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Role of credit risk, market risk, liquidity risk, and operational risk on banking financial performance with good corporate governance as a moderating variable

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Abstract

The purpose of this study was to determine the effect of credit risk, market risk, liquidity risk, and operational risk on banking financial performance. Good corporate governance moderates the relationship between these variables and banking financial performance. The population in this study consisted of banking companies listed on the Indonesia Stock Exchange from 2020 to 2024. The technique for sampling was purposive sampling, and based on the criteria that have been used, the number of samples obtained was 20 banking companies. Research hypothesis testing utilized Multiple Linear Regression Analysis and the Moderated Regression Analysis Technique. The results of this study indicated that the variables of credit risk, market risk, liquidity risk, and operational risk have a positive effect on banking financial performance. In addition, this research also showed that good corporate governance variables could strengthen the influence of credit risk, market risk, liquidity risk, and operational risk on banking financial performance. However, the MRA test results showed a significance of 0.765, which is greater than 0.005, so it can be concluded that good corporate governance did not have a significant influence on the variables of credit risk, market risk, liquidity risk, and operational risk on banking financial performance.

Keywords: Credit risk, Financial performance, Good corporate governance, Liquidity risk, Market risk, Operational risk.

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1. Introduction

Banking in Indonesia provides more than 40 percent of funding for the economy. The sustainable performance of commercial banks is important because it has a significant effect on overall economic growth [1-3]. In a company,

evaluation related to finance is very important to do continuously. We call this the financial report will later be ability to predict whether a company will be able to survive in the next era [4-6]. The bank's financial report will be useful for the parties who need it if the report is analyzed further [7-9]. In analyzing the financial statements of a company, certain tools are needed. The most commonly used tool is the financial ratio. Based on the report, a ratio will emerge that will be used as a basis for assessing the level of bank performance [10-13].

This decline in performance not only affects the company's goals but also becomes a responsibility to all shareholders and stakeholders in creating good corporate value [14-17]. Firm value is very important because firm value can show how well the company is performing and of it can affect the profitability of a company [18-21]. Referring to agency theory that the relationship between company owners and management must have a unidirectional relationship in running the company in order to avoid agency conflicts [22]. Signal theory suggests that company value is shown through signals in the form of information that will be received by investors. it can inform a company's financial ratios in measuring, assessing, and evaluating management performance to predict future earnings [23-25]. Agency theory is a perspective that is often used in understanding governance relationships within an organization or company. Basically, in building a company, all people involved in the company would have the same goal in aligning the vision and mission of the company. However, there are often differences of opinion on how to achieve these goals involving the interests of each party. According the separation of ownership by the principal and control by agents in an organization tends to cause agency conflicts between the principal and the agent [26-29]. Agency theory is a theory that explains agency relationships and the problems it causes. Agency relationship is the relationship that occurs between the principal and agent in transactions with third parties caused by information asymmetry. Due to agency problems, companies need to implement corporate governance [30-32]. Corporate governance is based on agency theory. Corporate governance is expected to function as a tool to provide confidence to investors that they will receive a return on the funds they have invested [33-36]. Corporate governance is closely related to how to make investors believe that managers will benefit them and that managers will not embezzle or invest in unprofitable projects related to the capital invested by investors. In addition, corporate governance is also related to how investors control managers. In other words, corporate governance is used to reduce agency costs [37-40].

Based on Bank Indonesia Regulation No. 6/10/PBI/2004 concerning the assessment of the soundness of commercial banks, the assessment of the soundness of banks and three assessments of bank performance usually use the CAMELS method (Capital, Asset, Management, Earnings, Liquidity, and Sensitivity to Market Risk). However, starting from January 2012, all commercial banks in Indonesia have to use the latest guidelines for assessing the soundness of banks based on Bank Indonesia Regulation No. 13/1/PBI/2011 concerning the Assessment of the Soundness of Commercial Banks. The latest procedure, referred to as the RGEC Method, stands for (Risk Profile, Good Corporate Governance, Earnings, and Capital). Changes in the business complexity and risk profile of banks, and considering the rapid development of the banking sector as well as changes in the methodology for assessing bank conditions that are applied internationally, have prompted the need for risk management and good corporate governance [41-44]. The aim is for banks to be able to identify problems early, carry out appropriate and faster follow-up improvements, and implement good corporate governance and risk management [45-47].

Good corporate governance, according to the National Committee on Governance Policy, is one of the pillars of the market economy system [48-51]. Good corporate governance is closely related to trust in both the companies that implement it and the business climate in a country [52-55]. The implementation of good corporate governance is considered to improve the image of banking, which was previously poor, protect the interests of stakeholders, and enhance compliance with applicable laws, regulations, and general ethics in the banking industry to foster a healthy banking system [56-59]. Several other studies on good corporate governance (GCG) in banking regarding the effects of credit risk, market risk, liquidity risk, and operational risk on the good corporate governance (GCG) of banks are as follows [60, 61]. This study aims to examine the effect of profitability with good corporate governance (GCG) and Dividend Payout Ratio as moderating variables.

Profitability has a positive effect on the probability of income smoothing practices. Good corporate governance is not able to weaken the positive effect of profitability on the probability of income smoothing practices. The dividend payout ratio is not able to strengthen the positive influence of profitability on the possibility of income smoothing practices [62-64]. This study aims to examine earnings management, risk profile, and operational efficiency in the prediction of bankruptcy models in Indonesia. The results of earnings management research, ROA, CAR, and NIM moderation of good corporate governance and risk profile can predict bank insolvency and have a significant positive effect [65-68]. This study attempts to examine the effect of the capabilities of banking companies, namely dynamic and unique capabilities, on the implementation of Good Corporate Governance (GCG) in Indonesia. The results showed a positive direct effect of the uniqueness of GCG capabilities. The findings indicate that top management capabilities, both unique and dynamic, affect the implementation of GCG to consistently create good and stable banking conditions. To apply the principles of Good Corporate Governance (GCG), banking institutions must always be monitored carefully [69]. Several other studies on banking financial performance regarding the effect of credit risk, market risk, liquidity risk, and operational risk on bank financial performance are as follows [70, 71] who examined the effect of risk management as a variable with the Capital Adequacy Ratio (CAR), Operational Costs and Income (BOPO), and Non-Performing Loans (NPL) on financial performance found that CAR, Operational Costs and Income (BOPO), and NPL simultaneously had a positive and significant effect on financial performance. Meanwhile, CAR, BOPO, and NPL have no significant effect on financial performance [72-75]. research on the effect of Non-Performing Loans, Loan to Deposit Ratio, and Operational Costs of Operating Income (BOPO) on Banking Profitability as proxied by Return On Assets. The results of the study indicate that the variable (NPL) had a negative and significant effect on (ROA), (LDR) had a positive and significant effect on (ROA), and Operational Costs of Operating Income had a negative and significant effect on Return On Assets (ROA) [76-79] researched to determine the effect of the capital adequacy ratio (CAR)

and financing to deposit ratio (FDR) on profitability, with non-performing financing (NPF) as a moderating variable. The results of this study indicate that CAR and FDR have a positive effect on ROA, while the Operational Costs of Operating Income (BOPO) have a negative effect on ROA. When using the moderating results of the NPF as a moderating variable, it does not have the effect of being able to moderate the relationship between CAR and FDR with ROA.

Based on the background described and previous research, the novelty in this study is that there is no research related to the influence of risk on banking on financial performance, moderated by Good Corporate Governance (GCG), coupled with the COVID-19 pandemic outbreak, which will have an influence on the banking world, especially banks in East Java, Indonesia. Therefore, this researcher takes the title "The Influence of Credit Risk, Market Risk, Liquidity Risk, and Operational Risk on Banking Financial Performance with Good Corporate Governance as a Moderating Variable: An Empirical Study on 20 Banking Companies in East Java Listed on the IDX from 2020 to 2024."

2. Theory and Hypothesis

Agency theory explains the relationship between the agent and the principal, where the manager is the agent and the owner of the company is the principal. The problem that often arises is agency conflict, namely when agents and principals fight for their interests, even though they have the same goal, which is to increase the value of the company [6]. In the financial management framework, the disclosure of financial statements is very important, considering that bank regulations and state laws are monitoring parties so that banks can manage their risks properly. Regarding agency theory, financial statements should be designed based on the desire for individual togetherness to minimize the agency costs incurred [80-83]. Signal theory states how signals affect the market through company information so that the market can judge these signals with personal assumptions. To be seen as superior, the company must do its best to maintain its quality. Signal theory explains the existence of information asymmetry between companies and interested parties. Therefore, companies need to convey useful information through financial reports to interested parties for future investment decisions [84-87]. One of the important things that is often seen by investors is that the level of profit development reported by the company through the income statement can be translated into a good signal or a bad signal [88-91]. If the profit of a company increases, it is considered good news, while the profit of a company is considered as bad news.

2.1. The Effect of Non-Performing Loans (NPL) on Return On Assets (ROA)

According to the credit risk is the risk due to the failure of other parties to fulfil obligations to financial institutions that provide credit under the agreed agreement [91, 92]. Due to various reasons, customers are unable to fulfill their obligations, such as the payment of principal and interest on loans, so the bank suffers losses due to continuing to incur interest expenses for customer deposits. Constraints in credit payments will result in funds that should have been the result of credit financing profits allocated to company finances because of bad loans; these profits are not obtained by banks. As a result, the circulation of money in the bank will be hampered, which leads to a decline in financial performance. Non-Performing Loans (NPL) have a positive effect on Return On Assets (ROA) [79]. Meanwhile, until this thesis was compiled, researchers have not found any previous research that states that Non-Performing Loans (NPL) have no effect on Return On Assets (ROA).

