Information Sciences Letters

Volume 12
Issue 8 *Aug. 2023*

Article 17

2023

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Information Sciences Letters
An International Journal

http://dx.doi.org/10.18576/isl/120817

Determinants of Non-Performing Financing for Islamic Commercial Banks in Indonesia with a Dynamic Panel Data Approach

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Received: 11 Feb. 2023, Revised: 13 July 2023, Accepted: 26 July 2023.
Published online: 1 Aug. 2023.

Abstract: Studying Non-Performing Financing (NPF) factors in the Indonesian Islamic banking sector is crucial to mitigating credit risk. In this study, we used factor analysis to determine indicators of internal and external factors in Islamic banking, then used system GMM estimation techniques to examine the dynamic effect of internal and external factors on NPF with panel data set at 14 Islamic Commercial Banks and 20 Islamic Business Units in 33 provinces from 2015 to 2019. The empirical results show that internal factors are formed in two dimensions: the fundamental dimension (Assets, Financing, and TPF) and performance measurement consisting of ROA, CAR, and CIR. External factors consist of two indicators (inflation and SBIS). The current NPF performance is not affected by the previous year's NPF. Conversely, the NPF of Islamic banking can decrease if ROA performance increases more than CIR. Islamic banking needs to strengthen its internal performance through its ability to manage invested funds to generate profits and strengthen the performance of the financing monitoring team to mitigate credit risk.

Keywords: Non-performing financing, internal factors, external factors, Islamic bank.

1 Introduction

1.1 Background

Understanding the factors affecting NPF is important for Islamic banking because it will determine future financing risk mitigation policies. These factors, however, are now a point of concern for Islamic banking in Indonesia, with the aim of ensuring banking sustainability. Islamic banking, as an element of the financial sector, is essential to a nation's economic development. It serves as a driving force for the real sector's growth, as seen by the banking intermediation function, which involves collecting, mobilizing, and channeling funds to the real sector. Numerous research studies have demonstrated that Islamic banking has a positive and significant impact on economic development [1,2,3,4,5] and poverty alleviation [6].

The soundness of banking not only be seen from the improvement in banking financial performance, but also from considering the element of risk in accordance with the bank's prudential principles, particularly NPF. In the last five years (2015-2019), NPF data for Islamic banking in Indonesia has fluctuated between 2.77%, 2.07%, 2.13%, 1.74%, and 1.89%. Based on the most recent data from 2019, the NPF level of Islamic banking has risen by 1.89% compared to 1.74% in 2018. This means that there is an indication of a decrease in the soundness level of Islamic banking by 0.15%, or equivalent to IDR 1.12 trillion within one year [7]. The increase in NPF in 2019 was due to the increase in NPF in the Islamic Business Unit (Islamic windows of conventional banks) of Rp. 822 billion. The rise in NPF indicates that the expansion of Islamic banking has not been accompanied by an improvement in financing quality. Therefore, potential growth in the Islamic banking business, followed by a deep understanding of the determinant factors that affect their NPF is important for Islamic banking management to determine the right policies for regulating financing risk.

In recent years, many efforts have been devoted to studying the determinant factors that affect NPF on Islamic banking in Indonesia. In general, there are two factors affecting the performance of NPF, namely internal and external banking factors. Some researchers use CAR (capital adequacy ratio) and FDR (financing to deposit ratio) [8,9,10,11,12,13,14,15,16,17], Bank Size (asset), CIR (cost to income ratio), and ROA (return on asset) [15,18], TPF (third party fund), NOM (net operating margin) [18,19], and RR (ratio of revenue sharing) [9,18,20,21] in explaining internal factors. External factors affecting the NPF of Islamic banking are generally explained by the main macroeconomic indicators, namely GDP (gross domestic product) [22] and Inflation [10,12,13,15,22], BI rate [11,19], SBIS (Bank Indonesia Syariah Certificates) [14,16,19], and Exchange Rate [10,21,23].

The previous research that has been carried out to find the factors that determine the NPF mostly uses the following methods: Multiple Linear Regression [8,9,10,13,14,20,21], Pooled Least Square [11,12,15,18], Static Panel Regression

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[19], and Vector Auto Regressive [16]. There are quite a few studies that focus on credit risk issues in Indonesia; however, the results of research from one article to another have many contradictions. Most researchers used multiple linear regression analysis and panel data with similar results. However, there is a significant difference between the results from the VAR analysis. It means that apart from indications of differences in cross-section (type of banking, or type of province), there are also indications of differences in the short-term and long-term impacts of internal banking financial factors on NPF. In the earlier study, data was collected from Islamic Commercial Banks at country level. There has been no research that has collected Islamic bank data at the provincial level, which is more precise and can capture the dynamics of Islamic bank data in greater depth. Then, dynamic data panels with System Generalized Method of Moment (SYS-GMM) have not been used in previous research to process Islamic banking data. SYS-GMM approaches allow capturing the accurate dynamic effect that could take place via variables that influence NPF [25, 26]. SYS-GMM is additionally useful to analyze the short-term and long-term effects of internal banking financial factors on NPF in order to provide appropriate risk mitigation.

