International Journal of Financial Systems

Volume 3, Number 2 (2025)
July-December 2025
Page : 111-128
P-ISSN : 3025-8480
E-ISSN : 3025-8537
DOI : https://doi.org/10.61459/ijfs.v3i2.88

Article history
Received : October 22, 2025
Revised : November 18, 2025
Accepted : December 7, 2025
Available online : December 31, 2025

Measuring the Financial Resilience of the Indonesian Banking Sector under Geopolitical Uncertainty Using Panel Vector Autoregression (PVAR)

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ABSTRACT

Geopolitical tensions can affect the stability of companies, including Indonesia's banking sector. Geopolitical risk, as measured by the Geopolitical Risk Index (GRI), is an external factor that reflects economic and political uncertainty arising from global adverse events. This study aims to understand the dynamics of the interaction of geopolitical risk on the stability of banking indicators, including ROA, ROE, CAR, and NPL. Furthermore, this study aims to assess financial resilience in the banking sector amid geopolitical tensions. Sampling was conducted across banking categories, including KBMI 4, KBMI 3, Islamic banks, and regional development banks. The data used are quarterly panel time series from 2015 to 2024. The analysis was conducted using Panel Vector Autoregression (PVAR) with the Generalised Method of Moments (GMM) approach. The results show that the impact of the GRI shock on banking indicators is short to medium-term, with the most significant effects on profitability (ROA, ROE) and credit quality (NPL). The results confirm that global geopolitical pressures play a dominant role in explaining fluctuations in bank indicators in Indonesia, particularly capital efficiency and capital structure. Based on the dynamics of these interactions, Bank A, Bank B, Bank D, and Bank E are classified as more resilient, and Bank C, Bank F, Bank G, and Bank H are classified as less resilient. More resilient banks are characterised by a low GRI impact on ROA and CAR, and a quick return to stability, while less resilient banks have a high GRI impact on ROE and CAR.

Keywords: Geopolitical Risk, Banking Resilience, Profitability, Capital Adequacy, Panel VAR

JEL Classification: G21, E44, C33

1 Introduction

The World Bank projects global growth for 2025 to remain stable as inflation approaches target levels. World trade is expected to recover in 2024, driven by increased goods trade in developing countries, but overall growth remains weak, hindering sustainable development. This situation is driven by political uncertainty, adverse trade policies, and persistent inflation in both advanced and developing countries. Growth prospects also vary across regions, influenced by geopolitical tensions and country-specific challenges (Geopolitical Futures, 2025). For instance, Russia's invasion of Ukraine since February 24, 2022, is still ongoing, causing many casualties, territorial damage, a refugee crisis, and impacting global health, security, and the economy (Džogović & Šabotić, 2024). Geopolitical tensions are not limited to the Ukraine conflict. Commercial and geopolitical tensions between China and the USA have risen during the Trump administration and are unlikely to decrease (Institute for International Trade, 2023). In addition, instability in the Middle East affects production, trade flows, and overall economic performance (Geopolitical Futures, 2025).

Geopolitical tensions impact the financial sector through various channels: increased risk premiums, unstable capital flows, and exchange rate fluctuations (International Monetary Fund. Monetary & Capital Markets Department, 2025). Developing countries tend to be more vulnerable to these pressures due to their limited domestic financial buffers and high dependence on external financing. According to the Global Financial Stability Report 2023, governments should focus on monitoring, managing, and mitigating financial stability risks caused by rising geopolitical tensions. To reduce geopolitical risks, financial institutions require enough capital and liquidity buffers, as well as a robust global financial safety net. To maintain global macro-financial stability, multilateral efforts should focus on reducing geopolitical tensions and preventing economic fragmentation (International Monetary Fund, 2023).

In the context of Indonesia, Bank Indonesia emphasises that one perceived source of shock that could disrupt Indonesia's financial system is the ongoing geopolitical conflict, which can increase global financial market volatility and lead to capital outflows. This condition has the potential to weaken the exchange rate, increase credit and market risks, and affect corporate performance, especially those with high import content (Bank Indonesia, 2024). Therefore, the government needs to strive for financial stability, given that foreign investors' share in Indonesia remains quite large at 43.04%. This heavy reliance on foreign capital makes the domestic financial market vulnerable to global shocks, which can trigger capital outflows and threaten the stability of the national financial system (Kustodian Sentral Efek Indonesia, 2024).

Indonesia's regulator is enhancing risk and negative shock monitoring by valuing banking, non-bank, and corporate institutions. The aim is to establish policies, regulate institutions, and establish supervision rules, while also enhancing financial system stability and resilience (Vinus & Kusairi, 2017). However, the Indonesian financial sector remains heavily reliant on banking, which holds more than 70% of the national financial system's total assets (Badan Pusat Statistik, 2024). This means that if an external shock occurs, the banking system becomes the main transmission channel for economic instability. Past experiences show that global crises, such as the 2008 subprime mortgage crisis and the COVID-19 pandemic, have had a significant impact on the Indonesian banking sector. The government must place great importance on supervision and risk mitigation in the banking sector, as it is the frontline in maintaining systemic stability.

In this context, measuring the banking sector's resilience to external shocks is crucial. Without a clear understanding of the bank's capacity to withstand global uncertainty, regulators will struggle to formulate accurate and targeted policies. The stability of the banking system depends on the central bank's response through both macro and micro-prudential monetary policy. For example, consider profitability, solvency, and credit risk. Jaelani (2023) emphasises that Return on Assets (ROA) and Return on Equity (ROE) measure the bank's ability to generate profit; the Capital Adequacy Ratio (CAR) indicates the sufficiency of capital to cover asset risks; and the Non-Performing Loan (NPL) assesses the proportion of problematic loans to total loans. All three are important for measuring the bank's health, as they provide a comprehensive picture of profitability, capital resilience, asset quality, and credit risk management.

