Jurnal Masharif al-Syariah: Jurnal Ekonomi dan Perbankan Syariah
ISSN: 2527 - 6344 (Printed), ISSN: 2580 - 5800 (Online)
Accredited No. 204/E/KPT/2022
DOI: https://doi.org/10.30651/jms.v11i4.31893
Volume 11, No. 3, 2026 (896 - 911)
Received 12 Jun 2026, Accepted 19 Jul 2026, Published Online: 22 Aug 2026

NON-PERFORMING FINANCING RESPONSE TO INFLATION AND EXCHANGE RATE SHOCKS IN INDONESIAN ISLAMIC COMMERCIAL BANKS: A FIRST-DIFFERENCE VAR APPROACH (2019–2025)

Abul Hasan Umar
Sekolah Tinggi Agama Islam Al Muntahy
Abulhasn044@gmail.com
Taufik's Word
Sekolah Tinggi Agama Islam Al Muntahy
firmanxzord@gmail.com
Sulaiha Ali
Sekolah Tinggi Agama Islam Al Muntahy
Sulaiha925@gmail.com

Abstract

The quality of Islamic banking assets serves as a foundational indicator of financial system resilience in Indonesia, yet the dynamic transmission of inflation and exchange rate shocks to Non-Performing Financing (NPF) remains underexplored for the post-pandemic period. This study examines the dynamic response of ΔNPF in Indonesian Islamic Commercial Banks and Islamic Business Units to shocks in inflation and the USD/IDR exchange rate, employing a first-differenced Vector Autoregression (VAR) framework. Monthly data spanning January 2019 to June 2025 yield 78 observations; ADF and KPSS tests confirm that all variables are integrated of order one, I(1), while Johansen cointegration tests find no robust long-run equilibrium relationship, justifying a VAR(2) specification in first differences with Cholesky ordering: Exchange Rate → Inflation → NPF. Impulse Response Functions reveal that ΔNPF responses to both inflation and exchange rate shocks are statistically insignificant across the full 1–12 month horizon, with 95% bootstrap confidence intervals crossing zero at every point. Forecast Error Variance Decomposition further confirms that own shocks account for 98.94% of NPF forecast error variance at horizon 12, while inflation contributes only 0.36% and the exchange rate 0.70%. These findings suggest that macroeconomic transmission to NPF during this period is substantially weaker than previous literature implies, consistent with the potential moderating role of OJK's post-pandemic financing restructuring policies and strong path dependency in NPF dynamics; the results underscore the primacy of direct prudential instruments over indirect monetary stabilization in managing Islamic bank asset quality.

Keywords: Non-Performing Financing; Vector Autoregression; Impulse Response Function; Indonesian Islamic banking; exchange rate

1. Introduction

The stability of the Islamic financial system is a fundamental prerequisite for the sustainability of profit-sharing-based financing intermediation in Indonesia. As the country with the largest Muslim population in the world, the quality of Islamic banking assets is not only a measure of the health of individual institutions but also a reflection of the resilience of the national financial system to external pressures. Among various indicators of financing health, Non-Performing Financing (NPF) occupies a central position because it directly reflects the capacity of debtors to meet their obligations—a capacity that is highly vulnerable to changes in macroeconomic conditions. When macro variables such as inflation and exchange rates fluctuate sharply, their transmission to financing quality is not always symmetrical or instantaneous, making understanding the dynamics of NPF responses to external shocks a pressing research agenda.

Empirical data from January 2019 to June 2025 recorded a series of unusual macroeconomic shocks. The gross non-performing financing (NPF) of Islamic Commercial Banks and Islamic Business Units reached 3.58% in April 2019, then showed a consistent downward trend to reach 2.04% in March 2024, a trajectory that occurred amid truly extraordinary turmoil. The COVID-19 pandemic forced the rupiah exchange rate to depreciate to 15,884 in April 2020, its weakest level during that period, before slowly recovering. National inflation, which had been depressed to the 1.3–1.7% range throughout 2020–2021 due to demand contraction, reversed dramatically and peaked at 5.95% in September 2022, triggered by a surge in global energy and food prices following economic normalization. Rupiah depreciation occurred again in 2024, with the exchange rate reaching 16,325 per US dollar in June 2024 and continuing to weaken to 16,768 in April 2025. This dual fluctuation of inflation and exchange rates, which move in cycles that do not always coincide, provides a rich empirical laboratory for testing macroeconomic transmission on the quality of Islamic assets.

Although the literature on the determinants of non-performing financing (NPF) in Indonesian Islamic banking has grown, most studies still rely on static panel regression or multiple linear regression approaches with annual data (Asiyah et al., 2022; Firginia Amanda et al., 2025; Surepno et al., 2023) . These approaches produce estimates of long-run average effects but inherently fail to capture the most policy-relevant temporal dimensions: how quickly NPFs react to inflation shocks, how long these effects persist, and at what lag the exchange rate effect peaks. Several studies using the VAR/VECM framework (Ardhiani Fadila & Pangestuti, 2022; Mubarok et al., 2026; Tsania Hayatun Thoyyibah & Faizal Amir, 2024) do offer a more dynamic

perspective, but generally cover shorter periods, fail to include the pandemic episode and the 2022 inflation spike simultaneously, or do not explicitly separate the short-term response based on the impulse response function (IRF) from the variance contribution analysis using Forecast Error Variance Decomposition (FEVD). Ibrahim et al.'s (2025) study on Bank Bukopin Syariah acknowledges limitations at the individual bank level, while Syarif et al.'s (2025) study limits their analysis to the 2015–2018 period, excluding post-pandemic volatility. This gap, which is addressed by VAR analysis based on aggregate monthly data covering the pandemic, the 2022 inflation spike, and the 2024–2025 rupiah depreciation, is a gap that this study seeks to fill.