The present paper addresses two research gaps: first, the subject of Islamic Commercial Banks combined with the Islamic Business Unit at the provincial level, and second, the data analysis using dynamic data panels with System Generalized Method of Moment (SYS-GMM). Improvements in data analysis are due to the significant difference in results between the period before and after 2015. This indicates that time influences the performance of Islamic banking. One of the main characteristics seen in the inflation trend in the period before 2015 has a high trend (6%-8%) compared to inflation in the period after 2015 (2-4%) [27]. The addition of the object of research by adding Islamic Business Unit is due to the NPF in the Islamic Business Unit in 2019 which tends to increase compared to 2018, and this affects the NPF of Islamic banking nationally. Based on indications of the influence of internal and external factors on the financing risk of Islamic banking, this study will re-examine the factors that can alleviate the financing risk of Islamic banking in Indonesia.

1.2 Literature Review

In Islamic banking, non-performing finance (NPF) refers to a bank loan that has been defaulted on or is unlikely to be paid back in full by the borrower [28,29]. It is referred to as a non-performing loan (NPL) in conventional banking. NPF is measured based on a comparison between total financing incurred and total financing provided [28,30]. Thus, the lower the NPF ratio, the better the bank's performance. NPF impacts the operational cost control of a bank and the financing policies implemented by the bank itself. Moreover, NPF has an unfavorable impact on the asset quality of the bank if it is large. Increasing the amount of NPF vis-à-vis increasing the amount of allowance for earning asset losses (PPAP) that has to be established by the banks If PPAP continues to be reserved, it will reduce bank capital.

One indicator of the soundness of a bank is measured by how well the assets are managed based on the NPF amount they have [31]. The ability of the Banks to manage their financing portfolios satisfactorily allows them to provide NPF at a low level and encourage contributing to high profits. Moreover, banking institutions are inherent with risks, with the probability of a bad outcome [32]. According to Bessis [33], there are seven identifiable banking risks: liquidity, financing/loan, interest rate, market, operational, foreign exchange, and other risks such as country risk, settlement risk, and performance risk. Therefore, implementing robust and integrated risk management in the banking system is mandatory.

The asset quality is measured by the nominal NPF, which is the ratio of the number of non-performing financing. The loan will be categorized as NPF if the customer does not pay obligations due for more than 90 days of the total financing. Thus, it can be concluded that NPF is financing whose quality is substandard, doubtful, and loss [34]. The NPF in terms of performance, which is in relation to the ability to generate income for banks, has decreased and even no longer exists. This NPF ratio is used to assess the condition of bank assets, including the anticipation of the risk of non-payment of financing that will arise at the maturity date of financing. Therefore, handling NPF is important for bank performance [35]. Most factors that affected the NPF based on published research are divided into internal and external factors.

Internal Factors Affecting NPF

Asset

Because the major products of the banking sector are financing and investment, the size is more likely to be determined by total assets. According to Firmansyah [42], banks with a large asset base or more assets have the potential to generate higher profits. Several prior research have demonstrated that the higher the bank's size, the greater the impact on NPF reduction [15,18,19,20]. Ambarwati [8] on the other hand, shows that the larger the bank, the larger the NPF.

Financing

Financing will demonstrate Islamic banks' ability to distribute third-party cash to finance productive industries. The higher the Financing to Deposit Ratio (FDR), the more probable the amount of funds to be granted will increase due to financing expansion. On the other hand, the more the quantity of finance granted, the higher the credit risk [33]. The NPF would be

kept low through careful finance distribution and adherence to banking governance. Several studies have found that financing has a considerable negative influence on NPF [13,14,16,17,23], a not significant positive effect [9,10,11,12,15], and no effect [8].

Third Party Fund (TPF)

TPF are funds handled by banks from a range of banking products like savings, current accounts, and deposits that come from community, individual, and company entities [43]. The majority of Islamic banking in Indonesia has a TPF structure, which makes up around 80–90% of the funding side and is used to finance activities [43]. The CASA (current account saving account) is defined as the proportion of deposits made in the form of current accounts and savings to total deposits by Janakiraman [44]. The CASA ratio is used to determine the percentage of inexpensive funds in TPF deposits. The bank's funding will be offered at competitive costs as the percentage of low-cost funds increases. With CASA reserves, banks' net interest margins (NIM) will rise towards the end, a sign of improved bank performance and a catalyst for rising Islamic banking profitability. A few studies were conducted to evaluate the relationship between TPF and NPF. Nugraheni [45] asserts that TPF does not significantly and adversely affect NPF.

Capital Adequacy Ratio (CAR)

The CAR is a capital ratio that demonstrates a bank's ability to supply cash for business development needs while also accommodating the potential risk of losses from bank operations. The higher the ratio, the stronger the capital position. Because the bank has enough loss reserves, a high capital ratio can reduce the occurrence of NPF. Some researchers such as [8,10,11,12,13,14,17,18], explain that CAR has a substantial negative impact on NPF. The value of a bank's NPF decreases as its capital (CAR) increases because a higher capital adequacy ratio can better accommodate the risk of loss dealing by banks. However, the findings of studies by Havidz [15] and Nihayah [9], in the period after the 2008 to 2014 crisis, showed no significant effect of CAR on NPF. Poetry [16] also explained in their research that there was no effect of CAR in the short term on NPF.

Cost to Income Ratio (CIR)

CIR is also known as costs against revenues from banking activities in Islamic banks. When CIR is high, bank management becomes increasingly inefficient, resulting in significant NPF. The operational load that the bank must bear will increase, which will reduce the bank's income. Income declines also represent banks' lesser fund reserves to offset problematic loans. A high CIR number indicates that the bank's costs exceed the income produced, showing that the quality of financing is poor, giving rise to NPF, and implying that CIR has a strong positive effect on NPF [12,15,17,18]. Other research states that CIR has a strong negative effect on NPF while not having a significant effect to NPF [10,14].