The Financial Services Authority (OJK) and Bank Indonesia (BI), as financial supervisory and regulatory institutions, need to formulate data-driven and risk-based mitigation policies. This is becoming increasingly important as business actors and the global financial sector are increasingly factoring geopolitical risks into their decision-making.

Based on the background, the aims of this study are as follows: (1) To understand the dynamics of interaction between banking indicators (ROA, ROE, CAR, NPL) in response to geopolitical shocks, (2) To map which banks are classified as more resilient and which are less resilient. By providing an empirical overview of the potential vulnerability of the banking system to external shocks, this study is expected to serve as a reference for policymakers in designing effective and adaptive mitigation policies in response to global dynamics. Beyond these practical implications, the study offers a novel contribution by integrating bank performance and resilience indicators into a Panel Vector Autoregression (PVAR) model to capture the dynamic relationships between banking ratios in the context of geopolitical shocks—an approach still rarely used in Indonesian literature. The study also provides new empirical evidence on how the Geopolitical Risk Index (GRI) is transmitted to banking stability at the micro level, thereby expanding theoretical understanding of shock-response mechanisms in Indonesia. Thus, this study not only fills a gap in financial stability research but also strengthens the foundation for developing a more comprehensive risk analysis framework.

2 Literature Review

2.1 Geopolitical Risk and Global Economic Uncertainty

Geopolitical risk (GRI) has become a crucial determinant of global economic dynamics. Caldara & Lacoviello (2022) introduced the Geopolitical Risk Index (GRI), which measures the threat, realisation, and amplification of events such as war, terrorism, and interstate tensions that disrupt the stability of international relations. This index is compiled from numerous international news sources. It has proven effective in capturing geopolitical pressures that impact investment, job creation, and even the potential for a global economic slowdown. The GRI triggers direct and indirect impacts on financial activity, including increased uncertainty, higher financing costs, and decreased investor confidence.

Research shows that even geopolitical threats that have not yet escalated to open conflict can generate financial stress comparable to that of actual war. In addition to influencing the macroeconomy, the GRI also shapes corporate behaviour. Nguyen et al. (2025) found

that US companies delay investment expansion when the GRI increases, while Adra et al. (2023) observed a decrease in corporate activities, such as share buybacks, during periods of geopolitical tension. On the other hand, companies with large cash reserves, Le & Tran (2021) or strong political connections, Alam et al., (2023) tend to be better able to withstand geopolitical pressures.

2.2 Geopolitical Risk and Banking Sector Vulnerability

Geopolitical risk dynamics directly impact the banking sector through the transmission of market volatility, macroeconomic uncertainty, and changes in borrower behaviour. Several studies have shown that geopolitical risk tends to reduce banking stability, suggesting that smaller, less diversified banks are more vulnerable to geopolitical shocks due to heightened market volatility and disruptions in capital flows (Phan et al., 2022). Wang et al. (2025) added that GRI increases systemic risk by increasing asset risk and the potential for price bubbles.

Geopolitical risk also impacts bank operations. Nguyen & Thuy (2023) found that banks implemented stricter credit standards, increased lending rates, and reduced exposure to high-risk segments when geopolitical uncertainty increased. Demir & Danisman (2021) noted that while total credit volume did not necessarily decline, household credit was significantly affected due to the increased risk of default.

These findings are consistent with regional studies. In Indonesia, Nadia et al. (2024) found that geopolitical uncertainty weakened credit growth in both the short- and medium-term, while Andriani et al. (2024) confirmed the interaction between GRI, credit risk, and financial risk in reducing banking performance in ASEAN. Bilgin et al. (2021) showed that Islamic banks tend to be more resilient to long-term stress, raising discussions about differences in resilience based on banking business models.

2.3 Empirical Evidence on Geopolitical Risk, Bank Stability, and Credit Performance

Cross-country research shows a consistent pattern: higher geopolitical risk lowers bank stability, though the impact is heterogeneous. Research by Phan et al. (2022) found that increasing GRI reduces bank stability, but banks with large capital and high asset scale can mitigate the negative impact. Fianto & Ibrahim (2025) report that in the GCC, Islamic banks are more resistant to global risks but vulnerable to local risks, while smaller banks with low liquidity experience the most tremendous stress.

However, empirical evidence does not always point in a uniform direction. Research by Vuong et al. (2024) shows that while macroeconomic uncertainty generally undermines banking stability in the ASEAN region, geopolitical risk is positively associated with bank resilience, suggesting unique dynamics in the ASEAN banking sector's response to external shocks. This finding suggests that ASEAN's economic structure and institutional characteristics may provide some protection against geopolitical stress, differing from patterns seen in other regions.

Alsagr & Almazor (2020) assert that banking-sector profitability in emerging markets declines as the GRI increases, with oil revenues mitigating the impact in oil-dependent countries. Shabir et al. (2023) show that economic and geopolitical uncertainty increases bank risk, but CEO and board power moderate the adverse effects. In India, Kumar & Rao (2024) find that the GRI significantly impacts foreign exchange, bond, equity, and banking markets, with the transmission of shocks varying across market conditions.

Other research highlights institutional stability. De Sybel (2024) showed that

geopolitical instability increases the risk of global financial conflict and requires financial institutions to integrate geopolitics into their compliance frameworks. Meanwhile, Sivaprasad et al. (2025) found minimal evidence of geopolitical risk transmission to banks in post-Soviet countries, indicating structural resilience.

