INTEGRATION OF ERROR CORRECTION MODEL IN TESTING THE INTERACTION EFFECT OF CREDIT GROWTH AND BANKING RISK MANAGEMENT IN INDONESIA

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ABSTRACT

This study explores the impact of market risk, operational risk, liquidity risk, and solvency risk, while also investigating the moderating effect of credit growth on bank performance. The Error Correction Model-Eagle Granger (ECM-EG) methodology was applied to data from 2014 to 2023. Findings indicate that, in the short term, market and operational risks significantly impact bank performance. In the long term, only solvency risk does not significantly affect bank performance. Additionally, credit growth moderates the relationship between market and liquidity risks and bank performance in the short term, while in the long term, it only moderates the relationship between market risk and bank performance. Our empirical findings demonstrate that effective risk management enhances bank performance. This research provides valuable insights for policymakers, researchers, and academics in fostering a conducive environment for corporate activities.

Keywords : Financial risk management; Bank performance; Credit growth

ABSTRAK

Penelitian ini mendalami pengaruh antara risiko pasar, risiko operasional, risiko likuiditas dan risiko solvabilitas, sekaligus menyelidiki pengaruh moderasi dari pertumbuhan kredit terhadap kinerja perusahaan perbankan. Error Correction Model-Eagle Granger (ECM-EG) digunakan dalam penelitian ini dengan data dari tahun 2014-2023. Temuan menunjukkan bahwa dalam jangka pendek risiko pasar dan risiko operasional yang berpengaruh signifikan terhadap kinerja perusahaan. Sementara dalam jangka panjang hanya risiko solvabilitas yang tidak berpengaruh terhadap kinerja perbankan. Selain itu, pertumbuhan kredit memainkan peran moderasi dalam hubungan antara risiko pasar, risiko likuiditas dan kinerja perusahaan dalam jangka pendek. Sedangkan pada jangka panjang pertumbuhan kredit hanya mampu memoderasi risiko pasar terhadap kinerja perbankan. Temuan empiris kami memperlihatkan bahwa manajemen risiko yang efektif dan efisien mampu meningkatkan kinerja perbankan. Penelitian ini memberi informasi berharga kepada para pembuat kebijakan, peneliti dan akademisi untuk mendorong lingkungan yang kondusif bagi kegiatan perusahaan.

Kata kunci : Manajemen risiko keuangan; Kinerja perbankan; Pertumbuhan kredit

INTRODUCTION

The banking industry in Indonesia plays a crucial role in the national financial system and significantly contributes to economic growth by systematically and strategically allocating credit resources to various economic sectors. Recently, however,

Indonesian banks have faced numerous challenges, including various financial risks. These risks encompass credit risk, liquidity risk, solvency risk, operational risk, and market risk, all of which substantially affect the banks' ability to maintain profitability and financial stability within an ever-evolving economic landscape (Saleem & Masood, 2023).

Indonesia's rapid credit growth, which reached approximately 11% in 2022 (Financial Services Authority of Indonesia, 2022), reflects the optimism within the banking sector regarding future prospects. Nevertheless, it is important to recognize that this growth trajectory is accompanied by heightened risk, particularly when it is not supported by effective risk management practices. Additionally, interest rates set by Bank Indonesia exert considerable influence over banks' lending decisions, as rising rates increase borrowing costs, potentially reducing credit demand and negatively impacting banks' financial performance.

The Indonesian banking industry also contends with global economic uncertainty and market volatility, both of which can impact liquidity and profitability. Given this complex context, it is essential to gain a comprehensive understanding of how financial risks interact with credit growth as a moderating variable affecting banks' financial performance.

As shown in Figure 1. (look at picture), the credit growth rate from 2014 to 2022 demonstrates significant fluctuations that can impact the effectiveness of banking performance. This is influenced by the risk management strategies employed by banks. In response to economic challenges, an adaptive and innovative risk management framework is crucial to maintaining stability and sustainable credit growth. Effective risk management practices better prepare banks to navigate uncertainty and capitalize on market opportunities.

This topic is highly relevant given the critical need to gain a comprehensive understanding of the complex dynamics of financial risk within the banking industry. This study aims to provide an in-depth exploration of the impact of financial risk on the performance of banks in Indonesia, while also examining the role that credit growth can play. The findings are expected to contribute significantly to the development of more effective risk management strategies in the banking sector, thereby enhancing overall financial resilience. This research uses NIM (net interest margin) as an indicator for

market risk, BOPO (operational expense to operational revenue) as an indicator for operational risk, LDR (loan-to-deposit ratio) as an indicator for liquidity risk, CAR (capital adequacy ratio) as an indicator for solvency risk, and credit growth as a moderating factor, with ROA (return on assets) used as a measure of firm performance.