$H_{1:}$ Non-Performing Loans (NPL) have a positive effect on Return On Assets (ROA).

2.2. The Effect of Net Interest Margin (NIM) on Return on Assets (ROA)

According to Rustam, the risk arises due to market price movements that affect several financial instruments. For example, a decrease in the Bank Indonesia rate (BI rate) will result in a decrease in market interest rates, thereby affecting the value of all interest rate-related instruments. Market risk is a condition experienced by a company caused by changes in market conditions and situations outside the company's control [93-96]. Unstable market influences from various factors result in the disruption of banking financial performance. Market uncertainty certainly makes decision-making by company leaders change depending on market conditions. If market conditions cannot be controlled, the decisions taken will also be more inaccurate. Mistakes in decision-making will have a direct impact on financial performance. Net Interest Margin (NIM) has a positive effect on Return On Assets (ROA), while Nurullaily [97] research states that Net Interest Margin (NIM) does not affect Return On Assets (ROA) [97, 98].

$H_{2:}$ Net Interest Margin (NIM) affects Return on Assets (ROA).

2.3. The Effect of Operating Costs and Operating Income (BOPO) on Return on Assets (ROA)

Operational risk is the risk of direct or indirect loss as a result of inadequate internal processes or failed internal processes, as well as a result of people, systems, or external events. One factor that affects profitability is efficiency in reducing operating and non-operating costs. When operational costs can be managed efficiently, financial performance will not be burdened with unnecessary costs, and the success of operations cannot be separated from the implementation of operational risk management by the company. Operational costs and operating income have a positive influence on Return on Assets (ROA). Research by Zhao and Chen [99], Liu, et al. [100], Li and Li [101] and Zhang and Wang [102] stated that, Meanwhile, Operational Costs and Operating Income (BOPO) do not affect Return On Assets (ROA).

$H_{3:}$ Operating Costs and Operating Income (BOPO) affect Return on Assets (ROA).

2.4. The Effect of Loan to Deposit Ratio (LDR) on Return On Assets (ROA)

The liquidity risk is also often referred to as short-term liquidity risk because of the bank's inability to meet its short-term obligations. In addition, liquidity risk is the risk due to the company's inability to meet maturing debts from cash flow funding sources or from high-quality liquid assets that can be pledged without disturbing the company's activities and

financial condition. With liquidity risk, financial performance will also be affected because this is related to the ability of banks to sell assets in a liquid market quickly. Bank assets that are not sold quickly will hamper financial performance because when banks need funds quickly, the assets owned cannot be sold to meet financial performance needs. The more liquid assets owned will also have an impact on customer interest in securities, etc. When securities can be easily liquidated, it will provide benefits to the bank. Researchers found that the Loan to Deposit Ratio (LDR) has a positive effect on Return On Assets (ROA). Meanwhile [79]. States that there is no effect of Loan to Deposit Ratio (LDR) on Return On Assets (ROA).

H_4: Loan to Deposit Ratio (LDR) affects Return On Assets (ROA).

2.5. Good corporate governance can moderate the relationship between Non-Performing Loans (NPL) and Return on Assets (ROA)

Credit risk has two types of time frames, namely short-term and long-term credit risk: short or long term. Good transparency in the aspects of Good Corporate Governance to customers on how to disclose information in a timely, adequate, clear, accurate, and comparable manner, and easily accessible to customers [103-106], get the results that Non-Performing Loans (NPL) have a positive effect on Return On Assets (ROA). Meanwhile, until this thesis was compiled, researchers have not found any previous research that states that Non-Performing Loans (NPL) do not affect Return On Assets (ROA).

H_5: Good corporate governance can strengthen the relationship between Non Performing Loans (NPL) and Return On Assets (ROA).

2.6. Good Corporate Governance Can Moderate the Relationship between Net Interest Margin (NIM) and Return on Assets (ROA)

According to the general market, risk is divided into four categories, namely interest rate risk, equity risk, exchange rate risk, and commodity position risk. Interest rate risk, exchange rate risk, and commodity position risk can come from either the trading book position or the banking book position, while equity risk comes from the trading book. In addition to the four types of market risk in general, there is also a specific market risk (specific market risk). Specific market risk is a form of risk that is only experienced specifically in one sector or part of the business without being comprehensive [107-110]. Research states that Net Interest Margin (NIM) does not affect Return on Assets (ROA).

H_6: Good corporate governance can strengthen the relationship between Net Interest Margin (NIM) and Return on Assets (ROA).

2.7. Good Corporate Governance Can Moderate the Relationship between Operating Costs and Operating Income on Return on Assets (ROA)

Operational risk is the risk of direct or indirect loss as a result of inadequate internal processes or failed internal processes, as well as a result of people, systems, or external events. These sources of risk can cause events that harm the company's operations, so the emergence of these types of operational risk events is one measure of the success or failure of operational risk management. The types of operational risk events can be classified into several categories, such as internal fraud, external fraud, labor practices and work environment safety, customers, business products and practices, damage to physical assets, disruption of business activities and system failures, as well as process and execution errors, including fraud arising from money laundering and terrorism financing activities [111-113] stated that Operational Costs and Operating Income (BOPO) have a positive influence on Return On Assets (ROA). Meanwhile, the research [114, 115] found that Operational Costs and Operating Income (BOPO) had a negative effect on Return on Assets (ROA).

H_7: Good corporate governance can strengthen the relationship between Operating Costs and Operating Income (BOPO) on Return on Assets (ROA).

2.8. Good Corporate Governance Can Moderate the Relationship Between the Loan to Deposit Ratio (LDR) to Return on Assets (ROA)

Categorization of Liquidity Risk in terms of Banking According to the Standard Guidelines for the Implementation of Risk Management for Commercial Banks is that liquidity risk can be categorized as market liquidity risk and funding liquidity risk. The main objective of risk management for liquidity risk is to minimize the possibility of the company's inability to obtain cash flow funding sources [69]. States that there is no effect of Loan to Deposit Ratio (LDR) on Return On Assets (ROA).

H_8: Good corporate governance can strengthen the relationship between the Loan to Deposit Ratio (LDR) to Return on Assets (ROA).

3. Methods

3.1. Research Type and Approach

The type of research in this study is causal-associative research. Causal-associative research aims to analyze the relationship between one variable and another.

3.2. Company Sample

The sample selection method in this study was purposive sampling, to obtain a sample that was by the research objectives. The criteria for this research sample are as follows:

1. Banking companies listed on the Indonesia Stock Exchange during 2020-2024.
2. Banking companies in East Java

Based on the sample criteria from banking companies in the financial sector for the 2020-2024 period, a sample of 20 banking companies in East Java was obtained.

Table 1.
Variable operational Definition.

Variable	Definition	Measurements
ROA	Return on investment, or better known as Return on Investment (ROI) or Return on Total Assets, is a ratio that shows the return on the total assets used in the company. ROI is also a measure of the effectiveness of management in managing its investments, Singh [116].	$\text{ROA} = \frac{profit\ before\ tax}{total\ asset} x100\%$ (According to Bank Indonesia circular letter No. 13/24/DPNP 25 October 2011)
NPL	The risk due to the failure of other parties to fulfill obligations to financial institutions that provide credit under the agreed agreement, Yin and Wong [117].	$\text{NPL} = \frac{total\ nonperforming\ loans}{total\ credit} x100\%$ (According to Bank Indonesia circular letter No.13/24/DPNP 25 October 2011)
NIM	Risks arising from market price movements that affect several financial instruments, Kim and Lee [118].	$\text{NIM} = \frac{net\ interest\ income}{average\ total\ productive\ assets} x100\%$
BOPO	Risk of direct or indirect loss as a result of inadequate internal processes or failed internal processes, as well as a result of people, systems, or external events, Zheng et al. [119], Bao et al. [120], Foglia et al. [121], Ballester et al. [122], Wu et al. [123] and Iakimenko et al. [124]	$\text{BOPO} = \frac{total\ operating\ cost}{total\ operating\ revenue} x100\%$
LDR	A ratio to measure the composition of the amount of credit granted compared to the amount of public funds and own capital used (According to Bank Indonesia Regulation No. 15/15/PBI/2013)	$\text{LDR} = \frac{credit\ given}{funds\ received} x100$ (According to Bank Indonesia circular letter No.6/23/DPNP 31 May 2004)
GCG	Defined as a set of rules and principles, including fairness, transparency, accountability, and responsibility, that regulate the relationship between shareholders, company management (directors and commissioners), creditors, employees, and other stakeholders related to their respective rights and obligations. (According to the National Committee on Corporate Governance Policy (KNKCG) in 2004).	Measurement of GCG implementation is carried out using the CGPI score, according to the Indonesia Institute for Corporate Governance (IICG).

3.3. Data Collection Technique

Data collection techniques in this study were carried out using documentation methods by examining the financial statements of the sample companies. With this technique, the authors collected 20 data points from the annual financial statements of banking companies from 2020 to 2024. The data was obtained through the IDX and the official websites of each banking company.