2.4 Geopolitical Risk, Financial Markets, and Systemic Transmission

Research also shows that GRI transmission is not limited to the banking sector but also extends to financial markets. Luca et al. (2025) found that credit and volatility are the main channels through which geopolitical factors affect developed countries. NguyenHuu & Orsal (2024) showed that developing countries experience significant stress in foreign exchange, banking, and debt markets when the GRI rises. A study by Bossman & Gubareva (2023) showed that the impact of the GRI on stock markets is asymmetric across countries, with different responses in bullish and bearish conditions.

On the other hand, several studies emphasise the dynamics of resilience. Kudrna & Gabor (2013) showed that unilateral policies favouring domestic banks during the European financial crisis weakened the resilience of foreign banks and underscore the need for regulatory reform in the European Union. Nițescu et al. (2025) assert that the transmission of geopolitical shocks yields diverse regional responses and requires policy recalibration. Ruza et al. (2019) introduced a new framework for measuring banking resilience in developed countries, providing a technical basis for developing an early warning system for geopolitical risks.

In this study, global shocks are measured using the Geopolitical Risk Index introduced by Dario Caldara and Matteo Iacoviello in their landmark paper "Measuring Geopolitical Risk", published in the American Economic Review (2022) . Geopolitical risk is described as the threat, realisation, and amplification of adverse events such as war, terrorism, and tensions between countries and political players that disrupt the flow of peaceful international relations (Caldara & Lacoviello, 2022).

ROA, ROE, CAR, and NPL are closely related to the Geopolitical Risk Index (GRI) because all three can reflect a bank's resilience to external shocks. ROA shows the bank's ability to maintain profitability amid global uncertainty, while CAR indicates the capital's resilience to absorb risks amid geopolitical turmoil that increases pressure on financial markets. On the other hand, NPL provides an overview of the impact of geopolitical risk on asset quality and the level of non-performing loans, particularly during an economic slowdown driven by international uncertainty. Thus, analysing ROE, ROA, CAR, NPL, and GRI is important for assessing the banking sector's resilience to global shocks.

3 Research Methods

This study uses a quantitative, causal-associative approach to analyze the causal relationship between global risk variables and banking performance. The data used are secondary and come from two primary sources, namely the Geopolitical Risk Index (GRI) obtained from the MacroMicro website as a global external indicator, and ROE, ROA, CAR, and NPL data taken from the financial reports of related banks through official publications of the Financial Services Authority (OJK). The data used are quarterly panel time series from 2015 to 2024. This is based on the financial reports of Indonesian banks, which are generally published quarterly. At the same time, monthly data is not always available in a timely or consistent manner, which can introduce noise into the model. The research sample consists of eight banks grouped into four categories: KBMI 4, KBMI 3,

Islamic banks, and Regional Development Banks (BPD). To maintain the confidentiality of institutional identities, each bank is identified anonymously using the codes Bank A–Bank H. To ensure a robust and relevant sample, the sample selection is based on the following reasons: KBMI 4 (Bank A and B) are large national banks with high capitalisation and profitability; KBMI 3 (Bank C and D) are medium-sized banks with significant roles in the corporate and retail segments; Islamic banks (Bank E and F) represent a growing share of the Islamic banking market and are among the largest Islamic banks in Indonesia; and Regional Banks (Bank G and H) focus on financing regional banks and MSMEs.

The analysis was conducted using a Panel Vector Autoregression (Panel VAR) model to capture the dynamics of interdependence between variables over a specific period. The PVAR model is a development of the VAR model, based on dynamic equilibrium theory, and is designed to analyse interactions among endogenous variables in panel data (Liu, 2021). Compared to VAR, which has the limitation of exponentially increasing parameter counts as the number of variables increases, PVAR uses a panel data structure, yielding more observations and more effective parameter estimation (Yang et al., 2023). In the PVAR method, all variables are treated as endogenous, allowing for simultaneous, mutually influencing relationships within the model (Canova & Ciccarelli, 2013). The Panel Vector Autoregression (PVAR) method in the context of geopolitical risks and dynamics has been used in several previous studies, such as a study of the impact of geopolitics on the crude oil energy supply system in Italy (Desogus et al., 2023), a study of the influence of geopolitical risk on energy security by emphasising endogenous interrelations between variables (Zhang et al., 2023), and a study of the relationship between geopolitical risk, economic policy uncertainty, and banking stability in BRICS countries (Olalere & Mukuddem-Petersen, 2024). These findings demonstrate the relevance of the PVAR method and support its use in this study, which examines the influence of geopolitical factors on banking performance. In general form, the Panel VAR model can be written as follows:

$$Y_{i,t} = \beta_1 Y_{i,t-1} + \beta_2 Y_{i,t-2} + \cdots + \beta_p Y_{i,t-p} + \mu_i + \lambda_t + \epsilon_{i,t} \quad (1)$$

where Y_{it} is a vector of endogenous variables (e.g. ROA, ROE, CAR, NPL, and GRI) for the *i*-th unit at time t, β_p is the coefficient matrix for *p*-th lag, μ_i denotes individual (bank) fixed effect, and λ_t denotes a time fixed effect (a standard global shock) (Holtz-Eakin et al., 1988). This study does not explicitly include macroeconomic variables, as the primary focus is on the impact of geopolitical risk on banking performance and internal stability. The ROA, ROE, CAR, and NPL indicators were chosen because they represent key dimensions of bank health: profitability, capital resilience, and asset quality. Furthermore, macroeconomic variables are influenced by monetary and fiscal policies that respond to geopolitical dynamics, potentially biasing estimates of the net impact of geopolitical risk on the banking sector. Model estimation using the Generalised Method of Moments (GMM), which aims to address potential endogeneity between variables and ensure consistent, efficient estimation (Love & Zicchino, 2006). Furthermore, GMM allows the use of internal instruments (lags of the variables), making it suitable for panel data with balanced or semi-balanced time-series and cross-section dimensions. In further analysis, this model can be extended using the Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) to determine the dynamic response of one variable to shocks in other variables, as well as the proportion of error variance explained by each shock.