The choice of the Vector Autoregression (VAR) first difference method in this study is not merely a technical choice, but rather a statistically and substantively justified decision. The results of the stationarity test indicate that NPF, inflation, and the exchange rate are all integrated to the first order or I(1), while the cointegration test does not find a robust long-run equilibrium relationship between the three variables. This condition precludes the use of VECM and requires estimation in first difference form. More importantly, VAR allows researchers not only to estimate the average effect size but also to trace the NPF response path to a one-standard deviation shock to either inflation or the exchange rate through the IRF, an analytical tool relevant for risk managers who need to know "how many months ahead" financing exposure will increase after an exchange rate pressure occurs. Meanwhile, the FEVD allows the decomposition of the contribution of each variable to the variation of NPF over the time horizon, answering the question of the relative dominance of inflation shocks versus exchange rate depreciation in the formation of financing risk (Benavides-Franco et al., 2023; Peykani et al., 2025) . This approach is in line with recent developments in the dynamic credit risk literature that emphasize the importance of a temporal perspective, rather than simply a static average influence coefficient (Kishimba et al., 2024) .

Based on the description above, this study aims to analyze the dynamic response of Non-Performing Financing of Islamic Commercial Banks and Islamic Business Units in Indonesia to inflation and exchange rate shocks through a first difference VAR approach with monthly data from January 2019–June 2025, using Impulse Response Function and Forecast Error Variance Decomposition to reveal the magnitude, direction, and duration of the response in the context of three critical macroeconomic episodes that have never been studied in an integrated manner: the COVID-19 pandemic, the 2022 inflation spike, and the continued rupiah depreciation from 2024–2025.

2. Literature review

2.1 Non-Performing Financing (NPF) in Islamic Banking

Non-Performing Financing (NPF) is an indicator of Islamic banking asset quality that reflects the proportion of non-performing financing, including Substandard, Doubtful, and Loss collectibility, to total disbursed financing. Unlike conventional non-performing loans (NPLs) that are entirely based on interest mechanisms, NPF, from a

muamalah fiqh perspective, touches on the dimension of contract integrity and the principle of ta'awun (reciprocity), so its handling cannot be separated from the Islamic legal framework (Asiyah et al., 2022) . The Financial Services Authority (OJK) has set a gross NPF threshold of 5% as a prudential tolerance limit; during the period January 2019–June 2025, the gross NPF of BUS and UUS was consistently below this threshold despite facing two major shocks.

The literature divides the determinants of NPF into internal and external factors. Internal factors include CAR, FDR, and operational efficiency (BOPO), which are within the control of bank management. Surepno et al. (2023) and Asiyah et al. (2022) confirmed that CAR has a significant negative effect on NPF, while BOPO is positively correlated. External factors such as inflation, exchange rates, GDP growth, and interest rates are beyond the control of banks but have a direct impact on borrowers' repayment capacity. Profit-sharing financing, such as mudharabah and musyarakah, is structurally more vulnerable to macroeconomic pressures than murabahah, as bank returns depend directly on the profitability of the customer's business (Syarif et al., 2025) .

2.2 Inflation and its Transmission to Financing Quality

The relationship between inflation and banking asset quality can be explained through two theoretical frameworks. Financial Accelerator Theory (Bernanke et al., 1999) explains how rising inflation erodes the real value of collateral, weakens borrowers' positions, and increases default risk through financial feedback mechanisms. Credit Risk Theory complements this framework by emphasizing direct transmission: inflation drives up production costs, squeezes borrowers' operating margins, and reduces cash flow available for loan repayments. Within the Monetary Transmission Mechanism (MTM) framework, high inflation typically triggers contractionary monetary policy, which tightens financing conditions systemically.

Empirical evidence generally confirms this positive relationship, although the magnitude depends on the method and period. Fadila et al. (2022) found inflation to be the variable that exerts the greatest shock on NPF in a VAR/VECM analysis. Thoyyibah et al. (2024) using monthly data from 2012–2023 confirmed a significant positive effect of inflation in both the short and long term. Peykani et al. (2025) using TVP-VAR estimated that every 1% increase in inflation results in a 0.0061% increase in NPL—a cumulatively significant effect over a period of prolonged inflation spikes. Studies using static regression, on the other hand, often find no significant partial effect of inflation (Asiyah et al., 2022; Firginia Amanda et al., 2025) , indicating that static methods fail to capture the dynamic lag in inflation transmission, which can last several months.

2.3 Exchange Rates and Sharia Financing Risks

Exchange rate depreciation transmits pressure on financing quality through three main channels. First, the cost-push channel: Rupiah depreciation increases the cost of importing raw materials and drives up production costs for borrowers dependent

on imported inputs, thereby squeezing business margins and repayment capacity. Second, the purchasing power channel: Depreciation accompanied by imported inflation reduces borrowers' real incomes, particularly for the SME segment, the primary market for Indonesian Islamic banking. Third, the balance sheet channel: Although Islamic banks essentially limit their foreign exchange exposure, borrowers in import-oriented sectors remain directly exposed to exchange rate risk (Kishimba et al., 2024) .

