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The Role of Risk Management on the Effect of Asset Quality and Sustainability on Banking Financial Distress

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ABSTRACT

This study examines the influence of asset quality, sustainability, and risk management on financial distress in banks registered with the Financial Services Authority (OJK) during the 2020–2023 period. Asset quality is measured by Non Performing Loans (NPL), sustainability by Green Loans, and risk management by the Capital Adequacy Ratio (CAR). A quantitative explanatory research method using Structural Equation Modeling (SEM) analysis was employed to test the direct and indirect relationships among the variables. The results indicate that NPL and Green Loans do not have a significant direct effect on financial distress but do influence risk management. Risk management itself does not directly affect financial distress but acts as an intervening variable that strengthens the relationship between sustainability and financial distress. Practical implications emphasize the importance of strengthening the integration of sustainability principles into risk management and developing more proactive asset quality management strategies to maintain banks' financial stability. This study provides theoretical and practical contributions to banking risk management and forms the basis for recommendations for regulators, bank management, and future research.

Keywords: Financial Distress, Asset Quality (NPL), Green Loans, Risk Management (CAR)

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INTRODUCTION

The banking sector plays a crucial role in Indonesia's economy. As a financial intermediary, banks bridge the gap between surplus and deficit units, facilitating the flow of funds within the economy. This function not only drives national economic growth but also maintains financial stability. Banks play extensive roles, including individual and corporate financing, purchasing government securities, and expanding public access to financial products such as mortgage and vehicle loans (Rohman Abdul, 2023). Furthermore, the sector supports infrastructure development and strategic national projects (Kompasiana, 2023), thereby serving as a key driver of economic activity (Dwi Ceysa et al., 2024). The banking sector also faces serious challenges, including the risk of financial

distress. Financial distress refers to the deterioration of a company's financial condition, marked by its inability to meet short-term obligations, which may eventually lead to bankruptcy (Goh, 2023). This situation can be caused by various factors, including poor cash flow, excessive expenses, and a lack of external support.

A major contributor to financial distress in banking is the decline in asset quality, typically indicated by rising Non-Performing Loans (NPL). The higher the NPL ratio, the worse the bank's credit quality, increasing the likelihood of financial difficulties (Ani Nur Fadilah et al., 2024). In addition, weak implementation of sustainability principles, particularly in relation to Environmental, Social, and Governance (ESG) criteria, can erode stakeholder trust and negatively impact the institution's reputation and financial condition (Adriyani et al., 2024). The Altman Z-Score is commonly used to measure the risk of financial distress. Developed by Edward Altman, this model predicts bankruptcy likelihood using financial indicators. A lower Z-score indicates a higher risk of financial distress (Rahmat, 2020). This situation worsened during the COVID-19 pandemic, which triggered economic contraction, increased funding costs, and elevated credit risks. In Indonesia, the economy contracted by 5.32% in the second quarter and 3.49% in the third quarter of 2020, directly affecting asset quality in the banking sector (KNEKS, 2020). In response, the Financial Services Authority (OJK) issued credit restructuring policies for debtors impacted by the pandemic (OJK, 2020).

These policies stabilized the short-term outlook, but challenges persist. After the credit restructuring policy ended in March 2024, credit risk increased again, particularly in the MSME segment. OJK data shows that Indonesia's banking NPL ratio as of June 2024 stood at 2.27%, indicating ongoing pressure on asset quality (OJK, 2024). At the same time, rapid digitalization of banking services during the pandemic led to higher operational costs, despite improvements in service efficiency. Interest rate easing supported credit growth but negatively affected Net Interest Margin (NIM) (Bank Indonesia, 2023). A global perspective, the pandemic also exacerbated debt crises in developing countries. The World Bank responded to the crisis with the Debt Service Suspension Initiative (DSSI) to support recovery efforts (World Bank, 2020). Although not as severe as the 2008 crisis, this situation highlighted the importance of risk management and capital resilience in navigating systemic pressures. Asset quality is closely linked to capital resilience. Healthy assets reflect the bank's ability to generate profits and manage credit risk effectively. On the other hand, sustained losses can erode capital and weaken a bank's long-term survival (Bukit & Syahrianti, 2021). A key indicator of asset quality is the NPL ratio. According to Bank Indonesia Regulation No. 6/10/PBI/2004, banks are considered unhealthy if their NPL ratio exceeds 5% (Alfonso, 2023; Abdilah et al., 2025). Thus, effective credit risk management is essential in maintaining asset quality.

Sustainability issues have also gained attention in the banking industry, particularly through green loans that finance environmentally friendly projects. Despite their potential, the adoption of green loans in Indonesia remains low compared to other ASEAN countries (ASEAN Catalytic Green Finance Facility, 2023). Nevertheless, awareness of the importance of sustainability is growing among environmental activists, business players, and academics (Meutia, 2020). Given these challenges, it is important to understand the role of risk management, represented by the Capital Adequacy Ratio (CAR), in mitigating the impact of asset quality and sustainability on financial distress. Using CAR as an intervening variable is essential to examine whether effective risk management can reduce the negative effects of high NPLs and low green loan adoption on financial distress. Given these challenges, understanding the role of risk management, as reflected in the Capital Adequacy Ratio (CAR), is crucial for explaining how banks respond to deteriorating asset quality and limited sustainability practices. Previous studies indicate that CAR serves as a key buffer, enabling banks to absorb losses arising from increased credit risk and financial instability (Altman et al., 2020; Basel Committee on Banking Supervision, 2023). Banks with higher capital adequacy are better positioned to withstand shocks caused by rising non-performing loans and economic uncertainty.