Return on Asset (ROA)

One of the profitability ratios is ROA. Profitability is the foundation of the relationship between operational efficiency and the quality of services provided by a bank. ROA is a number used to assess a bank's management ability to maximize earnings. Because of the higher return, the higher the ROA, the better the company's performance. Previous research shows that ROA has negative substantial impact to NPF [18,23]. However, other studies have produced contradictory results, ROA does not have significant effect to NPF [9,15].

External Factors Affecting NPF

Inflation

External factors that affect the NPF are related to the macroeconomic conditions of a country. The results of research by Poetry & Sanrego [16], Mutaminah & Chasanah [21], and Effendi et al., [18] show that inflation as a macroeconomic indicator has a negative impact on the NPF. However, research by Havidz & Setiawan [15], Akbar [13], Fadhlurrahman et al., [11], Retnowati & Jayanto [12], and Rofiáh & Aýun [14] shows that inflation has no significant effect on NPF. In general, inflation is described as an increase in the price of products and services because there is more money than goods or services available. Furthermore, inflation affects the fall in the value of money. Inflationary pressures reduce people's real income. Inflation regularly has a large impact on financial sector performance in developing countries but is not significant in developed countries [49]. The deterioration of this society's real revenue will have an impact on the problematic financing, as the community will find it difficult to meet its commitments to the bank.

SBIS (Bank Indonesia Syariah Certificates)

SBIS are short-term securities based on shariah principles denominated in rupiah issued by Bank Indonesia. Conventional bonds are based on interest rates without regard to the possibility of profit or loss on investment, whereas SBIS utilizes ju'alah contracts or is in accordance with the benefits obtained (National Sharia Council Fatwa Indonesian Ulema Council Number 64/DSN-MUI XII, 2007). In addition, when the SBIS rate increases, there are incentives for banks to invest their funds as opposed to financing. This is due to the fact that the investment of funds in the form of SBIS carries a lower

level of risk than financing risk, reducing both financing risk and default risk. Research by Poetry & Sanrego [16] found that SBIS has a substantial long-term effect on NPF. Contrarily, research by Rofiáh & Aýun [14] shows that SBIS has no significant effect on NPF.

Gross Domestic Product (GDP)

GDP is one of the economic factors that affects the NPF, both in terms of its nominal value and its growth. GDP is a term used to describe the total amount of goods and services produced in a country's economy over time. In the event of a downturn in GDP, sales and corporate profitability will suffer, affecting the company's capacity to repay the loan. Non-current financing will rise as a result [50]. Meanwhile, GDP development may boost consumers' ability to meet their obligations, resulting in a fall in NPF. Research by Wu et al., [51], Rahmawulan [50], Zeman & Jurca [52], Barajas [53], Firmansyah [42], Ekayanake [54], Sandica [55], Qwader [56], and Hernawati [28] shows that increasing GDP will reduce NPF. Contrarily, the results of studies by Ihsan [57], Mutaminah & Chasanah [21], and Effendi [18] show that the higher the GDP, the higher the NPF. Other research by Retnowati & Jayanto [12] shows that there is no significant impact of GDP on NPF in Islamic Commercial Banks. Therefore, based on the preceding research, the impact of GDP on NPF is still debatable.

Exchange Rate

The foreign currency exchange rate is the rate at which one currency is exchanged for another. Foreign currency exchange rates against the Indonesian currency are indicative of Indonesia's economic stability. Strengthening the rupiah exchange rate; the stronger the rupiah, the better this country's national economy. Changes in exchange rates will also have a significant impact on the customer's business. If the value of the rupiah declined relative to foreign currencies and the business utilized imported materials, it would have a negative impact on customer business and increase the ratio of problematic financing. The exchange rate is another macroeconomic indicator that contributes positively to the NPF [21], which demonstrates the positive impact of the IDR exchange rate on the NPF. Monetary policies such as exchange rates and interest rates have an influence on credit quality in Slovak banks [52].

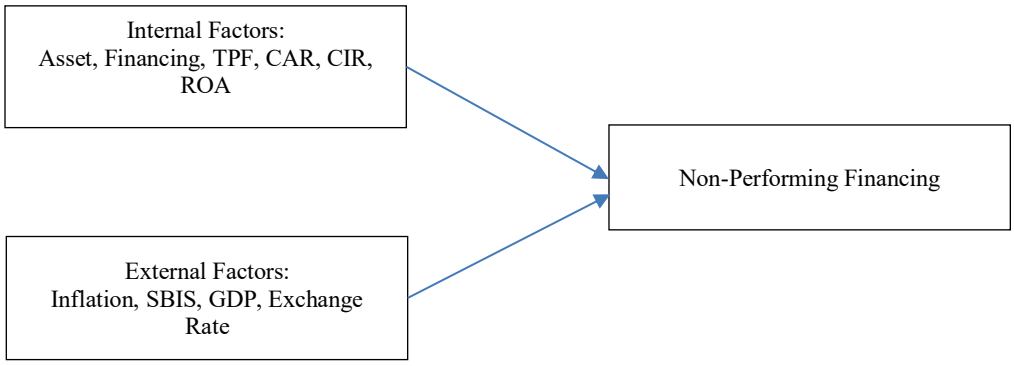

Fig. 1: Conceptual Framework

2 Methodologies

2.1 Data and Variables

The quantitative method was used for this study. From 14 Islamic Commercial Banks and 20 Sharia Business Units in Indonesia, a total of 165 data points were compiled to form the panel data set (2015-2019). The internal factors used in this study consist of ten variables; Assets, Financing, TPF, CIR, ROA, CAR, and the external factors consist of macroeconomic indicators, namely, GDP, Exchange Rate, Inflation, and Bank Indonesia Syariah Certificates (SBIS).