As part of the robustness test, this study applies two important procedures. First,

a data stationarity test is conducted using the Augmented Dickey-Fuller Test (ADF) to determine the stationarity of each variable (Dickey & Fuller, 1981). If a variable is found to be non-stationary and not cointegrated, it is transformed (by first differencing) to meet the assumptions of the PVAR analysis. Second, because some estimates use the GMM estimator to address endogeneity, this study conducts the Sargan–Hansen test (Andrews & Lu, 2001). This test aims to determine whether the instruments used in GMM estimation are valid, meaning there is no correlation between the instruments and the residuals. The relevance of the Panel VAR model in this study is crucial because it can empirically and simultaneously address two main objectives. First, by utilising the IRF and FEVD, the dynamic response patterns of each banking indicator to GRI shocks over several future time horizons can be identified, for example, the short- and long-term responses of CAR and NPL to geopolitical fluctuations. Second, the FEVD approach allows mapping the extent of GRI's contribution to explaining the variation in each banking variable, thereby enabling the identification of banks classified as more or less resilient to external shocks. Thus, this model provides a robust statistical and economic overview for analysing complex multivariate interactions in the financial system and provides a credible quantitative basis for policy recommendations to mitigate systemic risk in the face of global dynamics.

4 Results and Analysis

4.1 Results

ROA, ROE, CAR, and NPL are the leading indicators used to evaluate a company's performance, including in banking. ROA and ROE reflect a bank's ability to generate profits from assets and equity. CAR indicates the capital strength to cover risks, and NPL measures the level of non-performing loans. These four indicators complement each other in assessing a bank's overall financial stability and performance. The characteristics of the ROA, ROE, CAR, and NPL values of these eight banks are presented in the boxplot in Figure 1.

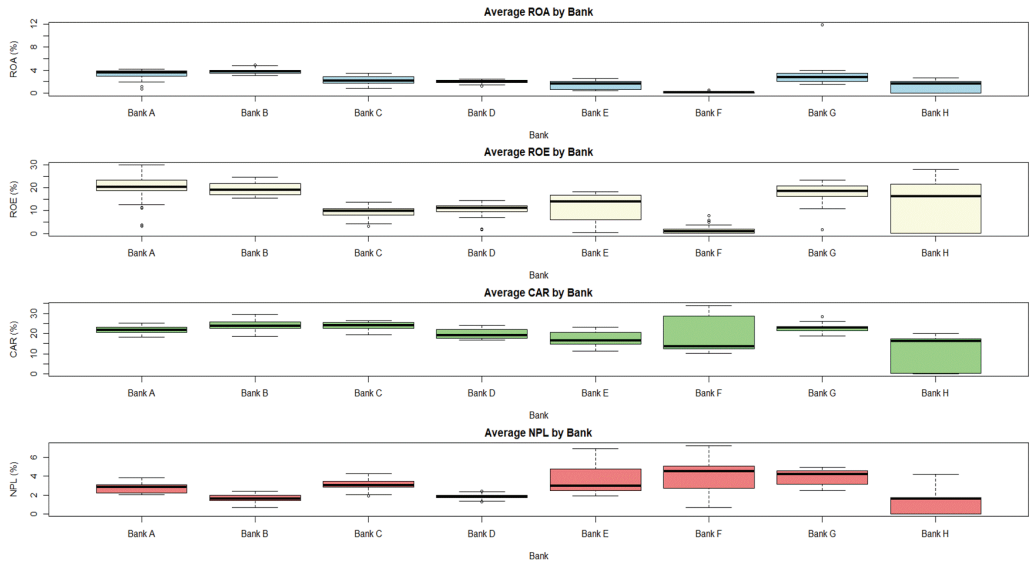

Figure 1. Distribution of ROA, ROE, CAR, and NPL values for each bank

For the ROA variable, Bank B has the highest median among the seven other banks, at around 4%, with a stable distribution of data in the boxplot. Similar to Bank B, the ROA values of Bank A and Bank G are relatively high and stable. Therefore, these three banks demonstrate efficiency in generating profits from their assets. Meanwhile, Bank F has the lowest ROA value and indicates very weak profitability. This ROA value is in line with each bank's ROE. Based on the boxplot, it is known that Bank A and Bank B have high and stable ROE values (ranging from 18–25%). This certainly indicates a strong return on equity. Similarly, Bank F showed the lowest ROE, further indicating weak profitability. A high CAR value can be an advantage if accompanied by efficiency and profitability, as is the case with Bank B and Bank C. These two banks have the highest CAR values, followed by good ROA and ROE values. Bank F's CAR (ranging from 25–30%) is also high, indicating substantial capital. However, the high CAR is not accompanied by poor ROA and ROE performance, which could also indicate underutilised capital. Meanwhile, regarding the NPL variable, Bank B and Bank D have the lowest NPLs, indicating excellent credit quality. Bank E and Bank F have the highest NPL rates (over 3.5%), indicating a high risk of non-performing loans at both banks.

Before model estimation, all variable data, including GRI, ROA, ROE, CAR, and NPL, were tested for stationarity to ensure they met the key requirement for time-series and panel VAR modelling. The stationarity test used the Augmented Dickey-Fuller (ADF) test. Table 1 presents the results of the stationarity test for the Geopolitical Risk Index (GRI), ROA, ROE, CAR, and NPL variables. At the 5% significance level, the GRI (p-value = 0.01), ROA (0.042), and NPL (0.034) variables are stationary, as their p-values are below 0.05. Meanwhile, the ROE (0.098) and CAR (0.089) variables are not stationary at the level, as their p-values exceed 0.05. However, after the first difference, all variables show p-values <0.01. This indicates that all variables become stationary at the first differentiation. Thus, it can be concluded that the data in this study are stationary at the first order of integration (I(1)), making it suitable for further analysis.