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Furthermore, sustainability practices, particularly through green loan financing, have been shown to influence banks' risk profiles and capital structures. Green financing is associated with lower default risk, improved reputational standing, and enhanced long-term resilience, especially when supported by regulatory frameworks (Dafermos & Nikolaidi, 2021; Mirovic et al., 2023). However, the benefits of sustainability on financial distress may not be direct and often operate through improved risk management and capital adequacy. From a theoretical perspective, risk-based capital theory suggests that risk management serves as an intermediary in transmitting the effects of asset quality and sustainability to financial distress outcomes. Poor asset quality increases credit risk, which puts capital adequacy at risk and increases the likelihood of financial distress, whereas effective risk management can mitigate these adverse effects by maintaining sufficient capital buffers. Similarly, sustainability-oriented financing strengthens banks' risk management frameworks, thereby enhancing financial stability. Therefore, positioning CAR as an intervening variable is essential to examine whether effective risk management can reduce the negative impact of high non-performing loans and low green loan adoption on financial distress. Based on this theoretical and empirical foundation, the research hypotheses are subsequently developed.

Problem Identification

Based on the background discussed above, Indonesia's banking sector is currently confronted with several interconnected challenges. One of the main issues is the decline in asset quality, which is reflected in the relatively high level of non-performing loans (NPLs). In addition, the adoption of sustainability practices remains limited, particularly in the use of green loan instruments within banks' financing portfolios. At the same time, these conditions highlight the urgent need for effective risk management, especially through adequate capital adequacy ratios (CAR), to mitigate the potential impact of increasing NPLs and the expansion of green loans on banks' financial distress.

Scope of the Study

This study examines the relationship between asset quality, sustainability, and risk management in influencing financial distress within the banking sector. Asset quality is proxied by Non-Performing Loans (NPL), sustainability is represented by green loans, and risk management is measured using the Capital Adequacy Ratio (CAR). The analysis focuses on both the direct and indirect effects of NPL and green loans on financial distress, with CAR positioned as an intervening variable to capture the role of capital strength in mediating these relationships. The empirical scope of the study is limited to banking institutions registered with the Financial Services Authority (OJK) during the 2020–2023 period, a timeframe characterized by increased financial vulnerability and the growing implementation of sustainable finance policies.

Within this scope, the study seeks to investigate whether NPL and green loans have a direct influence on financial distress and whether both variables affect risk management as reflected by CAR. In addition, the study evaluates the effect of CAR on financial distress and examines its mediating role in the relationship between asset quality and financial distress as well as between sustainability-oriented lending and financial distress. Accordingly, the objective of this study is to provide a comprehensive explanation of how asset quality and sustainability interact with risk management in determining bank financial stability. The significance of this study lies in both its theoretical and practical contributions. Theoretically, this study enriches the banking and financial distress literature by integrating asset quality, sustainability, and risk management into a single analytical framework, thereby extending previous studies that have predominantly examined these factors separately. The inclusion of CAR as an intervening variable strengthens the theoretical understanding of the dynamic interactions among credit risk, sustainable finance, and capital adequacy in the banking context. Practically, the findings offer valuable insights for bank management in strengthening asset quality control, capital adequacy management, and sustainability-oriented lending strategies. The results also provide empirical evidence to support regulators in formulating policies related to banking stability and sustainable finance, assist investors and other stakeholders in making more

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informed decisions, and enhance public awareness regarding the importance of maintaining financial stability in the banking sector.

THEORETICAL FRAMEWORK

Based on this framework, the research hypotheses are formulated as follows:
Previous empirical studies provide strong support for the proposed hypotheses. Regarding H1, several studies confirm that deteriorating asset quality, reflected in higher non-performing loans (NPLs), significantly increases the probability of financial distress in banks. Poor asset quality reduces cash flows, increases provisioning costs, and weakens profitability, thereby exposing banks to financial difficulties (Lubis et al., 2024; Madugu et al., 2020; Berger & DeYoung, 1997). In relation to H2, recent research suggests that sustainability practices, particularly through green financing, contribute to banking stability and lower financial distress. Green loans are associated with lower default risk, improved stakeholder trust, and better long-term performance, especially when supported by regulatory incentives (Dafermos & Nikolaidi, 2021; Mirovic et al., 2023). However, their impact on distress may vary depending on regulatory maturity and market conditions. For H3, empirical evidence indicates that asset quality plays a crucial role in shaping risk management and capital adequacy. Higher asset quality reduces credit risk exposure, enabling banks to maintain stronger capital buffers and improve Capital Adequacy Ratios (CAR) (Fatika, 2024; Safitri et al., 2024). This relationship highlights the importance of effective credit portfolio management in strengthening bank capital.

Concerning H4, prior studies emphasize that sustainability-oriented financing positively affects risk management by reducing reputational, operational, and regulatory risks. Banks with higher exposure to green loans tend to adopt more comprehensive risk management frameworks and maintain stronger capital positions, particularly in jurisdictions with supportive sustainability regulations (Dafermos & Nikolaidi, 2021; Basel Committee on Banking Supervision, 2023). With respect to H5, a substantial body of literature confirms that effective risk management, as reflected by adequate capital buffers, significantly reduces the likelihood of financial distress. Banks with higher CAR are better equipped to absorb losses and withstand economic shocks, thereby enhancing financial resilience (Altman et al., 2020; OJK, 2024). Regarding the mediating role proposed in H6, several studies demonstrate that risk management acts as a key transmission mechanism through which asset quality influences financial distress. Poor asset quality increases credit risk, which in turn pressures capital adequacy and ultimately raises the risk of distress. Conversely, strong risk management can mitigate this effect by absorbing losses through sufficient capital buffers (Lubis et al., 2024; Madugu et al., 2020). Finally, H7 is supported by studies suggesting that the impact of sustainability on financial distress is often indirect and operates through improved risk management. Green financing enhances capital resilience and reduces risk exposure over time, thereby lowering the probability of financial distress through the mediating role of capital adequacy and risk control mechanisms (Dafermos & Nikolaidi, 2021; Mirovic et al., 2023; Basel Committee on Banking Supervision, 2023).