The expansion of Islamic banking at the national level can also be seen at the provincial or regional level. The DKI Jakarta Province (region) held Rp386 trillion in sharia banking assets in 2019, accounting for 56 percent of all sharia banking assets. The DKI Jakarta Province recorded a CAGR of 14.8 percent for assets, 14.5 percent for financing, and 13.8 percent for third-party funds from 2015 to 2019. Similarly, West Java Province has the second highest asset growth, with a CAGR of 9.6 percent assets, 7.7 percent financing, and 13.0 percent third-party funds from 2015 to 2019. On the other hand, East Nusa Tenggara Province, which has the lowest assets, shows a CAGR of sharia banking assets decreasing by 3.9%, financing decreasing by 6.5%, and third-party funds increasing by 2.3%. Data from 33 provinces in Indonesia shows that the largest concentration of Islamic banking activities with assets greater than 10 trillion rupiahs accumulated in 9 provinces, namely DKI Jakarta, East Java, Central Java, West Java, Aceh, North Sumatra, West Nusa Tenggara, South Sumatra, and Banten, controls 88% of Islamic banking assets nationally. This indicates that national economic activity is also concentrated in these provinces.

Table 1: Description of data and sources

Variable	Description	Measurement	Sources
NPF	Non-Performing Financing (ratio of financing problems in Islamic Bank, due more than 90 days)	Percentage Ratio	Islamic Banking Statistic, OJK
Asset	Total asset of Bank or Bank Size	IDR	Islamic Banking Statistic, OJK
Financing	Total financing or credit	Percentage Ratio	Islamic Banking Statistic, OJK
TPF	Third-party fund (total saving account, current account, deposit)	IDR	Islamic Banking Statistic, OJK
CIR	Cost to income ratio (ratio of operational cost to operational income) or BOPO	Percentage Ratio	Islamic Banking Statistic, OJK
ROA	Return on assets (a measure of a company's profitability in relation to its total assets)	Percentage Ratio	Islamic Banking Statistic, OJK
CAR	Capital adequacy ratio (the proportion of a bank's capital in relation to its risk weighted assets and current liabilities)	Percentage Ratio	Islamic Banking Statistic, OJK
Inflation	Regional Inflation Rate	Percentage Ratio	Statistics Indonesia, BPS
SBIS	Islamic Bank Indonesia Certificates	Percentage Ratio	Statistics Indonesia, BPS
Exchange rate	Foreign exchange, or forex, is the conversion of one country's currency into another.	USD/IDR	Statistics Indonesia, BPS
GDP	The market value of all final goods and services produced in a given time period is quantified and reported as the Gross Domestic Product. .	IDR	Statistics Indonesia, BPS

Source: various website sources, including OJK (Financial Services Authority), and BPS (Central Bureau of Statistics)

The variables in Table 1 consist of the dependent and independent variables. NPF categorize as the dependent variable, which will later analyse what causes the changes in the NPF level of Islamic banking in a particular area and time (panel data).

2.2 Analysing Methods

Factor Analysis

There are ten variables categorized as independent variables. Based on the studies prepared previously, there are indications of the similarity of factors from these independent variables. In the context of testing the factors between independent variables, the factor analysis described below was carried out in this study. Factors analysis is used to identify several common factors needed to explain correlations between indicators. In this case, ten existing variables will identify to form a set of variables with a common factor. The formation of a new set of variables is called a factor that still has most of the information from the original variable.

Factor analysis was carried out in five stages referring to Hair Jr et al., [58]. The first, compiling a correlation matrix based on the Barlett test, KMO test (Kaiser Meyer Olkin), and MSA (Measure of Sampling Adequacy) test. The Barlett test examines the formed correlation matrix. The KMO evaluation aims to evaluate the data's sufficiency. The greater the KMO value, the greater the level of data adequacy (minimum standard of 0.7). The MSA test was then used to determine the intercorrelation of variables with a minimum standard of 0.5. This stage is crucial because it determines what variables can be used in factor analysis. If the MSA value between variables (indicated by the diagonal MSA value) < 0.5, then that variable must be removed from the factor analysis method. It means that there is an indication of a low level of intercorrelation with other variables. The second stage performs factor extraction to reduce the number of variables into several new variable sets or factors that are fewer in number and can explain the correlation between indicators. The factor extraction method used is factor analysis. The criteria for factor formation are according to the characteristic root value ≥ 1 and the percentage of diversity. In social science research, the limit for total diversity used is at least 60%. The third stage is to rotate the factors to obtain a more straightforward structure to facilitate interpretation. The factor rotation

method uses Varimax (orthogonal type), which aims to minimize the number of indicators with a high factor loading value for each factor. The fourth stage is the interpretation of the formed factors by knowing the variables that make them up. Interpretation is made through judgment by referring to the literature review. At this stage, the number of factors formed along with naming each factor obtained. The last stage is to calculate the score of each factor formed. Furthermore, factor scores are used as independent variable data in dynamic panel regression analysis. The following is a formula for calculating the score factor in matrix form.