4. Results

A statistical t-test was conducted to show how far the influence of one independent variable individually explains the variation of the dependent variable. The t-test can be seen from the t-significance value of each output variable using SPSS regression results with a significance level of 0.05 (α=5%). If the significance value is greater than 0.05 (α = 5%), then the hypothesis is rejected (the regression coefficient is not significant), which means that the independent variable individually does not have a significant effect on the dependent variable. If the significance value is less than 0.05 (α = 5%), then the hypothesis is accepted (significant regression coefficient), meaning that the independent variable individually has a significant influence on the dependent variable.

Hypothesis 1: The effect of credit risk (NPL) on financial performance (ROA). The first hypothesis testing is aimed at testing the effect of credit risk (NPL) on financial performance.

Table 2.
The Result of the Test of NPL.

Coefficients[a.]						
		Unstandardized Coefficients				
Model		B	Std. Error	Standardized Coefficients Beta	t	Sig
1	(Constant)	3.674	0.643		8.243	0.000
	NPL	-1.086	0.324	-0.621	-3.314	0.003

Note: a. Dependent Variable: ROA.

The t-test of the NPL variable (X1) obtained a t-count of (-3.314) with a significance value of 0.003. Because the arithmetic is smaller than the t table (-3.314 < 2.131) and the significance is smaller than 5% (0.003 < 0.05), partially the NPL variable (X1) affects return on assets (Y), then H1 is accepted.

Hypothesis 2: The effect of market risk (NIM) on financial performance (ROA). The first

Hypothesis testing is aimed at testing the effect of market risk (NIM) on financial performance (ROA).

Table 3.
The result of T T-test of NIM.

Coefficients[a.]						
		Unstandardized Coefficients				
Model		B	Std. Error	Standardized Coefficients Beta	t	Sig
1	(Constant)	-1.436	0.464		-2.884	0.013
	NIM	0.654	0.074	0.876	7.823	0.004

Note: a. Dependent Variable: ROA.

The t-test of the NIM variable (X2) obtained a t-count of 7.823 with a significance value of 0.004. Because the arithmetic is greater than the table (7.823 > 2.131) and the significance is smaller than 5% (0.004 < 0.05), the partial NIM variable (X2) affects return on assets (Y), then H2 is accepted.

Hypothesis 3: The effect of operational risk (BOPO) on financial performance (ROA). The first hypothesis testing is aimed at testing the effect of operational risk (BOPO) on financial performance (ROA).

Table 4.
The Result of T T-test of the BOPO.

Coefficients[a.]						
		Unstandardized Coefficients				
Model		B	Std. Error	Standardized Coefficients Beta	t	Sig
1	(Constant)	10.342	0.767		14.653	0.004
	BOPO	-0.127	0.008	-0.924	-11.378	0.003

Note: a. Dependent Variable: ROA.

The t-test of the BOPO variable (X3) obtained t t-count of (-11,378) with a significance value of 0.003. Because the arithmetic is smaller than the table (-11.378 < 2.131) and the significance is smaller than 5% (0.003 < 0.05), the partially BOPO variable (X3) has an effect on return on assets (Y), then H3 is accepted.

Hypothesis 4: The effect of liquidity risk (LDR) on financial performance (ROA). The first hypothesis testing is aimed at testing the effect of liquidity risk (LDR) on financial performance (ROA).

Table 5.
The result of the T-test of LDR.

Coefficients[a.]						
		Unstandardized Coefficients				
Model		B	Std. Error	Standardized Coefficients Beta	t	Sig
1	(Constant)	8.672	2.432		3.743	0.004
	LDR	-0.075	0.034	-0.575	-2.863	0.024

Note: a. Dependent Variable: ROA.

The t-test on the LDR variable (X4) obtained a t-count of -2.863 with a significance value of 0.024. Because the arithmetic is smaller than the t table (-2.863 < 2.131) and the significance is smaller than 5% (0.024 < 0.05), partially LDR variable (X4) partially affects return on assets (Y), then H4 is accepted.

4.1. Moderated Regression Analysis (MRA)

Moderated Regression Analysis (MRA) is a model used to determine whether the presence of a moderating variable strengthens or weakens the influence of the independent variable on the dependent variable. The following are the results of the moderation test:

Hypothesis 5: Good corporate governance can moderate the relationship between Non

Performing Loans (NPL) and Return On Assets (ROA).

Table 6.
The result of MRA test in Hypothesis 5.

Coefficients[a.]

Model		Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig
		B	Std. Error			
1	(Constant)	3.876	0.219		17.785	0.001
	NPL	8.963	2.678	5.074	3.356	0.003
	NPL*GCG	-0.125	0.034	-5.689	-3.723	0.004

Note: a. Dependent Variable: ROA.

Based on Table 6, it can be seen that the resulting beta of 8.963 has a positive value, which means that GCG moderation strengthens the effect of NPL on return on assets, and has a significant effect because its significance is less than 0.05, which is worth 0.003.

Hypothesis 6: Good corporate governance can moderate the relationship between Net Interest Margin (NIM) and Return On Assets (ROA).

Table 7.
The result of the MRA test in Hypothesis 6.

Coefficients[a.]

Model		Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig
		B	Std. Error			
1	(Constant)	-1.434	0.201		-7.067	0.001
	NIM	1.899	0.345	2.784	7.547	0.004
	NIM*GCG	-0.023	0.002	-1.974	-5.037	0.002

Note: a. Dependent Variable: ROA.

Based on Table 7 it can be seen that the beta generated is 1.899 with a positive value, which means that GCG moderation strengthens the effect of NIM on return on assets and has a significant effect because its significance is less than 0.05, which is worth 0.004.

Hypothesis 7: Good corporate governance can moderate the relationship between Operating Costs and Operating Income (BOPO) on Return On Assets (ROA).

Table 8.
The result of the MRA test in Hypothesis 7.

Coefficients[a.]

Model		Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig
		B	Std. Error			
1	(Constant)	10.450	0.373		33.346	0.002
	BOPO	-0.034	0.023	-0.467	-3.246	0.004
	BOPO*GCG	-0.003	0.002	-0.578	-4.278	0.001

Note: a. Dependent Variable: ROA.

Based on Table 8, it can be seen that the resulting beta (-0.034) has a negative value, which means that GCG moderation weakens the effect of BOPO on return on assets and has a significant effect because its significance is less than 0.05, which is worth 0.004.

Hypothesis 8: Good corporate governance can moderate the relationship between the Loan to Deposit Ratio (LDR) to Return on Assets (ROA).

Table 9.
The result of MRA test in Hypothesis 8.

Coefficients[a.]

Model		Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig
		B	Std. Error			
1	(Constant)	14.256	1.089		13.867	0.010
	LDR	0.123	0.056	0.986	4.897	0.003
	LDR*GCG	-0.002	0.003	-1.642	-8.784	0.004

Note: a. Dependent Variable: ROA.

Based on Table 9, it can be seen that the resulting beta, 0.123, has a positive value, which means that GCG moderation strengthens the effect of LDR on return on assets and has a significant effect because its significance is less than 0.05, which is worth 0.003.

Good corporate governance can moderate the relationship between credit risk (NPL), market risk (NIM), liquidity risk (LDR), and operational risk (BOPO) on banking financial performance (ROA).

Table 10.
The result of MRA Test.

Coefficients[a.]

Model		Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig
		B	Std. Error			
1	(Constant)	12.243	4.421		2.774	0.021
	NPL	-0.187	0.236	-0.120	-0.384	0.712
	NIM	0.154	0.167	0.489	2.262	0.037
	LDR	0.010	0.067	0.006	0.086	0.903
	BOPO	-0.068	0.078	-0.643	-3.923	0.010
	GCG	-0.089	0.063	-0.351	-2.647	0.030
	NPL*NIM*LDR*BOPO*GCG	0.0000195	0.003	0.043	0.142	0.765

Note: a. Dependent Variable: ROA.

Based on Table 10, it can be seen that the results of the MRA test explain the significance of 0.765, which is greater than 0.05, indicating that the GCG variable (moderating variable) does not interact with other variables and also does not have a significant relationship with the financial performance variable (ROA). The moderating predictor variable means that this moderating variable only acts as a predictor variable (independent) in the relationship model that is formed.