METHODS

This study uses secondary data from financial and sustainability reports of banks registered with the Financial Services Authority (OJK). The data were obtained from official sources, including the Indonesia Stock Exchange (IDX) website, annual reports, and sustainability documents for each bank for the period 2020 to 2023. Data collection was conducted online via platforms that provided access to the banks under study's financial and sustainability documents. The approach used is quantitative, focusing on numerical data analysis to test the relationships between variables deductively, with a positivist paradigm that is objective and measurable (Paramita et al., 2021). The

research design employs an explanatory, causal approach to examine cause-and-effect relationships among variables. The variables in this study consist of the dependent variable, financial distress, measured by the Altman Z-score Non Manufacturing model; independent variables, asset quality represented by Non Performing Loans (NPL), and sustainability represented by green loans; and the intervening variable, risk management, represented by the Capital Adequacy Ratio (CAR). The population includes all banks registered with OJK during 2020–2023. The sample was selected by purposive sampling, resulting in 33 banks that met the criteria of having complete reports, yielding a total of 132 observations (33 banks × 4 years). Data collection techniques involved documenting publicly available annual and sustainability reports, along with a literature review to strengthen the theoretical framework.

Data analysis was conducted in stages, starting with initial data processing using Microsoft Excel 2010 for tabulation, graphs, and descriptive statistics. The main analysis employed Structural Equation Modeling (SEM) in AMOS version 21, accounting for an intervening variable. The analysis stages include constructing the path diagram, evaluating indicator factor loadings (ideally >0.7), formulating the structural model, and testing goodness-of-fit using indices such as Chi-Square, GFI, AGFI, CFI, NNFI/TLI, RMSEA, and RMR. Convergent validity and model reliability were assessed through Average Variance Extracted (AVE > 0.5) and Composite Reliability (CR > 0.7). The model was declared fit after evaluation and adjustments based on Modification Indices (MIs) with a threshold of≥ 3.85, without altering the model's main structure (Ghozali, 2017). Hypothesis testing was conducted using SEM with two main structural equations: risk management as a function of asset quality and sustainability, and financial distress as a function of asset quality, sustainability, and risk management.

RESULT AND DISCUSSION

Overview of Research Objects

This study utilized a sample of 33 banks per year from a total population of 103 banks registered with the Financial Services Authority (OJK) during the 2020–2023 period. The research focused on four main variables: financial distress, asset quality, sustainability, and risk management.

Financial Distress

Measured using the Altman Z-Score, the results show fluctuations in banks' financial risk levels. The lowest score occurred in 2020 (2.565), followed by an increase in 2021 (3.179), indicating signs of recovery. However, the score declined again in 2022 (3.004) and 2023 (2.556), signaling a renewed increase in financial distress risk.

Asset Quality

Calculated using the Non-Performing Loan (NPL) ratio. In 2020, NPL exceeded 3% due to the pandemic's impact. Nevertheless, a gradual improvement was observed through to 2023. Although still above the ideal threshold (<5%), the trend indicates improved credit management effectiveness in banks.

Sustainability

Represented by the ratio of green loans to total loans (ROGL). A positive trend was recorded, increasing from 9.00% in 2020 to 21.34% in 2023. This reflects banks' growing commitment to environmentally friendly financing and sustainable development.

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Table 1. Risk Management

Variable	Indicator	Measurement	Description
Risk Management	Capital Adequacy Ratio (CAR)	CAR (%)	Reflects banks' capital resilience and ability to anticipate financial risks during the study period

Source: Primary data processed

Financial Distress

The results of the financial distress calculations for 33 banks during the 2020–2023 period indicate significant fluctuations in financial conditions, with varying Z-scores reflecting each bank's resilience to bankruptcy risk. In 2020, at the peak of the COVID-19 pandemic, most banks faced substantial financial pressure, with many falling into the distress zone ($Z < 1.81$). Conditions began to improve in 2021, albeit unevenly, and continued to strengthen in 2022 in line with national economic recovery efforts. By 2023, the majority of banks (30 out of 33) had reached the safe zone ($Z > 2.99$), indicating strong financial stability, although two banks remained in the distress zone and one in the grey area. The highest Z-score during the period was recorded by PT Bank Raya Indonesia Tbk in 2021 (22.033), while the lowest was by PT Bank Panin Dubai Syariah Tbk in 2023 (-107.633), reflecting a stark disparity in financial health across banks. These findings highlight that while the banking sector has generally recovered, some banks remain vulnerable and require strengthened risk management and improved financial performance strategies.

Asset Quality

An analysis of asset quality across 33 banks from 2020 to 2023 indicates a significant improvement in credit risk management. Asset quality is measured using the Non-Performing Loan (NPL) ratio, which reflects the health of a bank's loan portfolio. In 2020, 12 banks recorded NPL ratios above 4%, highlighting the pressure caused by the COVID-19 pandemic. However, this number decreased to 7 banks in 2021, 5 in 2022, and only 2 in 2023, namely PT Bank Amar Indonesia and PT Bank Raya Indonesia Tbk. This downward trend indicates more effective credit risk management and a broader recovery in the banking sector. PT Bank Amar Indonesia posted the highest NPL ratio in 2023 (9.23), suggesting high credit risk and poor asset quality. In contrast, PT BPD Jawa Barat dan Banten Tbk consistently recorded the lowest NPL ratio (0.01), reflecting excellent asset quality and minimal credit risk. Overall, the trend demonstrates improved financial stability and effective regulatory oversight in Indonesia's banking sector.