LITERATURE REVIEW

Signaling Theory

Brigham and Houston (2019) discuss signaling theory as a strategy employed by company management to assess future prospects and overall potential of an organization. It is important to recognize that all stakeholders, including investors and company managers, typically have access to the same information regarding company performance and expected prospects. This phenomenon, marked by the uniformity of information available to all stakeholders, is commonly known as symmetric information in academic literature (Malini & Yulindisti, 2022). However, in practice, information asymmetry often occurs, referring to discrepancies in knowledge and insights held by managers and investors regarding a company's operations and potential. Signaling theory emphasizes the importance of companies sending signals to attract and inform prospective investors about their financial position and future prospects (Brigham and Houston, 2019). Positive signals communicated by companies to potential investors can be effectively conveyed through systematic financial reports, which serve as formal representations of a company’s financial performance and can be further explained through various financial ratios that provide insights into operational efficiency and profitability.

Firm Performance

Firm performance relies on operational efficiency, risk mitigation, and strategic business decisions to achieve both financial and non-financial goals. As demonstrated in the study by Ali et al. (2023), firm performance encompasses various elements, such as profitability, productivity, and expansion. Enhanced profitability signals strong financial performance. In this study, profitability is used as a measure of banking performance using the return on assets (ROA) ratio. This ratio indicates the effectiveness of overall management by measuring the earnings generated relative to the assets controlled. An increasing ROA signifies improved company performance, as it reflects higher income

generation by the firm. The ROA formula is expressed as follows: ROA = (Net Income)/(Total Assets) x 100

Risk Management

According to the Financial Services Authority of Indonesia (2016), risk management is a comprehensive framework of methodologies and protocols used to identify, measure, monitor, and mitigate risks arising from a bank's overall operational activities. Bank Indonesia has implemented a risk assessment framework to evaluate the financial health of banking institutions, as outlined in Bank Indonesia Regulation No. 13/1/PBI/2011, encompassing four key dimensions: Risk Profile, Good Corporate Governance, Earnings, and Capital, known as the RGEC framework. The Risk Profile in this study includes market risk, operational risk, liquidity risk, and solvency risk (Wijayanti & Yuliana, 2020).

Market Risk

Market risk involves uncertainties arising from fluctuations in the value or price of financial instruments due to external factors, including stock market valuations, interest rates, exchange rates, and overall market conditions (Rahma Dewi, 2021). These uncertainties have the potential to impact the overall value of investments or portfolios and are generally beyond the control of individual or institutional investors. In this study, interest rate risk is used as an indicator of market risk, measured by the net interest margin (NIM) ratio. This ratio reflects management's ability to generate net interest income from productive assets (Dwitanto et al., 2023). A higher NIM leads to increased interest income from the productive assets managed by the company.

Research conducted by Al Rasyid & Sazly (2021), Saleem & Masood (2023), Bikker & Vervliet (2018), Lestari & Setianegara (2020), and Rahma Dewi (2021) indicates that NIM has a significant positive effect on firm performance. This implies that higher NIM ratios lead to greater interest income for the company, thereby enhancing its performance. However, other studies have found that NIM does not influence firm performance (Ardiyani & Yadnyana, 2023; Putri & Wibisono, 2022). Conversely, Murtini et al. (2023) and Ahmed (2018) found that NIM negatively impacts firm performance. The NIM formula is expressed as follows: NIM = (Net Interest Income)/(Average Productive Assets) x 100

H1: Market risk has a positive effect on firm performance.

Operational Risk

Operational risk arises from deficiencies or failures in internal processes, human errors, disruptions in technological systems, or unforeseen external events that significantly impact a company's overall operations (Financial Services Authority of Indonesia, 2016). In this study, operational risk is measured using the operating expense to operating income ratio (BOPO). This ratio assesses the company's operational efficiency (Rafinur et al., 2023). Lower BOPO ratios indicate better financial performance, as they reflect greater efficiency and lower operational costs.

Research by Zikri et al. (2023), Lestari & Setianegara (2020), Putra & Hasibuan (2021), Daulay et al. (2023), and Malini & Widayatmoko (2021) found that BOPO has a significant negative impact on firm performance, indicating that an increase in the BOPO ratio will reduce company performance. In contrast, studies by Harsono (2021) and Iklin (2023) revealed that BOPO has a significant positive effect on firm performance, while Putri & Wibisono (2022) found that BOPO does not directly influence firm performance. The formula for BOPO is as follows: BOPO = (Operating Cost)/(Operating Income) x 100

H2: Operational risk has a negative effect on firm performance.