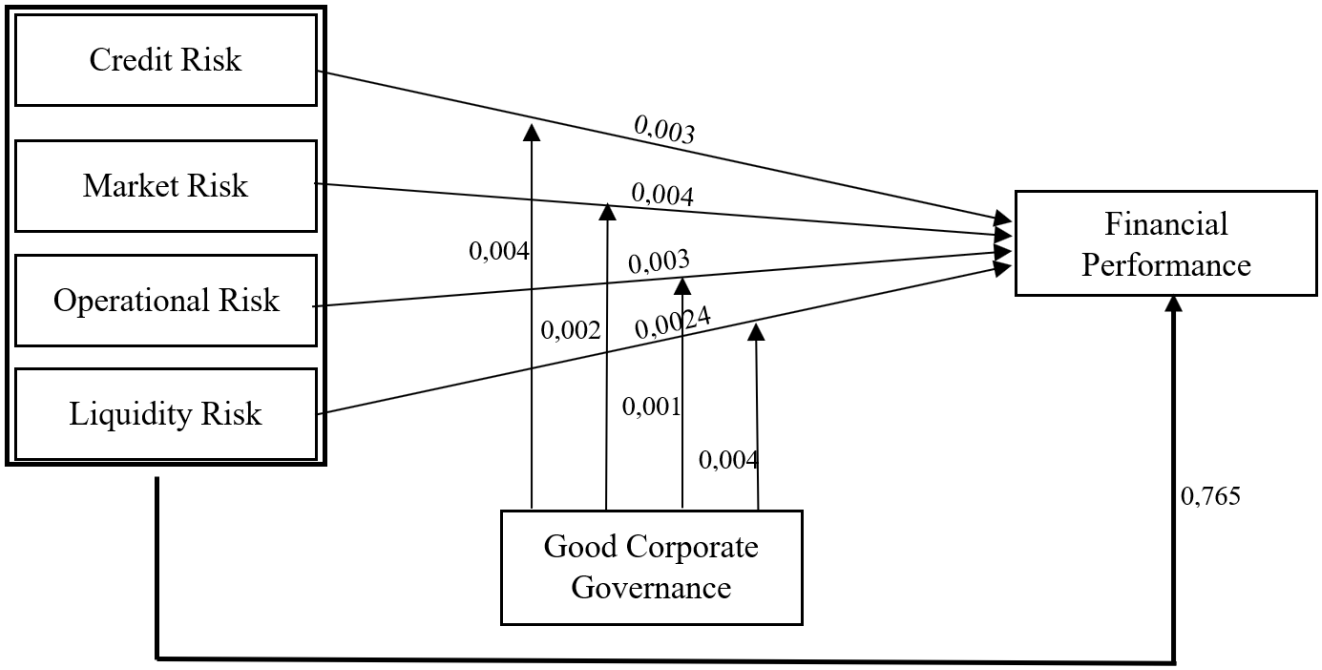

Figure 1.
Relationship between variables.

Based on Figure 1, the results of hypothesis testing are obtained as follows:

Table 11.
The results of hypothesis testing.

No.	Hypothesis	Significance	Explanation
H1	The effect of credit risk (NPL) on financial performance (ROA).	0.003 < 0.05	Received
H2	Effect of market risk (NIM) on financial performance (ROA).	0.004 < 0.05	Received
H3	Effect of operational risk (BOPO) on financial performance (ROA).	0.003 < 0.05	Received
H4	The effect of liquidity risk (LDR) on financial performance (ROA).	0.024 < 0.05	Received
H5	Good corporate governance can moderate the relationship between Non Performing Loans (NPL) and Return On Assets (ROA).	0.004 < 0.05	Received
H6	Good corporate governance can moderate the relationship between Net Interest Margin (NIM) and Return On Assets (ROA). (ROA)	0.002 < 0.05	Received
H7	Good corporate governance can moderate the relationship between Operating Costs and Operating Income (BOPO) on Return On Assets (ROA).	0.001 < 0.05	Received
H8	Good corporate governance can moderate the relationship between Loan to Deposit Ratio (LDR) to Return On Assets (ROA).	0.004 < 0.05	Received

5. Discussion

5.1. The Effect of Credit Risk (NPL) on Banking Financial Performance (ROA).

These results were obtained by looking at the results of the t-test with a significance of 0.03 < 0.05. The results showed that Good Corporate Governance significantly strengthens the effect of credit risk on banking financial performance. This indicates that banks have the ability to manage the risk of bad loans so that they do not need to be burdened with interest to customers who save and are also able to settle bond obligations to investors. Good transparency in the aspects of Good Corporate Governance allows customers to access information in a timely, adequate, clear, accurate, and comparable manner. The results of this study were in line with the notion that credit risk affects financial performance [122]. The main objective of credit risk management is to ensure that the activities of providing funds to financial institutions are not exposed to credit risk that can cause losses to financial institutions. In general, credit risk exposure is one of the main risk exposures in financial institutions in Indonesia, so the ability of financial institutions to identify, measure, monitor, and control credit risk and provide sufficient capital for this risk will be very important. The risk due to the failure of other parties to fulfill obligations to financial institutions that provide credit in accordance with the agreed agreement [125].

5.2. The Effect of Market Risk (NIM) on Banking Financial Performance (ROA)

These results were obtained by looking at the results of the t-test with a significance of 0.04 < 0.05. The company/bank is also able to keep the market risk within the tolerable limits of the bank, and the bank has sufficient capital to cover market risk so as not to interfere with the bank's financial performance. Having a responsibility to stakeholders makes the bank a good corporate citizen, including caring for the environment and carrying out social responsibility. The results of this study are in line with the fact that market risk affects financial performance [126-129]. Market price movements that affect several financial instruments. For example, a decrease in the price of the Bank Indonesia rate (BI rate) will result in a decrease in market interest rates so which it affects the value of all instruments related to interest rates [130-133]. With market risk management, the company/bank can minimize the possible negative impact due to changes in market conditions on the company's assets and capital. The company/bank is also expected to be able to keep the market risk within the tolerable limits of the bank, and the bank has sufficient capital to cover market risk so as not to interfere with the bank's financial performance.

5.3. The Effect of Operational Risk (BOPO) on Banking Financial Performance (ROA)

These results were obtained by looking at the results of the t test with a significance of

0.003 < 0.05. The greater the operational costs, of course, will put a burden on the financial performance of banks, especially during the COVID-19 pandemic, which requires the implementation of health protocols so that banks can avoid losses that may occur. The results of this study indicate direct or indirect losses as a result of inadequate internal processes or failed internal processes, as well as losses resulting from people, systems, or external events [134, 135]. One factor that affects profitability is efficiency in reducing operating and non-operating costs. Banks that are efficient in reducing their operational costs can alleviate the burden on financial performance. In risk management, efficiency is one of the factors that determines the magnitude of profits. When banks can efficiently identify the problems that need to be addressed in their operations, the profits obtained can also be maximized.

5.4. The Effect of Liquidity Risk (LDR) on Banking Financial Performance (ROA)

These results were obtained by looking at the results of the t-test with a significance of 0.024 < 0.05. This shows that banks are able to maintain the liquidity of their assets, both stocks and bonds. Banks are also able to fulfill the obligations of shareholders in providing dividends and are able to pay maturing bonds, so that they do not have a financial burden that affects the bank's financial performance. The aspect of transparency is very important because banks will always be required to provide information to customers, stakeholders, and the government in various matters. With good management, liquidity risk can be resolved properly, as well as the implementation of risk management, which has a positive impact on banking. The results of this study are in line with Nurullaily [97], which shows that liquidity risk has a positive impact on financial

performance. Liquidity risk is a form of risk experienced by a company due to its inability to fulfill its short-term obligations, which affects the disruption of company activities to a position that is not running normally [5]. The main objective of risk management for liquidity risk is to minimize the possibility of the company's inability to obtain cash flow funding sources and maintain the company's liquidity at an optimal level so that the costs of liquidity management are within tolerable limits. The Loan to Deposit Ratio (LDR) is the ratio of loans to funds received. The LDR ratio is one of the tools used to measure the liquidity aspect of a bank.

5.5. The Moderate Effect of Good Corporate Governance (GCG) between Credit Risk (NPL), Market Risk (NIM), Liquidity Risk (LDR) and Operational Risk (BOPO) on Banking Financial Performance (GCG)

The results showed that Good Corporate Governance could not affect X1, X2, X3, and X4 simultaneously. Judging from the significance of 0.765, which is greater than 0.05, the GCG variable (moderating variable) does not interact with other variables and is also not significantly related to the financial performance variable (ROA), acting as a predictor variable (independent) in the relationship model that is formed. A good application of credit risk, market risk, operational risk, and liquidity risk can have a positive impact on banking financial performance. Apart from that, Good Corporate Governance does not have an effect due to the good performance in other aspects or the lack of implementation of GCG when compared to the overall risk management simultaneously. The effective implementation of risk management cannot be separated from Bank Indonesia Regulation Number 5/8/PBI/2003 in Chapter II, Article 2, Paragraph 1, which explains that banks are required to implement risk management effectively. By implementing good risk management, the company is expected to be able to make decisions that can minimize losses [136]. It states that the factors affecting financial performance are as follows: the ability of banks in existing capital to cover possible losses in credit or securities trading, good bank operations that positively impact the bank's financial performance, high net interest income with the ability of bank management in managing its productive assets, small non-performing loans at the bank, and total bank loans with total savings in one period. Therefore, the implementation of good risk management can maximize the benefits that will be obtained; this is in accordance with the results of research that GCG has no effect.

6. Conclusion

The results of the study indicated that credit risk (NPL) has a significant influence on financial performance (ROA); this was indicated by the results of the study obtained.

Constraints in credit payments will result in funds that should have been the result of credit financing profits allocated to company finances because of bad loans; these profits are not obtained by banks. As a result, the circulation of money in the bank will be hampered, which leads to a decline in financial performance. The existence of credit risk management improves financial performance.

The Net Interest Margin (NIM) variable partially has a significant effect on return on assets; this is indicated by the results of the research obtained. The ability to make decisions in market uncertainty will greatly affect the profits obtained. Through proper risk management, decisions in market uncertainty can be carried out correctly, which will have an impact on increasing company profits.

The effect of BOPO on return on assets is partially affects return on assets significantly. Therefore, when the company can run operations efficiently, the profits will increase. This is in accordance with the results of the study, which showed that operational risk had a significant effect on financial performance, as seen from the significance of 0.003.

The LDR variable partially has a significant effect on return on assets; in this study, liquidity risk has a significance of 0.024 on financial performance.

Simultaneously, NPL, NIM, BOPO, and LDR can significantly affect return on assets. However, when Good Corporate Governance moderated the regression, there was no strengthening or weakening change; it can be seen that the significance of GCG moderation was 0.765.