Table 1. Results of Stationarity Test

Stationarity test	GRI	ROA	ROE	CAR	NPL
Level	0.01	0.042	0.098	0.089	0.034
1st difference	<0.01	<0.01	<0.01	<0.01	<0.01

Source: Data processed by the author, 2025

After the stationarity assumption was met, a Panel VAR was used to test the dynamic relationships among variables. Estimation was performed using the Generalised Method of Moments (GMM) approach to address potential simultaneity and endogeneity bias in panel data. This approach was chosen because it aligns with the characteristics of short-term panel data and effectively handles heterogeneity across cross-sectional units (in this case, the observed banks). The model uses a lag of 1 period (lag 1), following the principle of parsimony, which prioritises a simple model while still capturing the main dynamics among variables (Daganzo et al., 2012). Furthermore, the validity of the instruments in the GMM estimation was confirmed using the Sargan–Hansen test. The results of the Hansen test of overidentifying restrictions showed a chi-square value of 50 with a probability (Prob > chi^2) approaching 1, indicating that the null hypothesis cannot be rejected and the instruments used are valid and uncorrelated with the error term (Results of data processing with RStudio). This confirms that the model estimation results are reliable and free of bias

from inappropriate instrument selection. Furthermore, the Impulse Response Function (IRF) results indicate the influence of the geopolitical shock.

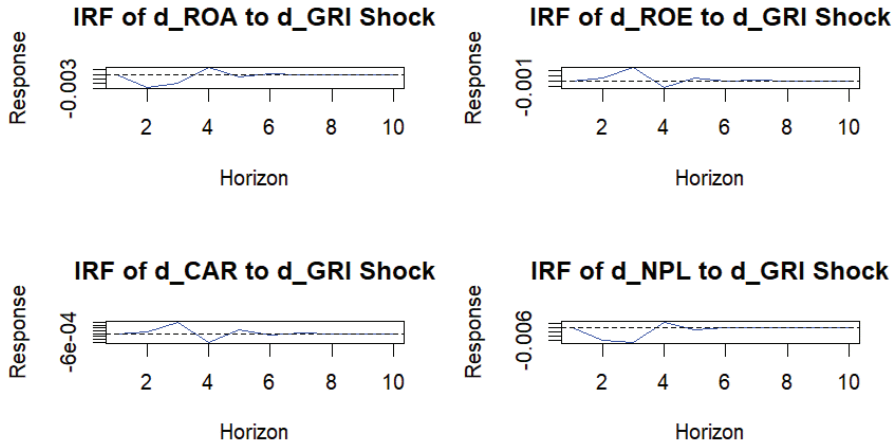

Figure 2. Impulse Response Function of Geopolitical Risk on Banking Indicators

Based on the IRF results, the response of bank indicators to shocks in GRI changes (d_GRI) is generally short and temporary. The response values for d_ROA, d_ROE, d_CAR, and d_NPL to the d_GRI shock show tiny deviations from zero and tend to return to stability in the following 2 to 4 periods. Specifically for d_NPL, there appears to be a brief decline at the beginning of the period, followed by a quick recovery, indicating a short-term negative impact of geopolitical uncertainty on credit risk. Similarly, d_CAR shows initial fluctuations, but returns to neutral after the fourth horizon. This indicates that, although geopolitical shocks affect banking indicators, their influence is not persistent or long-lasting. Meanwhile, the magnitude of GRI's variance contribution to other variables can be determined from the Forecast Error Variance Decomposition (FEVD) results.