Surepno et al. (2023) found the exchange rate to be the only significant external variable affecting BPRS NPF. Fadila et al. (2022) placed the exchange rate as the dominant factor alongside inflation in a VAR/VECM analysis. Mubarok et al. (2026) using VECM confirmed the significance of the exchange rate in the short run. The asymmetric effect between exporter and importer debtors on exchange rate shocks creates complexity that cannot be captured by a single coefficient in a static regression model, a strong argument for using a dynamic approach capable of tracking heterogeneous responses over time horizons.

2.4 Vector Autoregression (VAR) Model: Specification and Justification

The VAR model was introduced by Sims (1980) and comprehensively developed by Kilian and Lütkepohl (2017) as a data-driven approach that allows the identification of dynamic relationships between variables without a priori causality restrictions. The choice between the three main specifications of the VAR level, VAR first difference, and VECM is determined by the stationarity and cointegration properties of the data. The VAR level is applicable when all variables are stationary I(0); the VECM is used when the variables are I(1) and cointegrated; while the VAR first difference is the right choice when the variables are I(1) but not cointegrated (Enders, 2015; Lütkepohl, 2005) . Lütkepohl (2005) explicitly emphasized that the use of VECM on non-cointegrated variables produces inconsistent estimates, while the VAR level on non-cointegrated I(1) data carries the risk of spurious regression. The test results in this study showed that all variables were I(1) and no robust integration coefficient was found, thus statistically requiring the use of VAR first difference (Hamilton, 1994) .

Formally, the VAR(p) model with K endogenous variables is expressed as:

$$Y_t = \mathrm{c} + \mathrm{A}_1\mathrm{Y}_{t-1} + \mathrm{A}_2\mathrm{Y}_{t-2} + \ldots + \mathrm{A}_p\mathrm{Y}_{t-p} + \epsilon_t \ldots \ldots\ldots\ldots\ldots\ldots\ldots\ldots \ldots (1)$$

where: Y_t= vector (K×1) of endogenous variables; c = vector of constants (K×1); A_1= coefficient matrix (K×K) at lag i; p = optimal lag; ϵ_t= vector of white noise innovations with E(ϵ_t)=0 and Var(ϵ_t)=Sigma.

In this study, the endogenous variables are:

$$Y_t = [\,\Delta NPF_t,\ \Delta INF_t,\ \Delta KURS_t\,]' \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where: Delta denotes the first difference operator; NPF_t= gross NPF; INF_t= YoY inflation; $KURS_t$= USD/IDR exchange rate in period t.

The Impulse Response Function (IRF) is derived from the infinite moving average (MA) representation of the VAR system:

$$IRF_{\{kj\}}(h) = \frac{\partial Y_{k,t+h}}{\partial \epsilon_{j,t}} = [\psi_h]_{kj} \quad \ldots\ldots (3)$$

where: $IRF_{\{kj\}}(h)$ *= response of variable k at horizon h due to shocks to variable j;* ψ_h *= MA coefficient matrix of order h, identified through Cholesky decomposition Sigma = P,P '.*

Forecast Error Variance Decomposition (FEVD) measures the contribution of each shock to the predicted variation:

$$FEVD_{\{kj\}}(h) = \frac{\sum_{s=0}^{h-1}([\psi_s P]_{k,j})^2}{\sum_{s=0}^{h-1}[\psi_s \sum \psi' s]_{kk}} \quad \ldots (4)$$

Where: $FEVD_{\{kj\}(h)}$= proportion of the variance of the prediction error of variable k at horizon h contributed by shocks to variable j *; applies* $Sum_{\{j=1\}}^{\{K\}} FEVD_{\{kj\}(h)} = 1$*to any k and h.*

The combination of IRF and FEVD allows this study to answer two complementary questions: (1) how much and how long does the NPF respond to inflation and exchange rate shocks (IRF), and (2) which variables have historically been more dominant in explaining variations in the NPF (FEVD). This dual analytical capability is not available in any static regression approach. (Enders, 2015) .

2.5 Previous Research and Research Position

Table 1. Summary of Previous Research

No	Researcher & Year	Variables & Periods	Method	Key Results	Gap
1	Fadila et al. (2022)	NPF, GDP, Exchange Rate, Inflation, BI Rate, IDX (2006–2020)	VAR/VECM	Inflation exerts the greatest impact on NPFs; exchange rates and the BI rate are the dominant short-term factors.	Ends 2020; excludes 2022 inflation spike and 2024 exchange rate depreciation.
2	Surepno et al. (2023)	NPF BPRS, CAR, FDR, BOPO, Inflation, Exchange Rate, BI Rate (2013–2020)	Multiple Regression	Exchange rate has a significant positive effect; inflation is not partially significant.	Static approach; does not capture dynamic lag and temporal response.
3	Asiyah et al. (2022)	Muamalat Bank NPF, CAR, BOPO, FDR,	Multiple Regression	CAR is significantly negative; BOPO is significantly positive;	Single bank; not representative of

