows:

Ho: No structural change is accepted

Ha: The structural change is present

The F statistic for this test is formulated as follows

$$F = \frac{(RSS_R - RSS_{UR})/k}{(RSS_{UR})/(n_1 + n_2 - 2k)}$$

Where

$RSS_R$  = Restricted Residual Sum of Squares obtained from the regression of  $n_1$  and  $n_2$  combined

$RSS_{UR}$  = Unrestricted Residual Sum of Squares obtained from the RSS of regression with  $n_1$  plus the RSS of regression with  $n_2$

$k$  = The degrees of freedom for numerator, the number of parameters estimated

$n_1 + n_2$  = The degrees of freedom for denominator

The decision is that no structural change is accepted if the F statistic < the critical value of F. The structural change is present if the F statistic > the critical value of F.

## 4. Regression Results

### 4.1. Description of Data

As reported in Table 1, during this study period, the mean of NPL shows a figure of 3.0187% with the minimum and maximum figures of 1.5235% and 6.4852%, respectively. This minimum figure is observed in July 2013 and the maximum is observed in January 2003.

The mean loan growth (LOANGRW) is 1.3278% with the maximum growth of 9.8454% is observed in January 2020 and the minimum of -3.6296% is observed in January 2019. The negative figure represents a loan contraction.

The mean lending rate (LENDRATE) shows a figure of 12.7770% p.a. while the minimum and maximum figures are 8.350% and 18.2220%, respectively.

The production index (IDXPORD) that is the proxy of GDP shows a mean value of 123.7386. The minimum and maximum figures are 92.3200 and 158.0000, respectively.

The IDR exchange rate (XRATE) has a mean value of IDR 11,230.15 per USD. The minimum and maximum values are IDR 8320 per USD and IDR 16,367 per USD, respectively.

Data of inflation rate (INFL) shows a mean value of 5.7854 % with a minimum and a maximum values of 1.32% and 18.38%, respectively.

Table 1  
Data Description

	NPL	LOANGRW	LENDRATE	IDXPROD	XRATE	INFL
Mean	3.0187	1.3278	12.7770	123.7386	11230.15	5.7854
Median	2.9454	1.2894	12.8600	123.3685	10125.00	5.2150
Maximum	6.4852	9.8454	18.2200	158.0000	16367.00	18.3800
Minimum	1.5235	-3.6296	8.3500	92.3200	8320.000	1.3200
Std. Dev.	0.8859	1.7682	2.1456	14.5063	2261.399	3.4026
Obs	228	228	228	228	228	228

#### 4.2. Regression Results

The result of Chow test shows the F-statistic of 64.6649 with prob 0.0000 while the result of Hausman test shows the Chi-square statistic of 12.3295. Based on these two tests, the appropriate model is time fixed effect. Table 2 presents the results.

Table 2  
Time Fixed Effect Regression Results

Dependent Variable: NPL?					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	
LOANGRW?	-0.0280	0.0108	-2.5967	0.0101	
LENDRATE?	0.3408	0.0425	8.0216	0.0000	
LNXRATE?	-0.9382	0.4312	-2.1758	0.0307	
INFL?	-0.04240	0.0108	-3.9286	0.0001	
IDXPROD?	0.0008	0.0027	0.2815	0.7786	
Interceptions					

_YEAR2003--C	8.3184	_YEAR2013--C	6.4854	
_YEAR2004--C	8.0041	_YEAR2014--C	6.7017	
_YEAR2005--C	7.3367	_YEAR2015--C	7.2425	
_YEAR2006--C	7.3568	_YEAR2016--C	7.9206	
_YEAR2007--C	7.5357	_YEAR2017--C	8.1843	
_YEAR2008--C	7.0228	_YEAR2018--C	8.2345	
_YEAR2009--C	7.4136	_YEAR2019--C	8.1760	
_YEAR2010--C	7.1328	_YEAR2020--C	8.7911	
_YEAR2011--C	6.6990	_YEAR2021--C	9.1054	
_YEAR2012--C	6.4665			
R-squared	0.9301	F-statistic	118.0800	
Adjusted R-squared	0.9223	Prob(F-statistic)	0.0000	

The regression results show that loan growth (LOANGRW) has a significant coefficient with a negative sign. Lending rate (LENDRATE) also has a significant coefficient but with a positive sign. The production index (IDXPROD) as a proxy of GDP also has a positive coefficient but insignificant. The exchange rate represented by its logarithmic value (LNXRATE) has a significant coefficient with a negative sign. Finally, the inflation rate using year on year figures (INFL) also has a negative sign and this coefficient is significant.

As reported in Table 2, the results show that the regression intercepts vary from year to year indicating the regression model is unstable. The results show that in years 2020 and 2021 the intercept figures are the highest. This is in coincidence with the outbreak of the pandemic of Covid19.

