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ANALYSIS OF FACTORS INFLUENCING THE RATIO OF HOUSING NON-PERFORMING LOAN FOR THE 2015-2024 PERIOD

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ABSTRACT
This study aims to analyze the internal and external factors influencing the non-performing financing (NPF) ratio of home ownership financing in Islamic commercial banks in Indonesia during the period 2015–2024. Internal factors analyzed include the BOPO ratio, and Capital Adequacy Ratio (CAR), while external factors consist of exchange rate, and money supply. The study employs secondary data and the Error Correction Model (ECM) method to examine both short-term and long-term effects of these variables on NPF. The results indicate that both internal and external factors simultaneously have a significant impact on the NPF of home ownership financing. These findings provide important implications for risk management in Islamic banks to maintain financing quality and support the stability of the Islamic banking sector in Indonesia.

Keywords: NPF, BOPO, CAR, Money Supply, Exchange Rate, RGEC, VECM

INTRODUCTION

A country's economy often relies on the banking sector, which is important because banking plays a major role in a country's financial and economic systems (Adeola and Ikpesu, 2017). Therefore, a country must be able to maintain the stability of its banks and economy because the two are interconnected. Agustina (2019) explains the other role of banks as financial intermediaries between parties with a surplus of funds and parties with a lack of funds. It is not surprising that banking is always involved in various activities in the economic sector.

In today's digital era, banking activities are experiencing rapid development, one of which is in the aspect of financing. Financing is one of the main components of Islamic bank income, especially through profit and loss sharing schemes. This scheme not only contributes significantly to bank income but also carries risks, especially the risk of customer default (Antonio, 2011). This risk can affect the financial stability of banks if not managed properly (Ascarya & Yumanita, 2008). Therefore, risk management in financing is very important to maintain the sustainability of income and the overall health of banks. This risk is reflected through the Non-Performing Financing (NPF) indicator in Islamic Commercial Banks and Non-Performing Loans (NPL) in Conventional Commercial Banks. When NPF is low, the bank's financial condition is good, and vice versa, when NPF is high, it will cause vulnerability in the financial condition. This is because high problematic financing can quickly erode capital and reduce bank stability (Wardhani et al., 2022).

According to Sharia Banking Statistics data released by the Financial Services Authority (OJK), Sharia Commercial Banks (BUS) offer 21 types of financing, one of which is Residential Property Financing. During the period from 2015 to 2024, Home Ownership Financing contributed 15.74 percent of total financing each year. Although the percentage of home financing is relatively small, it is not in line with the trend of Non-Performing Financing in the Home Ownership sector (NPFR), which has actually increased from year to year.

This condition is reinforced by the NPFR trend when compared to the overall NPF trend. While the aggregate NPF shows a decline, the NPF in this sector has actually increased from year to year. This discrepancy is noteworthy, as consistency between aggregate and

sectoral data is a basic principle in financial analysis to assess the health of the financial system (Ministry of Tourism and Creative Economy, 2024). Data consistency indicates that information obtained from various levels or sources, whether aggregate or sectoral, must be consistent and not contradictory when representing the same economic or financial conditions. Furthermore, considering that residential mortgage financing is one of the three largest types of financing among the 21 types of financing recorded in the Sharia Commercial Bank report released by the OJK in December 2023.

The high level of financing in the housing sector can be understood because housing is a primary need that is very important for the community (Kasmir, 2018). The increase in population and housing needs that are not matched by people's purchasing power, mainly due to inflation which causes house prices to continue to increase, encourages people to apply for long-term financing (Bank Indonesia, 2022). However, the risk of problematic financing remains because there are many debtors who have difficulty in repaying their obligations (Siregar & Purba, 2020).

With the increasing NPF ratio in the Residential Home Financing sector, appropriate preventive measures are needed. One of them is to identify and analyze the factors that influence the increase in NPF in this sector. This step is important to maintain the financial health of banks, which aims to ensure the sustainability of housing financing in the future and support the economic development of a country. According to Popita (2013), the factors that influence the occurrence of non-performing loans are caused by three elements, namely the bank itself (creditor), the debtor, and the macroeconomy. The creditor factor is an internal factor of the bank, while the other two factors, namely the debtor and macroeconomic factors, are external. The internal bank factor of non-performing financing can be proxied by Operating Expenses to Operating Income (BOPO). Nugroho & Bimo (2019) state that BOPO has a positive effect on Non-Performing Financing (NPF). This research is supported by Rahmatina & Kasri (2020), who state that BOPO has a significant effect, as well as Fatimah & Izzaty (2022). However, this differs from the research conducted by Purnamasari & Musdhalifah (2016), who stated that BOPO does not have a significant effect on NPF.

The occurrence of non-performing financing can also be caused by the adequacy of capital owned by banks, which is represented by the Capital Adequacy Ratio (CAR). Research conducted by Nugrohowati & Bimo (2019) and Lidyah (2016) states that CAR has a negative effect on NPF. However, this differs from the research conducted by Astrini et.al (2020) and Fatimah & Izzaty (2022), which states that CAR has no effect on NPF. Similarly, research by Purnamasari & Musdhalifah (2016) states that CAR has no significant effect on NPF.