		Inflation, Exchange Rate (2013–2021)		inflation and exchange rate are insignificant.	BUS+UUS aggregate; static method.
4	Thoyyibah et al. (2024)	NPF BUS, Inflation, Unemployment (2012–2023)	VAR/VECM	Inflation has a significant positive effect on short-term and long-term NPF.	Does not include exchange rates; IRF exchange rates are not discussed.
5	Mubarok et al. (2024)	ROA BUS, NPF, Exchange Rate, Inflation, BI Rate (2007–2023)	VECM	NPF, exchange rate, inflation have a significant effect on long-term ROA.	The dependent variable is ROA, not NPF; the profitability perspective, not credit risk.
6	Syarif et al. (2025)	NPF three contracts, Inflation, Exchange Rate, IPI, M2 (2015–2018)	VAR/VECM + IRF + FEVD	Inflation and exchange rates are dominant in IRF and FEVD for the majority of contracts.	Period 2015–2018; excludes pandemic, 2022 inflation, and 2024–2025 depreciation.
7	Ibrahim et al. (2025)	NPF Bank Bukopin Syariah, FDR, CIR, Inflation, BI Rate (2016–2023)	VAR/VECM + IRF	FDR, CIR, inflation, BI Rate are significantly positive in the long term.	Individual bank level; exchange rates are not included.
8	Amanda et al. (2025)	NPF 10 BUS, FDR, CAR, Inflation (2019–2023)	Static Panel Regression	FDR and CAR have a significant negative effect; inflation has no effect.	Static panel; does not capture temporal dynamics; exchange rates absent.
9	Mubarok et al. (2026)	NPF BUS, Inflation, Exchange Rate, GDP, IHSG, BOPO (2007–2025)	VECM	Exchange rates and inflation are significant in the short term; BOPO and GDP are significant in the long term.	VECM assumes cointegration; does not analyze VAR first differences.
10	Peykani et al. (2025)	Iranian Banking NPL, GDP, Inflation, Exchange Rate, Unemployment (2007–2021)	TVP-VAR + Panel	A 1% inflation increase in NPLs by 0.0061%; exchange rate shocks increase credit risk.	Iranian context; not specifically Indonesian Islamic banking.

Source : Processed from various sources

From the review of the ten studies above, two dominant weaknesses emerge. First, static regression-based studies (Asiyah et al., 2022; Firginia Amanda et al., 2025; Surepno et al., 2023) are definitively unable to analyze dynamic lag, response direction over time, or decompose shock contributions. Second, studies that have used VAR/VECM (Ardhiani Fadila & Pangestuti, 2022; Ibrahim et al., 2025; Mubarok et al., 2026; Syarif et al., 2025) are limited by: (a) period coverage that does not simultaneously encompass all critical episodes, (b) a focus on individual banks that are not representative of the aggregate, or (c) the use of VECM that assumes cointegration without exploring the implications of non-cointegration conditions. This study contributes by filling three gaps simultaneously: monthly aggregate BUS+UUS data for the period January 2019–June 2025 (78 observations) covering the COVID-19 pandemic, the 2022 inflation surge to 5.95%, and the rupiah depreciation to 16,768 in April 2025; a statistically justified first-difference VAR specification due to the I(1)

condition without cointegration; and simultaneous IRF and FEVD analysis for NPF as the main dependent variable.

2.6 Framework of Thought

Based on the theoretical and empirical synthesis above, the conceptual framework of this research can be summarized. Inflation shocks operate through the Credit Risk channel (cost pressures and reduced debtor purchasing power) and the Monetary Transmission Mechanism channel (contractionary monetary policy that tightens liquidity conditions). Exchange rate shocks operate through the cost-push channel on importing debtors, the real purchasing power channel through imported inflation, and the balance sheet channel on foreign exchange-exposed business segments. These two shocks are endogenously linked: exchange rate depreciation can exacerbate inflation through imported inflation, while inflation differentials can trigger capital flight, further weakening the exchange rate. The first-difference VAR model fully captures this endogenous interdependence, making it the most appropriate analytical framework to address the magnitude, direction, and duration of the BUS NPF response to inflation and exchange rate shocks in Indonesia during the 2019–2025 period .

3. Research Methods (bold 12 pt)

3.1 Data and Variables

This study uses monthly time series data from January 2019 to June 2025, resulting in 78 observations. Three variables are analyzed: gross non-performing financing (NPF) of Islamic Commercial Banks and Islamic Business Units (%), year-on-year national inflation (%), and the USD/IDR exchange rate (rupiah per US dollar). NPF data are sourced from the Financial Services Authority (OJK) Islamic Banking Statistics, inflation data from the Central Bureau of Statistics (BPS), and exchange rate data from the FRED St. Louis database in the form of monthly averages. All variables are transformed into first difference (Δ) form after the stationarity test confirms that they are integrated to the first order, I(1), using both the Augmented Dickey-Fuller (ADF) and KPSS tests. The selected period covers three episodes of macroeconomic shocks with different characteristics: the COVID-19 pandemic contraction (2020), the 2022 inflation spike, and the persistent rupiah depreciation in 2024–2025, thus providing sufficient variation in conditions for identifying dynamic responses.

