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(Research/Review) Article

Dynamic Analysis of Non-Performing Loans in Indonesian Banking

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Abstract: This study analyzes the dynamics of Non-Performing Loans (NPLs) in the Indonesian banking sector by examining both internal and external factors affecting financial stability. The variables included in the research are NPL, Loan to Deposit Ratio (LDR), lending interest rate, inflation, Household Debt to Income (HDTI), fintech lending, and Capital Adequacy Ratio (CAR). Using annual secondary data from 2005 to 2024, sourced from the World Bank and Statistics Indonesia (BPS), the study employs a Vector Autoregression (VAR) method. This method includes stationarity tests, optimal lag selection, cointegration tests, Impulse Response Function (IRF), and Forecast Error Variance Decomposition (FEVD). The results show that most variables demonstrate a dominant contribution from their own shocks, although interactions between variables remain significant. The IRF analysis reveals that CAR and HDTI are relatively stable and quickly return to equilibrium, while fintech lending, inflation, and NPLs show more volatile responses, making them more susceptible to external shocks. LDR and lending interest rates are sensitive in the short term but tend to stabilize over the long run. FEVD further indicates that inflation plays a significant role in driving NPL variations, while fintech lending is closely associated with CAR in the long term. The study concludes that the stability of Indonesia's banking sector is influenced by both internal factors like CAR and LDR, as well as external factors such as inflation, fintech lending, and household debt. Thus, a coordinated approach involving monetary policy, macroprudential measures, and financial supervision is crucial to enhance the resilience of the banking sector against global and domestic economic shifts.

Keywords : Capital Adequacy Ratio (CAR); Fintech Lending; Loan to Deposit Ratio (LDR); Non-Performing Loan (NPL); Vector Autoregression (VAR)

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1. Introduction

The banking sector serves as the backbone of Indonesia's financial system, where the intermediation function through credit distribution acts as the main driver of national economic growth. However, in practice, banks cannot be separated from credit risk, which is reflected in the increase of Non-Performing Loans (NPLs). A high NPL ratio indicates a greater level of borrower failure to meet repayment obligations, and if not properly managed, it may disrupt the overall stability of the financial sector.

Indonesia's economic growth and development are characterized by rapid and dynamic changes. One of the efforts to strengthen the national economy is the establishment of financial institutions known as banks. Banks are business entities responsible for carrying out banking transactions, including fund mobilization (funding), fund distribution (lending), and providing other banking services. Generally, banks play a central and vital role in supporting the strength and efficiency of the payment system, as well as in enhancing the effectiveness of monetary policy implementation in Indonesia (Bilqis Tahta Maulida & Anita Handayani, 2022).

The existence of banks is therefore crucial to the economic development of a country. The banking sector occupies a strategic position in driving the economic engine of a nation, to the extent that no country can function without banking institutions.

The banking industry is constantly required to develop strategies and innovate in providing services to customers. Such innovation is necessary to address growing competition alongside the rapid advancement of financial technology. Banks with strong innovative capacity are more likely to maintain their competitiveness and ensure their existence in increasingly fierce competition while maximizing profitability (Ashari & Arifin, 2020).

In many developing countries, including Indonesia, banks play an essential role in supporting the stability of the payment system and the effectiveness of monetary policy. According to Law No. 10 of 1998, banks are business entities authorized to collect funds from the public in the form of deposits and redistribute them to the public in the form of credit or other financial instruments to improve the standard of living of society. The redistribution of funds is carried out through current accounts, savings, and time deposits, which are then channeled back to society in the form of loans (credit).

Nevertheless, credit distribution exposes banks to risks, particularly in the form of delayed repayments or what is commonly referred to as credit risk. Credit risk may manifest as bad loans, often known as Non-Performing Loans (NPLs). NPLs are an indication of underlying problems within a bank which, if left unresolved, could have negative implications for its performance. Several factors contribute to the occurrence of NPLs. The Loan to Deposit Ratio (LDR), for instance, measures the proportion between the total funds distributed as loans and the total funds sourced from public deposits and equity. This ratio also reflects the bank's ability to meet withdrawal demands from depositors by relying on loans granted as a source of liquidity.

To mitigate risks arising from credit issues, banks are required to allocate funds for business development and to absorb potential losses caused by operational activities, which is measured through the Capital Adequacy Ratio (CAR). A higher CAR reflects a stronger capacity of the bank to minimize credit risk, meaning that the bank can cover potential credit losses with adequate capital reserves derived from the proportion between equity and risk-weighted assets (Abyanta et al., 2020).