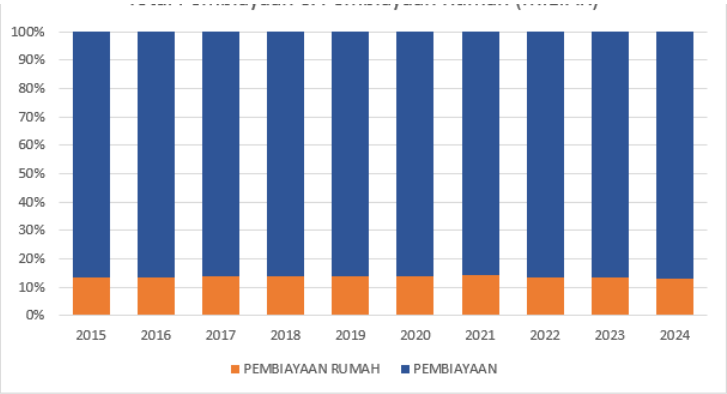

Figure 1. Total Financing and Residential Financing of Islamic Banks in Indonesia
Source: Sharia Banking Statistics (2025)

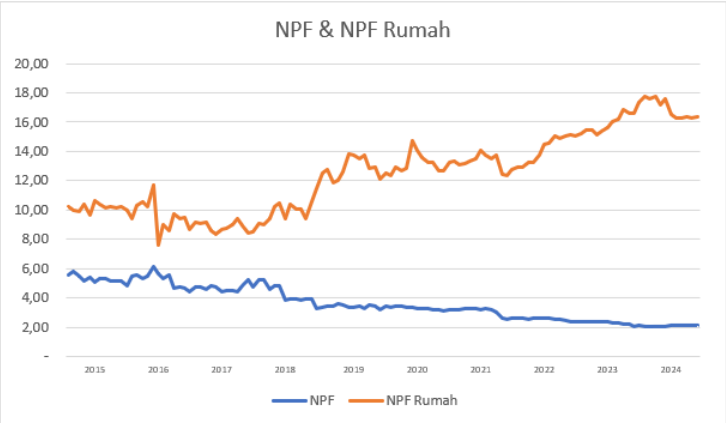

Figure 2. Non-Performing Financing and Non-Performing Financing for Home Ownership in Islamic Banking in Indonesia
Source: Sharia Banking Statistics (2025)

Meanwhile, the cause of non-performing loans from external banks can be represented by the exchange rate. This variable is related to non-performing financing, as can be seen from the exchange rate of the rupiah against the dollar. If the rupiah depreciates against foreign currencies, this can have a negative impact on business debtors who depend on imported raw materials. An increase in the exchange rate has the potential to increase production costs, making it difficult for debtors to meet their financing obligations to banks. This condition can ultimately lead to an increase in the non-performing financing (NPF) ratio in Islamic banking (Martiningsih, 2014) and is reinforced by research by Fatimah & Izzaty (2022), which states that the exchange rate has a significant positive effect on NPF. This contrasts with the research conducted by Purnamasari & Musdhalifah (2016), which states that the exchange rate does not have a significant effect on NPF.

Next is the factor of money supply (MS). If the money supply increases, it can encourage economic growth and GDP through increased consumption and investment, but if it is excessive, it can cause inflation and decrease the value of money (Ulfa & Fisabilillah, 2023). Therefore, the management of the money supply needs to be carried out carefully in order to match the capacity of the economy. Research conducted by Panorama (2016) states that MMR has a positive effect on NPF. However, research conducted by Sumarlin (2016), Muttaqin (2017), and Lemiyana & Litriani (2016) states that MMR has no effect on NPF.

This study has a number of differences and updates compared to previous studies. Most of the previous studies focused more on analyzing internal and external factors that affect financing risks in Islamic commercial banks in Indonesia. However, not many have specifically explored financing risks for residential property ownership. In addition, the selection of the starting point for the study was based on the existence of significant global economic shocks in 2015. The shocks that occurred in that year affected many countries, including Indonesia, which experienced a decline in economic growth due to weakening global demand, falling world commodity prices, and turmoil in global financial markets triggered by the normalization of US monetary policy and the economic slowdown in China (Jasin, 2016).

In addition, a distinctive feature of this study is that internal factors are measured using bank health indicators, while external factors are analyzed using macroeconomic indicators. Bank health is measured using the RGEC approach, with earnings represented by the ratio of operating expenses to operating income (BOPO). BOPO is used to assess the operational efficiency of banks. Meanwhile, the Capital aspect is represented by the Capital Adequacy Ratio (CAR), which shows the adequacy of a bank's capital to risk-

weighted assets (RWA). Meanwhile, external variables are measured using macroeconomic indicators divided into aspects of public consumption capacity, which are reflected using monetary condition variables, and exchange rate and money supply variables. This study uses secondary data from 2015 to 2024 to analyze the influence of internal and external factors on non-performing financing in residential property financing (NPFR) in Indonesia. internal and external factors on non-performing financing in Residential Property Financing (NPFR) in Indonesia.

LITERATURE REVIEW

Risk Management Theory

Risk management is a structured approach to identifying, analyzing, evaluating, and controlling various potential risks in business activities, with the aim of reducing negative impacts and ensuring business continuity (Hanggraeni, 2016). According to the COSO ERM Framework (2017), risk management is a structured and continuous process of identifying, evaluating, and controlling risks that could hinder the achievement of organizational objectives. This process includes identifying sources of risk from internal and external factors, assessing the possible impacts, and implementing strategic measures to reduce or manage these risks so that the organization can remain stable and sustainable. In the banking sector, Risk Management is defined in Article 1 of Financial Services Authority Regulation Number 18/POJK.03/2016 concerning the Application of Risk Management for Commercial Banks as a series of methodologies and procedures used to identify, measure, monitor, and control risks arising from all banking activities.

An optimal risk management process includes the stages of risk identification, analysis, mitigation efforts, and routine risk monitoring to enable appropriate preventive actions to be taken. Specifically in In the context of sharia-based property, risk management needs to take into account Islamic principles, such as the prohibition of usury and excessive uncertainty (gharar), so that the strategies applied must be tailored to the characteristics of sharia products and the needs of consumers (Muhaimin et al., 2022). Therefore, a risk management approach is needed that not only focuses on reducing losses but also is oriented towards sustainability and long-term business ethics.

Non-Performing Financing (NPF) of Residential Property Ownership

One important indicator in risk management in the banking sector, especially in Islamic banks, is Non-Performing Financing. NPF is a ratio that indicates the level of problematic or non-performing financing. NPF describes the quality of financing assets and reflects the effectiveness of credit risk management by the bank. The lower the NPF value, the better the bank's ability to manage credit risk and maintain the quality of its financing portfolio (Sugianto et al., 2024). NPF is a major concern because high levels of problematic financing can have a serious impact on a bank's liquidity and capital. Therefore, good risk management must be able to detect potential financing risks early on and implement mitigation measures such as strict selection of prospective customers, regular monitoring, and restructuring of financing when necessary (Palosong et al., 2025).