3.2 Model Specifications

The model used is Vector Autoregression of order p, VAR(p), in first difference form. Compactly, the system is written as:

$$\Delta Y_t = c + \sum_{i=1}^{p} A_i \Delta Y_{t-i} + \epsilon_t \quad (1)$$

where $\Delta Y_t = [\Delta NPF_t, \Delta INF_t, \Delta KURS_t]$ is a vector (3×1) of endogenous variables in first difference; c = constant vector; A_i = coefficient matrix (3×3) at lag i; p = optimal lag; ϵ_t ~ WN(0, Sigma) is a white noise innovation vector with variance-covariance matrix Sigma.

The choice of first-difference VAR over VECM is based on the results of Johansen's (1991) cointegration test , which did not find a robust long-run equilibrium relationship among the three variables. Lütkepohl (2005) asserts that VECM on non-cointegrated variables produces inconsistent estimates, making first-difference VAR a more procedurally appropriate specification. This approach is fully consistent with Sims' (1980) original VAR framework , which was designed to analyze short-run dynamics without imposing a priori structural restrictions.

To identify orthogonal structural shocks, the Cholesky decomposition is applied to the Sigma matrix in the order: Exchange Rate → Inflation → NPF. This order reflects the assumption of decreasing exogeneity: the rupiah exchange rate is highly influenced by global external conditions and is therefore assumed to be the most exogenous in the system; domestic inflation responds to exchange rate movements through imported inflation but is more endogenous to domestic conditions; while the NPF is placed as the most endogenous because it is an outcome variable that reflects the accumulated pressures from the two previous macro variables. The Impulse Response Function (IRF) specification is derived from the moving average representation of the VAR system:

$$\Delta Y_{t+h} = \sum_{s=0}^{h} \psi_s \, \epsilon_{t+h-s} \quad (2)$$

*where Psi_s = the recursive MA coefficient matrix of order s of A_i, with $\psi_0 = I_3$ structural shocks identified through P from the Cholesky decomposition Sigma = P*P', thus $IRF_{\{kj\}}(h) = [\psi_h P]_{kj}$ measuring the response of variable k at horizon h due to a one standard deviation shock to variable j.*

3.3 Estimation Procedure

Estimation is performed in the following sequence. The stationarity of each variable is tested using ADF and KPSS simultaneously; confirmation of I(1) of both is a prerequisite for first difference transformation. The optimal lag p is selected based on the Akaike (AIC) and Schwarz/Bayesian (BIC) criteria, given that BIC tends to produce more parsimonious lags in medium samples. The Johansen cointegration test is then applied to the level variables to ensure the absence of long-run equilibrium relationships that require a VECM. Once the VAR(p) estimates are obtained, model diagnostics are performed using the characteristic root stability test (all roots within the unit circle), the Portmanteau residual autocorrelation test, and the Jarque-Bera multivariate normality test. The IRF and Forecast Error Variance Decomposition (FEVD) are calculated over a 12-month horizon with 95% confidence intervals through 1,000 bootstrap replications, to explore the magnitude, direction, and persistence of the NPF response to one-standard deviation shocks to inflation and the exchange rate. All estimations were performed using R software (vars package) and EViews 12.

4. Results and Discussion (bold 12 pt)

4.1 Descriptive Statistics and Prerequisite Tests

The three variables analyzed showed different dynamics during the period from January 2019 to June 2025. The gross NPF of BUS and UUS recorded an average of 3.42% in 2019 and decreased consistently to 2.09% in 2024, a structural decline that occurred precisely amidst two major shock waves. Inflation moved with high volatility: depressed to a low of 1.32% in August 2020 due to post-pandemic demand contraction, then soared sharply to a peak of 5.95% in September 2022 triggered by a global commodity supply shock, before leveling off again to 1.57% at the end of 2024. The rupiah exchange rate moved in a long-term depreciation trend with episodes of high volatility: from 13,739 in January 2020, breaking through 15,884 in April 2020 due to pandemic capital outflow, then crawling to 16,325 in June 2024 and reaching 16,768 in April 2025. Complete descriptive statistics are presented in Table 1.

Table 1. Descriptive Statistics of Research Variables (n = 78 observations)

Variables	Mean	Std. Dev.	Min	Max
NPF gross (%, level)	2,758	0.530	2,040	3,580
ΔNPF (points %)	−0.016	0.083	−0.400	0.230
YoY inflation (%, level)	2,679	1,269	−0.090	5,950
ΔInflation (points %)	−0.012	0.403	−0.990	1,260
USD/IDR exchange rate (level, Rp)	14,954	786	13,740	16,768
ΔExchange rate (Rp)	27.69	306.76	−973.08	1,477.12

Source: OJK-SPS, BPS, FRED St. Louis (processed, 2025). ΔNPF and ΔInflation units in percentage points; ΔExchange rate in rupiah.

The results of the ADF test are presented in Table 2. NPF and Exchange Rate are non-stationary at the level (t = −1.0597 and −0.1923) but are strongly stationary at the first difference (t = −3.6671 and −4.7730, significant at α = 1%). Inflation shows a slight ambiguity: the ADF value at the level of −2.2609 is close to the critical value of 10% but has not yet crossed the 5% threshold, while at the first difference t = −2.4860 is obtained which is significant at α = 5% but is in the lower limit range. Considering that the complementary KPSS test results confirm the non-stationarity of inflation at the level, and for the sake of system consistency in VAR estimation that requires a homogeneous integration order, inflation is treated as I(1) following the convention applied in similar studies (Ardhiani Fadila & Pangestuti, 2022; Tsania Hayatun Thoyyibah & Faizal Amir, 2024) . The Johansen cointegration test using both trace and maximum eigenvalue statistics did not find a significant cointegration vector at α = 5%, so there is no robust long-run equilibrium relationship between the three variables. This condition procedurally closes the VECM option and requires the specification of a first-difference VAR.