Liquidity Risk

Liquidity risk pertains to challenges arising from a company's inability to meet its financial obligations through various cash flows or liquid assets while safeguarding its operations and financial health (Financial Services Authority of Indonesia, 2016). This study measures liquidity risk using the loan-to-deposit ratio (LDR). This ratio indicates the company's capacity to generate revenue through credit distribution compared to total deposits (Baasalem, 2021).

Research conducted by Ardiyani & Yadnyana (2023), Jayanti & Sartika (2021), and Zikri et al. (2023) found that LDR has a significant positive effect on firm performance, indicating that an increase in the LDR ratio enhances company performance. However, studies by Rotinsulu et al. (2023), Lestari & Setianegara (2020), Rahma Dewi (2021), Iklin (2023), and Putra & Hasibuan (2021) found that LDR does not influence firm performance. The formula for LDR is as follows: LDR = Credit/DPK x 100

H3: Liquidity risk has a positive effect on firm performance.

Solvency Risk

Solvency risk is the risk a company faces if its asset value is insufficient or lower than its liabilities (Horobet et al., 2021). This study uses the capital adequacy ratio (CAR) to assess solvency risk. CAR indicates the bank's ability to finance its risk-weighted assets through its capital (Yulianingsih et al., 2024). A higher CAR implies that the bank has more capital available to support its operational activities.

Research by Harsono (2021) and Murtini et al. (2023) found that CAR risk has a significant negative impact on firm performance, indicating that a higher CAR ratio tends to decrease company performance. However, studies by Zikri et al. (2023), Hussain & Rasheed (2022), and Iklin (2023) demonstrated that CAR has a significant positive effect on firm performance, while Budhiarjo et al. (2022), Rahma Dewi (2021), Rotinsulu et al. (2023), and Rafinur et al. (2023) found that CAR does not influence firm performance. The formula for CAR is as follows: CAR = Capital/ATMR x 100

H4: Solvency risk has a positive effect on firm performance.

Credit Growth

Credit growth is a critical indicator of a country's economic activity. According to Cecchetti & Kharroubi (2018), credit growth refers to a significant and measurable increase in the total volume of loans extended by companies to borrowers over a specific period. Banks often increase lending volumes to maximize potential interest income, with the expectation that these strategic decisions will lead to overall revenue growth, thus supporting financial performance and sustainability. While sustainable credit growth can drive economic growth, it also carries risks if not balanced with effective risk management. Healthy and controlled credit growth can increase company revenue, thereby contributing to enhanced performance. Therefore, it is essential for banks to establish sustainable strategies for credit growth that are not only profitable in the long term but also incorporate robust risk management practices to mitigate potential adverse outcomes. The formula for calculating credit growth is as follows: CG = $(Credit_t – Credit_{t-1})/(Credit_{t-1})$ x 100

H5: Credit growth moderates the effect of market risk, operational risk, and solvency risk on firm performance.

METHODS

Method is a method of work that can be used to obtain something. While the research method can be interpreted as a work procedure in the research process, both in searching for data or disclosing existing phenomena (Zulkarnaen, W., et al., 2020:229). This quantitative study uses secondary data in the form of time series data from national reviews conducted by the Financial Services Authority (OJK), presented as monthly averages over the 2014–2023 period. The study population consists of Indonesian banking firms listed with OJK from 2014 to 2023, with 105 banking companies and monthly observations totaling 12 months. This study's sample comprises the full set of observations over the 2014–2023 period, totaling 120 observations. Data analysis in this study employs the Error Correction Model–Eagle Granger (ECM-EG) with EViews 12 software. The study's variables include market risk as an independent variable measured by net interest margin (NIM), operational risk as an independent variable measured by BOPO (operating expense to operating income ratio), liquidity risk as an independent variable measured by loan-to-deposit ratio (LDR), and solvency risk as an independent variable measured by capital adequacy ratio (CAR). Credit growth serves as a moderating variable, while firm performance, the dependent variable, is measured by return on assets (ROA).

RESULTS AND DISCUSSION

Unit Root Test

Table 1 shows that BOPO and ROA are stationary at the level at a 5% significance level. NIM, BOPO, LDR, CAR, and CG are stationary at the 1st difference level, as indicated by unit root probabilities of less than 1%.