In the context of residential mortgage financing, NPFR is a crucial indicator for evaluating the level of credit risk that arises. Given that this type of financing generally has a long tenor and a large loan value, the potential for default needs to be addressed with careful risk management. Effective risk management includes analyzing the debtor's financial capacity, monitoring the proper use of funds, and applying the principle of prudence in the financing process (Sugianto et al., 2024). On the other hand, in the sharia property system, Residential Property Financing must also be in line with sharia principles that prioritize the elements of fairness and transparency. With an approach based on these values, the risk of problematic financing can be significantly reduced (Muhaimin et al., 2022).

Internal Factors of Islamic Banking

Bank Health

According to Kasmir (2018), bank health refers to a bank's ability to carry out its operations in a reasonable and sustainable manner, as well as can fulfill all of its obligations properly, in accordance with the provisions and regulations applicable in the banking sector. Based on Bank Indonesia Regulation Number 6/10/PBI/2004 concerning the assessment system for the health of commercial banks, the health of a bank is important for all interested parties, including owners, bank management, customers using banking services, and Bank Indonesia as the supervisory agency for the banking industry. As it develops, banking business activities continue to face various risks closely related to the role of banks as intermediaries in financial activities.

RGEC Method

Risk Profile, Good Corporate Governance, Earning, and Capital, commonly referred to as RGEC, is an assessment method that aims to provide a comprehensive overview of a bank's internal condition and its ability to deal with various risks, as well as to measure a bank's health. This approach was introduced to replace Bank Indonesia Regulation Number 6/10/PBI/2004, which previously used the CAMELS method. RGEC assesses a bank's performance and stability based on four main aspects, namely:

Risk Profile

In accordance with Bank Indonesia Regulation (PBI) Number 13/1/PBI/2011 concerning the Assessment of Commercial Bank Health, Article 7 explains that the assessment of risk profile covers eight types of risk, namely credit risk, market risk, liquidity risk, operational risk, legal risk, strategic risk, compliance risk, and reputational risk. To measure the amount of credit risk borne by a bank, the Non-Performing Financing (NPF) indicator is used. The NPF ratio serves as a measuring tool to determine the extent of non-performing financing, calculated based on the ratio of total non-performing financing to the total amount of financing disbursed by the bank (Popita, 2013).

Good Corporate Governance (GCG)

Good corporate governance is a set of laws, rules, and norms that must be obeyed. It aims to encourage the optimal use of company resources so as to create sustainable long-term economic value, both for shareholders and the wider community (Effendi & Arief, 2009). GCG also acts as the main mechanism that is expected to support the creation of sound business practices. Assessment of GCG factors is carried out to measure the extent to which the quality of bank management applies the principles of good corporate governance (Mulazid & Sofyan, 2016).

Earning

Profitability describes a company's ability to generate net income from its capital. Profitability is measured by comparing the profit earned from business activities with the total capital used (Gilarso, 2003). The assessment of profitability factors aims to evaluate the extent to which a company is able to generate profits. This aspect includes analysis of profitability performance, sources of income, profit sustainability, and management in managing profitability. Profitability assessment is also intended to assess the extent to which a bank's ability to generate profits can support its operations and capital (Pramana et al., 2015). Good financing and liquidity management is a reflection of the health of a bank, and in terms of profitability, it can be measured using the BOPO indicator (Hakim, 2018)

Operating Expenses Operating Income (BOPO)

In their research, Purnamasari and Musdhalifah (2019) cited Dendawijaya (2009, p. 121), who stated that the BOPO ratio is used to assess the level of efficiency and the bank's ability to manage its operational activities, especially in controlling operational costs against operational income. A decrease in this ratio reflects improved efficiency in cost management by banks. This efficiency contributes to increased profits, which directly

impacts the bank's income. Therefore, the bank's financial performance will show improvement in line with the bank's ability to optimize operational costs in its business processes. According to Jusmansyah and Sriyanto (2013), BOPO is calculated using the following formula (i)

$$BOPO = \frac{\text{Operating Expenses}}{\text{Operating Income}}\ x\ 100\% \quad \text{(i)}$$

Capital

The assessment of capital includes an analysis of the adequacy of the bank's capital and the effectiveness of its capital management. In the capital calculation process, banks are required to comply with regulations set by Bank Indonesia regarding Minimum Capital Requirements. In addition, banks must also maintain a Capital Adequacy Ratio as a measure to anticipate various risks that may arise (Pramana et al., 2015). The Capital Adequacy Ratio (CAR) is a ratio that shows the comparison between total capital, both core capital and supplementary capital, and risk-weighted assets (RWA). The availability of adequate capital is crucial for banks to cover potential losses, especially those resulting from the inability of debtors to repay their loans. When the CAR of Islamic Commercial Banks (BUS) increases, banks tend to feel more secure in expanding their financing distribution. However, this condition can also trigger a relaxation of standards in distributing financing. If this happens, the possibility of banks providing financing to less eligible customers becomes higher, which in turn can increase the NPF ratio in the event of default (Mardiani, 2013). According to Astrini (2014), CAR can be calculated using the following formula (ii).

$$CAR = \frac{\text{Bank Capital}}{\text{Risk}-\text{weighted Assets}}\ x\ 100\% \quad \text{(ii)}$$

External Factors of Islamic Banking

Macroeconomic Concepts

Macroeconomics is the study of the economy as a whole, including aspects such as a country's economic growth, the causes of poverty, inflation, economic recession and depression, public income, unemployment rates, government policy, and other related issues (Dornbusch et al., 2019). The preparation of the state budget in Indonesia uses the concept of Basic Macroeconomic Assumptions, which consists of the exchange rate and the amount of money in circulation (Fiscal Policy Agency, 2021).