Table 2. Augmented Dickey-Fuller (ADF) Test Results

Variables	ADF Level (t-statistic)	ADF First Diff (t-statistic)	Conclusion	Information
NPF	−1.0597	−3.6671***	I(1)	Stationary after diff
Inflation	−2.2609	−2.4860**†	I(1)	See notes †
Exchange rate	−0.1923	−4.7730***	I(1)	Stationary after diff

**** and ** are significant at α = 1% and α = 5%, respectively. MacKinnon critical values: 1% = −3.51; 5% = −2.89; 10% = −2.58. The test is conducted with 4 lags and an intercept. † First-diff inflation is significant at α = 5% (t = −2.4860 > −2.89) but is borderline; treated as I(1) for system consistency based on KPSS confirmation.*

4.2 Lag Selection and Model Diagnostics

Table 3 presents the information criterion values for lags 1–6 of the actual estimation results. AIC recommends an optimal lag of p = 2 (value of 4.7677), while the more parsimonious BIC and HQC suggest p = 1 (values of 5.2002 and 4.9792). Considering that monthly data with 78 observations requires sufficient parameters to capture short-term dynamics without overfitting, this study uses VAR(2) as recommended by AIC—a choice commonly adopted in the monthly data-based VAR literature (Lütkepohl, 2005) . Stability tests indicate that all characteristic roots lie within the unit circle with the largest modulus of 0.6795, thus the VAR(2) process is proven to be stationary and the IRF can be interpreted validly. The Portmanteau test does not find significant residual autocorrelation at lags 1–12, and the model is deemed suitable for IRF and FEVD analysis .

Table 3. Selection Criteria for Lag VAR(p) First Difference

Lag	AIC	BIC	HQC
1	4.8322	5,2002*	4.9792*
2	4.7677*	5,4166	5,0268
3	4,8203	5,7544	5,1929
4	5,0000	6.2236	5,4876
5	5,1078	6.6256	5,7120
6	5,3209	7,1375	6,0433

** indicates the optimal lag according to each criterion. Selected lag: p = 2 (AIC). Figures are the actual estimated results from the research data.*

4.3 Impulse Response Function (IRF)

The ΔNPF response to a one-standard-deviation shock in ΔINF exhibits a pattern that is small in magnitude and statistically insignificant across all horizons. In the first period (h = 0), the ΔNPF responds by −0.0049 percentage points—negative and very small—and then fluctuates with decreasing amplitude and converges to zero starting at horizon 6. The 95% confidence interval of the bootstrap results from 1,000 replications crosses zero across horizons 1–12, meaning that in no single period does the NPF response to inflation shocks prove significant. This finding contrasts with Fadila et al. (2022) and Thoyyibah et al. (2024) found a significant effect of inflation in the VECM, but this can be explained by one prominent empirical phenomenon in the

data: when inflation surged to 5.95% in September 2022, the NPF actually continued its downward trend from 2.67% (May 2022) to 2.35% (December 2022). This counterintuitive pattern suggests that the OJK's financing restructuring policy, implemented since POJK No. 11/POJK.03/2020—and extended several times post-pandemic—effectively dampened the transmission of macroeconomic pressures to the official NPF ratio, at least during the period covered by this study.

The ΔNPF response to the ΔRATE shock exhibits a slightly more dynamic oscillation pattern. At h = 0 the response is slightly negative (−0.0012), turns positive at h = 1 (0.0034) indicating a one-month transmission lag before depreciation begins to depress financing quality, and then becomes negative again at h = 2 (−0.0047) before gradually damping down towards zero starting at h = 6. The peak amplitude of the exchange rate shock (|−0.0047| at h = 2) is slightly larger than the peak amplitude of the inflation shock (|−0.0049| at h = 0), but the difference is not material and neither exceeds the threshold of statistical significance. As with inflation, the 95% confidence interval passes through zero across all horizons. This oscillation pattern is consistent with the argument that the transmission of exchange rate depreciation to the NPF through the cost-push and purchasing power channels is filtered by banks' internal restructuring and provisioning mechanisms before being reflected in the officially reported NPF ratio.

Comparatively, both shocks generated small, rapidly dampened (within 6 months), and statistically insignificant NPF responses. These findings collectively imply that, in the context of aggregate BUS+UUS data for the 2019–2025 period, NPF is determined more by internal idiosyncratic factors than by direct macroeconomic shocks. This does not imply that inflation and the exchange rate are structurally irrelevant to Islamic financing risk, but rather reflects period-specific conditions dominated by an unusually strong prudential policy response. This interpretation should be considered cautiously: if restructuring policies are fully lifted, macroeconomic transmission to NPF is likely to return to a stronger level, as studies have found in the pre-pandemic period.

4.4 Forecast Error Variance Decomposition (FEVD)

The variance decomposition of the NPF prediction error (Table 4) consistently reinforces the IRF findings. In the first month (h = 1), 99.46% of the variation in ΔNPF is explained by the own shock, while inflation contributes 0.36% and the exchange rate 0.18%. The contributions of both macro variables increase slowly but converge to very small values: at horizon 12, inflation contributes 0.36% and the exchange rate 0.70% of the total variance in NPF prediction. In aggregate, shocks from outside the financing system, inflation and the exchange rate, together, explain only about 1.06% of the long-term NPF variation, while the remaining 98.94% comes from the dynamics of the NPF itself. Alone .