Cointegration Test

Table 2 shows that the residual from the long-term equation is stationary at the level with a 1% significance level, indicating long-term equilibrium among variables, allowing residuals to be used in the ECM-EG short-term model.

The regression models applied are as follows:

$$\Delta ROA_t = \beta_0 + \beta_1 DNIM_t + \beta_2 DBOPO_t + \beta_3 DLDR_t + \beta_4 DCAR_t + \beta_5 NIM_{t-1} + \beta_6 BOPO_{t-1} + \beta_7 LDR_{t-1} + \beta_8 CAR_{t-1} + \varepsilon_t \quad \text{.....(1)}$$

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$$\Delta ROA_t = \beta_0 + \beta_1 DNIM_t + \beta_2 DBOPO_t + \beta_3 DLDR_t + \beta_4 DCAR_t + \beta_5 D(NIM_t.CG_t) + \beta_6 D(BOPO_t.CG_t) + \beta_7 D(LDR_t.CG_t) + \beta_8 D(CAR_t.CG_t) + \beta_9 NIM_{t-1} + \beta_{10} BOPO_{t-1} + \beta_{11} LDR_{t-1} + \beta_{12} CAR_{t-1} + \beta_{13} D(NIM_{t-1}.CG_{t-1}) + \beta_{14} D(BOPO_{t-1}.CG_{t-1}) + \beta_{15} D(LDR_{t-1}.CG_{t-1}) + \beta_{16} D(CAR_{t-1}.CG_{t-1}) + \beta_{17} ECT + \varepsilon_t \quad (2)$$

Description:

ROA	= Return On Assets
NIM	= Net Interest Margin
BOPO	= Operating Expense to Operating Income Ratio
LDR	= Loan Deposit Ratio
CAR	= Capital Adequacy Rasio
CG	= Credit Growth
ECT	= Error Correctiom Term
ε	= Residual

Table 3, the results for Model 1 show that NIM and BOPO have a significant positive impact on ROA, while LDR and CAR do not. The F-test indicates a significance level of <0.01, meaning that NIM, BOPO, LDR, and CAR jointly affect ROA, with an Adjusted R Square of 11.91%.

In Model 2, credit growth explains the influence of NIM and LDR on ROA. The model's significance level remains <0.01, and the coefficient of determination rises from 11.91% to 40.81% with the inclusion of CG. However, credit growth does not moderate the effects of BOPO and CAR on ROA, as shown by p-values >10%.

The residual (ECT) significantly influences the speed at which equilibrium is restored, with a 1% significance level and a negative coefficient. This aligns with ECT theory, where a valid model specification should yield a significant negative result (Sumantyo & Sutanto, 2019).

Table 4, the result for Model 1, only CAR does not affect ROA. The F-test indicates <0.01 significance, confirming that NIM, BOPO, LDR, and CAR jointly influence ROA, with an Adjusted R Square of 52.84%. In Model 2, only NIM can be moderated by credit growth in relation to ROA. Including CG increases the model's explanatory power from 52.84% to 56.23%.

In the short term, H1 is accepted, as market risk positively affects banking performance. This aligns with findings from Al Rasyid & Sazly (2021), Saleem & Masood (2023), Bikker & Vervliet (2018), and Lestari & Setianegara (2020), which show that high interest rates enhance interest income from productive assets, thereby

improving banking performance. In the long term, however, market risk negatively impacts banking performance, as higher interest rates reduce credit demand, lowering profitability and affecting banking performance.

In the short term, operational risk positively impacts banking performance, thus rejecting H2. This aligns with Harsono (2021) and Iklin (2023), suggesting that banks increase operational costs alongside income growth through business expansion, product innovation, and digitalization. However, in the long term, operational risk negatively impacts performance, indicating efficient resource management.

Liquidity risk has no short-term impact on banking performance, thus rejecting H3, consistent with previous research by Rotinsulu et al. (2023), Lestari & Setianegara (2020), and others. However, long-term effects show a positive impact, suggesting that greater lending improves profitability.

Both short- and long-term results consistently reject H4, as solvency risk does not impact firm performance. This supports findings by Budhiarjo et al. (2022) and others, indicating that banks cannot optimize available capital to increase profitability.

Credit growth in the short term only moderates the effects of market and liquidity risks on banking performance, weakening market risk's influence and strengthening liquidity risk's effect. Long-term credit growth weakens market risk's effect on banking performance.

CONCLUSION

The study finds no short-term impact of liquidity and solvency risks on banking performance, with only market and operational risks influencing bank performance. Long-term results show that only solvency risk does not impact banking performance. This highlights the importance of managing market, operational, and liquidity risks to improve financial performance in banking. However, increased credit growth may elevate market risk levels. Future research should incorporate additional variables and apply advanced time-series analysis techniques for more accurate results. Expanding the scope of future research to explore risk management practices further is also recommended.