Sustainability

The measurement of sustainability through the green loan ratio among banks in Indonesia during the 2020 to 2023 period shows variation in green financing levels across banks, reflecting differing levels of commitment to sustainable finance. In 2020, 10 banks reported green loan ratios below 5%, indicating that a significant portion of lending remained directed toward conventional sectors. In 2021, this number decreased to 9 banks, and further declined to 8 banks in 2022, suggesting increased awareness and efforts by some banks to expand their green financing portfolios. However, in 2023, the number rose again to 10 banks, signaling that despite progress in certain institutions, the overall implementation of sustainable financing remains uneven. PT Bank Raya Indonesia Tbk recorded the highest sustainability score, rising from 6.86 in 2020 to 41.95 in 2023, demonstrating a strong commitment to green financing. Conversely, PT Bank Tabungan Negara (Persero) Tbk consistently showed the lowest sustainability scores throughout the period, with a notably low figure of 0.0045 in 2021, rising slightly to 0.0271 in 2023. These variations in green loan ratios are influenced by internal factors such as lending policies, business strategies, and the understanding and application of ESG (Environmental, Social, and Governance) principles, as well as external factors such as government regulations, market demand for sustainable finance, and post-pandemic economic conditions. Overall, the data suggest that sustainability implementation in Indonesia's banking sector is still in a phase of strengthening and adaptation, with some banks showing

significant progress while others are still integrating sustainability principles into their business models.

Risk Management

Risk management in banking is measured through the Capital Adequacy Ratio (CAR), which reflects a bank's ability to absorb potential losses and maintain financial stability. During the 2020–2023 period, most banks in the sample recorded CAR values above the OJK's minimum requirement of 8%, indicating generally sound capitalization. Several banks reported exceptionally high CARs, such as PT Bank Jago Tbk, PT Bank Amar Indonesia, and PT Allo Bank Indonesia Tbk, suggesting substantial capital buffers, though this may also reflect underutilized funds for credit expansion. Conversely, some banks showed alarmingly low CARs, notably PT BPD Jawa Barat dan Banten Tbk, which consistently recorded CARs below 1%, and PT Bank Mayapada International Tbk, which exhibited a declining trend. Major banks like BRI, Mandiri, BNI, and BCA maintained stable CAR levels above 20%, indicating strong and prudent risk management. Overall, the data reveal a significant disparity in capital adequacy across banks, highlighting the importance of ongoing CAR monitoring to anticipate potential financial stress and capital risks.

Descriptive Statistics

Descriptive statistics are presented to provide an initial overview of the data characteristics in this study. The research uses data from 33 banks observed over a 4-year period, from 2020 to 2023, yielding a total of 132 observations. The key variables in this study include Non-Performing Loans (NPL), Green Loans (GL), Capital Adequacy Ratio (CAR), and Financial Distress (FD). A summary of the descriptive statistics results is presented in Table 1, and an interpretative explanation for each variable is described as follows:

Table 1. Descriptive Statistics Results

Variable	N	Min	Max	Mean	Std. Deviation
NPL	132	0.00	38.73	3.12	3.56
GL	132	0.00	48.39	14.32	11.56
CAR	132	0.17	169.92	31.32	22.80
FD	132	-107.63	22.03	2.83	10.24

Source: Processed using SPSS, compiled in 2025.

Descriptive statistics in this study provide an initial overview of the data characteristics from 33 banks during the period 2020 to 2023, with a total of 132 observations. The variables analyzed include Non-Performing Loans (NPL), Green Loans (GL), Capital Adequacy Ratio (CAR), and Financial Distress (FD). The average NPL was 3.12%, with a standard deviation of 3.56% and a range of 0.00% to 38.73%. Although the average remains within a reasonable range (below the 5% threshold), the high maximum value indicates that some banks face serious credit risks. Green Loans showed an average disbursement of 14.32, with a standard deviation of 11.56 and a range of 0.00 to 48.39. This reflects disparities among banks in implementing sustainable financing, with some banks not disbursing any green loans. Meanwhile, the average CAR stood at 31.32% with a standard deviation of 22.80, ranging from 0.17% to 169.92%. This indicates a relatively strong capital structure, although there is a large disparity between banks with very low and very high CAR values. For the Financial Distress variable, the average was 2.83 with a standard deviation of 10.24 and a range from -107.63 to 22.03. The very low minimum value indicates some banks are under extreme financial pressure, while the positive maximum value reflects financial stability in other banks. The high variation across these variables underscores the need for further analysis of the impact of asset quality and green loans on financial distress, while accounting for the role of risk management in mitigating financial pressure.

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Model Identification Assessment

1. **Model Fit Test (Goodness of Fit Test)**

This stage aims to assess the adequacy of the developed model using various goodness-of-fit indicators. The test is divided into two parts: (1) evaluating model fit through statistical results, and (2) assessing the fulfillment of basic assumptions in Structural Equation Modeling (SEM). The tested model examines the role of Risk Management in the effect of Asset Quality and Sustainability on Banking Financial Distress. The full results are presented in Table 2.

Table 2. Model Fit Test (Goodness of Fit Test)

Criteria	Value *Cut Off*	Results of the Test	Description
Chi Square (CMIN)	Less than the table value (df = 0,715, p > 0,05)	0,715, p = 0,133	Good
RMSEA	≤ 0,08	0	Good
GFI	≥ 0,90	0,999	Good
AGFI	≥ 0,90	0,995	Good
CMIN/DF	≤ 2 atau 3	0,715 / 1 = 0,715	Good
TLI	≥ 0,90	1,09	Good
CFI	≥ 0,90	1	Good
RMR	≤ 0,05	0,022	Good

Source: Processed Results using AMOS, analyzed in 2025

The Goodness of Fit test was conducted to evaluate the extent to which the developed model fits the data analysed in this case, a model that describes the role of risk management in influencing asset quality and sustainability on bank financial distress. This test involves two main components: evaluating model fit using statistical results and assessing basic assumptions in Structural Equation Modeling (SEM). All goodness-of-fit indicators, such as Chi Square (p = 0.133), RMSEA (0), GFI (0.999), AGFI (0.995), CMIN/DF (0.715), TLI (1.09), CFI (1), and RMR (0.022), meet the recommended cut-off values. According to Hair et al. (2019), a model is considered acceptable if most of the indicators fall within the suggested tolerance limits. Therefore, it can be concluded that this SEM model is fit and suitable for further analysis.