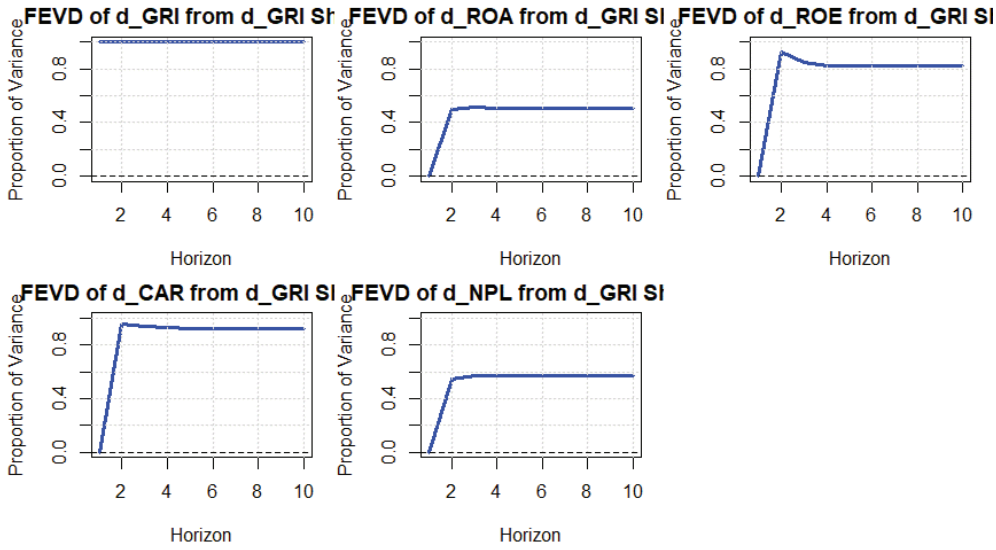

Figure 3. Variance Decomposition of Geopolitical Risk on Banking Indicators

The FEVD results in Figure 3 show that changes in Geopolitical Risk (d_GRI) have significantly explained variations in banking indicators. The d_GRI variable is almost entirely driven by its internal variables (self-driven), indicating endogenously stable dynamics. For d_ROA, approximately 50% of its variance is explained by the d_GRI shock, and it remains stable after the second horizon, indicating that geopolitical risk has a moderate impact on bank profitability. Meanwhile, d_ROE is the most sensitive to the d_GRI shock, contributing more than 80% since the second horizon, reflecting the high dependence of return on equity on external factors. Similarly, d_CAR accounts for 90% of the d_GRI shock and remains stable from the second horizon onward, indicating a significant influence of geopolitical risk on bank capital adequacy and risk management. Finally, d_NPL also has a reasonably strong influence (around 70%) on d_GRI, and has been stable since its inception, indicating that geopolitical pressures are quickly reflected in increased credit risk and debtor repayment capacity. This finding suggests that geopolitical fluctuations are an important determinant of the dynamics of banking indicators.

Table 2. Results of Variable Resilience Grouping

Variable	FEVD	Interpretation	Resilience Category
d_GRI	Almost 100% of its own shock and stable	d_GRI is highly dependent on internal dynamics (not on other variables)	Moderately Resilient
d_ROA	~50% explained by GRI shocks, then stable	GRI shocks explain profitability quite well, but are not dominant	Moderately Resilient
d_ROE	>80% explained by GRI shocks since horizon 2	Return on Equity is affected by geopolitical tensions	Less Resilient (High d_GRI Impact)
d_CAR	~90% influenced by GRI shocks since horizon 2	Capital adequacy is significantly affected by geopolitical tensions	Less Resilient (High d_GRI Impact)
d_NPL	~70% derived from GRI shocks	The non-performing loan ratio is quite sensitive but remains within reasonable limits.	Moderately Resilient

Source: Data processed by the author, 2025

Table 2 shows the criteria for more resilient and less resilient variables. Based on the FEVD analysis, the d_GRI variable is almost entirely influenced by its shock (reaching 100%) stably, indicating a self-driven nature and moderate resilience to other variables. d_ROA is explained by approximately 50% of the GRI shock, after which it stabilises. This shows that profitability is moderately affected by geopolitical conditions, but other internal factors still play a role, making it exceptionally resilient. d_NPL also shows moderate sensitivity to the GRI shock (around 70%) and indicates moderate resilience in managing credit risk. Conversely, d_ROE and d_CAR are highly significantly affected by geopolitical tension, with more than 80–90% of the variance explained by the GRI shock since the second horizon. This indicates that external pressures highly influence return on equity and capital adequacy, thus categorising them as less resilient (high d_GRI impact). Meanwhile, the more and less resilient results for each bank are shown in Table 3.

Table 3. Results of Banking Resilience Grouping

Grouping	Bank	GRI Impact (FEVD)	ROA Stability	CAR Stability	NPL Stability
More Resilient	Bank A	Moderate (ROA, NPL)	More Stable	More Stable	More Stable
	Bank B	Moderate (ROA, NPL)	More Stable	More Stable	Stable
	Bank D	Moderate (ROA, NPL)	More Stable	More Stable	More Stable
	Bank E	Moderate (ROA, NPL)	More Stable	More Stable	Quite Stable

Grouping	Bank	GRI Impact (FEVD)	ROA Stability	CAR Stability	NPL Stability
Less Resilient	Bank C	High (ROE, CAR)	Less Stable	Quite Stable	Less Stable
	Bank F	High (ROE, CAR)	Less Stable	Less Stable	Less Stable
	Bank G	High (ROE, CAR)	Less Stable	Quite Stable	Less Stable
	Bank H	High (ROE, CAR)	Less Stable	Less Stable	Less Stable

Source: Data processed by the author, 2025

Statistically, the more resilient bank group, such as Bank A, Bank B, Bank D, and Bank E, showed that key variables such as ROA, CAR, and NPL remained more stable despite the shock from d_GRI. The FEVD results indicate that the effect of d_GRI on ROA and NPL is approximately 50–70%, and the IRF quickly returns to zero, suggesting that the geopolitical shock has no significant long-term impact. This high stability indicates effective risk management and strong capitalization. In contrast, banks in the less resilient group, such as Bank C, Bank F, Bank G, and Bank H, showed more sensitivity to geopolitical shocks, especially in ROE and CAR, where, according to the FEVD results, more than 80% of the variation is explained by d_GRI. The IRF in these banks showed a persistent, fluctuating response, indicating structural instability. Some banks had CARs that were either too high (underutilised) or too low (risky), and sharply varying NPLs, indicating low resilience to external pressures.

4.2 Discussion

4.2.1 The Dynamics of Interaction Between Banking Indicators in Response to Geopolitical Shocks.

The problem formulation concerning the dynamics of interactions among banking indicators in response to global geopolitical shocks can be analysed using IRF and FEVD results within a Panel VAR framework. The IRF and FEVD results enable analysis that not only examines the direction and magnitude of shocks but also explores the dynamic responses of each variable. The IRF is used to visualise how each banking indicator, such as ROA, ROE, CAR, and NPL, responds to shocks stemming from changes in the Geopolitical Risk Index (GRI), a proxy for geopolitical pressures. The FEVD, meanwhile, quantifies the extent to which these shocks explain each variable's variation.

