“The impact of geopolitical risk transmission on banking stability: Evidence from ASEAN”

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THE IMPACT OF GEOPOLITICAL RISK TRANSMISSION ON BANKING STABILITY: EVIDENCE FROM ASEAN

Abstract

Banking systems in emerging economies face mounting exposure to geopolitically induced shocks, yet the precise transmission pathways through which geopolitical disruptions translate into fundamental banking vulnerabilities remain poorly understood, particularly in the ASEAN region. This study examines how geopolitical risk propagates into credit, liquidity, and operational dimensions of banking stability across five major ASEAN economies during the period 2022–2024. Employing a quantitative panel design, the study draws on daily-frequency data from 75 conventional commercial banks operating in Indonesia, Malaysia, Singapore, Thailand, and the Philippines. The analytical framework integrates a newly constructed ASEAN Geopolitical Risk Index derived from text mining and Natural Language Processing applied to over 50,000 regional news articles with Vector Autoregression (VAR) estimation, fixed-effects panel regression, and network-based spillover analysis. Results demonstrate that geopolitical risk exerts a statistically significant positive effect on credit risk (NPL: $\beta = 0.324$, $p < 0.01$) and liquidity risk (LDR: $\beta = 0.287$, $p < 0.01$), while its effect on operational risk (BOPO: $\beta = 0.198$, $p < 0.05$) is heterogeneous across countries. Singapore and Malaysia exhibit superior resilience compared to Indonesia and the Philippines. Network analysis identifies a credit-to-liquidity contagion mechanism with a transmission lag of two to three trading days, and spillover intensity escalates non-linearly with geopolitical stress severity. The study contributes the first region-specific geopolitical risk index for ASEAN, a hybrid VAR-network methodology for systemic risk analysis, and actionable evidence for macroprudential policy design and early warning system development in the region.

Keywords geopolitical risk, banking stability, network contagion, early warning system

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INTRODUCTION

The financial stability of banking systems in emerging economies is increasingly shaped by forces that originate beyond domestic borders. Geopolitical tensions encompassing interstate conflicts, territorial disputes, economic coercion, and diplomatic ruptures constitute a category of systemic shock that differs fundamentally from conventional cyclical or monetary disturbances (Schissler et al., 2026; Ngondo & Phiri, 2025). Unlike interest rate adjustments or credit cycle fluctuations, geopolitical shocks are discontinuous, difficult to anticipate, and capable of transmitting simultaneously across multiple risk dimensions within the banking sector (Rincón et al., 2025). Understanding how such shocks propagate into credit deterioration, funding stress, and operational disruption therefore represents a pressing scientific problem for both financial economists and prudential regulators (Kažyte et al., 2026).

The period from 2022 to 2024 has provided an exceptional natural laboratory for this inquiry. The prolonged Russia-Ukraine conflict, escalating tensions in the Taiwan Strait, and intensifying US-China strategic competition have collectively elevated geopolitical uncertainty to levels not observed in the post-Cold War era (He & Feng, 2025). These

dynamics have reconfigured global supply chains, redirected capital flows, imposed novel sanctions architectures, and amplified the frequency of cyber-threat incidents, each of which constitutes a potential transmission channel into banking fundamentals (Zhang et al., 2024). The ASEAN-5 economies (Indonesia, Malaysia, Singapore, Thailand, and the Philippines) occupy a particularly exposed position: as open, trade-dependent, and increasingly digitally integrated economies situated at the nexus of competing great-power interests, they face a distinct configuration of geopolitical vulnerabilities that global-level analyses fail to adequately capture (Cerqueira-Streit et al., 2021; Mariotti, 2024; Song et al., 2025).

The scientific problem addressed in this study is threefold. First, existing risk models rely on global geopolitical indices that lack the granularity to reflect the sentiment, conflict dimensions, and transmission channels specific to Southeast Asia (Rusmita et al., 2020). Second, the predominant use of low-frequency (monthly or quarterly) data in the literature obscures the short-horizon shock propagation that characterizes geopolitical episodes (Caldara & Iacoviello, 2022). Third, the assumption of linear, isolated risk relationships fails to account for the networked interdependencies through which an initial credit deterioration can cascade into liquidity stress and operational strain. These methodological and empirical gaps impede the construction of accurate predictive frameworks and leave ASEAN regulators with inadequate tools for anticipating systemic vulnerabilities. This study is designed to address each of these gaps systematically.

1. LITERATURE REVIEW

Research on geopolitical risk and its financial consequences has expanded substantially over the past decade, yet significant gaps persist with respect to regional specificity, data frequency, and the modelling of cross-risk contagion. The following synthesis reviews the principal streams of this literature and identifies the unresolved questions that motivate the present study.