$$\hat{\boldsymbol{f}}_{(nxm)} = (\boldsymbol{x_j} - \bar{\boldsymbol{x}})_{(nxp)} \boldsymbol{S}^{-1}_{(pxp)}\, \hat{\boldsymbol{L}}_{(pxm)} \tag{3.1}$$

The formula for calculating the score factor ($\hat{f}$) in the form of a matrix determined by the difference between the original variable (x) and the average of the original variable ($\bar{\boldsymbol{x}}$), sample covariance (S) and the estimated loading value ($\hat{\boldsymbol{L}}$).

Dynamic Panel Data Analysis

Panel data analysis is used to alleviate the shortcomings of prior research that used a static cross-section or time-series model. The dynamic data panel accommodates dynamic interactions by including the lag of the dependent variable in the regression model as a regressor [59]. As a result, there is an endogeneity problem, and estimating the model using a fixed-effect or random-effect model will give biased and inconsistent estimators. They were referring to Blundell, R and Bond, S [60]; the dynamic data panel analysis selected in this study used SYS-GMM (System GMM) with consideration of the small amount of data T (period) (T=5). SYS GMM is considered capable of overcoming the problem of weak instruments in the FD-GMM (First differences GMM) estimator, which indicates increased efficiency (dependent lag estimator is consistent, unbiased, and the instrument is valid) [61].

Dynamic panel analysis aims to obtain the best Islamic bank NPF model after comparing several models. The factor analysis results produced several factors that will later function as independent variables. So, to get the best dynamic panel model, it is necessary to conduct trials by utilizing all the existing independent variables, NPF lag, internal factors, external factors, and the eight original variables. Several possible Islamic bank NPF models, including models that explain the influence of internal factors, external factors, and NPF lag on NPF, represent the equation:

$$NPF_{it} = b_0 + b_1 NPF_{i,t-i} + b_2 Internal\ Factor_{it} + b_3 External\ Factor_{it} + e_{it}. \tag{3.2}$$

The model explains the influence of internal factors, as variables including external factors, and the NPF lag on the NPF, representing the equation:

$$NPF_{it} = b_0 + b_1 NPF_{i,t-i} + b_2 Internal\ Factors_{\ it} + b_3 EFG_{it} + e_{it}. \tag{3.3}$$

Furthermore, another alternative model that explains the influence of internal factors, all variables, including external factors and the NPF lag on the NPF represents the equation:

$$NPF_{it} = b_0 + b_1 NPF_{i,t-i} + b_2 Internal\ Factors_{it} + b_3 Inflation_{it} +$$
$$b_4 SBIS_{it} + b_5 ER_{it} + b_6 GDP_{it} + e_{it}. \tag{3.4}$$

Other models can show the influence of the initial variables in as many as eight variables without involving internal or external factors, which represent in the following equation:

$$NPF_{it} = b_0 + b_1 NPF_{i,t-i} + b_2 Asset_{it} + b_3 Financing_{it} + b_4 TPF_{it} + b_5 CIR_{it} +$$
$$b_6 ROA_{it} + b_7 CAR_{it} + b_8 Inflation_{it} + b_9 SBIS_{it} + b_{10} ER_{it} + b_{11} GDP_{it} + e_{it}. \tag{3.5}$$

After obtaining the dynamic panel regression results from each of these models, a model comparison is carried out in order to determine the best Islamic bank NPF model in Indonesia. By comparing the results of the model specification test with the parameter significance test, the optimum model is determined. Model parameters are tested using three criteria: Sargan, Arellano Bond (AR 2), and an unbiased test. The Sargan test (J-stat) is used to verify the validity of using instrument variables whose number exceeds the number of suspected parameters (overidentifying), which is determined by the success of rejecting the Ho hypothesis (p-value < 0.05). Furthermore, the Arellano-Bond Test attempts to test the consistency of the GMM figures, as demonstrated by the success of rejecting the Ho hypothesis (p-value < 0.05). The second-order first difference error (M2) has no autocorrelation. The third model specification criterion is the Unfamiliarity Test, which aims to identify the estimated estimator of the dependent variable's lag (NPF) lag. If the estimator is between the FEM (Fixed Effect Model) estimator and the CEM (Common Effect Model) estimator, the estimator is unbiased.

The parameter significance test attempts to discover the relationship between model variables. The simultaneous significance test attempts to determine the impact of all independent variables simultaneously on the NPF. Significance showed when successfully rejecting Ho, where the value of the F-test statistic or p-value is less than α (α value = 0.05). Furthermore, the individual significance test using the t-test has the same principle as the simultaneous significance test.

Nevertheless, the test is carried out on each independent variable separately and is unrelated to the NPF.

3 Results

3.1 Result of Factor Analysis

Based on the KMO and Bartlett's test (Table 2) shows the adequacy of the data and the correlation matrix of the eight variables used instead of the identity matrix. So, the data used deserves to be analyzed using factor analysis. These results strengthen by the MSA test of more than 0.5 on all analyzed variables. It means there is an intercorrelation between variables so that they can predict and analyzed further. In the end, at the stage of compiling the correlation matrix, eight out of 10 independent variables are obtained. Exchange Rate and GDP are two variables not included in the factor analysis stage because they reduce the value of the KMO test.