Exchange Rate

International trade encourages transactions between countries involving the exchange of two or more different currencies. This process creates demand and supply for certain currencies. In his research, Nopirin (2012) states that the exchange rate is a form of price comparison between two types of currencies from different countries, where the value ratio is known as the exchange rate. According to Mutamimah and Chasanah (2012), the exchange rate can be calculated using the following formula (iii)

$$\text{Exchange Rate } = \frac{\text{ER}_t - \text{ER}_{t-1}}{\text{ER}_{t-1}}\ x\ 100\% \quad \text{(iii)}$$

Money Supply

Money supply is an important indicator in the economy that shows the total amount of cash and savings that people have available for transactions (Boediono, 2008). Changes in the money supply can affect inflation, interest rates, and overall economic growth. According to Boediono (2008), the money supply includes currency (paper money and coins) and demand deposits (deposits in banks that can be withdrawn at any time). Meanwhile, according to Bank Indonesia (2020), the money supply that is often used in macroeconomic analysis is divided into M1, M2, and M3.

HYPOTHESIS

The Relationship between Operating Expenses to Operating Income (BOPO) and Non-Performing Financing (NPF) in Islamic Banking in Indonesia. A high BOPO indicates that banks are less efficient in carrying out their operations, which has an impact on customer trust and increases NPF. Research conducted by Fatimah & Izzaty (2022) on Islamic Commercial Banks registered in the first period of 2019 to the third quarter of 2020 shows that BOPO has a significant positive effect on NPF in Islamic banks. If BOPO is managed effectively, it can open up opportunities for banks to generate more optimal profits. This is reinforced by research conducted by (Lidyah, 2016), (Rahmatina & Kasri, 2020), and (Nugrohowati & Bimo, 2019). H1: Operating expenses to operating income (BOPO) affect the risk of residential property financing.

The relationship between Capital Adequacy Ratio (CAR) and Non-Performing Financing (NPF). A high CAR indicates that a bank has strong capital to cover the risk of losses from assets that tend to be at high risk. This has an effect on customer attractiveness and the ability to expand business. In Lidyah's (2016) study discussing internal and external factors in Islamic Commercial Banks during the 2010-2014 period, it was shown that CAR has a negative effect on NPF. A high CAR will increase a bank's financing distribution. A CAR above 20% in a bank can spur an increase in financing of up to 20%–25% in one year (Soedarto, 2004). This study is also in line with research conducted by (Nugraini, 2014), (Raysa, 2014) and (Nugroho & Bimo, 2019). H2: Capital adequacy ratio (CAR) affects the risk of residential mortgage financing.

The Relationship between Exchange Rates and Non-Performing Financing (NPF) in Islamic Banking in Indonesia. A high exchange rate indicates a weakening of the rupiah against the dollar. A high exchange rate can have a negative impact on economic growth because it can reduce the value of exports. One of the causes of the continuing increase in the exchange rate is the continued pressure on the rupiah due to large capital flows, which has resulted in a loss of confidence among foreign investors in the Indonesian economy (Ginting, 2013). In a study by Fatimah & Izzaty (2022) discussing internal and external factors in 9 Islamic commercial banks, it was stated that the exchange rate has a positive effect on NPF. Where changes in the exchange rate affect the NPF rate. These results are in line with previous studies (Supriani & Sudarsono, 2018) (Fadhlurrahman et al., 2021).H3: The exchange rate affects the risk of residential property financing.

The relationship between money supply and Non-Performing Financing (NPF) in Islamic Banking in Indonesia. When the money supply increases, this reflects an expansionary monetary policy that aims to encourage economic growth through increased consumption and investment. However, this policy also has consequences in the form of increased inflation and the risk of a decline in people's purchasing power if it is not balanced with adequate growth in the production of goods and services. Research by Doan Van (2020) shows that the money supply has a significant impact on GDP growth and inflation; the more money in circulation, the more inflation tends to increase and people's purchasing power can decline if inflation is not controlled (Van, 2020). This is in line with the findings of Anas (2006) and Budhi (2001), who state that a money supply that is greater than the production of goods and services will cause price increases or inflation (Budhi, 2001). H4: The money supply affects the risk of residential property financing.

METHODS

Variables and Data Sources

The variables used in this study are divided into two categories: dependent and independent variables. The dependent variable (Y) selected is Non-Performing Financing (NPF) for Residential Property Ownership, while the independent variables (X) are BOPO, CAR, Exchange Rate, and Money Supply. The data used in this study is secondary data obtained from the 2013-2024 financial reports of Islamic commercial banks obtained from

the Islamic Banking Statistics (SPS) of the Financial Services Authority (OJK) and macroeconomic data obtained from the official website of Bank Indonesia.

Table 1. Operational Definition

Variable	Definition	Data Source
Internal (Banking)		
BOPO	A ratio used to measure the operational efficiency of a bank or financial company.	Sharia Banking Statistics (Sharia Commercial Banks)
CAR	CAR A ratio that measures the adequacy of a bank's capital to cover all risks of loss from its business activities (such as credit risk, operational risk, market risk).	Sharia Banking Statistics (Sharia Commercial Banks)
External (Macroeconomics)		
Exchange Rate	The price of one currency against another currency	Bank Indonesia (JISDOR)
Money Supply	Money in the hands of the public and ready to be used as a means of transaction, both in the form of currency and demand deposits.	Bank Indonesia

Source: Data Processed (2025)

Model Estimation

The data analysis method used in this study is the Vector Error Correction Model (VECM) method, which is used to analyze the short-term and long-term dynamic relationships between variables that have a cointegration relationship. This model is an extension of VAR that includes an error correction term to capture adjustments towards long-term equilibrium in the event of short-term deviations (Anastasia, 2024). In the context of this study, the VECM model is used to determine the short-term and long-term effects of internal factors such as BOPO, CAR, exchange rates, and money supply on non-performing financing in the residential property sector in Indonesian Islamic banking. The general equation (iv) of the VECM model used in this study is:

$$\Delta \mathrm{NPFR}_t = \alpha + \sum_{i=1}^{\rho} \beta_i \, \mathrm{NPFR}_t + \sum_{i=1}^{\rho} \beta_i \, \mathrm{BOPO}_t + \sum_{i=1}^{\rho} \beta_i \, \mathrm{CAR}_t + \sum_{i=1}^{\rho} \beta_i \, \mathrm{ER}_t + \sum_{i=1}^{\rho} \beta_i \, \mathrm{MS}_t + \lambda \mathrm{ECT}_t + \varepsilon t \quad \text{(iv)}$$