2. **Evaluation of SEM Model Assumptions (Structural Equation Modeling)**

The next step was testing the assumptions in SEM, focusing on multivariate normality. This study found that the data were not normally distributed; the bootstrap approach introduced by Efron (1979, 1982) was employed as an alternative to obtain more robust parameter estimates. After examining outliers using the Mahalanobis Distance, 122 of 132 observations were deemed eligible for analysis. The bootstrap procedure was carried out with 500 resamples using the Maximum Likelihood (ML) method and a 90% bias corrected confidence interval, along with the Bollen-Stine Bootstrap test (Ghozali, 2017). The Bollen-Stine Bootstrap showed a p-value of p = 0.693, indicating no significant difference between the sample data and the model-estimated data. This suggests that the model remains fit despite the original data not being normally distributed. The bootstrap distribution showed discrepancy values ranging from 0.000 to 12.943, with a mean of 0.939 and a standard error of 0.064, reflecting a relatively stable spread around the mean. Based on these results, the developed model is statistically acceptable, retains its validity, and can be used to test the relationships among the variables in this study.

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Model Evaluation

1. Direct Effect Testing

Table 3. Results of Direct Effect Testing

Effect	*Estimate*	S.E.	C.R.	ρ	Description
NPL → CAR	0,420	0,055	7,699	<0,001	Significant
GL → CAR	0,147	0,049	3,025	0,002	Significant
NPL → FD	-0,101	0,064	-1,568	0,117	Not significant
GL → FD	0,079	0,049	1,625	0,104	Not significant
CAR → FD	0,169	0,088	1,929	0,054	Not significant

Source: Processed using AMOS, compiled in 2025

In the direct effect testing stage, the model examined the relationships between asset quality (NPL), sustainability (green loans), and risk management (CAR) on financial distress (FD). The direct effect of NPL on financial distress was not significant, with an estimate of -0.101 and a p-value of 0.117. This indicates that although NPL increases, it does not directly cause financial distress, possibly because banks mitigate risk. Similarly, green loans did not show a significant direct effect on financial distress (estimate = 0.079, p = 0.104), possibly due to the relatively small proportion of green financing or its long-term impact. However, NPL significantly influenced CAR (estimate = 0.420, p < 0.001), indicating that higher NPL prompts banks to strengthen capital as a risk management measure. Green loans also had a significant effect on CAR (estimate = 0.147, p = 0.002), suggesting that green financing affects the bank's capital structure, possibly due to the stability and lower risk associated with such loans. Meanwhile, the effect of CAR on financial distress was not significant (estimate = 0.169, p = 0.054), although the p-value was close to the significance threshold. This implies that capital adequacy has not yet become a dominant factor in directly explaining financial distress.

2. Examination of Indirect Effects Through a Mediating Variable

Table 4. Results of Indirect Effect Testing

Indirect Effects	*Estimate*	p-value	Description
***Green loans* → FD through CAR**	0,025	0,025	Significant
NPL → FD through CAR	0,071	0,071	Not significant

Source: Processed using AMOS, compiled in 2025

In the indirect effect testing through the intervening variable (CAR), the results indicate that green loans have a significant indirect effect on financial distress through CAR (estimate = 0.025, p = 0.025), thus it can be concluded that CAR plays a meaningful intermediary role between green financing and financial pressure. Conversely, NPL did not have a significant indirect effect on financial distress through CAR (estimate = 0.071, p = 0.071), suggesting that the mechanism by which NPL influences financial distress is not fully mediated by CAR. These findings highlight the importance of risk management in the context of the relationships between the main variables studied and demonstrate that, although some direct effects are not significant, the indirect effects through the intervening variable provide meaningful insights into understanding the dynamics of financial distress in the banking sector.

The Influence of Asset Quality on Financial Distress

This study finds that asset quality, measured by the Non-Performing Loan (NPL) ratio, does not have a significant effect on bank financial distress during the 2020–2023 period. Theoretically, a high NPL indicates deteriorating asset quality and potential financial risk. However, in practice, the relationship is not always direct due to mitigating factors such as adequate capital and effective risk management.

Several factors explain this result:
a. Credit restructuring policies issued by the Financial Services Authority (OJK) during the pandemic allowed restructured loans to be classified as performing, reducing the accuracy of NPL as a risk indicator.
b. Fiscal and monetary support maintained banking liquidity despite credit pressures.
c. Financial distress is multi-faceted, influenced by capital adequacy, liquidity, operational efficiency, and macroeconomic conditions.
d. Risk management practices and income diversification enhanced banks' resilience to non-performing loans.

Data from the OJK show a decline in NPL ratios after the pandemic peak, supporting the effectiveness of restructuring policies.

This finding is supported by several previous studies (Aminah et al., 2019; Bukit & Syahrianti, 2021; Abdilah et al., 2025), but also contradicts other studies (Suhartanto et al., 2022; Larojan, 2023), which found a significant effect of NPL on financial distress. In conclusion, the effect of asset quality on financial distress is context-specific and influenced by each bank's policies, economic conditions, and risk management practices. Therefore, other factors, such as efficiency, profitability, and capitalization, need to be considered when analyzing the financial condition of banks.

The Influence of Sustainability on Financial Distress

This study finds that sustainability, measured by green loans, does not have a significant effect on financial distress among Indonesian banks during the 2020–2023 period. Thus, the hypothesis that green loans significantly influence financial distress is rejected.