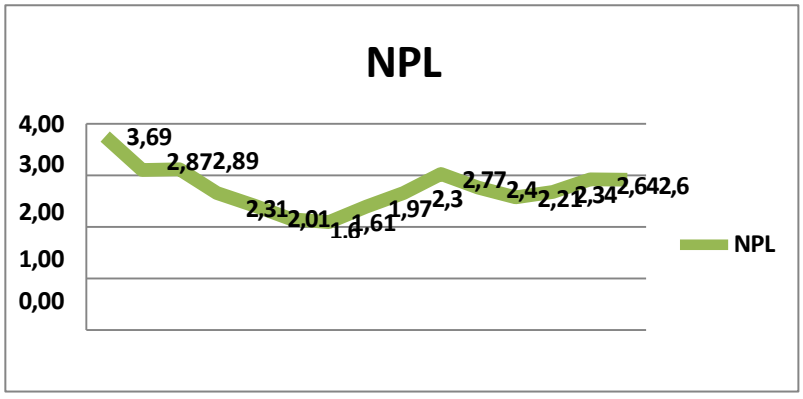

Figure 1. Indonesia's NPL Data for the Period 2007–2024
Sourcer: https://data.worldbank.org/indicator/FB.AST.NPER.ZS

The graph illustrates the development of Non-Performing Loans (NPLs) in Indonesia's banking sector from 2007 to 2021. In 2007, the NPL ratio reached its peak at 3.69 percent before following a downward trend, hitting its lowest point of 1.68 percent in 2013. Thereafter, NPLs gradually increased, reaching 3.23 percent in 2016 and 2.77 percent in 2017, then stabilizing within the range of 2–2.6 percent until 2021. Overall, despite some fluctuations, Indonesia's banking NPLs remained below the 5 percent threshold set by Bank Indonesia, indicating that credit quality has generally been maintained amid economic dynamics.

Bank Indonesia classifies NPLs into three categories based on repayment performance: (1) Substandard: loans overdue for 1–3 months; (2) Doubtful: loans overdue for 4–9 months;

and (3) Loss: loans overdue for more than 9 months. Elevated NPL ratios can trigger various negative consequences, such as: (1) reducing bank profitability, since bad loans generate no income; (2) increasing liquidity risk, as banks with high NPLs face difficulties meeting customer withdrawal demands; (3) creating systemic bad loans that may spark a financial crisis; and (4) undermining economic stability, as high NPLs hinder economic growth and weaken the financial system.

Several factors contribute to the occurrence of NPLs. First, unfavorable macroeconomic conditions may reduce borrower income and repayment capacity. Second, weaknesses in credit distribution, such as lending to borrowers without proper qualifications or viable business prospects. Third, deficiencies in credit management, where banks fail to monitor and collect loans effectively, leading to delayed or missed payments (Ainiah & Sriyana, 2024). Non-performing loans must be minimized to avoid bank losses and kept under the Bank Indonesia threshold. If left unaddressed, rising NPLs can erode bank capital.

Internal factors also influence NPLs. The first is the Loan to Deposit Ratio (LDR). High LDR levels may increase a bank's vulnerability to economic fluctuations. During uncertain economic conditions or recessions, credit risk tends to rise as borrowers struggle with repayments. Low liquidity, in turn, makes it harder for banks to manage short-term obligations. The second factor is the Capital Adequacy Ratio (CAR). A low CAR indicates limited capital capacity to absorb credit risk, while a high CAR reflects stronger risk management quality. The third factor is inflation. Rising inflation increases the cost of living and reduces repayment capacity. The fourth is the Bank Indonesia rate (BI rate). During periods of high interest rates, people tend to save rather than borrow, while low interest rates encourage borrowing (Istiqomah et al., 2024).

Meanwhile, advances in digital technology have accelerated the growth of the digital economy, underpinning the development of financial technology (fintech) as part of production, distribution, and consumption processes. Today, with 62.10% of Indonesia's population having internet access, digital platforms such as e-commerce and fintech dominate economic transactions. Fintech offers accessibility, speed, and flexibility, but its use requires adequate knowledge and understanding. As a fusion of finance and high-speed communication technology, fintech allows efficient transmission of data, voice, and video. With the growing presence of fintech services, competition has intensified. Fintech firms continue to innovate and promote aggressively to attract as many customers as possible, with profitability as the main objective. The ease of borrowing is fintech's main appeal; however, online loans also carry higher risks compared to conventional financial services (Sanusi Ghazali, Novianta et al., 2024).