Table 4. Forecast Error Variance Decomposition (FEVD) ΔNPF

Horizon (moon)	NPF (own shock)	Inflation	Exchange rate
1	99.46%	0.36%	0.18%
2	99.13%	0.36%	0.51%
3	99.04%	0.36%	0.60%
6	98.95%	0.36%	0.68%
9	98.94%	0.36%	0.70%
12	98.94%	0.36%	0.70%

Cholesky ordering: KURS → INF → NPF. VAR(2) first difference, 77 effective observations.

The dominance of own shocks in the FEVD is lower than the values reported by several VAR studies on Indonesian Islamic banking using periods prior to 2019 (Ardhiani Fadila & Pangestuti, 2022; Syarif et al., 2025) , which generally report more substantial contributions from inflation and exchange rates. This difference reflects the specific conditions of the 2019–2025 period: institutional factors, particularly the OJK's massive restructuring policy and the growth of BUS+UUS assets, which increased the denominator of the NPF ratio, became the dominant explanation for NPF variation, surpassing external macroeconomic influences. The dominance of own shocks also suggests a strong path dependency: past NPF patterns are the best predictors of future NPF, which has direct implications for risk early warning systems in Islamic banks.

From a policy perspective, although the exchange rate contribution (0.70% at h = 12) is slightly larger than inflation (0.36%), both figures are too small to support the argument that exchange rate stabilization or inflation control alone is sufficient to maintain the quality of Islamic banking assets. The Financial Services Authority (OJK) and Bank Indonesia (BI) appear to be more effective using direct prudential instruments, such as restructuring policies and adjusting collectibility limits, rather than relying on indirect transmission through monetary variables. This finding reinforces the relevance of the dual-regulatory approach in Indonesia and underscores the importance of synergy between macroprudential and microprudential policies in maintaining the stability of the Islamic financial system as a whole. sustainable .

4. Conclusion and Suggestions

5.1 Conclusion

VAR(2) first difference estimations of 78 monthly observations for the period January 2019–June 2025, the response of Islamic Commercial Banks' ΔNPF to inflation and exchange rate shocks is shown to be small in magnitude and statistically insignificant across all analysis horizons. To inflation shocks, ΔNPF responds by −0.0049 percentage points at h = 0 and converges to zero starting at h = 6; to exchange rate shocks, the response oscillates between −0.0012 (h = 0), +0.0034 (h = 1), and −0.0047 (h = 2) before damping down at the same horizon. The bootstrap 95% confidence intervals cross zero across horizons 1–12 for both shocks, thus there is no period where macroeconomic transmission to NPF is shown to be statistically significant within the VAR framework used.

The Forecast Error Variance Decomposition results reinforce the IRF findings: 98.94% of the variation in ΔNPF over a 12-month horizon is explained by own shocks, while inflation and the exchange rate contribute only 0.36% and 0.70%, respectively, or 1.06% combined. This contribution is numerically lower than that reported by Fadila et al. (2022) and Syarif et al. (2025) in the pre-pandemic period, which constitutes a novel finding of this study: the dynamic relationship between inflation, the exchange rate, and the NPF of Islamic banks (BUS) in the post-pandemic period in Indonesia is weaker than predicted by some previous literature. The dominance of own shocks also indicates a strong path dependency in NPF dynamics ; historical NPF patterns are a much more informative predictor of future NPF than the external macroeconomic variables tested. Interpretation of the results requires considering that the model only includes two external macroeconomic variables, so internal bank factors such as CAR, FDR, and BOPO are not included in the VAR system.

These findings are consistent with the possibility that the OJK's financing restructuring policy, enacted through POJK No. 11/POJK.03/2020 and extended several times until the middle of the study period, helped dampen the transmission of macroeconomic shocks to banks' reported official NPF ratios, although direct verification of this mechanism requires explicit modeling of the policy variable in a VAR system. The characteristics of sharia portfolios dominated by murabahah with fixed margins likely also contributed to the low sensitivity of NPFs to short-term shocks, a hypothesis that needs to be empirically tested in further research.

5.2 Suggestions

1. For the regulators OJK and Bank Indonesia: given the dominance of own shocks (98.94%) and the very small contribution of external macroeconomics (1.06% of the combined inflation and exchange rate at h = 12), direct prudential instruments such as collectibility policies, restructuring limits, and reserve requirements appear more effective in shaping NPF dynamics than indirect transmission through inflation stabilization or exchange rate intervention; synergy between the two authorities therefore needs to be directed at a more measured microprudential response to macroeconomic conditions.
2. For Islamic bank management: the strong path dependency in NPF dynamics as quantified by the 98.94% own shock in the FEVD confirms that a financing risk early warning system based on the bank's internal NPF historical data has higher predictive power than modeling solely based on external macroeconomic variables; the development of an NPF nowcasting model based on internal granular data needs to be prioritized as a component of operational risk management.
3. For further research: three development directions are recommended: first, incorporating bank internal variables (CAR, FDR, BOPO) into the VAR system to identify whether the dominance of own shocks reflects the influence of

accumulated internal factors; second, extending the analysis period beyond the full revocation of the OJK restructuring policy to test whether the transmission of inflation and exchange rate shocks to NPFs strengthens again after these institutional factors subside; third, applying Time-Varying Parameter VAR (TVP-VAR) to identify structural changes in coefficients over time, specifically comparing the pre-pandemic, pandemic, and post-pandemic sub-periods in one integrated estimation framework.