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PICTURE AND TABLE

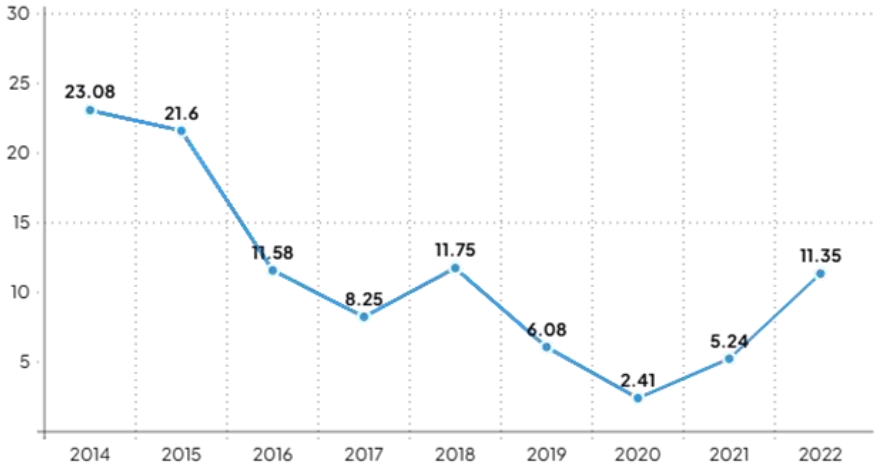

Figure 1. Annual Banking Credit Growth Rate
Source: SPI OJK, processed

Table 1. Unit Root Test Results

Variable	Unit Root			
	Level		1st Difference	
	ADF	Prob.	ADF	Prob.
NIM	-2.2639	0.1854	-12.5261	0.0000***
BOPO	-3.3818	0.0135**	-12.1945	0.0000***
LDR	-0.8430	0.8028	-9.2031	0.0000***
CAR	-0.5645	0.8731	-9.8173	0.0000***
CG	-1.5957	0.4813	-7.2196	0.0000***
ROA	-3.2669	0.0189**	-1.5208	0.5194

Information: *** sig. 1% ; ** sig. 5% ; * sig. 10%

Table 2. Cointegration Test Results at Level

Variable	Cointegration	
	ADF	Prob.
ECT	-5.8468	0.0000***

Table 3. ECM-EG Short-Term Test Results

Model	Model 1		Model 2	
	Coefficient	Prob.	Coefficient	Prob.
(Constant)	-0.0033	0.7831	-0.0008	0.9357
D(NIM)	0.3303	0.0002***	0.2146	0.0091***
D(BOPO)	0.0184	0.0090***	0.0030	0.6554
D(LDR)	0.0197	0.1852	0.0296	0.0278**
D(CAR)	0.0306	0.3241	0.0079	0.7784
D(CG)			0.1823	0.4728
D(NIM.CG)			-0.0340	0.0317**
D(BOPO.CG)			-0.0026	0.2222
D(LDR.CG)			0.0041	0.0173**
D(CAR.CG)			-0.0085	0.1077
ECT			-0.1955	0.0007***
F Statistic	4.9897		9.1375	
Prob(F Statistic)	0.0009***		0.0000***	
Adjusted R Square	0.1191		0.4081	

Dependent Variable = ROA ; *** sig. 1% ; ** sig. 5% ; * sig. 10%
Source: Processed,2024

Table 4. ECM-EG Long-Term Test Results

Model	Model 1		Model 2	
	Coefficient	Prob.	Coefficient	Prob.
(Constant)	6.4055	0.0000	6.4079	0.0000
NIM	-0.1259	0.0167**	-0.0459	0.4337
BOPO	-0.0647	0.0000***	-0.0662	0.0000***
LDR	0.0212	0.0001***	0.0183	0.0046***
CAR	0.0003	0.9782	0.0003	0.9855
CG			0.5431	0.4553
NIM.CG			-0.1005	0.0243**
BOPO.CG			-0.0058	0.3037
LDR.CG			0.0043	0.3931
CAR.CG			0.0000	0.9972
F Statistic	34.3381		17.9884	
Prob(F Statistic)	0.0000***		0.0000***	
Adjusted R Square	0.5284		0.5623	

Dependent Variable = ROA ; *** sig. 1% ; ** sig. 5% ; * sig. 10%
Source: Processed,2024