In recent years, the financial sector has undergone major shifts due to advancements in information and communication technologies. Fintech represents one of the most prominent manifestations of this transformation, reshaping conventional business models in finance, including banking. Fintech has changed how people transact, save, borrow, and manage finances. This phenomenon presents both challenges and opportunities for traditional banks. While fintech may erode conventional banks' market share, it also offers opportunities to enhance operational efficiency, expand service outreach, and create innovative products tailored to customer needs in the digital era (Lia Nazliana Nasution & Efendi, 2025).

The most likely risk in fintech lending is loan default, where borrowers fail or delay repayment. This leads to a rise in bad loans. Although fintech firms conduct thorough verification before disbursing loans, such measures cannot guarantee reduced default rates. Non-performing loans remain a major challenge for all financial service providers, including fintech lending. Moreover, some fintech operators not registered with Indonesia's Financial Services Authority (OJK) still enjoy regulatory loopholes, particularly regarding interest rate limits (Munandar et al., 2021).

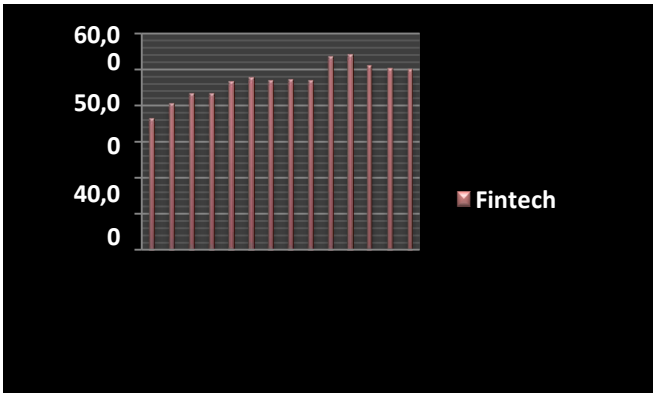

Figure 2. Fintech Lending Data in Indonesia for the Period 2020–2024 Source: https://data.worldbank.org/indicator/FM.AST.DOMS.CN?locations=AE

The trend of loan disbursement by fintech companies shows consistent growth from 2020 to 2024. The total amount of loans disbursed has continued to increase each year, indicating that fintech lending is increasingly accepted as an alternative source of financing, particularly among communities that are not yet fully served by formal banking services. This growth aligns with the advancement of digital technology and the rising demand for fast, simple, and flexible access to financing. Nevertheless, the increase in loan volume also raises concerns about credit risk levels, especially among low-income groups who may face the burden of double exposure between banks and fintech lenders. On the other hand, Indonesia's improving economic growth in the post-pandemic period fosters optimism regarding borrowers' ability to meet their financial obligations. However, global threats such as international geopolitical tensions, food and energy crises, and uncertainty in global financial markets remain significant challenges that could reintroduce pressure on the national banking system. Therefore, it is essential to dynamically examine the relationship between NPL-related factors to provide a comprehensive overview of the resilience of Indonesia's banking sector against economic shocks. This analysis will assist financial authorities and banking practitioners in formulating credit risk mitigation strategies that are more adaptive to changes in both national and global economic conditions.

2. Literature Review

The Loan to Deposit Ratio (LDR) is a liquidity ratio used to measure the composition of loans disbursed in comparison to the amount of public funds and the bank's own capital employed (Ainiah & Sriyana, 2024). A higher LDR in a bank results in lower liquidity because a greater amount of funds is required to finance the loans, whereas a lower LDR indicates higher liquidity in the respective bank. This reflects the impact on a bank's credit capacity, as a higher LDR suggests that the loans disbursed by the bank are also higher in fulfilling its short-term obligations. Conversely, a lower LDR indicates that the loans disbursed by the bank are also lower in meeting its short-term obligations. In this regard, banks must pay greater attention to the statutory reserve requirement ratio. The minimum reserve requirement that must be maintained is 5% for rupiah-denominated funds (Amalia, 2014).