5. Bibliography

Ardhiani Fadila, & Pangestuti, DC (2022). Examining the Effect of Economic Collison: Case On Credit Performance in Islamic Banking. *International Journal of Finance & Banking Studies (2147-4486)* , *11* (1), 132–145. https://doi.org/10.20525/ijfbs.v11i1.1578

Asiyah, B.N., Septiana, A., & Wahyudi, A. (2022). Determinants of Bank Mu'amalat Indonesia's Non-Performing Financing: Internal and External Reviews. *El-Qish: Journal of Islamic Economics* , *2* (2), 97–112. https://doi.org/10.33830/elqish.v2i2.4157.2022

Benavides-Franco, J., Carabalí-Mosquera, J., Alonso, J.C., Taype-Huaman, I., Buenaventura, G., & Meneses, L.A. (2023). The evolution of loan volume and non-performing loans under COVID-19 innovations: The Colombian case. *Heliyon* , *9* (4), e15420. https://doi.org/10.1016/j.heliyon.2023.e15420

Bernanke, B.S., Gertler, M., & Simon Gilchrist, S. (1999). The financial accelerator in a quantitative business cycle framework. In *Handbook of Macroeconomics* (Vol. 1, pp. 1341–1393). Elsevier. https://doi.org/10.1016/S1574-0048(99)10034-X

Enders, W. (2015). *Applied Econometric Time Series* (4th ed.). John Wiley & Sons.

Firginia Amanda, Any Eliza, & Rahmat Fajar Ramdani. (2025). Impact of Internal and External Factors on Non-Performing Financing in Indonesia's Islamic Commercial Banks. *Mutanaqishah: Journal of Islamic Banking* , *5* (1), 138–151. https://doi.org/10.54045/mutanaqishah.v5i1.2741

Hamilton, J.D. (1994). *Time series analysis* . Princeton University Press.

Ibrahim, MA, Rahmawati, M., Laila, N., Zulaikha, S., & Rusydiana, AS (2025). Impulse Response Function (IRF) Analysis of Non-Performing Financing (NPF) to Internal and External Economic Shocks: Evidence from an Islamic Bank in Indonesia. *International Journal of Research and Innovation in Social Science* , *IX* (XX), 50–59. https://doi.org/10.47772/IJRISS.2025.90200005

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica* , *59* (6), 1551. https://doi.org/10.2307/2938278

Kilian, L., & Lütkepohl, H. (2017). *Structural Vector Autoregressive Analysis:* (1st ed.). Cambridge University Press. https://doi.org/10.1017/9781108164818

Kishimba, K.J., Akande, J.O., & Muzindutsi, P.-F. (2024). Macro Credit Risk Stress Testing in Tanzanian Banking Sector: A Global Vector Autoregressive (GVAR) Approach. *Journal of African Business* , *25* (3), 531–554. https://doi.org/10.1080/15228916.2023.2215579

Lütkepohl, H. (2005). *New Introduction to Multiple Time Series Analysis* . Springer-Verlag.

Mubarok, F., Wibowo, M., Pradana, H.D., & Yaacob, Z. (2026). The Influence of Macroeconomic Shocks, Operational Efficiency, and Financing Risk: An Empirical Study of Non-Performing Loans (NPF) in Indonesian Islamic Banks. *Falah: Jurnal Ekonomi Syariah* , *11* (1), 22–42. https://doi.org/10.22219/jes.v11i1.43291

Peykani, P., Sargolzaei, M., Oprean-Stan, C., Kamyabfar, H., & Reghabi, A. (2025). The effect of macroeconomic shocks on non-performing loans and credit risk in the Iranian banking system using time-varying parameter vector autoregressions. *PLOS One* , *20* (8), e0329587. https://doi.org/10.1371/journal.pone.0329587

Sims, C. A. (1980). Macroeconomics and Reality. *Econometrica* , *48* (1), 1. https://doi.org/10.2307/1912017

Surepno, S., Azmi, SN, & Subchanifa, DPV (2023). Determinants of Non-Performing Financing in Islamic Rural Banks in Indonesia. *EL MUHASABA: Journal of Accounting (e-Journal)* , *14* (1), 1–12. https://doi.org/10.18860/em.v14i1.15113

Syarif, F.A., Ismail, R., & Ali, Z.M. (2025). The Influence of Macroeconomic Indicators on Non-Performing Financing in Islamic Banking Using Mudharabah, Musharakah, and Murabahah Contracts. *Indonesian Journal of Social Sciences* , *6* (1), 82–101. https://doi.org/10.59141/jiss.v6i1.1590

Tsania Hayatun Thoyyibah & Faizal Amir. (2024). THE EFFECT OF INFLATION AND UNEMPLOYMENT ON NPF IN ISLAMIC COMMERCIAL BANKS IN INDONESIA. *I-Finance: A Research Journal on Islamic Finance* , *10* (2), 289–303. https://doi.org/10.19109/acznrq12