Table 2: Result of Factor Analysis

Variabel	KMO-test	Bartlett's-test	MSA	Eigen value	% of Variance
Asset	0,714	2924,978***	0,75	3,475	43,433
Financing			0,695		
TPF			0,604		
ROA			0,688	2,858	79,159
CAR			0,893		
CIR			0,708		
SBIS			0,663	1,018	91,885
Inflation			0,764		

Source: Compiled from Output SPSS. 23

Based on the KMO and Bartlett's test shows the adequacy of the data and the correlation matrix of the eight variables used instead of the identity matrix. So, the data used deserves to be analyzed using factor analysis. These results strengthen by the MSA test of more than 0.5 on all analyzed variables. It means there is an intercorrelation between variables so that they can predict and analyze further. In the end, it can be concluded that at the stage of compiling the correlation matrix, eight out of 10 independent variables obtain. Exchange Rate and GDP are two variables not included in the factor analysis stage because they reduce the value of the KMO test. Next, the factor extraction process uses the factor analysis method, which is tested based on the eigenvalue. The results show that three main factors form whose eigenvalues > 1. There is a reduction process from eight variables to 3 new variables or factors, representing a correlation between variables on the same factor. The results show that two factors form from internal factors, and one factor shows external factors. The factor interpretation stage is explained further in the following subsection.

Internal Factor Dimension

Based on the factor analysis process, 8 out of 10 variables passed the MSA test. The eight variables were extracted using the factor analysis method, and the results based on the eigenvalues show that there are three factors. The first factor has an eigenvalue of 3.475, the second factor has an eigenvalue of 2.858, and the third factor has an eigenvalue of 1.018 (requirement for the formation of a factor is when the eigenvalues > 1). This factor can explain how factors internal and external affect the Islamic Bank's financial performance. The first and second factors are the dimensions of the internal factors of Islamic banks. The first factor can explain the internal factors of 43.433% and the second factor of 35.726%. External factors are formed from two variables that can explain 12.726%.

Table 3: Fundamental Dimension

Fundamental Dimension	Loading Factor
Asset	0.996
Financing	0.996
TPF	0.998

Source: Author's own computation

The first dimension that explains the internal factors of Islamic banking is the fundamental factor consisting of Assets, Financing, and TPF. Table 3 above, all three have loading factor values in the same range (0.99). Therefore, these three are indicators that are quite important in assessing the fundamentals of Islamic banks. Asset, financing, and TPF indicators are critical for banks to recognize the absolute growth of their banking operations. This indicator enables banks to understand the movement of the size of banking assets, the number of funds lent to borrowers, and the number of funds collected from funding clients. These three indications will raise concerns about the banking position in the national banking market share and must be considered when developing a banking strategy for market penetration. The Assets, financing, and TPF are reported on the balance sheet of Islamic banking [62,63,64].

Table 4: Performance Measurement Dimension

Performance Measurement Factor	Loading Factor
ROA	0.979
CAR	0.958
CIR	-0.981

Source: Author's own computation

The second dimension of the internal factors of Islamic banks is the financial performance measurement factor consisting of return on assets (ROA), capital adequacy (CAR), and cost to income ratio (CIR). CAR, ROA, and CIR indicators are critical for banks to fully comprehend their financial performance as assessed by a comparison scale or ratio and stated as a percentage. In accordance with central bank requirements, the appropriate CAR indication is at least 8%, indicating that the bank has enough capital to cover the risk [18,33]. The ROA indicator, which is stated as a percentage, is critical for banks to determine how effectively assets have been utilized to create profits. CIR is important for banks to measure the level of banking efficiency in carrying out operational activities. These financial performance indicators become important information for Islamic banking stakeholders.

3.3 External Factor Dimension

External factors consist of inflation and Bank Indonesia Syariah Certificates (SBIS). The highest loading factor value is 0.820 from the SBIS variable which means that an external factor that needs to be considered by Islamic banking in maintaining its business is the placement in the SBIS portfolio. Short-term SBIS issued by Bank Indonesia allow for the investment of excess liquidity in Islamic banking. The SBIS yield rate becomes a guideline for investment in Islamic banking, such as the position of Bank Indonesia Certificates (SBI) which becomes the benchmark for investment in conventional banks.

Table 5: External Factor

External Factor	Loading Factor
Inflation	-0.804
SBIS	0.820

Source: Author's own computation

An inflation situation is where prices rise in an extreme manner and will affect people's purchasing power for production goods. With the decline in purchasing power, the industry will weaken and give rise to problematic financing (NPF) from the weakened industries [16]. SBIS is an alternative investment and as an indicator of the level of return on investment in Islamic banking.

3.4 The Influence of Fundamental, Performance Measurement, and External Factors on the NPF of Islamic Banks

Fundamental variables, performance measurement, and external factors are new independent variables resulting from factor analysis. Furthermore, the data will then be processed in dynamic panel analysis with a system GMM estimation technique. There are five models used to explain the influence of fundamental, performance measurement, and external factors on the NPF of Islamic banks dynamically. As can be seen in Table 6, the five models are used to check the reliability of the effect of each independent variable on the dependent variable. The first model uses the three factors resulting from factor analysis: fundamentals, performance measurement, and external factors of the NPF. The second model uses performance measurement factors, and external factors, and uses one indicator of the fundamental factor (financing) on the NPF. The third model only uses performance measurement and external factors as independent variables on the NPF. The fourth model maintains the performance measurement factor, while the other two factors are represented by one of the indicators, namely inflation and financing. Finally, the fifth model tries not to use the results of factor analysis but treats all variables as independent variables on the NPF. The five regression models follow the dynamic panel equation by taking in the independent variable NPF in the previous period. This variable is critical in distinguishing between short-term and long-term NPF. If there is a short-term imbalance, the coefficient of the prior period's NPF works as an adjustment coefficient.