The Capital Adequacy Ratio (CAR), also referred to as the Minimum Capital Adequacy Requirement (KPMM), is a capital ratio that reflects a bank's ability to provide funds for business development purposes and to accommodate the risk of losses arising from banking operations (Heningtyas et al., 2021). According to Bank Indonesia regulations, which are aligned with the Bank for International Settlements (BIS), banks are required to maintain a minimum CAR of 8% to ensure banking soundness. Banks must provide a minimum Tier 1 capital of 6% of risk-weighted assets (RWA) and a minimum Common Equity Tier 1 (CET1) of 4.5% of RWA, both on an individual basis and on a consolidated basis with their subsidiaries. Risk-Weighted Assets (RWA) represent risks related to capital allocation for assets ranging from low-risk to high-risk. CAR serves as an indicator of a bank's solvency; if the ratio falls below the minimum threshold, it could jeopardize depositors' funds (Nikmah et al., 2023).

Initially, inflation was defined as an increase in the money supply or liquidity within an economy. This definition refers to the general phenomenon triggered by rising money circulation, which is assumed to cause a sustained increase in the overall price level of goods

and services in the economy (Sanusi Ghazali Pane, 2024). The interest rate channel of monetary expansion functions through increased aggregate demand, resulting from higher inflation expectations and a decline in real interest rates. A decrease in real interest rates stimulates investment and lowers capital costs in the production process, leading to higher aggregate output. Rising inflation expectations further reduce real interest rates, causing currency depreciation, an increase in net exports, and, consequently, economic growth. As economic growth accelerates, rising income and public demand push prices upward, which in turn fuels inflation. This increase in inflation indicates a disruption to economic stability (Rusiadi; Novalina & Sembiring, 2017).

The idea that household debt can cause economic downturns can be traced back to Fisher's (1933) influential work, which regained prominence following the Global Financial Crisis (GFC). From a theoretical perspective, several studies have examined how debt-constrained household behavior may contribute to the slowdown of economic activity. From an empirical perspective, evidence suggests that increased credit supply unrelated to improvements in income fundamentals or productivity may represent shocks that trigger household debt booms and busts. Other scholars link high household debt levels at the onset of the Great Recession to weaker output growth and higher unemployment (Jin et al., 2025).

Fintech Lending, also known as Fintech Peer-to-Peer Lending (P2P Lending) or Technology-Based Money Lending Services (LPMUBTI), is a financial innovation that utilizes technology to enable lenders and borrowers to conduct loan transactions without the need for face-to-face interaction (Riyasni, 2023).

3. Proposed Method

The Vector Autoregression (VAR) model (Caraiani et al., 2023) is an econometric analysis technique that takes into account the reciprocal relationships among multiple time series variables. The variables in this study include NPL, LDR, lending interest rates, inflation, HDTI, fintech lending, and CAR, with a research period of 20 (twenty) years, spanning from 2005 to 2024, focusing on Indonesia. In the VAR model, it is assumed that each variable in the system influences both other variables in the system as well as itself in the previous period (Rusiadi et al., 2024). Each variable is based on secondary data obtained from Data Indonesia, the World Bank (https://data.worldbank.org/), and Statistics Indonesia (https://www.bps.go.id/id). Thus, the VAR model enables us to understand the dynamic interactions among these variables over time.

The application of the VAR model has become widespread and has been employed in various fields of economics, including macroeconomics, finance, and policy analysis. This model has several important applications, such as forecasting variables, analyzing the impact of unexpected policies, identifying the transmission effects among economic variables, and testing causal relationships among them. Therefore, the VAR model provides a powerful tool for understanding and predicting economic behavior within complex and dynamic contexts.

A conceptual framework that formulates the VAR model is presented as follows:

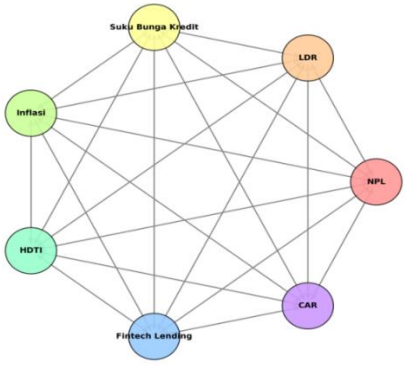

Figure 3. Conceptual Framework Of Vector Autoregression

$$\mathbf{HDTI}_t = \beta_{10}\mathbf{HDTI}_{t-p} + \beta_{11}\mathbf{NPL}_{t-p} + \beta_{12}\mathbf{INF}_{t-p} + \beta_{13}\mathbf{SBK}_{t-p} + \beta_{14}\mathbf{CAR}_{t-p} + \beta_{15}\mathbf{LDR}_{t-p} + \beta_{16}\mathbf{FL}_{t-} + \mathbf{e}_{t1}$$