For further researchers, it is recommended to refine the number of variables to be studied, considering that in this study only four variables were used and the year period was not long enough. The addition of variables, along with an extended research period, will provide even better data results. For companies, the importance of risk management in banking is fundamental. Every activity carried out, especially by banks managing customer money, certainly carries a high risk; the implementation of effective risk management will help avoid potential losses.

References

[1] M. Xie, "Economic policy uncertainty and credit risk in microfinance: A cross-country analysis," *International Journal of Finance & Economics*, vol. 30, no. 2, pp. 1969-1985, 2025. https://doi.org/10.1002/ijfe.3003

[2] C. Edirisinghe, J. Sawicki, Y. Zhao, and J. Zhou, "Predicting credit rating changes conditional on economic strength," *Finance Research Letters*, vol. 47, p. 102770, 2022. https://doi.org/10.1016/j.frl.2022.102770

[3] A. Leung, L. Moldovan, and M. Ata, "Teaching economics in higher education with universal design for learning," *International Review of Economics Education*, vol. 44, p. 100273, 2023. https://doi.org/10.1016/j.iree.2023.100273

[4] C. A. Preciado, J. García Regalado, and G. Cornejo Marcos, "building a probability scoring model: The case of segumar sa," *Revista de Métodos Cuantitativos para la Economía y la Empresa*, vol. 35, pp. 157-174, 2023. https://doi.org/10.46661/revmetodoscuanteconempresa.7256

[5] A. Hoyyi and D. Rosadi, "Variance gamma model in determining the default probability of coupon bond issuing company," *IAENG International Journal of Applied Mathematics*, vol. 54, no. 5, pp. 961–968, 2024.

[6] F. Dainelli, G. Bet, and E. Fabrizi, "The financial health of a company and the risk of its default: Back to the future," *International Review of Financial Analysis*, vol. 95, p. 103449, 2024. https://doi.org/10.1016/j.irfa.2024.103449

[7] M. R. Keffala, "The effect of off-balance sheet activities on credit risk of African banks," *Journal of Financial Reporting and Accounting*, 2024. https://doi.org/10.1108/JFRA-07-2023-0358

[8] A. I. Hunjra, F. Muhammad, and S. Sebai, "The impact of real earnings management on corporate credit risk," *Journal of Financial Reporting and Accounting*, vol. 21, no. 5, pp. 1171-1187, 2023. https://doi.org/10.1108/JFRA-12-2021-0441

[9] E. Harb, R. El Khoury, N. Mansour, and R. Daou, "Risk management and bank performance: Evidence from the MENA region," *Journal of Financial Reporting and Accounting*, vol. 21, no. 5, pp. 974-998, 2023. https://doi.org/10.1108/JFRA-07-2021-0189

[10] A. Siddique, M. A. Khan, and Z. Khan, "The effect of credit risk management and bank-specific factors on the financial performance of the South Asian commercial banks," *Asian Journal of Accounting Research*, vol. 7, no. 2, pp. 182-194, 2022. https://doi.org/10.1108/AJAR-08-2020-0071

[11] K. Hamdi and G. Hassen, "Economic policy uncertainty effect on credit risk, lending decisions and banking performance: evidence from Tunisian listed banks," *Journal of Economic and Administrative Sciences*, vol. 38, no. 2, pp. 287-303, 2022. https://doi.org/10.1108/JEAS-09-2020-0159

[12] A. Bandyopadhyay and M. Saxena, "Interaction between credit risk, liquidity risk, and bank solvency performance: a panel study of Indian banks," *Indian Economic Review*, vol. 58, no. 2, pp. 311-328, 2023. https://doi.org/10.1007/s41775-023-00202-y

[13] A. I. Hunjra, A. Mehmood, H. P. Nguyen, and T. Tayachi, "Do firm-specific risks affect bank performance?," *International Journal of Emerging Markets*, vol. 17, no. 3, pp. 664-682, 2022. https://doi.org/10.1108/IJOEM-04-2020-0329

[14] A. I. Hunjra, I. Jebabli, S. S. Thrikawala, S. M. Alawi, and R. Mehmood, "How do corporate governance and corporate social responsibility affect credit risk?," *Research in International Business and Finance*, vol. 67, p. 102139, 2024. https://doi.org/10.1016/j.ribaf.2023.102139

[15] A. U. Rehman, S. Farid, and M. A. Naeem, "The link between corporate governance, corporate social sustainability and credit risk of Islamic bonds," *International Journal of Emerging Markets*, vol. 18, no. 12, pp. 5990-6014, 2022. https://doi.org/10.1108/IJOEM-02-2021-0210

[16] F. Barth, B. Hübel, and H. Scholz, "ESG and corporate credit spreads," *The Journal of Risk Finance*, vol. 23, no. 2, pp. 169-190, 2022. https://doi.org/10.1108/JRF-03-2021-0045

[17] C. E. Bannier, Y. Bofinger, and B. Rock, "Corporate social responsibility and credit risk," *Finance Research Letters*, vol. 44, p. 102052, 2022. https://doi.org/10.1016/j.frl.2021.102052

[18] B. A. Saleh and V. Paz, "Credit risk management and profitability: Evidence from Palestinian banks," *Banks and Bank Systems*, vol. 18, no. 3, p. 25, 2023. https://doi.org/10.21511/bbs.18(3).2023.03

[19] P. D. Nguyen, "Non-performing loans and bank profitability: evidence from Vietnam," *Macroeconomics and Finance in Emerging Market Economies*, pp. 1-21, 2024. https://doi.org/10.1080/17520843.2024.2318927

[20] H. Sutanto and M. D. Ariefianto, "The dynamic relationships of credit risk, profitability, and capital: Evidence from Indonesia," *Asian Economic and Financial Review*, vol. 14, no. 3, p. 191, 2024. https://doi.org/10.55493/5002.v14i3.5014

[21] J. J. Matos Bautista, A. B. Martinez Luna, and G. H. Ninanya Carnejo, "An analysis of profitability, capital structure, and credit risk in the Peruvian microfinance sector," 2022. https://doi.org/10.33094/ijaefa.v13i1.608

[22] Q. T. N. Kim, "The effect of agency problem and internal control on credit risk at commercial banks in Vietnam," *International Journal of Asian Business and Information Management (IJABIM)*, vol. 13, no. 1, pp. 1-22, 2022. https://doi.org/10.4018/IJABIM.305114

[23] S. Chiang, G. Kleinman, and P. Lee, "The effect of key audit matters on the association of credit risk and earnings quality," *Managerial auditing journal*, vol. 38, no. 7, pp. 997-1023, 2023. https://doi.org/10.1108/MAJ-02-2022-3465

[24] S. K. Ganguli and S. G. Deb, "Public sector bank dominated financing and earning quality: Indian evidence," *Journal of Asia Business Studies*, vol. 17, no. 1, pp. 1-14, 2021. https://doi.org/10.1108/JABS-03-2021-0116

[25] G. N. Febrianto, T. Ratnawati, and S. Riyadi, "The effect of macroeconomic factor, earning management and financial risk on firms'value: An empirical analysis of listed commercial banks," *International Journal of Economics and Finance Studies*, vol. 14, no. 2, pp. 156-170, 2022. https://doi.org/10.34109/ijefs.20220030

[26] D. Taylor, "Did diversified and less risky banks perform better amid the pandemic?," *Economics letters*, vol. 211, p. 110251, 2022. https://doi.org/10.1016/j.econlet.2021.110251

[27] Z. Shang, H. Meng, Y. Zhao, R. Xu, Y. Xu, and L. Cui, "Cross-domain credit default prediction via interpretable ensemble transfer," *International Journal of Crowd Science*, vol. 7, no. 3, pp. 106-112, 2023. https://doi.org/10.26599/IJCS.2023.9100011

[28] C. Ma, D. Cheng, M. Ge, J. Cao, J. Kou, and Z. Chen, "The impact of geographic factors on credit risk: A study of chinese commercial banks," *Economics*, vol. 18, no. 1, p. 20220086, 2024. https://doi.org/10.1515/econ-2022-0086

[29] W. Feng and M. Chen, "Application of business intelligence based on the deep neural network in credit scoring," *Security and Communication Networks*, vol. 2022, no. 1, p. 2663668, 2022. https://doi.org/10.1155/2022/2663668

[30] B. Buchanan and C. Kaya, "Foundation ownership and creditor governance: Evidence from publicly listed companies," *Journal of International Financial Markets, Institutions and Money*, vol. 93, p. 101982, 2024. https://doi.org/10.1016/j.intfin.2024.101982

[31] M. A. Altawalbeh, "corporate governance systems and financial risks: A developing country evidence," *Journal of Governance and Regulation/Volume*, vol. 12, no. 3, 2023. https://doi.org/10.22495/jgrv12i3siart5

[32] U. H. Umar, M. Abduh, and M. H. A. Besar, "Corporate governance quality index and Islamic bank risk-taking," *International Journal of Disclosure and Governance*, vol. 22, no. 1, pp. 284-303, 2025. https://doi.org/10.1057/s41310-024-00260-5

[33] F. Jiao and C. Zhang, "Lumpy investment and credit risk," *Journal of Corporate Finance*, vol. 77, p. 102293, 2022. https://doi.org/10.1016/j.jcorpfin.2022.102293