Where:ΔNPFRt : Change in Non-Performing Financing for Residential Property at time t; ΔNPFRt : Change in BOPO at lag ke-I; ΔCARt : Change in CAR at lag ke-I; ΔERt : Change in Exchange Rate at lag I; ΔERt : Change in Money Supply at lag I; ECTt−1 : Error correction term in the previous period, which shows the deviation from long-term equilibrium.; λ : Speed of adjustment towards long-term equilibrium (error correction parameter); εt : Random error or residual at time t.

The VECM model is very suitable for use in research on the financial and Islamic banking sectors in Indonesia, particularly for analyzing the influence of internal and macroeconomic factors on Non-Performing Financing (NPF). Empirical studies show that VECM is capable of identifying both short-term and long-term influences between variables, as well as providing

RESULTS

VECM Method (Analysis Requirements Testing)

Stationarity Test

The following are the results of the stationarity test of the BOPO, CAR, Exchange Rate, and Money Supply index variables using the Group unit root test

Table 2. Stationarity Test

Metode	Level		First Difference	
	Statistic	Prob	Statistic	Prob
levin	0.91668	0.8203	-32.2283	0.0000
Im	2.27357	0.9885	-28.7318	0.0000
ADF	2.58423	0.9896	379.093	0.0000
PP	2.74676	0.9898	392.249	0.0000

Source: Processed secondary Data (2025)

Based on Table 2 of the stationarity test results, it can be seen that all variables do not show stationarity at the level. However, after conducting a stationarity test at the First Difference level, all variables show stationarity because the probability values of all methods are less than 0.05%.

Stability Test

After all variables become stationary, the next step is to conduct a stability test. At this stage, the maximum length of the stable VAR system will be observed. The following (Table 3) are the results of the stability test conducted in this study. Based on the test results, it can be concluded that all roots have a modulus smaller than one (Modulus < 1) and all are within the unit circle. Therefore, the research data is stable.

Table 3. Stability Test

Root	Modulus
0.089630 – 0.0586281i	0.593092
0.089630 + 0.0586281i	0.593092
-4.70114	0.470114
0.424559	0.424559
-0.312990 – 0.281810i	0.421165
-0.312990 + 0.281810i	0.421165
0.094118 – 0.357603i	0.369781
0.094118 + 0.357603i	0.369781
-0.142383 – 0.195293i	0.241687
-0.142383 + 0.195293i	0. 241687

Source: Processed secondary Data (2025)

Determination of Optimal Lag

After the research data is stable, the next step is to determine the optimal lag length in this study. The goal is to determine the most appropriate number of lags. The following (Table4) are the results of determining the optimal lag length in this study. The optimal lag length was determined based on the best interval candidates selected using the Final Prediction Error (FPE) and Akaike Information Criterion (AIC) criteria, which were found to be optimal at lag 2.

Table 4. Determination of Optimal Lag

Lag	LogL	LR	FPE	AIC	SC	HQ
0	199.2042	NA	2.42e-08	-3.348348	-3.229659*	-3.300167*
1	233.2807	64.62788	2.07e-08	-3.504840	-2.792704	-3.215753
2	258.6247	45.88138*	2.06e-08*	-3.510771*	-2.205189	-2.980779
3	274.2010	26.85570	2.44e-08	-3.348293	-1.449265	-2.577396

Source: Processed secondary Data (2025)

Granger Causality Test

After determining the optimal lag length, this study continued with a Granger causality test (Table 5) to evaluate whether there was a causal relationship between the observed variables of BOPO, CAR, Exchange Rate, and Money Supply and to identify the direction of the relationship

Table 5. Granger Causality Test

Null Hypothesis	Obs	F-Statistic	Prob.
BOPO does not Granger Cause NPFR	118	6.05641	0.0032
NPFR does not Granger Cause BOPO		3.11637	0.0481
CAR does not Granger Cause NPFR	118	3.54386	0.0322
NPFR does not Granger Cause CAR		0.56681	0.5689
NT does not Granger Cause NPFR	118	6.37049	0.0024
NPFR does not Granger Cause NT		10.0718	9.E-05
JUB does not Granger Cause NPFR	118	3.13674	0.0472
NPFR does not Granger Cause JUB		1.84750	0.1624
CAR does not Granger Cause BOPO	118	4.58062	0.0122
BOPO does not Granger Cause CAR		3.27112	0.0416
NT does not Granger Cause BOPO	118	1.18938	0.3082
BOPO does not Granger Cause NT		10.1783	9.E-05
JUB does not Granger Cause BOPO	118	13.7517	5.E-06
BOPO does not Granger Cause JUB		1.24430	0.2921
NT does not Granger Cause CAR	118	0.85610	0.4276
CAR does not Granger Cause NT		5.96456	0.0034
JUB does not Granger Cause CAR	118	2.09565	0.1277
CAR does not Granger Cause JUB		0.24599	0.7824
JUB does not Granger Cause NT	118	9.48631	0.0002
NT does not Granger Cause JUB		0.51158	0.6009

Source: Processed secondary Data (2025)

Based on the results of the Granger causality test, it was found that there is a significant one-way relationship from BOPO to NPFR (p-value = 0.0032), which indicates that operational efficiency (BOPO) affects the level of non-performing financing (NPFR). The less efficient a bank's operational cost management is, the greater the potential for an increase in NPF. However, the opposite direction was not found, which means that NPFR does not significantly affect BOPO. Similarly, the results of the analysis show that CAR significantly affects NPFR (p-value = 0.0322), indicating that capital adequacy plays a role in reducing non-performing financing risk. However, the effect of NPFR on CAR is not significant. Interestingly, a significant two-way relationship is found between the exchange rate (NT) and NPFR, where both exchange rate fluctuations affect NPF (p-value = 0.0024) and, conversely, NPF also affects the exchange rate (through the variable CAR → NT with a p-value = 0.0034).