$$NPL_t = \beta_{10}HDTI_{t-p} + \beta_{11}NPL_{t-p} + \beta_{12}INF_{t-p} + \beta_{13}SBK_{t-p} + \beta_{14}CAR_{t-p} + \beta_{15}LDR_{t-p} + \beta_{16}FL_{t-} + e_{t1}$$

$$INF_t = \beta_{10}HDTI_{t-p} + \beta_{11}NPL_{t-p} + \beta_{12}INF_{t-p} + \beta_{13}SBK_{t-p} + \beta_{14}CAR_{t-p} + \beta_{15}LDR_{t-p} + \beta_{16}FL_{t-} + e_{t1}$$

$$SBK_t = \beta_{10}HDTI_{t-p} + \beta_{11}NPL_{t-p} + \beta_{12}INF_{t-p} + \beta_{13}SBK_{t-p} + \beta_{14}CAR_{t-p} + \beta_{15}LDR_{t-p} + \beta_{16}FL_{t-} + e_{t1}$$

$$CAR_t = \beta_{10}HDTI_{t-p} + \beta_{11}NPL_{t-p} + \beta_{12}INF_{t-p} + \beta_{13}SBK_{t-p} + \beta_{14}CAR_{t-p} + \beta_{15}LDR_{t-p} + \beta_{16}FL_{t-} + e_{t1}$$

$$LDR_t = \beta_{10}HDTI_{t-p} + \beta_{11}NPL_{t-p} + \beta_{12}INF_{t-p} + \beta_{13}SBK_{t-p} + \beta_{14}CAR_{t-p} + \beta_{15}LDR_{t-p} + \beta_{16}FL_{t-} + e_{t1}$$

$$FL_t = \beta_{10}HDTI_{t-p} + \beta_{11}NPL_{t-p} + \beta_{12}INF_{t-p} + \beta_{13}SBK_{t-p} + \beta_{14}CAR_{t-p} + \beta_{15}LDR_{t-p} + \beta_{16}FL_{t-} + e_{t1}$$

Where:

NPL = Non-Performing Loan (Percent)
INF = Inflation (Percent)
SBK = Lending Interest Rate (Percent)
FL = Fintech Lending (Percent)
HDTI = Household Debt to Income Ratio (Percent)
CAR = Capital Adequacy Ratio (Percent)
LDR = Loan to Deposit Ratio (Percent)
et = Random Disturbance (Error Term)
p = Lag Length

4. RESULTS

Results of Vector Autoregression (VAR) Analysis

The results of the Vector Autoregression (VAR) analysis provide an overview of the dynamic relationships among endogenous variables within an economic or financial system. In the VAR model, each variable is treated as an endogenous variable, meaning that its movement is influenced not only by its own past values (lags) but also by other variables in the system during the same period. Accordingly, the results of the VAR analysis offer insights into the extent to which the interactions among variables can explain short-term, medium-term, and long-term patterns of the phenomenon under study.

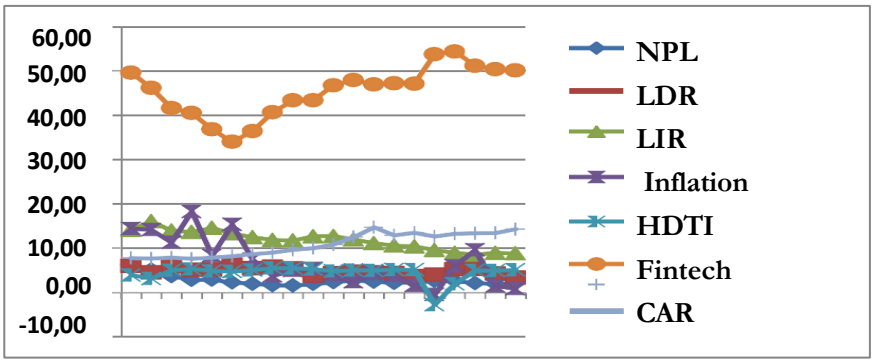

Figure 4. Interpretation of Non-Performing Loans in Indonesian Banking
Source: World Bank, Processed by the Author (2025)