Key reasons include:
a. Green loans remain a small portion of total bank lending, limiting their overall impact on financial health.
b. Green loans are long-term and strategic, while financial distress tends to reflect short-term financial issues, such as the inability to meet obligations.
c. Main predictors of financial distress are financial ratios like profitability, liquidity, and asset quality, not sustainability indicators.
d. Green financing adoption in Indonesia is still early-stage, with varying levels of implementation across banks.

Although green loans may enhance reputation and long-term value, they do not yet serve as an effective tool for mitigating short-term financial crises. Previous studies, such as those by Ecole (2020) and Sibarani & Lusmeida (2021), also found that sustainability does not always have a significant impact on financial distress. On the other hand, international research, such as that conducted by Ali et al. (2023) and Citterio & King (2023), found that ESG indicators can reduce financial risk and improve the accuracy of financial distress prediction. These differing findings highlight that the impact of sustainability on financial stability is heavily influenced by industry context, regulatory frameworks, and prevailing risk management practices. Therefore, strengthening the integration of sustainability principles into risk management is necessary to realize the benefits more effectively within Indonesia’s financial system.

The Influence of Asset Quality on Risk Management

This study finds a positive and significant relationship between asset quality (measured by NPL) and risk management (measured by CAR). In other words, the better a bank’s asset quality, the stronger its ability to provide sufficient capital to cover potential risks. Good asset quality reflects effective credit portfolio management, reduces non-performing loan risk, and supports the bank's financial stability and profitability. Risk management in banking involves a structured approach that encompasses organizational culture, systematic processes, and robust controls to comprehensively

manage risk. The Capital Adequacy Ratio (CAR) serves as a key indicator of a bank's ability to maintain sufficient capital in the face of risk.

This research supports the hypothesis that asset quality significantly affects risk management, highlighting the importance of healthy asset management as a fundamental strategy to ensure banking sector resilience, especially during uncertain market conditions, such as those experienced from 2020 to 2023. Fatika's (2024) study supports this finding, indicating that rising NPLs prompt banks to strengthen their capital as a risk-mitigation measure. The relationship between asset quality and CAR suggests that effective credit management positively affects a bank's capital structure. A study by Lubis et al. (2024) found that asset quality, bank size, Financing to Deposit Ratio (FDR), and Return on Assets (ROA) influence financial distress, particularly for Bank Muamalat Indonesia. Improved risk management and strict selection of financing were recommended as key strategies to enhance financial stability. However, this finding does not fully align with Safitri et al. (2024), who reported that asset quality has a negative but insignificant effect on CAR. Instead, liquidity was found to be a more dominant factor influencing capital adequacy. Madugu et al. (2020) also found that credit risk affects the profitability of local banks, but CAR does not always contribute positively, especially in foreign banks. This suggests that the relationship between risk management, asset quality, and financial performance is complex and highly contextual.

The insignificant relationship between asset quality and capital adequacy reported in some prior studies can be explained from both empirical and theoretical perspectives. Empirically, the impact of asset quality on CAR may be weakened by regulatory capital requirements that compel banks to maintain a minimum capital level regardless of fluctuations in non-performing loans. As a result, changes in NPL ratios do not always lead to proportional adjustments in capital adequacy, particularly in large or well-capitalized banks. In addition, differences in bank size, ownership structure, and business models may cause heterogeneous responses in capital management, thereby reducing the statistical significance of the relationship. From a theoretical perspective, capital adequacy is not solely determined by asset quality but is also influenced by other dominant factors such as liquidity management, profitability, and regulatory intervention. According to the risk-based capital framework, banks may prioritize liquidity risk or market risk over credit risk when determining their capital buffers. Consequently, even when asset quality deteriorates, banks may rely on alternative risk mitigation strategies such as asset restructuring, loan rescheduling, or government support rather than increasing capital. This theoretical argument supports the findings of Safitri et al. (2024), which emphasize liquidity as a more influential factor in shaping capital adequacy.

Furthermore, the relationship between asset quality and risk management is inherently contextual. During periods of economic stress, banks may adopt conservative capital strategies driven by macroprudential policies rather than internal asset quality conditions. This explains why CAR does not always respond significantly to changes in NPLs, as noted by Madugu et al. (2020), particularly in foreign banks operating under different regulatory and market environments. Therefore, the insignificance of asset quality in influencing CAR does not necessarily indicate weak risk management; rather, it reflects the complex interaction among regulatory frameworks, bank characteristics, and broader economic conditions. Recent data support the importance of risk management. BRI and Mandiri reduced their NPL ratios in 2024–2025, while rural banks (BPRs) experienced a spike in NPLs to 11.67%, highlighting the need for strengthened risk management in this sector. BTN reduced problematic assets through strategic partnerships, while Bank Indonesia and the Financial Services Authority (OJK) have maintained national financial system resilience by reinforcing CAR and implementing macroprudential supervision. Overall, asset quality and capital adequacy are interrelated and serve as key determinants of banking stability. However, their impact may vary depending on the type of bank and economic conditions. Therefore, comprehensive and responsive risk management strategies are essential to address current economic dynamics.

The Influence of Sustainability on Risk Management

The study finds that sustainability, measured by the proportion of green loans, has a positive and significant effect on risk management, as reflected in the Capital Adequacy Ratio (CAR). Green loans are generally allocated to environmentally sustainable projects with lower credit risk and are often supported by regulations and government incentives, thus reducing the likelihood of default. Additionally, green financing helps banks reduce reputational and operational risks, enhancing public trust and financial stability. By diversifying credit portfolios through green loans, banks strengthen their capital structure and resilience. With a more holistic approach to risk management, green loans help enhance capital capacity. Therefore, the hypothesis stating that sustainability significantly affects risk management in banks is accepted. These findings are supported by previous studies. Dafermos & Nikolaidi (2021) stated that green loans can strengthen capital positions when backed by appropriate macroprudential policies. Mirovic et al. (2023) highlighted that green loans enhance the relationship between liquidity and profitability. However, other studies (Ahmad Febriyanto et al., 2023; Sutrisno & Furqan, 2023) found that green financing does not always have a significant impact on financial performance and is more influenced by regulatory frameworks and market pressures than internal bank factors.