The estimation results in Figure 3 indicate that the Geopolitical Risk Index (GRI) shock triggered a decline in banking profitability, reflected in ROA, albeit temporarily. Geopolitical tensions weakened credit demand, depressed net interest margins, and increased the cost of funds, thus impacting returns on assets. The FEVD indicates that approximately 50% of the variance in ROA is explained by the GRI shock at the initial horizon and remains stable until horizon 10, confirming that bank profitability performance in Indonesia is sensitive to global geopolitical dynamics. This finding aligns with the findings of Phan et al. (2022), Andriani et al. (2024) and (Banna et al., 2023), which states that geopolitical risk negatively impacts bank financial performance, particularly in the short term. Within the context of this sample and research period, the average ROA was around 2.14%, indicating that although profitability was relatively positive, it remained vulnerable to external shocks.

Furthermore, the impact of geopolitical risk on asset returns is heterogeneous, depending on the asset type and underlying market conditions. Geopolitical risk can disrupt economic stability, increase uncertainty, and trigger financial market volatility, thus impacting asset performance differently. (Umar et al., 2022) emphasise that these

effects can be positive or negative depending on the market context, while Nguyen & Thuy (2023) suggest that banks adopt a more conservative stance during periods of geopolitical tension by tightening credit standards and strengthening risk management. While these measures are defensive in nature, in the short term, they can actually promote efficient asset utilisation and help maintain stable ROA amid global pressures.

The ROE response showed an immediate decline following the GRI shock, though not as sharp as ROA, and tended to stabilise after the third period. This reflects that geopolitical tensions pressured the efficiency of banks' use of equity. However, the impact was relatively moderate and quickly corrected through internal adjustment mechanisms, such as flexible dividend distribution and more active capital management. All ROE responses also remained within the confidence interval, indicating that geopolitical risk shocks did not have a statistically significant impact on ROE during the observation period. This finding aligns with Adra et al. (2023) and Nguyen et al. (2025), which stated that geopolitical uncertainty has a greater impact on corporate behaviour (e.g., investment delays and share buybacks) than directly on profitability. In the context of this study, the average ROE for banks was around 12.99%, indicating relatively strong and stable equity performance amidst global dynamics.

Nevertheless, the FEVD results indicate that geopolitical risk accounts for more than 80% of the variation in ROE, indicating the high sensitivity of bank equity performance to global and regional political uncertainty. Geopolitical tensions tend to slow economic activity, suppress credit demand, and increase the cost of capital and credit risk, leading to lower net income and a direct impact on ROE. This is in line with (Ginn & Saadaoui, 2025), who stated that geopolitical risk shocks, particularly on a global scale, negatively impact equity value from an early stage. Overall, the IRF and FEVD results indicate that geopolitical risk has a dominant but temporary impact on ROE, requiring investors and banks to respond with diversification strategies, strengthening capital structures, and maintaining liquidity.

Geopolitical tensions negatively impacted CAR in the first quarter, albeit to a relatively small and temporary extent. This decline reflects pressure on capital adequacy due to declining asset values and increased systemic risk, prompting banks to hold more capital as a buffer against potential losses, in line with (Behn et al., 2025). This condition was also influenced by increasing external financing costs and declining asset quality, which put pressure on banks' ability to maintain capital adequacy. (Carney et al., 2024). In this study, the average banking CAR was 20.02%, indicating that banks generally maintain a substantial capital buffer despite geopolitical pressures.

Furthermore, the FEVD results show that short- to medium-term CAR variability is significantly influenced by geopolitical risk shocks, with a contribution approaching 90%. This confirms that geopolitical uncertainty is a significant factor influencing fluctuations in bank capital resilience. These findings align with (Hodula et al., 2024), who stated that geopolitical shocks increase systemic risk and put pressure on capital buffers such as CAR, potentially undermining banking stability if not appropriately managed.

The NPL response to the GRI shock showed a short-term decline, reflecting banks' prudential stance through credit tightening and financing restructuring. However, this effect reversed to positive and remained relatively stable after the fourth period, as economic conditions worsened, supply chain disruptions increased, and borrowers' repayment capacity declined. This finding aligns with Caglayan & Xu (2019) and Nadia et al. (2024), who asserted that economic uncertainty and geopolitical risk drive a decline in lending

and an increase in credit risk in the medium term. In the context of this study, the average banking NPL value was around 2.78%, indicating relatively manageable credit quality, but remaining vulnerable to ongoing geopolitical shocks.

The FEVD results indicate that approximately 50% of the variation in NPL changes is explained by geopolitical risk shocks, indicating that geopolitical factors play a significant role in determining the stability of bank credit quality. The initial negative response, followed by recovery and stabilisation, reflects the dynamics of medium-term adjustment to external pressures. This finding is consistent with Nguyen & Thuy (2023), which showed that large-scale uncertainty, including during the pandemic, plays a significant role in increasing the risk of non-performing loans. This underscores the importance of strengthening credit risk management to maintain banking stability amidst global geopolitical dynamics.

4.2.2 Mapping of More Resilient and Less Resilient Banks under Geopolitical Shocks

Panel VAR analysis in Table 2 (FEVD) and Table 3 (Impulse Response Function/IRF) shows significant differences in the response of Indonesian banks to geopolitical shocks. The combination of the two tables categorises banks as more resilient or less resilient based on their patterns of ROA, ROE, CAR, and NPL.

The results in Table 3 show that Banks A, B, D, and E fall into the more resilient category. The resilience of Bank A can be explained by its large asset scale, diversified MSME financing portfolio, and substantial capital buffer, which makes the impact of GRI on ROA and CAR relatively low. Previous studies support these findings by demonstrating the role of digitalisation in MSME services and the strengthening of BRI's capital in enhancing the micro sector's resilience to macroeconomic volatility (Supari & Anton, 2022). At Bank B, the high proportion of low-cost funds (CASA) maintains liquidity stability and reduces funding costs during external uncertainties (Aprilia, 2024). The business focuses on domestic retail transactions, which also makes Bank B less exposed to global geopolitical risks, thereby maintaining ROE and CAR.