Table 1. Results of the Stationarity Test

Variable	*Augmented Dickey Fuller*	
	t-statistic	Stasioneritas
CAR	0.0004	1ST
Fintech Lending	0.0022	1ST
HDTI	0.0001	1ST
Inflation	0.0000	1ST
LDR	0.0014	1ST
Non Performing Loan	0.0000	1ST
Lending Interest Rate	0.0054	1ST

Lending Interest Rate 0.0054 1st

Source: Data Analysis, EViews (5% and 10%)

In Table 1, the results of the stationarity test above indicate that the Augmented Dickey-Fuller (ADF) values for each variable are stationary at different levels. The variables CAR, Fintech Lending, HDTI, Inflation, LDR, NPL, and Lending Interest Rate are stationary at the 1st difference level. All variables have a probability value of 0.00 < 0.05.

Table 2. Results of Lag Length Test (Lag 1 and Lag 2)

Vector Autoregression Estimates LAG 1	
Akaike information criterion	31.45857
Schwarz criterion	34.22325
Number of coefficients	56
Vector Autoregression Estimates LAG 2	
Akaike information criterion	25.56649
Schwarz criterion	30.77374
Number of coefficients	105

Source: Data Analysis, EViews 10

The Schwarz Criterion (SC) and the Akaike Information Criterion (AIC) are used to determine the optimal lag. The optimal lag is indicated by lower AIC and SC values compared to other lags. Based on the lag selection results in Table 2 above, the AIC value at lag 2 (31.45857) is lower than at lag 1 (25.56649), indicating that lag 2 is more optimal. Therefore, the analysis can be continued using lag 2. The Johansen cointegration test is explained as follows:

Table 3. Results of Johansen Cointegration Test

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.992879	268.6984	125.6154	0.0000
At most 1 *	0.920360	159.9144	95.75366	0.0000
At most 2 *	0.913554	104.2492	69.81889	0.0000
At most 3 *	0.737263	50.38798	47.85613	0.0283
At most 4	0.439713	20.98276	29.79707	0.3587
At most 5	0.287628	8.238044	15.49471	0.4403
At most 6	0.034686	0.776643	3.841466	0.3782

Source: Data Analysis, EViews 10

The Johansen cointegration test reveals the relationship patterns among the variables. Table 3 above shows that there are four (4) cointegrated equations at the 5% significance level, namely HDTI, CAR, Fintech Lending, and Inflation. This finding confirms the

existence of a long-term relationship among the variables. To further analyze the VAR results, the next step is to examine the stability test of the lag structure, which is presented in the following table and figure:

Table 4. Stability Test of Lag Structure

Root	Modulus
0.930427	0.930427
0.855667	0.855667
0.546761 - 0.628112i	0.832750
0.546761 + 0.628112i	0.832750
-0.743873 - 0.279271i	0.794569
-0.743873 + 0.279271i	0.794569
0.092886 - 0.743223i	0.749005
0.092886 + 0.743223i	0.749005
-0.642237	0.642237
0.095451 - 0.565838i	0.573832
0.095451 + 0.565838i	0.573832
-0.451105	0.451105
0.425787	0.425787
0.200417	0.200417

Source: Data Analysis, EViews 10

Inverse Roots of AR Characteristic Polynomial

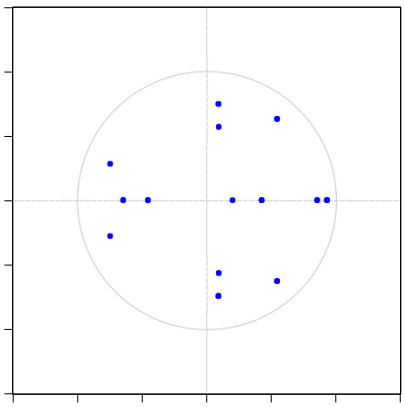

Figure 5. Inverse Roots of AR Characteristic Polynomial

Source: Data Analysis, EViews 10

From Table 4 and Figure 5 above, the results show that the modulus root values are below 1, consistent with the figure indicating that the roots lie within the circle. This demonstrates that, using the characteristic polynomial and inverse roots approach, the model produced is stable. Accordingly, the lag stability test has been satisfied, making it possible to proceed with the VAR analysis as follows:

Table 5. Results of VAR Estimation Test

Variable	Largest Contribution	
	First Larges	Second Largest
CAR	CAR	HDTI
Fintech Lending	Fintech Lending	CAR
HDTI	HDTI	Inflation
Inflation	Inflation	Fintech Lending
LDR	LDR	HDTI
Non Performing Loan	NPL	Inflation
Lending Interest Rate	Lending Interest Rate	HDTI