The insignificant effect of sustainability, as measured by green loans, on risk management, as reported in several previous studies, can be explained from both empirical and theoretical perspectives. Empirically, the proportion of green loans across many banks remains relatively small compared to total lending, limiting their immediate impact on capital adequacy. As a result, increases in green financing may not be substantial enough to significantly influence CAR, especially in the short term. In addition, the benefits of green loans tend to be long-term, while CAR reflects short-term capital conditions shaped by regulatory minimums and immediate risk exposures. From a theoretical perspective, green financing does not automatically translate into stronger capital adequacy. According to financial intermediation theory, capital buffers are primarily driven by overall risk exposure, profitability, and regulatory capital requirements rather than by loan portfolio sustainability alone. In some cases, green projects may still carry technological, market, or transition risks, particularly in developing economies where sustainable finance ecosystems are still evolving. Consequently, banks may adopt a cautious capital strategy, treating green loans as part of diversification rather than as a direct driver of capital strengthening.

Furthermore, regulatory and institutional factors play a crucial role in shaping the effectiveness of green financing. When sustainability initiatives are driven more by regulatory compliance or reputational considerations than by internal risk-return optimization, their impact on CAR may appear insignificant. This explains the findings of Ahmad Febriyanto et al. (2023) and Sutrisno & Furqan (2023), who suggest that the effectiveness of green financing depends heavily on regulatory frameworks, incentives, and market readiness rather than internal bank performance alone. Therefore, the absence of a significant relationship between green loans and risk management does not necessarily indicate that sustainability practices are ineffective. Instead, it reflects the transitional nature of sustainable finance implementation, where structural constraints, time lags, and regulatory dependence moderate the impact of green financing on capital adequacy. As regulatory support and market maturity improve, the influence of sustainability on risk management is expected to become more pronounced.

Regulatory support in Indonesia is evolving, marked by the OJK's issuance of the Climate Risk Management and Scenario Analysis (CRMS) guidelines in March 2024. Major banks such as PT Bank Negara Indonesia reported disbursements of green loans totaling IDR 71.27 trillion as of June 2024 and Sustainability-Linked Loans totaling IDR 5.9 trillion. PT Bank DBS Indonesia disbursed IDR 6.1 trillion in transition financing, including renewable energy and green buildings, while also strengthening ESG risk and human resource aspects. Globally, financial institutions are increasingly adopting sustainability principles to anticipate climate and energy transition risks. The Basel

Committee and Reuters (2025) emphasize that sustainability has become a key long-term strategy in maintaining business stability and continuity. In conclusion, the relationship between sustainability and risk management in Indonesia's banking sector is context-dependent, shaped by each bank's characteristics and strategies, as well as regulatory support. Although green financing promises long-term stability and profitability, its implementation still faces various internal and external challenges.

Risk Management Influences Financial Distress

This study finds that risk management, as proxied by the Capital Adequacy Ratio (CAR), does not significantly affect financial distress in banks. This means that even if a bank has a high CAR, it does not automatically prevent financial pressure. This is because CAR is a preventive measure and does not reflect the bank's actual financial condition. In addition, other factors such as asset quality, management efficiency, and credit portfolio structure play a more dominant role in influencing financial distress. CAR also does not capture external dynamics, such as economic crises or regulatory changes, that directly affect a bank's financial resilience. These findings are consistent with the research of Aminah et al. (2019) and Suardika et al. (2023), who concluded that, although CAR may be high, it does not necessarily protect banks from bankruptcy risk. They emphasized that other factors beyond capital adequacy, such as asset management and credit risk control, must also be considered.

On the other hand, the results contradict the findings of Kareem et al. (2022), who reported that CAR has a significant effect on financial distress. This divergence suggests that the influence of CAR can vary depending on the economic context, the bank's organizational structure, and the research period. For instance, during the COVID-19 pandemic, even banks with strong capital were affected by external pressures, leading to financial distress. Lestari & Wahyudin (2021) found that the board of directors has a significant negative effect on financial distress, meaning that the more effectively the board performs its duties, the lower the likelihood of financial distress. However, the board of commissioners and audit committee were found to have no significant effect. Profitability was also found to be a moderating variable, strengthening the board of directors' influence on financial condition. Ragil et al. (2024) noted that effective risk management directly impacts a bank's reputation, as evidenced by the case of Bank Central Asia Syariah. A positive reputation reflects the successful implementation of risk management and helps mitigate the risk of financial distress.

Although the average CAR of Indonesian banks reached 25.9% in 2023 (Kontan, 2023), financial pressures persisted amid global interest rate hikes, weakening purchasing power, and international economic instability. This indicates that high capital alone is insufficient without comprehensive risk management. Overall, this study emphasizes that bank risk management must be holistic, not rely solely on capital strength (CAR), but also incorporate factors such as asset quality, internal governance, operational efficiency, and responsiveness to external risks.

Asset Quality Influences Financial Distress Through Risk Management

Bank asset quality, measured by Non-Performing Loans (NPL), is theoretically an important indicator for anticipating financial distress risk. However, this study found that NPL does not have a significant effect on financial distress, as measured by the Capital Adequacy Ratio (CAR), a proxy for risk management.

The main reasons for this insignificance include:

a. A high CAR does not always reflect effective credit risk management.
b. CAR is reactive and does not immediately adjust to increases in NPL.
c. External factors like economic conditions can weaken capital resilience.
d. Information asymmetry and regulatory relief can distort NPL reporting.
e. Risk management practices are not yet fully integrated in many banks.