The measurement of geopolitical risk has been dominated by the global GPR Index developed by Caldara and Iacoviello (2022), which aggregates newspaper-based conflict terminology into a continuous daily series. While widely adopted, this index has been criticized for its Western-media bias, which systematically underweights regional conflicts and political instabilities of salience in developing economies (Beck Aguilera et al., 2023). Cheong and Lee (2009) documented analogous limitations in earlier composite indices, showing that generic proxies introduce systematic measurement error when applied to Asian financial markets. Regional scholars have responded by constructing geographically tailored measures: Aftab et al. (2023) demonstrated that sentiment-derived indices from ASEAN regional media produce substantially different risk profiles than their global counterparts, while Haudi et al. (2022) confirmed that locally constructed indices outperform global ones in explaining domestic banking system variance. These contributions underscore the scientific necessity of a region-specific index for the present study.

With respect to credit risk, the theoretical literature posits that geopolitical uncertainty disrupts macroeconomic activity through multiple channels supply-chain fragmentation, investment delay, and demand compression each of which impairs corporate cash flows and, consequently, debt-servicing capacity (Zabel & O'Brien, 2024). Empirical evidence from Haberly and Wójcik (2020) confirms that banks with significant exposure to conflict-affected sectors registered notable non-performing loan (NPL) increases, with effects becoming manifest after lags of several months. Benavides-Franco et al. (2023) refined this finding by identifying lag structures in geopolitical shock transmission to credit quality, while Olalere and Mukuddem-Petersen (2023) highlighted the moderating role of bank capitalization: better-capitalized institutions absorbed credit shocks with smaller NPL increments. These cross-country inconsistencies in effect magnitude suggest that both bank-level heterogeneity and the precision of risk measurement are critical determinants of empirical outcomes.

Liquidity risk emerges as a second major transmission channel through the so-called flight-to-

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quality mechanism. Wolfson (2012) provided the foundational theoretical account, demonstrating that geopolitical uncertainty triggers precautionary reallocation of deposits and institutional funding toward safer assets, disproportionately straining banks with high loan-to-deposit ratios or wholesale funding dependence. Bouteska et al. (2025) documented analogous liquidity dynamics in ASEAN banks during prior regional stress episodes, while Sintani et al. (2024) showed that capital buffer adequacy constitutes the principal institutional moderator of geopolitical-liquidity transmission. The implication is that liquidity stress is not merely a concurrent correlate of geopolitical events but a structurally conditioned response whose intensity varies systematically with bank-level balance sheet characteristics.

The operational risk dimension has received comparatively less systematic attention. Hanandeh et al. (2024) documented increases in the cost-to-income ratio (BOPO) during geopolitical stress periods, attributing these to heightened expenditures on cybersecurity, sanctions compliance, and risk infrastructure. Evidence from ASEAN markets, reviewed by Kashif et al. (2025), indicates that operational efficiency deterioration during global conflicts is measurable, though its magnitude is smaller than the effects on credit and liquidity.

Macroeconomic moderators constitute a critical layer of the transmission architecture (Ibrahim & Khaled, 2026). Inflation functions as an amplifier of geopolitical shocks: supply-chain disruptions elevate commodity prices, raise the general price level, and compress real household income, thereby increasing loan defaults and straining banks (Albahouth, 2025; Todorova & Myftarallari, 2024; Sidiq et al., 2024). Central bank interest rate responses to geopolitical volatility create additional stress by increasing debt-service costs for floating-rate borrowers and reducing asset valuations (Pradhan et al., 2025; Bouteska et al., 2025). Exchange rate depreciation exacerbates these pressures by inflating the local-currency value of foreign-currency-denominated liabilities, with particularly acute consequences for banks in trade-intensive ASEAN economies (Fraihat et al., 2023). GDP growth slowdowns, documented as a consistent correlate of elevated geopolitical risk, exacerbate banking risk non-linearly when growth falls below threshold levels (Firman & Munim, 2022; Jamaani, 2021).

The network contagion dimension representing the propagation of an initial shock across interconnected risk categories is the least developed area of the literature. Systemic risk theory, as reviewed by Putra and Oktora (2024) and Zahra et al. (2021), posits that modern financial systems are characterized by non-linear interdependencies through which credit impairment can trigger liquidity shortfalls and operational strain in rapid sequence. Beglaryan et al. (2024) and Vuong et al.