Table 6: The regression result of Panel dynamic model

Variable	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
Fundamental	-9.312(0.492)				
Performance Measurement	3.237***	3.469***	2.969***	3.959***	
External Factor	-2.295***	-1.923***	-1.883***		
Inflation				3.863***	
Financing		-0.385		-0,475	1,046

					(0,619)
NPF (-1)	-1.583***	-1.623***	-1.532***	-1,2606***	0,4 (0,344)
Asset					-0,408 (0,616)
ROA					-33,657 (0,0005)***
CIR					-2,764 (0,00)***
CAR * Inflation					-0,004 (0,934)
Instrument validity test (Sargant-test) : J-STAT	1.222 (0.543)	1.199(0.548)	1.888(0.596)	1.487 (0.475)	2,518 (0,472)
Model consistency test (Arellano-Bond test):					
- *m*1	0.975(0.33)	1.133 (0.257)	0.393(0.69)	-0.351 (0,725)	-2,181 (0,029)**
- *m*2	-4.653(0.00)	-4.192 (0.00)	-2.146(0.03)	-0.505 (0.614)	0,126 (0,899)
Test of Bias Coefficient Lag					
- Coeff. Lag on FEM	-0.362	-0.363	-0.362	-0.297	0,206
- Coeff. Lag on CEM	0.219	0.218	0.22	0.223	0,562

Notes: * (Sig 0,1), ** (Sig 0,05), *** (Sig 0,01)

Source: Author's own computation

4 Discussions

Model one to model 3 show the same estimation results, where all three can explain the effect of performance measurement, external factors, and NPF one year earlier (NPF-1) on NPF. The three models are similar, even though they have replaced the fundamental variable with a financing variable in model two and tried to remove it in model three. The three models explain that performance measurement has a positive and significant effect on NPF at a significant level (α = 0.01). Meanwhile, NPF in the previous year had a negative and significant effect on NPF at a significant level (α = 0.01). The estimation results of the three models explicitly explain that if Islamic banking performs poorly, it will have an impact on encouraging an increase in the number of non-performing financing (NPF) of at least 2.969% (result of model 3) to the highest of 3.469% (result of model 2). Conversely, poor performance on the amount of non-performing financing in one the previous year (NPF-1) will be corrected in the following period by -1.532 (the lowest value obtained from model 3) to the highest is -1.623 (obtained from model two). The bank's efforts to address NPF risk in the previous period are rescheduling, reconditioning, and restructuring policies, where rescheduling is an extension of the period, reconditioning is rearranging part or all of the financing requirements, and restructuring is changing the requirements for increasing capital or converting contracts for financing [67].

Other estimation results show that the performance of positive external factors can benefit Islamic banking in minimizing non-performing loans with a significance level of 1%, which the three models can explain. The lowest reduction in non-performing loans find in model 3 of -1.883, and the highest was -2.295 in model one. Nevertheless, there are better choices than models one through three. Because the best model is not only determined based on the significance level of each variable but also needs to test the resulting parameters to determine whether they meet valid, consistent, and unbiased criteria. The validity test shown by the j-stat value in models one to three can see in Table 6. The p-value is higher than 10% (α = 0.1), so it decides that it failed to reject H0 or was insignificant. The implication is that no instrument variables correlate with errors, so all instrument variables are valid.

Furthermore, the Arellano-Bond test from models one to three showed a p-value greater than the significant level (α=0,1), so it decided to fail to reject H0 or not significant. It means there is a serial correlation of the error component at the first difference ($E(v_{it}, v_{it-1})$. To strengthen the consistency test for parameter estimators, it is also necessary to fulfill the assumption that the autocovariance of the second order (m2) in all periods must be zero (the hypothesis accepts Ho). The test results show that the p-value of m2 in models one to three is smaller than the significance level (α = 0.01), so it decides to reject H0 successfully. The implication of this m2 test shows that there is autocovariance. Finally, test the unbiased parameter estimators of the three models The above shows that the estimated value of the NPF coefficient (-1) is not between the tolerance values, namely between the coef lag on FEM and the coef lag on REM. The implications of

this result show that the estimator produced from one to three models is biased.

The fourth model tries to replace external factors with one of its indicators, namely inflation, and includes fundamental (financing) indicators. The results show that model four can also explain the effect of performance measurement, NPF one year earlier (NPF-1), and inflation on NPF. All three are significant at the 1% significance level ($\alpha = 0.01$). The estimation results from the fourth model are almost identical to those in models one to 3. The only difference is that the magnitude of the effect coefficient of performance measurement is larger (3.959) than the previous three models. The findings of this fourth model emphasize the importance of good Islamic banking performance in minimizing lousy credit problems. In addition, inflation has a positive and significant effect in line with the findings by [68] and [24]. The higher the prices of manufactured goods, the lower the people's purchasing power. Consequently, the industrial sector recorded declining sales and profits, disrupting the company's cash flow. Thus, the industrial sector will find it challenging to pay obligations to banks, contributing to NPF expansion. Likewise, the wider community will experience a decrease in income due to inflation, which will impact its ability to pay banks. However, the results of testing the validity, consistency, and unbiased parameters of the estimator produced by model four are almost identical to the previous models. Only the validity test was able to be fulfilled by model four with a p-value (0.475) is higher than the 10% significance level ($\alpha = 0.1$). Meanwhile, the consistency and unbiased estimator parameters test unfulfilled.