Bank D demonstrates resilience due to its stable NPL ratio. Its 2024 Annual Report shows an NPL ratio of 1.6% — lower than the industry average — which helps mitigate the impact of geopolitical shocks on ROA and CAR. Empirical evidence from the Fitch Ratings report also reinforces this finding by emphasising Bank D's capital strength and asset quality amid external risks. (Aris, 2024). Meanwhile, Bank E, as a merged sharia bank, has the most significant assets in the sharia sector, a financing portfolio in the domestic real sector, and government support to strengthen its capital. Post-merger research found significant increases in CAR, decreases in NPF, and improvements in profitability, all of which strengthen Bank E's resilience to external risks. These results are supported by previous research that emphasizes that the integration of three Islamic banks strengthens Bank E's financial stability post-merger (Lestari et al., 2024).

On the other hand, several banks fall into the less resilient category or have lower resilience than other banks. This category is not intended to assess performance negatively, but rather to illustrate that these banks still face specific structural challenges in maintaining their stability and profitability, especially amid uncertain geopolitical conditions.

Bank F still faced a relatively high Non-Performing Financing (NPF) level in 2024. This condition puts pressure on the bank's ability to maintain profitability, as some financing arrangements experience delays or defaults. Meanwhile, Bank C has a reasonably strong position in the automotive financing sector. However, according to the 2020 annual

report, the gross Non-Performing Loan (NPL) ratio increased to 3.0% from 2.8% in 2019, indicating pressure on asset quality. This increase mainly occurred in the automotive sector, which was significantly affected by the COVID-19 pandemic. These pressures indicate that, although the bank has a strong business base, its reliance on sectors sensitive to economic cycles can affect its resilience to external shocks.

Both Bank G and Bank H have a loyal regional customer base, particularly among civil servants, which provides stability in third-party funds. However, both still have room to expand productive financing, without relying too heavily on the consumer segment, to strengthen their role in driving regional economic growth. A broader diversification of the financing portfolio can be a strategic step to enhance resilience against future economic changes and external risks.

5 Conclusion

5.1 Conclusion

This research emphasises that geopolitical shocks significantly affect profitability, capital, and banking risk indicators, with ROE and CAR emerging as the most sensitive variables. The Panel VAR analysis also shows a lack of uniform resilience across banks, underscoring the importance of resilience mapping to understand the banking sector's vulnerability to external risks.

The research results show that Bank A is more resilient due to its large asset base, diverse MSME portfolio, and strong capital buffer, which keep ROA and CAR stable. Bank B is also resilient, driven by a high CASA ratio and a domestic business focus, which makes it better protected against global risks. Bank D demonstrates resilience through stable, low NPLs, thereby maintaining secure ROA and CAR. Bank E has become stronger after the merger due to increased CAR, reduced NPF, and government support for capital strengthening. Conversely, Bank F is less resilient due to still high NPF, and Bank C faces pressure from rising NPLs in the automotive sector. At the same time, Banks G and H remain limited to the consumer segment and need to expand their productive financing to enhance resilience going forward.

These findings indicate that banking stability is not only determined by internal conditions but also by each bank's ability to absorb the impact of global uncertainty. By using a mapping approach, this research provides an initial overview of strategies to strengthen the banking sector's stability amid future geopolitical risks.

5.2 Policy Recommendations

Based on the research findings, the following recommendations can be made: First, banks should diversify their productive portfolios to enhance resilience during geopolitical shocks. Concentration in a few industries, especially those exposed to global trade or commodity fluctuations, can increase sensitivity to geopolitical shocks. Furthermore, consumptive portfolios are high risk because when geopolitical shocks occur, and the economy slows, some people lose their income, so instalment payments in the consumptive portfolio may default.

Second, banks should have robust institutional agility to respond quickly to changes in geopolitical conditions. Rapid decision-making in the face of uncertainty helps banks manage liquidity, rebalance portfolios, and adjust strategies. Enhancements in digital systems, scenario planning, and early warning systems help banks cope with capital flow reversals, currency fluctuations, and supply chain issues arising from geopolitical tensions.

Third, banks must enhance risk management through integrity, transparency, and good governance to remain stable under pressure. Good governance ensures that decisions regarding exposure, asset quality, and capital allocation are accountable. Transparent reporting and ethical management support public and investor trust, which is crucial during times of uncertainty. Integrity-focused risk practices help banks maintain operational stability and withstand long-term shocks.

5.3 Research Limitations

Nevertheless, it is important to note two prominent disclaimers in this study. First, the results and findings of this research are valid only for the observation period during which geopolitical shocks occurred. They therefore cannot be generalised to different or more stable economic conditions. Second, the results of this study are specific to the sample of banks, variables, and analytical models used, meaning that different results may emerge if other studies use different approaches or indicators. Therefore, the classification of banks as less resilient is based solely on this study's model results and is not intended as a comprehensive assessment of each bank's long-term performance or stability.

Acknowledgments

The author would like to express gratitude to the MacroMicro website for providing the Geopolitical Risk Index data used in this research. The author also expresses gratitude to the Financial Services Authority of Indonesia (Otoritas Jasa Keuangan, OJK) for providing secondary data related to banking performance, including Return on Assets (ROA), Return on Equity (ROE), Capital Adequacy Ratio (CAR), and Non-Performing Loan (NPL).

In addition, the author gratefully acknowledges the OJK Institute for organizing the KARISMA 2025 program, where this article was selected and received academic support that contributed significantly to the completion of this research.

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