Source: Data Analysis, EViews 10

Based on the contribution analysis results, it is evident that each variable in the system has mutually influencing relationships. The Capital Adequacy Ratio (CAR) shows the largest contribution from itself, although the Household Debt to Income Ratio (HDTI) also emerges as the second most significant external factor. For the Fintech Lending variable, the largest contribution also comes from itself, followed by CAR, indicating a close connection between financial technology development and the strength of banking capital. The HDTI variable is primarily influenced by itself, but inflation appears as the second dominant external factor shaping household debt risks. Meanwhile, inflation has the greatest contribution from itself, followed by fintech lending, which exerts an additional effect on price stability.

For the Loan to Deposit Ratio (LDR), the strongest influence comes from itself, with HDTI as the second factor reinforcing the dynamics of credit distribution. Regarding Non-Performing Loans (NPLs), the largest contribution originates from itself, but inflation also serves as a significant determinant in shaping credit risk. As for lending interest rates, these are predominantly influenced by themselves, with HDTI emerging as the next external factor that significantly impacts banking financing dynamics.

Overall, these findings indicate that most variables demonstrate a dominant contribution from their own shocks, while the interactions among variables—particularly through inflation, HDTI, and fintech lending—emerge as key factors influencing banking stability in Indonesia.

Figure 6. Summary Graph of Impulse Response Function (IRF) Test Results
Source: Data Analysis, Eviews 10

The Impulse Response Function (IRF) analysis indicates that the resilience of Indonesia's financial system exhibits different patterns across variables. The Capital Adequacy Ratio (CAR) and Household Debt to Income (HDTI) remain relatively stable and quickly return to equilibrium, thus serving as buffers for financial stability. In contrast, Fintech Lending, inflation, and Non-Performing Loans (NPL) display more volatile responses, reflecting a higher degree of vulnerability to shocks from both the banking and macroeconomic sectors. The Loan to Deposit Ratio (LDR) and lending interest rates also

show significant short-term sensitivity, but tend to subside over time. Overall, these findings emphasize that the stability of Indonesia's financial system does not solely depend on the strength of bank capitalization, but is also influenced by fintech developments, credit quality, and price stability. Therefore, synergy between monetary policy, macroprudential measures, and financial sector supervision is necessary to strengthen the resilience of the financial system in facing various economic dynamics.

4. Discussion

The results of the variance decomposition analysis show the relative contribution of each variable in explaining the variation of shocks to other variables in the system. The Capital Adequacy Ratio (CAR) is mostly influenced by its own shocks, but the contribution of the Household Debt to Income (HDTI) also emerges as the second dominant factor, indicating a strong linkage between banks' capital health and household debt conditions. Fintech Lending is initially driven primarily by its own shocks, but over time, the role of CAR becomes more prominent, illustrating a transmission effect from the traditional banking sector to fintech. HDTI remains relatively stable with the largest contribution coming from itself, although inflation provides an additional significant effect. Inflation is also largely dominated by its internal shocks, yet fintech lending begins to play a role in its variation. The Loan to Deposit Ratio (LDR) shows that its own shocks are the dominant factor, but the influence of HDTI remains significant in the long run. Non-Performing Loans (NPL) are influenced not only by internal shocks but also largely explained by inflation, suggesting that price stability is closely linked with the quality of bank credit. Meanwhile, lending interest rates are primarily affected by their own shocks, with HDTI as an additional contributor, underscoring the role of household debt in shaping loan cost dynamics. Overall, the results of this variance decomposition indicate that nearly all variables have strong internal drivers, but inter-variable interactions remain significant, particularly the interlinkages among CAR, HDTI, fintech lending, inflation, and NPL. This implies that Indonesia's financial stability is strongly shaped by a combination of internal banking factors, household behavior, and the development of financial technology.