#### 4.3. Stability Test for Regression Structure

Testing the change in the regression structure over time this study divides the data into two subperiods, each with 114 months. This test is formulated as follows:

Ho: The Structure of the two regression does not differ (the regression is stable)

Ha: The structure of the two regression differs (the regression is not stable)

##### 4.3.1. Regression for the whole data (n = 228)



$$NPL_t = -15.5515 - 0.0205LOANGRW_t + 0.4533LENDRATE_t + 1.4484LNXRATE_t \\ - 0.1168INFL_t + 0.0049IDXPORD_t + \varepsilon_t$$

$$SSR_1 = 93.8869 \quad df = n_1 + n_2 - k = 114 + 114 - 6$$

#### 4.3.2. Regression for the first half data (n = 114)

$$NPL_t = 3.1230 + 0.01328LOANGRW_t + 0.6291LENDRATE_t - 0.8937LNXRATE_t \\ - 0.0797INFL_t + 0.0050PRODGRW_t + \varepsilon_t$$

$$SSR_2 = 19.5514 \quad df = n_1 - k = 114 - 6$$

#### 4.3.3. Regression for the second half data (n = 114)

$$NPL_t = -22.9495 - 0.0230LOANGRW_t + 0.1231LENDRATE_t + 2.6275LNXRATE_t \\ - 0.1658INFL_t + 0.000075PRODGRW_t + \varepsilon_t$$

$$SSR_3 = 5.7294 \quad df = n_2 - k = 114 - 6$$

The coefficient of LOANGRW is positive for the first half data while it is negative for the second half data. The coefficient of LNXRATE is negative for the first half data while it is positive for the second half data

According to Biu and Nwakuya (2022)

$$SSR_4 = SSR_2 + SSR_3 = 19.5514 + 5.7294 = 25.2808 \quad df = n_1 + n_2 - 2k$$

$$= 114 + 114 - 2(6) = 216$$

$$SSR_5 = SSR_1 - SSR_4 = 93.8869 - 25.2808 = 68.6061 \quad df = k = 6$$

The Chow (or F) statistic will be:

$$F = \frac{(SSR_R - SSR_{UR})/k}{SSR_{UR}/(n_1 + n_2 - 2k)} = \frac{SSR_5/k}{SSR_4/(n_1 + n_2 - 2k)} = \frac{68.6061/6}{25.2808/216} = 97.6955$$

Based on F-table of critical values using alpha 5%, the critical F-value with numerator df of 6 and denominator df of 120 (maximum) is 3.70. Since the calculated F-statistic is greater than its

critical value, the decision is to reject  $H_0$ . Therefore, there is no stability in regression structures over time.

### 5. Discussions

This study examines the determinants and stability of non performing loans at private commercial banks in Indonesia during 2003-2021.

The negative influence of loan growth on NPL found in this study does not support the hypothesis. The negative influence of loan growth on NPL due to the fact that the loan growth in private bank group is not excessive with maximum figure smaller than ten percents.

The positive influence of lending rate on NPL shown in this study supports the hypothesis. The increase in interest rates reduces the borrower's repayment capacity, therefore, causes an increase in non-performing loans.

The insignificant influence of GDP represented by production index does not replicate with the literature as GDP has negative relation with NPL. This might due to the use of industrial production index as the proxy for GDP does not represent the structure of Indonesia economy. The negative influence of exchange rate does not support the hypothesis. An increase in exchange rate, that is a depreciation in home currency will result in costly imported goods which put a pressure to finance letter of credits, and thus increasing the risk of default. The hypothesis assumes that the borrowers are importers. The negative influence of exchange rate on NPL might be true if borrowers are exporters. The negative effect of inflation rate does not support the hypothesis. Actually, this result can be accepted since theoretically the relationship between inflation and NPLs is ambiguous. In one side, inflation may make it easier for borrower to service debt by reducing its real value, in other side the inflation may also lead to higher nominal interest rates which raise burden on borrower.

The regression on NPL at private commercial banks is not stable making NPL prediction will be difficult. This study finds that the regression equation on NPL show a structural change over time. The intercept also differs over years during the study period. In years 2020 and

2021 the intercept figures are the highest. This is in coincidence with the outbreak of the pandemy of Covid19.

### 6. Conclusion

Some conclusions can be drawn from this empirical study. Using panel data regression this study finds that the effect of credit growth, lending rate, production index, exchange rate and inflation rate follows a time fixed effect process. Loan growth has a negative impact on NPL, lending rate has a positive impact on NPL, GDP represented by production index has no impact on NPL, exchange rate and inflation rate both have a negative effect on NPL. A structural instability of NPL function is observed either by the regression structure or by the differences in intercepts year by year. At the end, this study concludes that the Indonesia Banking Regulator and the Indonesia Government have to play their roles in order to control the Levels of NPL. A strong role should be played to keep the loan growth on rise while at the same time keep the lending rate low.

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