In conclusion, CAR is not an effective mediator of the relationship between asset quality and financial distress, underscoring the need for more comprehensive and dynamic risk management approaches. These findings are consistent with the findings of Suardika et al. (2023) and Aminah et al. (2019), which indicate that CAMEL ratios, including NPL and CAR, do not individually have a significant impact on financial distress, especially when risk management is effectively implemented. Conversely, in the context of Nigeria, the study by Joseph Toby & Katon Danjuma (2021) shows that capital adequacy regulations can significantly affect business risk. Other studies by Alfonso (2023) and Erawati & Kariyah (2024) reinforce that appropriate credit allocation strategies and sound asset management can improve bank financial stability and reduce credit risk, though this does not necessarily lower distress unless accompanied by efficiency and cost control. This is reflected in the Reuters report (2025), which notes that although the national NPL rate is maintained at 3.2%, bank profitability remains pressured by funding costs and global inflation.

Therefore, it is recommended that banks apply holistic risk management, including: (a) credit policies based on analytics for early risk detection; (b) optimization of operational cash flow as liquidity reserves; (c) improvement of governance and risk transparency; and (d) collaboration with regulators on adaptive macroprudential policies, such as relaxation of provisioning and incentives for NPL reduction during the recovery period.

Sustainability Influences Financial Distress Through Risk Management

This study shows that sustainability has a positive and significant impact on financial distress through risk management, with statistical evidence supporting this hypothesis. Sustainability in banking is not only a commitment to environmental and social aspects but also a strategic factor for long-term financial stability. Sustainability is measured using indicators such as green loans, which reflect the proportion of bank financing allocated to environmentally friendly and sustainable sectors. Banks adopting sustainability principles tend to implement stricter credit selection criteria and consider long-term risks, leading to more adaptive, anticipatory risk management systems. Such banks conduct comprehensive risk analyses, including environmental impact, business sustainability, and compliance with ESG regulations. Effective risk management allows banks to better assess and mitigate credit, operational, and reputational risks, minimizing bad loans and capital pressures.

Conversely, banks that neglect sustainability often focus solely on short-term financial gains, weakening risk management and increasing the likelihood of accumulating problematic assets and financial distress. Financial distress, as measured by models such as the Altman Z-Score, reflects significant financial pressure. Empirical data show that banks with strong sustainability practices and risk management maintain stable financial health, while those without are more vulnerable to distress. The relationship between sustainability and financial distress is mediated by the effectiveness of risk management. Consistent application of sustainability strengthens risk management, helping banks anticipate uncertainties and maintain financial stability. This finding is supported by theory and confirmed by empirical statistical tests. In conclusion, sustainability is a long-term strategy that enhances risk management capabilities and financial stability, reducing the risk of financial distress.

Several studies support these findings, such as Liu & Huang (2022), who stated that sustainable financing strengthens risk management in state-owned banks, and Neagu et al. (2024), who showed that green financing can reduce credit risk. Sutrisno & Furqan (2023) also found a positive influence of green loans on profitability, although this effect was not always mediated by specific risk management variables. However, findings by Hatmadi & Trihadmini (2022) and Ahmad Febriyanto et al. (2023) indicate that the impact of green financing on credit risk and financial performance in Islamic banks is not yet significant, suggesting that these effects may be indirect or require time to materialize. The implementation of sustainability principles has been shown to strengthen risk

management and reduce the potential for financial distress, supported by evidence from several major banks in Indonesia and by encouragement from regulators and international institutions. Therefore, integrating sustainability aspects, risk management, and financial stability is key to maintaining the resilience of Indonesia's banking sector.

CONCLUSION

This study found that asset quality, measured by the Non-Performing Loan (NPL) ratio, has no significant effect on financial distress in banks during the 2020–2023 period. Factors such as credit relaxation policies, effective risk management, capital adequacy, and fiscal and monetary support during the COVID-19 pandemic served as main buffers mitigating the negative impact of high NPLs. Similarly, sustainability, measured by the proportion of green loans, did not have a significant direct effect on financial distress, as the proportion remains low and its impact tends to be long-term. However, asset quality was found to have a positive and significant effect on risk management, as measured by the Capital Adequacy Ratio (CAR), as did sustainability, which strengthened bank risk management. Nevertheless, risk management proxied by CAR did not significantly affect financial distress directly, indicating that capital adequacy alone is insufficient to prevent financial pressure without comprehensive risk management systems. Furthermore, asset quality did not affect financial distress through risk management, suggesting that capital alone is not an effective mediator in dynamic conditions. In contrast, sustainability has a positive and significant indirect effect on financial distress through risk management, indicating that banks that implement sustainability principles supported by strong risk management systems are more resilient to financial pressure. These findings emphasize the importance of integrating sustainability principles into risk management policies to strengthen the long-term stability of Indonesia's banking sector.

The practical implications of this study highlight the need to strengthen credit risk management through proactive supervision and early warning systems, as well as by integrating sustainability principles into risk management policies and staff training. CAR should be optimized not only to meet regulations but as part of an integrated risk evaluation. Risk management must be holistic, leveraging technology and independent risk units. The synergy between sustainability strategies and risk management should be enhanced, such as by incorporating environmental risks into credit rating assessments. Strong management commitment and governance, including the establishment of sustainability committees and risk oversight, are essential. Regulators such as the OJK and Bank Indonesia are expected to provide policy support and incentives for sustainability-based risk management practices. Theoretical Implications reinforce agency theory by emphasizing risk management as a control tool to reduce conflicts of interest between principals and agents in banking. Additionally, this study emphasizes the importance of integrating risk management with sustainability principles to prevent financial distress. Empirical Implications show that NPL positively affects CAR, confirming the importance of managing asset quality in risk management. Green loans are also associated with higher CAR, indicating that sustainability is a key factor in banks' financial stability. Green financing managed through risk management helps reduce financial distress risks and strengthen bank resilience.

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