The application of the VAR model begins with a stationarity test using the Augmented Dickey-Fuller (ADF) test to ensure the data do not produce biased regression results (Rusdiadi, 2011). The results show that CAR, Fintech Lending, HDTI, Inflation, LDR, NPL, and Lending Interest Rate are stationary at the first difference, with probability values of $0.00 < 0.05$. The next step is determining the optimal lag using the Schwarz Criterion (SC) and Akaike Information Criterion (AIC). Lag 2 was selected as the most optimal since it had lower AIC and SC values compared to Lag 1. This is supported by the Johansen cointegration test, which revealed cointegration at the 5% significance level, indicating the existence of long-term relationships among variables. Model stability was confirmed through root modulus values below 1, showing that the model is stable using both the Roots of Characteristic Polynomial and the Inverse Roots of AR Characteristic Polynomial. The VAR estimation results reveal how each variable contributes to others in the context of NPL in Indonesian banking. CAR is most influenced by itself and HDTI, indicating that a decline in bank performance will affect public trust, since banking essentially operates as a trust-based industry, and thus bank soundness must be safeguarded.

The assessment of capital adequacy ratios, commonly used to measure bank health, is reflected in the Capital Adequacy Ratio (CAR) (Ismaulina et al., 2021). For Fintech Lending, the most significant influence comes from fintech itself, followed by fintech and CAR. With the support of fintech, banks can rely on internet or mobile networks, which are crucial in today's life. The internet enables easier, faster, and more efficient interaction between customers and banks. This convenience in transactions, without requiring face-to-face meetings, allows banks to mobilize funds from customers more effectively (Prameswari & Purwanto, 2016). For HDTI, the greatest contribution comes from HDTI itself, highlighting that household debt is a crucial part of household financial behavior, and its allocation and proper management are essential for household financial health. On one hand, household debt, up to a certain level, provides opportunities for households to increase consumption and investment, thus strengthening their economic capacity and standard of living. On the other hand, excessive debt may create economic stress and risks for households, and even potentially trigger financial and economic crises (Fintech et al., 2024).

For the LDR variable, the largest contribution comes from LDR itself. The Loan to Deposit Ratio (LDR) influences the bank primarily in terms of liquidity and profitability. A high LDR indicates that the bank channels more credit, which can increase profitability but also carries the risk of reduced liquidity if insufficient funds are available to meet obligations. Conversely, a low LDR means that banks hold excess idle funds, boosting liquidity but potentially reducing profitability due to limited credit distribution (Winarsih, 2022). For NPL, the largest contribution comes from NPL itself, followed by inflation. NPLs and inflation have a complex relationship that is not always directly causal but mutually influence each other in the economy. High inflation can weaken household purchasing power, creating financial difficulties that may increase NPLs as borrowers struggle to meet loan repayments. Conversely, a high level of NPLs in the banking system can weaken the economy and potentially fuel inflation if banks reduce lending and slow down economic activity (Eka P, 2021). Lastly, for the Lending Interest Rate variable, the dominant influence comes from its own shocks, followed by HDTI. Lending interest rates in the economy are influenced primarily by benchmark lending rates (such as the BI Rate) set by the central bank and the basic lending rates (SBDK) issued by commercial banks. Both types of rates affect household and business borrowing decisions, ultimately influencing inflation, economic growth, and monthly installment burdens (Yuliani Agustin, 2018).

4. CONCLUSION

This study analyzes the dynamics of Non-Performing Loans (NPL) in the Indonesian banking sector using the Vector Autoregression (VAR) model, which incorporates seven variables: NPL, Loan to Deposit Ratio (LDR), lending interest rate, inflation, Household Debt to Income (HDTI), fintech lending, and Capital Adequacy Ratio (CAR). The findings reveal that most variables are predominantly influenced by their own shocks, although interactions among variables remain significant. In particular, the interconnections between inflation, HDTI, fintech lending, and CAR play a crucial role in shaping the dynamics of NPL.

The results of the Impulse Response Function (IRF) indicate that CAR and HDTI are relatively stable and quickly revert to equilibrium, thereby acting as buffers for financial system stability. In contrast, fintech lending, inflation, and NPL exhibit more volatile response patterns, signaling higher vulnerability to external shocks. LDR and lending interest rates also demonstrate short-term responsiveness, but their effects tend to diminish over the long run.

Furthermore, the variance decomposition (FEVD) results show that NPL, apart from being influenced by its own shocks, is also significantly affected by inflation, while fintech lending demonstrates a strong long-term association with CAR. These findings emphasize that the stability of Indonesia's banking sector is not solely determined by internal factors such as CAR and LDR, but is also strongly influenced by external factors including inflation, fintech lending developments, and household debt conditions. Therefore, integrated coordination among monetary policy, macroprudential measures, and financial sector supervision is essential to strengthen the resilience of the national financial system in facing both global and domestic economic dynamics.

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