Model five is the final experiment to determine the best dynamic panel model that can explain the factors that influence the NPF of Islamic banking in Indonesia. The estimation results show a difference with the previous model, where NPF one year earlier (NPF-1) proved to have no significant effect on NPF because the p-value (0.344) is higher than the 10% level ($\alpha = 0.1$). Only ROA and CIR significantly affect NPF, where both p values are lower than the 1% level ($\alpha = 0.01$). Compared to the previous four models, which explain the importance of performance measures in influencing the NPF of Islamic banking, this fifth model can concretely explain the performance that needs to be improved by Islamic banking, namely ROA and CIR. The fifth model is the best of the five existing models because it meets the requirements of a valid, consistent, and unbiased parameter estimator. Only the fifth model can show consistent parameter estimation, as seen from the m1 test, which is significant (no serial correlation), and m2 is not significant (no autovariance).

Therefore, Islamic banking needs to improve ROA and CIR performance to mitigate non-performing or non-performing loans. Based on the estimation results from the fifth model, ROA had a negative and significant effect of -33,567. If Islamic banks can improve their fund management performance and become profitable, lousy credit risk can be avoided or reduced by 33,567%. The results of this study are in line with those of Effendi et al., [18], Setiawan & Sherwin [23] and contradict those of Wardhana [69]. The higher the ROA, the better the bank's performance because the bank can optimize assets to maximize profits. Likewise, controlling bank risk on NPF is beneficial because an increase in profits from the amount of financing exposure does not increase NPF. On the other hand, large profits allow banks to make NPF reserves that have been formed from company profits so that net NPF becomes good performance.

The following result is CIR performance, where based on the five-value model, the coefficient is -2.764. If Islamic banks can optimize high operational costs for credit financing monitoring activities, the risk of bad loans can be reduced by up to 2.764%. The results of this study are in line with Aryani's research [19] and contrary to the research by Effendi et al., [18] and Retnowati & Jayanto [12]. In this case, the cost-to-income ratio (CIR) is the comparison between operating costs and operating income of banking institutions. Operational costs are banking costs directly related to the period in which they occur, including employee salaries, allowances, depreciation costs for fixed assets, electricity costs, water costs, and office stationery costs. High CIR is consistent with substantial bank assets that necessitate high operational costs. This high operational cost comprises the development of a division or unit dedicated to monitoring the quality of financing/credit, which necessitates operational expenditures. This will have an effect on sustaining the NPF, but the operational will be considerable. This is also explained in Al-Quran Surah Al Baqarah 282 that loans must be written and monitored properly and fairly.

An interesting finding from the fifth model is that when two performance measurement indicators significantly affect NPF, only CAR is insignificant, even though the effects are equally adverse. CAR calculation is obtained from the ratio of capital to risk-weighted assets. The ratio assesses the level of financial soundness of a bank by calculating available capital as a percentage of risk-weighted financing exposure. The greater the CAR, the lower the level of bank risk, especially from financing. This capital adequacy ratio also illustrates that the greater the CAR, the greater the room for banks to expand financing. On the other hand, a large CAR indicates that the bank needs to be more efficient in using its capital to generate profits. Thus, CAR is not directly related to NPF, so this study's findings confirm that CAR's effect is not significant on NPF. It is different from the findings of Effendi et al.,[18], Retnowati & Jayanto [12], Muhammad et al.,[45], and Hernawati et al.,[28] and is in line with the research by Nihayah & Walyoto [9].

5 Conclusions

Factor analysis was able to group 8 out of 10 tested variables that had passed the MSA correlation test into three factors.

First, the fundamental factors consist of ASSETS, FINANCING, and TFP. Second, the performance measurement factors consist of ROA, CAR, and CIR, which are internal factors that affect the NPF of Islamic banks. At the same time, the third factor is external factors consisting of inflation and SBIS. Model 5 is the best model that meets the valid, consistent, and unbiased requirements. The current NPF performance is not affected by the previous year's NPF. On the other hand, ROA and CIR have a negative and significant effect on NPF (at a 5% significance level). Islamic banking in Indonesia needs to improve the performance of managing investment funds to generate high profits and improve the performance of strict credit supervision.

6 Recommendations

Various limitations in this study need to be corrected in further research. This study includes only Islamic Commercial Banks and Islamic Business Units as a sample, with data obtained at the provincial level. Further studies comparing Islamic and conventional banks and exploring other internal and external variables would be invaluable.

Conflicts of Interest Statement

The authors declare that there is no conflict regarding the publication of this paper.

Acknowledgment:

Thank you for the research funding assistance from the University of Indonesia with contract number NKB-510/UN2.RST/HKP.05.00/2021, and publication funding support through contract number NKB-1364/UN2.RST/HKP.05.00/2022. We also express our gratitude for the contribution of all parties who have helped research on time.

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