This reflects that exchange rate instability can worsen non-performing loans in the residential sector, and conversely, NPF conditions can also reflect pressure in the external sector. Furthermore, the money supply (MS) shows a one-way effect on NPFR (p-value =

0.0002), which means that an increase in MS has the potential to increase non-performing loans, but there is no reciprocal effect from NPFR to MS. In addition to the relationship with NPFR, a relationship was also found between other internal variables. CAR has a significant effect on BOPO (p-value = 0.0122), indicating that the adequacy of bank capital affects operational efficiency.

BOPO also affects CAR (p-value = 0.0416), albeit at a weaker level of significance, suggesting a relatively weak potential two-way relationship between the two. Conversely, no significant relationship was found between BOPO and JUB (p-value = 0.2921), indicating that the two do not causally influence each other. The one-way relationship between CAR and the exchange rate (p-value = 0.0034) shows that the stability of bank capital also plays a role in maintaining exchange rate stability. Finally, the amount of money in circulation has been proven to significantly affect the exchange rate (p-value = 0.0002), indicating that liquidity pressures in the monetary sector can trigger exchange rate volatility.

Cointegration Test

The next step is to conduct a cointegration test to evaluate the long-term equilibrium between the observed variables. Cointegration refers to a condition in which data are individually non-stationary but become stationary when linearly linked. The following are the conditions for the cointegration test

Table 6. Cointegration Test

Hypothesized No. of CE(s	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.467802	237.8492	69.81889	0.0001
At most 1 *	0.397013	164.6833	47.85613	0.0000
At most 2 *	0.316890	106.0035	29.79707	0.0000
At most 3 *	0.234405	61.79602	15.49471	0.0000
At most 4 *	0.233271	30.81219	3.841466	0.0000

Source: Processed secondary Data (2025)

The cointegration test results show that the Probability of Significance value is 0.00, which is less than 0.05%. This indicates the existence of cointegration between these variables, suggesting that there is a long-run equilibrium between BOPO, CAR, Exchange Rate, and Money Supply variables. Therefore, further research will use the Error Correction Model (ECM) estimation.

VECM Model Estimation

The use of the Vector Error Correction Model (VECM) in estimation aims to analyze the relationship between dependent variables that are influenced by the imbalance of several variables. The following are the results of the model estimation produced in this study

Short-Term Estimation

Based on short-term estimates in the NPFR equation model, the following is formed:

$$NPFR_t = -0.015460 + 0.053451\Delta NPF_{t-2} - 0.007937\Delta BOPO_{t-2} + 0.029275\Delta CAR_{t-2} + 3.652382\Delta LOG(ER_{t-2}) - 0.015460\Delta LOG(MS_{t-2}) \quad (v)$$

The interpretation of the short-term non-performing financing (NPFR) equation is as follows: (1) The constant value of –0.015460 indicates that if all exogenous variables are constant (unchanged), NPFR will decrease by 0.015460 units in the short term. However, this coefficient is not statistically significant and the t-stat is –0.97660; (2) The value of the NPFR lag 2 coefficient is 0.053451 with a t-stat of 0.54014, which is not significant, so that changes in NPFR two periods earlier do not have a significant effect on current NPFR in

the short term; (3) The value of the BOPO coefficient at lag 2 is –0.007937 with an insignificant t-statistic, indicating that changes in operational efficiency (BOPO) in the previous two periods have not had a significant effect on changes in NPFR in the short term; (4) The CAR coefficient value at lag 2 is 0.029275 with an insignificant t-statistic, indicating that the capital adequacy ratio has not shown a significant effect on NPFR changes in the short term; (5) The exchange rate coefficient value at lag 2 is 3.652382 with a t-statistic of 1.13552, which is insignificant, indicating that changes in the exchange rate in the previous two periods did not have a significant effect on the current NPFR; (6) The coefficient value of money supply at lag 2 is 0.553671 with an insignificant t-statistic, indicating that changes in money supply do not affect NPFR in the short term.

Table7. Short-Term VECM Model Estimation

Endogen	Exogen	Coefficient	S.E	T stat
NPFR	**D(NPFR(-1))**	**-0.292617**	**(0.10156)**	**[-2.88131]**
	D(NPFR(-2))	0.053451	(0.09896)	[0.54014]
	D(BOPO(-1))	-0.047490	(0.04426)	[-1.07306]
	D(BOPO(-2))	-0.007937	(0.04384)	[-0.18103]
	D(CAR(-1))	0.011130	(0.09951)	[0.11185]
	D(CAR(-2))	0.029275	(0.09978)	[0.29340]
	D(LOG(NT(-1)))	-6.446287	(3.28333)	[-1.96334]
	D(LOG(NT(-2)))	3.652382	(3.21648)	[1.13552]
	D(LOG(JUB(-1)))	-0.560199	(5.17625)	[-0.10822]
	D(LOG(JUB(-2)))	0.553671	(5.42742)	[0.10201]
	C (Constanta)	-0.015460	(0.01583)	[-0.97660]

Source: Processed secondary Data (2025)

Long-Term Estimates

Based on long-term estimates in the NPFR equation model, the following is formed (vi):

$$NPFRt = -859{,}0976 + 2{,}030246BOPO_t + 26{,}57296MS_t + \varepsilon t \ldots\ldots\ldots \text{(vi)}$$

To determine whether the exogenous variable affects the endogenous variable, the T stat must have a value greater than the T table with a degree of freedom of 115 using a significance level of 5%, which is 1.65821. The interpretation of the long-term NPFR index equation is as follows: (1) The short-term correction constant value of NPFR is 1.000000. This means that when an imbalance occurs, the NPFR will adjust itself completely (100%) in one period towards long-term equilibrium; (2) The BOPO coefficient value shows a t-stat of 5.64523. This figure is greater than the T Table value of 1.65821. This means that every 1% increase in BOPO tends to increase NPFR by 2.030246%; (3) The CAR coefficient shows a t-stat of 1.32832. This figure is smaller than the T Table value of 1.65821. This means that, regardless of whether the direction of influence is negative or positive, CAR fluctuations do not have a significant effect on NPFR;(4) The exchange rate (NT) coefficient shows a t-stat of -1.19230. This figure is smaller than T Table 1.65821. This means that despite the negative or positive direction of influence, NT fluctuations do not have a significant effect on NPFR; (5) The money supply coefficient (JUB) shows a t-stat of 1.87344. This figure is greater than T Table 1.65821. This means that a 1 billion increase in the money supply tends to drive a 26.57296% increase in NPFR.