[34] G. Abdukadyrova, A. Tabyshova, M. Nazekova, J. Alymbaeva, and C. Toktosunova, "Comprehensive dynamics of banking: A systemic approach incorporating lending, investment, and capital variables," *Journal of Systems Science and Information*, vol. 12, no. 3, pp. 323–339, 2024. https://doi.org/10.21078/JSSI-2023-0148

[35] X. Liu and S. Zhang, "The impact of credit risk on labor investment efficiency," *Finance Research Letters*, vol. 61, p. 104996, 2024. https://doi.org/10.1016/j.frl.2024.104996

[36] J. Helwege and J. Jindra, "Sources of Funding in a Crisis: Evidence from Investment Banks," *The Quarterly Journal of Finance*, vol. 13, no. 03, p. 2350008, 2023. https://doi.org/10.1142/S2010139223500088

[37] D. Taylor, B. Sarpong, and E. Y. Cudjoe, "Cost-efficiency and bank profitability during health crisis," *Applied Economics Letters*, vol. 31, no. 8, pp. 732-737, 2024. https://doi.org/10.1080/13504851.2022.2146644

[38] J. Dai, N. Hu, R. Huang, and Y. Yan, "How does credit risk affect cost management strategies? Evidence on the initiation of credit default swap and sticky cost behavior," *Journal of Corporate Finance*, vol. 80, p. 102401, 2023. https://doi.org/10.1016/j.jcorpfin.2023.102401

[39] L. Gu, Y. Peng, S. A. Vigne, and Y. Wang, "Hidden costs of non-green performance? The impact of air pollution awareness on loan rates for Chinese firms," *Journal of Economic Behavior & Organization*, vol. 213, pp. 233-250, 2023. https://doi.org/10.1016/j.jebo.2023.07.014

[40] I. Ibrahim and H. Falkenbach, "Diversification and cost of public debt for REITs: evidence from the US," *Journal of Real Estate Portfolio Management*, vol. 30, no. 1, pp. 36-53, 2024. https://doi.org/10.1080/10835547.2023.2233348

[41] S. Eyalsalman, K. Alzubi, and Z. Marashdeh, "The impact of ifrs 9, liquidity risk, credit risk, and capital on banks'performance," *Journal of Governance and Regulation/Volume*, vol. 13, no. 1, 2024. https://doi.org/10.22495/jgrv13i1siart13

[42] M. B. Seitshiro and S. Govender, "Credit risk prediction with and without weights of evidence using quantitative learning models," *Cogent Economics & Finance*, vol. 12, no. 1, p. 2338971, 2024. https://doi.org/10.1080/23322039.2024.2338971

[43] X. Li *et al.*, "Does corporate social sustainability influence on business environment? Impact of corporate governance on distance to default of Sukuk issuers in Islamic banks," *International Review of Economics & Finance*, vol. 93, pp. 520-528, 2024. https://doi.org/10.1016/j.iref.2024.03.002

[44] A. Jmaii, N. Zaafouri, and H. G. Mehri, "On the measurement of corporate governance and its impact on bank profitability and credit risk: The case of Tunisian listed banks," *African Development Review*, vol. 36, no. 2, pp. 239-251, 2024. https://doi.org/10.1111/1467-8268.12748

[45] R. K. Shira, "Nexus between credit risk, liquidity risk, corporate governance and bank performance during times of crisis," *FWU Journal of Social Sciences*, vol. 17, no. 3, pp. 100–118, 2023. https://doi.org/10.51709/19951272/FALL2023/8

[46] M. Mateev and T. Nasr, "Banking system stability in the MENA region: the impact of market power and capital requirements on banks' risk-taking behavior," *International Journal of Islamic and Middle Eastern Finance and Management*, vol. 16, no. 6, pp. 1107-1140, 2023. https://doi.org/10.1108/IMEFM-05-2022-0198

[47] R. Mohammad, A. I. Nour, and S. M. Al-Atoot, "Risk and reward: unraveling the link between credit risk, governance and financial performance in banking industry," *Journal of Islamic Marketing*, 2024. https://doi.org/10.1108/JIMA-11-2023-0378

[48] C. Zara and S. Ramkumar, "Circular economy and default risk," *Journal of Financial Management, Markets and Institutions*, vol. 10, no. 01, p. 2250001, 2022. https://doi.org/10.1142/S2282717X22500013

[49] Y. Sha, "Rating manipulation and creditworthiness for platform economy: Evidence from peer-to-peer lending," *International Review of Financial Analysis*, vol. 84, p. 102393, 2022. https://doi.org/10.1016/j.irfa.2022.102393

[50] F. Neagu, L. Tatarici, F. Dragu, and A. Stamate, "Are green loans less risky? Micro-evidence from a European Emerging Economy," *Journal of Financial Stability*, vol. 70, p. 101208, 2024. https://doi.org/10.1016/j.jfs.2023.101208

[51] M. Su, Y. Duan, and Y. Cui, "The digital economy and corporate credit risk: An empirical study based on Chinese new energy enterprises," *Frontiers in Energy Research*, vol. 11, p. 1141793, 2023. https://doi.org/10.3389/fenrg.2023.1141793

[52] Q. K. Nguyen and V. C. Dang, "Does the country's institutional quality enhance the role of risk governance in preventing bank risk?," *Applied Economics Letters*, vol. 30, no. 6, pp. 850-853, 2023. https://doi.org/10.1080/13504851.2022.2026868

[53] D. Fejza, D. Nace, and O. Kulla, "The credit risk problem—a developing country case study," *Risks*, vol. 10, no. 8, p. 146, 2022. https://doi.org/10.3390/risks10080146

[54] G. Birindelli, G. Bonanno, S. Dell'Atti, and A. P. Iannuzzi, "Climate change commitment, credit risk and the country's environmental performance: Empirical evidence from a sample of international banks," *Business Strategy and the Environment*, vol. 31, no. 4, pp. 1641-1655, 2022. https://doi.org/10.1002/bse.2974

[55] L. Abdul Razak, M. H. Ibrahim, and A. Ng, "Environment, social and governance (ESG) performance and CDS spreads: the role of country sustainability," *The journal of risk finance*, vol. 24, no. 5, pp. 585-613, 2023. https://doi.org/10.1108/JRF-10-2022-0278

[56] M. L. Erdas and Z. Ezanoglu, "How do bank-specific factors impact non-performing loans: Evidence from G20 countries," *Journal of Central Banking Theory and Practice*, vol. 11, no. 2, pp. 97-122, 2022. https://doi.org/10.2478/jcbtp-2022-0015

[57] P. E. Carrillo, W. M. Doerner, and W. D. Larson, "House price markups and mortgage defaults," *Journal of Money, Credit and Banking*, vol. 55, no. 4, pp. 747-782, 2023. https://doi.org/10.1111/jmcb.12940

[58] P. Piccoli, "Valuating consumer credit portfolios," *Latin American Journal of Central Banking*, vol. 3, no. 3, p. 100067, 2022. https://doi.org/10.1016/j.latcb.2022.100067

[59] G. Marinelli, A. Nobili, and F. Palazzo, "The multiple dimensions of bank complexity: Effects on credit risk-taking," *Journal of Banking & Finance*, vol. 134, p. 106039, 2022. https://doi.org/10.1016/j.jbankfin.2020.106039

[60] M. Walker, "Good intentions in risk management and the LDI crisis," *Journal of Risk Management in Financial Institutions*, vol. 16, no. 3, pp. 228-236, 2023.

[61] S. Tatiparti, K. N. Mahajan, S. K. Reddi, H. M. Aancy, and B. Kumar, "Analyzing the financial risk factors impacting the economic benefits of the consumer electronic goods manufacturing industry in India," *Journal of Advanced Manufacturing Systems*, vol. 22, no. 04, pp. 823-847, 2023. https://doi.org/10.1142/S0219686723500385

[62] A. Qureshi and E. Lamarque, "Risk management practices and credit risk of the significantly supervised European banks," *Journal of Financial Regulation and Compliance*, vol. 31, no. 3, pp. 261-280, 2023. https://doi.org/10.1108/JFRC-12-2021-0117

[63] P. KAUR and G. KHANNA, "Asset securitisation: A contemporary practice in banking sector-an empirical study in banks of India," *Finance India*, vol. 36, no. 4, pp. 1205–1244, 2022.