Table 8. Long-Term VECM Model Estimates

Endogen	Exogen	Coefficient	S.E	T stat	T Table
NPFR (1.000000)	BOPO	2.030246	(0.35964)	[5.64523]	1.65821
	CAR	1.011193	(0.76125)	[1.32832]	
	NILAI TUKAR	24.47059	(28.7096)	[0.85235]	
	JUMLAH UANG BEREDAR	26.57296	(14.1841)	[1.87344]	
	C		-859.0976		

Source: Processed secondary Data (2025)

Based on the data processing results, it can be concluded that the BOPO ratio plays a role in suppressing the NPF rate. An increase in the BOPO ratio indicates that Islamic banking has experienced a decline in efficiency in managing operating costs, which in turn can increase the risk of non-performing financing (NPF). This study identifies that the high BOPO value during the analysis period is influenced by the amount of operational expenses that are not proportional to the operational income earned. This low income indicates problems in the quality of financing disbursed, which contributes to an increase in the potential for NPF.

These results support signaling theory, which explains that internal factors such as the BOPO ratio can provide an indication of the possibility of non-performing financing (NPF). In addition, the high BOPO ratio indicates that the financing process by Islamic Commercial Banks tends to exceed actual needs, thereby impacting the increase in operational inefficiencies in each bank. Thus, a high BOPO ratio reflects weak managerial efficiency and a decline in financing quality, which can increase the risk of NPF.

On the other hand, based on an analysis of bank health using the RGEC approach, the BOPO ratio for the period 2015 to 2024 is still in the “Very Healthy” category, indicating that, in general, banks are able to manage their operational efficiency quite well. Nevertheless, this efficiency remains an important consideration in maintaining the quality of financing. The results of this study are in line with the findings of Fatimah and Izzaty (2022) and Nugroho and Bimo (2019), which state that increasing operational efficiency through a reduction in BOPO can reduce the NPF rate. Therefore, increasing operational cost efficiency must be a strategic priority for Islamic banking in order to maintain asset quality and reduce the risk of problematic financing in the future.

The Effect of CAR on Non-Performing Financing (NPF) in Residential Property Financing
The CAR lag 2 coefficient of 0.029275 in the short-term estimation is insignificant, indicating that the capital adequacy level two months prior has not had a significant effect on NPFR in the short term. In the long-term estimation, the effect of CAR is also insignificant (t-stat 1.32832 < t-table), although the direction is positive. This indicates that CAR does not have a strong and significant effect on NPFR in either the short-term lag 2 or long-term.

Based on the data processing results, it can be concluded that the Capital Adequacy Ratio (CAR) does not have the ability to directly reduce the Non-Performing Financing (NPF) rate. As stated by Rahmadani (2015), fluctuations in NPF, both increases and decreases, are not caused by changes in the CAR value. Instead, CAR is more This represents the impact of high NPF levels, because when customers experience difficulties in meeting their obligations, banks need to provide capital reserves to cover potential losses. Therefore, no matter how high a bank's CAR ratio is, it does not necessarily reduce non-performing loans. In Indonesia, the average CAR for Islamic banks is well above the minimum threshold of 8% set by Bank Indonesia, reflecting that Islamic banks have sufficient capital capacity to anticipate financing risks. This finding is in line with the results of research conducted by Havidz & Setiawan (2015), which states that there is no significant influence between CAR and NPF levels. However, these results contradict the view in commercial loan theory, which states that a low CAR ratio indicates a bank's limited ability to handle non-performing financing risks.

In this study, the CAR ratio in Islamic banking shows excellent performance, falling into the "Very Healthy" category, which indicates that banks have adequate capital to bear the risks that may arise from financing activities. This finding is reinforced by the results of studies conducted by Astrini et al. (2020) and Fatimah & Izzaty (2022), which also show that CAR does not have a significant effect on the NPF rate. Thus, although capital availability is a crucial factor in maintaining bank financial stability, risk control and selective policies in financing become more decisive factors in maintaining asset quality and reducing the potential for non-performing financing in Islamic banking.

The Effect of Exchange Rates on Non-Performing Financing (NPF) in Residential Property Financing. The lag 2 exchange rate has a coefficient of 3.652382 with a t-stat of 1.13552, which is not significant in the short-term estimation, so that changes in the exchange rate two months earlier do not have a significant effect on NPFR. In the long-term estimation, the exchange rate is also insignificant (t-stat –1.19230 < t-table), so that exchange rate fluctuations are not proven to significantly affect NPFR in the short term lag 2 or long term.

Based on the results of data analysis, it can be concluded that the exchange rate variable does not have a direct ability to reduce the level of Non-Performing Financing (NPF). This lack of correlation is due to the exchange rate's tendency to have an immediate impact on problematic financing conditions in Islamic banks. Exchange rate fluctuations do not have a direct effect on financing margins in Islamic banks, unlike conventional banks that use a floating interest rate system. The fixed margin system applied in Islamic bank financing products enabling customers to manage their cash flow more stably. Furthermore, based on 2015 Indonesian Banking Statistics data, the portion of financing in foreign currency at Islamic banks is only around 5% of total financing disbursed, so exposure to exchange rate risk on NPF is very limited. Moreover, the characteristics of Islamic commercial bank financing, which focuses on the domestic real sector, mean that its connection to the global financial system is relatively low.