[64] E. P. Dzhagityan and O. R. Mukhametov, "Three objectives of international banking regulation: Analysis of their interrelationship and issues," *Finance: Theory and Practice*, vol. 27, no. 6, pp. 79–88, 2023. https://doi.org/10.26794/2587-5671-2023-27-6-79-88

[65] T. S. Mohamed and M. M. Elgammal, "Are donor funds used effectively? An examination of Islamic and conventional microfinance institutions," *International Journal of Islamic and Middle Eastern Finance and Management*, vol. 16, no. 5, pp. 1009-1029, 2023. https://doi.org/10.1108/IMEFM-11-2021-0462

[66] N. A. Caserini and P. Pagnottoni, "Effective transfer entropy to measure information flows in credit markets," *Statistical Methods & Applications*, vol. 31, no. 4, pp. 729-757, 2022. https://doi.org/10.1007/s10260-021-00614-1

[67] K. Ahmed and G. Calice, "The effects of the EBA's stress testing framework on banks' lending," *Economic Modelling*, vol. 132, p. 106624, 2024. https://doi.org/10.1016/j.econmod.2023.106624
[68] K. Zaghdoudi, "The effects of risks on the stability of Tunisian conventional banks," *Asian Economic and Financial Review*, vol. 9, no. 3, p. 389, 2019. https://doi.org/10.18488/journal.aefr.2019.93.389.401
[69] D. Ni, M. K. Lim, X. Li, Y. Qu, and M. Yang, "Monitoring corporate credit risk with multiple data sources," *Industrial Management & Data Systems*, vol. 123, no. 2, pp. 434-450, 2023. https://doi.org/10.1108/IMDS-02-2022-0091
[70] A. Yahaya, F. Mahat, and A. Mamman, "Credit risk and bank performance: a Sub-Saharan African perspective," *Afro-Asian Journal of Finance and Accounting*, vol. 14, no. 2, pp. 170-191, 2024. https://doi.org/10.1504/AAJFA.2024.137359
[71] B. Lawrence, M. Doorasamy, and P. Sarpong, "The impact of credit risk on performance: a case of South African commercial banks," *Global Business Review*, vol. 25, no. 2_suppl, pp. S151-S164, 2024. https://doi.org/10.1177/0972150920969927
[72] A.-L. Stone, "Payday alternative loans: PAL or Foe?," *Finance Research Letters*, vol. 66, p. 105666, 2024. https://doi.org/10.1016/j.frl.2024.105666
[73] M. Salas, P. Lamothe, E. Delgado, A. L. Fernández-Miguélez, and L. Valcarce, "Determinants of nonperforming loans: A global data analysis," *Computational Economics*, vol. 64, no. 5, pp. 2695-2716, 2024. https://doi.org/10.1007/s10614-023-10543-8
[74] C. Saliba, P. Farmanesh, and S. A. Athari, "Does country risk impact the banking sectors' non-performing loans? Evidence from BRICS emerging economies," *Financial Innovation*, vol. 9, no. 1, p. 86, 2023. https://doi.org/10.1186/s40854-023-00494-2
[75] A. Džidić, I. Živko, and A. Čolak, "Macroeconomic factors of non-performing loans: the example of Bosnia and Herzegovina," *Ekonomska misao i praksa*, vol. 31, no. 2, pp. 421-438, 2022. https://doi.org/10.17818/EMIP/2022/2.4
[76] S. Heck, "Corporate bond yields and returns: a survey," *Financial Markets and Portfolio Management*, vol. 36, no. 2, pp. 179-201, 2022. https://doi.org/10.1007/s11408-021-00394-4
[77] T. Li and X. Sun, "Predicting stock market returns using aggregate credit risk," *International Review of Economics & Finance*, vol. 88, pp. 1087-1103, 2023. https://doi.org/10.1016/j.iref.2023.07.039
[78] M. Isakin and X. Pu, "Dispersion in news sentiment and corporate bond returns," *International Review of Financial Analysis*, vol. 89, p. 102761, 2023. https://doi.org/10.1016/j.irfa.2023.102761
[79] X. Yang and Y. Hu, "Default risk and stock returns: From a perspective of measurement errors," *International Review of Economics & Finance*, vol. 92, pp. 1545-1561, 2024. https://doi.org/10.1016/j.iref.2024.02.026
[80] M. Billio, M. Costola, I. Hristova, C. Latino, and L. Pelizzon, "Sustainable finance: A journey toward ESG and climate risk," *International Review of Environmental and Resource Economics*, vol. 18, no. 1-2, 2024. https://doi.org/10.1007/s11146-021-09838-0
[81] M. Billio, M. Costola, L. Pelizzon, and M. Riedel, "Buildings' energy efficiency and the probability of mortgage default: the dutch case," *Journal of Real Estate Finance and Economics*, vol. 65, no. 3, pp. 419–450, 2022.
[82] A. Cohen and N. Costanzino, "Merton's model with recovery risk," *Journal of Credit Risk*, vol. 18, no. 2, pp. 1–26, 2022. https://doi.org/10.21314/JCR.2021.020
[83] E. Ślązak and M. Skwarzec, "The effects of IFRS 9 valuation model on cost of risk in commercial banks–the impact of COVID-19," *Bank i Kredyt*, vol. 53, no. 1, pp. 47-78, 2022.
[84] S. Genc Ileri, "An investigation of the impacts of asset ratio policy on the banking system during the Covid-19 crisis in Turkey," *International Journal of Emerging Markets*, vol. 18, no. 11, pp. 5135-5154, 2023. https://doi.org/10.1108/IJOEM-05-2021-0796
[85] X. Pang, S. Wu, and S. Zhu, "Integrated stock–bond portfolio management," *Journal of Investment Strategies*, 2023. https://doi.org/10.21314/JOIS.2023.007
[86] R. Agliardi, "Green securitisation," *Journal of Sustainable Finance & Investment*, vol. 12, no. 4, pp. 1330-1345, 2022. https://doi.org/10.1080/20430795.2021.1874214
[87] P. K. Ozili, "Bank loan loss provisioning for sustainable development: the case for a sustainable or green loan loss provisioning system," *Journal of Sustainable Finance & Investment*, pp. 1-13, 2023. https://doi.org/10.1080/20430795.2022.2163847
[88] B. Abu Khalaf, A. B. Awad, and S. Ellis, "The impact of non-interest income on commercial bank profitability in the Middle East and North Africa (MENA) region," *Journal of Risk and Financial Management*, vol. 17, no. 3, p. 103, 2024. https://doi.org/10.3390/jrfm17030103
[89] A. Mehmood and F. De Luca, "How does non-interest income affect bank credit risk? Evidence before and during the COVID-19 pandemic," *Finance Research Letters*, vol. 53, p. 103657, 2023. https://doi.org/10.1016/j.frl.2023.103657
[90] T. T. Nguyen and T. T. Nguyen, "Income diversification, credit risk and bank stability: evidence from an emerging market," *Asia-Pacific Journal of Accounting & Economics*, vol. 31, no. 6, pp. 987-1007, 2024. https://doi.org/10.1080/16081625.2023.2257219
[91] J. Skoglund and W. Chen, "On the Comprehensive Balance Sheet Stress Testing and Net Interest Income Risk Attribution," *Available at SSRN 3547286*, 2020. https://doi.org/10.21314/JCR.2021.014.
[92] G. Chi, J. Xing, and A. Pan, "Default forecasting based on a novel group feature selection method for imbalanced data," *Journal of Credit Risk*, vol. 19, no. 3, 2023. https://doi.org/10.21314/JCR.2023.005
[93] D. Tokic and D. Jackson, "When a correction turns into a bear market: What explains the depth of the stock market drawdown? A discretionary global macro approach," *Journal of Asset Management*, vol. 24, no. 3, pp. 184-197, 2023. https://doi.org/10.1057/s41260-023-00306-3
[94] P. Gete, A. Tsouderou, and S. M. Wachter, "Climate risk in mortgage markets: Evidence from Hurricanes Harvey and Irma," *Real Estate Economics*, vol. 52, no. 3, pp. 660-686, 2024. https://doi.org/10.1111/1540-6229.12477
[95] E. Bartov, L. Faurel, and P. Mohanram, "The role of social media in the corporate bond market: Evidence from Twitter," *Management Science*, vol. 69, no. 9, pp. 5638-5667, 2023. https://doi.org/10.1287/mnsc.2022.4589
[96] E. I. Altman, X. Hu, and J. Yu, "Has the Evergrande debt crisis rattled Chinese capital markets? A series of event studies and their implications," *Finance Research Letters*, vol. 50, p. 103247, 2022. https://doi.org/10.1016/j.frl.2022.103247
[97] S. Nurullaily, "Analysis of Influence Financial Ratios on Sharia Banking Performance in Indonesia (Empirical Study at Bank Muamalat Indonesia, Bank Syariah Mandiri, and Bank Mega Syariah)," *Global Review of Islamic Economics and Business*, vol. 4, no. 2, pp. 135-159, 2016.
[98] E. M. Sugiyanto, "Earning management, risk profile and efficient operation in the prediction model of banking: Eviden from Indonesia," *Int J Sci Res Sci Technol*, vol. 4, no. 5, pp. 135–150, 2018.

[99] X. Zhao and H. Chen, "Research on influencing factors and transmission mechanisms of green credit risk," *Environmental Science and Pollution Research*, vol. 29, no. 59, pp. 89168-89183, 2022. https://doi.org/10.1007/s11356-022-22041-9
[100] Y. Liu, S. Li, C. Yu, and M. Lv, "Research on green supply chain finance risk identification based on two-stage deep learning," *Operations Research Perspectives*, vol. 13, p. 100311, 2024. https://doi.org/10.1016/j.orp.2024.100311
[101] D. Li and L. Li, "Research on Efficiency in Credit Risk Prediction Using Logistic-SBM Model," *Wireless Communications and Mobile Computing*, vol. 2022, no. 1, p. 5986295, 2022. https://doi.org/10.1155/2022/5986295
[102] W. Zhang and J. Wang, "Credit risk contagion in complex companies network–Empirical research based on listed agricultural companies," *Economic Analysis and Policy*, vol. 82, pp. 938-953, 2024. https://doi.org/10.1016/j.eap.2024.04.025
[103] R. Cerqueti, F. Pampurini, A. Pezzola, and A. G. Quaranta, "Dangerous liasons and hot customers for banks," *Review of Quantitative Finance and Accounting*, vol. 59, no. 1, pp. 65-89, 2022. https://doi.org/10.1007/s11156-022-01039-x
[104] X. He and M. Xiao, "Customer information disclosure and collateral loan: Evidence from Chinese listed companies," *Emerging Markets Finance and Trade*, vol. 58, no. 6, pp. 1515-1524, 2022. https://doi.org/10.1080/1540496X.2021.1898943
[105] S. Liu, G. Wei, S. Wu, and Y. Sun, "An ensemble learning based strategy for customer subdivision and credit risk characterization," *Tehnički vjesnik*, vol. 30, no. 2, pp. 426-433, 2023. https://doi.org/10.17559/TV-20221220085239
[106] H. Zhang, Z. Guo, and Y. Sun, "Analysis of bank customer default risk based on embedded microprocessor wireless communication," *Security and Communication Networks*, vol. 2022, no. 1, p. 5635152, 2022. https://doi.org/10.1155/2022/5635152
[107] F. Fhima, R. Nouira, and P. Adair, "Lending relationship, small businesses and NPLs in Tunisia," *Middle East Development Journal*, vol. 14, no. 2, pp. 337-352, 2022. https://doi.org/10.1080/17938120.2022.2146347
[108] A. Bitetto, P. Cerchiello, S. Filomeni, A. Tanda, and B. Tarantino, "Can we trust machine learning to predict the credit risk of small businesses?," *Review of Quantitative Finance and Accounting*, vol. 63, no. 3, pp. 925-954, 2024. https://doi.org/10.1007/s11156-024-01278-0
[109] G. Kozhamzharova, L. Omarbakiyev, O. Kogut, S. Zhumasheva, A. Saulembekova, and G. Abdrakhmanova, "Banking risks and lending to tourism and hotel businesses amid the COVID-19 pandemic," *Journal of Environmental Management & Tourism*, vol. 13, no. 2, pp. 427-437, 2022. https://doi.org/10.14505/jemt.v13.2(58).12
[110] M.-J. Ariza-Garzón, J. Arroyo, M.-J. Segovia-Vargas, and A. Caparrini, "Profit-sensitive machine learning classification with explanations in credit risk: The case of small businesses in peer-to-peer lending," *Electronic Commerce Research and Applications*, vol. 67, p. 101428, 2024. https://doi.org/10.1016/j.elerap.2024.101428
[111] A. Bernales, D. W. Beuermann, D. Cumming, and C. Olid, "Blue-collar crime and finance," *Journal of International Financial Markets, Institutions and Money*, vol. 83, p. 101732, 2023. https://doi.org/10.1016/j.intfin.2022.101732
[112] Y. Cao and J. Zhai, "A survey of AI in finance," *Journal of Chinese Economic and Business Studies*, vol. 20, no. 2, pp. 125-137, 2022. https://doi.org/10.1080/14765284.2022.2077632
[113] J. Ruan and R. Jiang, "Does digital inclusive finance affect the credit risk of commercial banks?," *Finance Research Letters*, vol. 62, p. 105153, 2024. https://doi.org/10.1016/j.frl.2024.105153
[114] M. Adam, R. Safitri, and T. Wahyudi, "Effect of company size, liquidity and operational efficiency on bank profitability with problem credit risk as a moderating variable at commercial banks that are listed on the Indonesia Stock Exchange," *Jurnal Perspektif Pembiayaan Dan Pembangunan Daerah*, vol. 6, no. 3, pp. 331-344, 2018.
[115] M. Yusuf and S. Surjaatmadja, "Analysis of financial performance on profitability with non performance financing as variable moderation (study at Sharia commercial bank in Indonesia period 2012–2016)," *International Journal of Economics and Financial Issues*, vol. 8, no. 4, pp. 126-132, 2018.
[116] K. Singh, "Performance and returns volatility of banks in India: public versus private sector," *Journal of Economic and Administrative Sciences*, 2024. https://doi.org/10.1108/JEAS-07-2023-0181
[117] J. Yin and H. Y. Wong, "Bond portfolio optimization with long-range dependent credits," *Journal of Industrial and Management Optimization*, vol. 19, no. 10, pp. 7090-7104, 2023. https://doi.org/10.3934/jimo.2022253
[118] D. Kim and D. Lee, "An empirical investigation of artificial intelligence instruments for forecasting credit risk in the digital age," *International Journal of Intelligent Systems and Applications in Engineering*, vol. 12, no. 4, pp. 463–469, 2024.
[119] C. Zheng, A. W. K. Cheung, and T. Cronje, "Social capital and bank liquidity hoarding," *Journal of International Financial Markets, Institutions and Money*, vol. 80, p. 101653, 2022. https://doi.org/10.1016/j.intfin.2022.101653
[120] X. Bao, M. Han, R. Lau, and X. Xu, "Corporate integrity culture and credit rating assessment," *Journal of International Financial Markets, Institutions and Money*, vol. 93, p. 102007, 2024. https://doi.org/10.1016/j.intfin.2024.102007
[121] M. Foglia, C. Di Tommaso, G.-J. Wang, and V. Pacelli, "Interconnectedness between stock and credit markets: The role of European G-SIBs in a multilayer perspective," *Journal of International Financial Markets, Institutions and Money*, vol. 91, p. 101942, 2024. https://doi.org/10.1016/j.intfin.2024.101942
[122] L. Ballester, A. González-Urteaga, and L. Shen, "Green bond issuance and credit Risk: International evidence," *Journal of International Financial Markets, Institutions and Money*, vol. 94, p. 102013, 2024. https://doi.org/10.1016/j.intfin.2024.102013
[123] B. Wu, F. Wen, Y. Zhang, and Z. J. Huang, "Climate risk and the systemic risk of banks: A global perspective," *Journal of International Financial Markets, Institutions and Money*, vol. 95, p. 102030, 2024. https://doi.org/10.1016/j.intfin.2024.102030
[124] I. Iakimenko, M. Semenova, and E. Zimin, "The more the better? Information sharing and credit risk," *Journal of International Financial Markets, Institutions and Money*, vol. 80, p. 101651, 2022. https://doi.org/10.1016/j.intfin.2022.101651
[125] G. De Novellis, P. M. Tanzi, and E. Stanghellini, "Covenant-lite agreement and credit risk: A key relationship in the leveraged loan market," *Research in International Business and Finance*, vol. 70, p. 102377, 2024. https://doi.org/10.1016/j.ribaf.2024.102377
[126] X. Liu, J. Liu, and Y. Hao, "Climate change shocks and credit risk of financial institutions: evidence from China's commercial banks," *Emerging Markets Finance and Trade*, vol. 60, no. 7, pp. 1392-1406, 2024. https://doi.org/10.1080/1540496X.2023.2278659
[127] K. Kato and N. Nakamura, "PDE-based bayesian inference of CEV dynamics for credit risk in stock prices," *Asia-Pacific Financial Markets*, vol. 31, no. 2, pp. 389-421, 2024. https://doi.org/10.1007/s10690-023-09420-z
[128] T. S. Mohamed and M. M. Elgammal, "Credit risk in Islamic microfinance institutions: The role of women, groups, and rural borrowers," *Emerging Markets Review*, vol. 54, p. 100994, 2023. https://doi.org/10.1016/j.ememar.2022.100994

[129] F. Yang and T. A. Masron, "Role of financial inclusion and digital transformation on bank credit risk," *Journal of International Financial Markets, Institutions and Money,* vol. 91, p. 101934, 2024. https://doi.org/10.1016/j.intfin.2023.101934

[130] Z. Ma, C. Ma, and Z. Wu, "Pricing commodity-linked bonds with stochastic convenience yield, interest rate and counterparty credit risk: Application of Mellin transform methods," *Review of Derivatives Research,* vol. 25, no. 1, pp. 47-91, 2022. https://doi.org/10.1007/s11147-021-09181-9

[131] A. J. Batoon and E. Rroji, "Analyzing the impact of carbon risk on firms' creditworthiness in the context of rising interest rates," *Risks,* vol. 12, no. 1, p. 16, 2024. https://doi.org/10.3390/risks12010016

[132] C. Basten and M. Mariathasan, "Interest rate pass-through and bank risk-taking under negative-rate policies with tiered remuneration of central bank reserves," *Journal of Financial Stability,* vol. 68, p. 101160, 2023. https://doi.org/10.1016/j.jfs.2023.101160

[133] T. Petr, M. Matěj, and Č. Liběna, "An alternative assessment of banks'risk in a low interest rate environment," *Экономический журнал Высшей школы экономики,* vol. 26, no. 1, pp. 104-119, 2022. https://doi.org/10.17323/1813-8691-2022-26-1-104-119

[134] V. V. Lopatenko and A. M. Karminsky, "Simulation of the bankruptcy event of companies associated with a business group," *Finance: Theory and Practice,* vol. 28, no. 3, pp. 94–108, 2024. https://doi.org/10.26794/2587-5671-2024-28-3-94-108

[135] R. Calabrese, T. Dombrowski, A. Mandel, R. K. Pace, and L. Zanin, "Impacts of extreme weather events on mortgage risks and their evolution under climate change: A case study on Florida," *European Journal of Operational Research,* vol. 314, no. 1, pp. 377-392, 2024. https://doi.org/10.1016/j.ejor.2023.11.022

[136] S. D. Aguais and L. R. Forest Jr, "Climate-change scenarios require volatility effects to imply substantial credit losses: shocks drive credit risk not changes in economic trends," *Frontiers in Climate,* vol. 5, p. 1127479, 2023. https://doi.org/10.3389/fclim.2023.1127479