These findings are in line with previous research which states that exposure to foreign exchange in Islamic banks is still minimal, with financing activities more directed towards domestic economic needs (Amalia et al., 2022). Thus, exchange rate changes do not directly affect the level of financing risk in Islamic banking. This contradicts the Keynesian theory approach, which argues that a decline in export-import activities due to exchange rate fluctuations can affect debtors' ability to meet their installment obligations. Although the direct effect of exchange rates on NPF is relatively small, exchange rate instability remains a potential risk, especially for customers who depend on imported components or who are active in the international trade sector. Exchange rate changes can affect the prices of raw materials, including building materials sourced from abroad, thereby indirectly reducing debtors' ability to make payments on residential financing. Therefore, even though the impact of exchange rates on NPF is not statistically significant, Islamic banks are still advised to pay attention to exchange rate dynamics as part of their risk management strategy, especially for financing that is potentially affected by external factors.

The Effect of Money Supply on Non-Performing Financing (NPF) in Home Ownership Financing. The coefficient of money supply lag 2 of 0.553671 with a t-stat of 0.10201 is not significant in the short-term estimate, indicating that changes in money supply two months prior have no real impact on NPFR. However, in the long-term estimation, the money supply has a positive and significant effect with a coefficient of 26.57296 and a t-stat of 1.87344 > t-table, indicating that an increase in the money supply substantially drives an increase in NPFR in the long term. Based on the results of data analysis, it can be concluded that the growth of the Money Supply (MS) has the potential to reduce the Non-Performing Financing (NPF) rate, especially if the increase in liquidity is accompanied by increased productivity and efficiency in the distribution of financing by Islamic banks. However, the effect of MS on NPF can also occur indirectly through inflation. In this case, an increase in inflation can trigger an increase in problematic financing, because high

inflation tends to slow economic growth and suppress people's purchasing power, especially in the real business sector. This situation can ultimately reduce the ability of debtors to meet their financing obligations. When there is an unexpected surge in inflation, the real value of financing returned by customers and the returns received by banks may be lower than projected. This condition can reduce the performance of the financial sector, including the capital market and banking, due to increased default risk. The results of this study are in line with the findings of Panorama (2016), which states that there is a significant effect of the amount of money in circulation on NPF. This occurs when liquidity growth is accompanied by increased productivity and efficiency in financing distribution. In this context, Islamic banks face additional pressure in maintaining the quality of their financing assets. Therefore, if other variables are considered constant (ceteris paribus), uncontrolled inflationary pressure can hamper the intermediary function of banks and contribute to an increase in NPF risk in the Islamic banking industry. Therefore, JUB management and inflation stability are important factors in maintaining financing quality and reducing potential systemic risk.

CONCLUSION

This study was conducted with the aim of analyzing the influence of internal and external factors on Non-Performing Financing (NPF) in Residential Home Financing at Sharia Commercial Banks in Indonesia during the period 2015 to 2024. Specifically, this study evaluates internal bank indicators using the RGEC approach (consisting of BOPO and CAR) and macroeconomic variables (exchange rate and money supply) in influencing the NPF ratio, with the Vector Error Correction Model (VECM) approach as the main analytical tool.The results show that in the long term, the BOPO and money supply variables have a significant positive effect on NPF. These findings indicate that increased operating costs and increased liquidity in the market have a real contribution to the deterioration of financing quality. On the other hand, the CAR ratio and exchange rate do not show a significant effect in the long term on NPF.

The Granger causality test shows a one-way relationship between BOPO, CAR, and money supply on NPFR, as well as a two-way relationship between exchange rate and NPFR. This confirms that non-performing financing is influenced by internal and external factors, and in some cases, also affects macroeconomic conditions, such as exchange rate stability. In addition, a two-way relationship was found between CAR and BOPO, as well as a one-way effect of JUB on internal bank variables. These findings emphasize the importance of strengthening efficiency, capital adequacy, and liquidity management in maintaining the quality of financing in Islamic banking. Based on these results, there are a number of important implications. For further research, it is recommended to add more diverse variables such as economic growth, as well as dummy variables for certain macro events such as pandemics or strategic fiscal policies. The use of a panel data approach involving comparisons between banks or between regions can also broaden the scope of the analysis. In addition, strengthening the longitudinal dimension with a longer observation period, including the post-pandemic years, will provide a more complete picture of the trends and resilience of the Islamic financing sector.

For the Islamic banking industry, this study provides important input for strengthening operational efficiency and risk management. Banks need to ensure that increased profitability is not achieved at the expense of financing quality, and be more selective in financing expansion amid fluctuating economic conditions. Improving cost efficiency (BOPO) and credit risk management are also key to maintaining the stability of the NPF ratio. In addition, banks also need to improve service quality and digital innovation in order to remain competitive and attractive to the public.

Meanwhile, the government and financial authorities such as Bank Indonesia and OJK are expected to continue to maintain macroeconomic stability, particularly in controlling and maintaining exchange rate stability. In addition, policies that encourage financial inclusion

through Islamic banking, such as housing sector financing incentives, the establishment of guarantee funds, or Sharia-based risk mitigation regulations, can have a positive long-term impact on bank financial health and customer protection. Synergy between regulators, industry, and the real sector needs to be strengthened to support a competitive and sustainable Islamic financing system. However, this study has limitations. First, the use of national aggregate data cannot capture individual variations between banks or regions. Second, there are limitations in including other important variables that may affect NPF due to secondary data limitations. Third, the VECM approach used is highly dependent on the selection of lags and stationarity assumptions, so the results need to be interpreted carefully and cannot be generalized absolutely.

In conclusion, this study is expected to contribute theoretically and practically to the development of literature related to financing risks in the housing sector in Islamic banking. These empirical findings provide a basis for more careful banking policy and strategy making, especially in the face of evolving economic challenges. With an integrated approach between internal and external analysis, it is hoped that the residential property financing system in Islamic banking can be managed more effectively and sustainably.

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