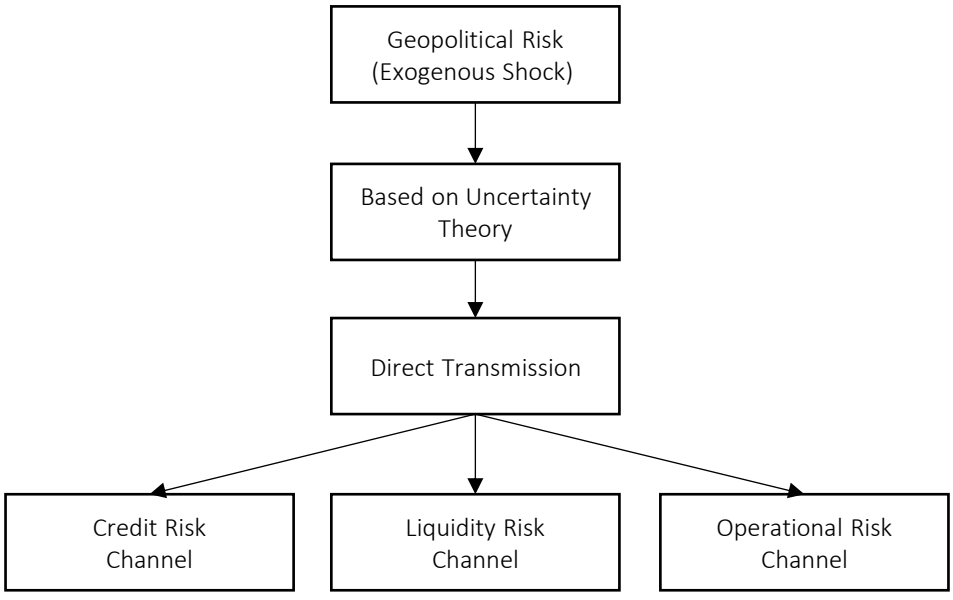

Figure 1. Geopolitical risk transmission framework

(2023) have emphasized that the acceleration of financial digitalization has shortened transmission lags and increased the potential for cross-risk amplification. Yet the empirical literature on geopolitical risk in ASEAN, including studies by Mahmood and Furqan (2025) on pandemic-period banking risk and Aniqoh et al. (2022) on monetary policy effects, has not systematically modelled these inter-risk spillovers. Rofiqoh and Mukaffi (2021) focused on capital market and exchange rate effects while explicitly bypassing banking fundamentals. Tan (2021) and Alexandri and Supriyanto (2022) identified a gap between geopolitical risk exposure and banking outcomes in the ASEAN context but employed low-frequency data and linear specifications that preclude detection of rapid, non-linear contagion. Awad et al. (2024), Alexandri et al. (2023), and Jamaani (2021) have similarly highlighted the inadequacy of existing analytical frameworks for anticipating systemic vulnerabilities under geopolitical stress.

In aggregate, the literature reveals three unresolved deficiencies. Global indices introduce systematic measurement error for the ASEAN context; low-frequency data mask the short-horizon transmission dynamics that define geopolitical shock propagation; and the predominance of single-risk, linear models precludes the detection of networked contagion. The present study addresses all three deficiencies through a region-specific index, high-frequency data, and a hybrid VAR-network methodology. Based on this integrated theoretical and empirical foundation, the following hypotheses are advanced:

H1: Geopolitical risk exerts a significant positive effect on the credit risk of ASEAN-5 banks.

H2: Geopolitical risk exerts a significant positive effect on the liquidity risk of ASEAN-5 banks.

H3: Geopolitical risk exerts a significant positive effect on the operational risk of ASEAN-5 banks.

H4: The impact of geopolitical risk on banking risk is moderated by macroeconomic conditions, including inflation, interest rates, exchange rates, and GDP growth.

H5 Geopolitical risk intensifies spillover effects across banking risk categories, generating non-linear systemic contagion.

Thus, this study examines the influence of geopolitical risk on bank stability in ASEAN, including liquidity, credit, and banking operational risks.

2. METHODOLOGY

This study employs a quantitative, longitudinal panel design grounded in the integrated framework of Uncertainty-Based Risk Transmission and Systemic Contagion Theory. The research period spans January 2022 to December 2024, a window selected to capture the peak intensity of contemporary geopolitical tensions. The unit of analysis is the individual conventional commercial bank operating in one of the five ASEAN-5 countries: Indonesia, Malaysia, Singapore, Thailand, and the Philippines.

The population comprises all 143 conventional commercial banks active across these five jurisdictions during the study period. Sample selection employed purposive criteria requiring:

1) total assets of at least USD 1 billion;

2) listing on the relevant national stock exchange;

3) availability of complete daily financial data throughout the observation window; and

4) absence of significant merger or acquisition activity during the period.

Application of these criteria yielded a final sample of 75 banks, collectively representing approximately 82% of total ASEAN-5 banking assets, providing a highly representative coverage of the regional system.

Data originate from four primary sources. Daily bank-level financial metrics, including NPL ratios, loan-to-deposit ratios, and cost-to-income efficiency, were drawn from Bloomberg Terminal and Thomson Reuters Eikon. Country-level macroeconomic series (inflation, policy interest rates, exchange rate changes, and quarterly GDP

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growth) were sourced from each country's central bank and from the IMF International Financial Statistics database. News-article data for index construction were retrieved from five major media platforms per country (25 sources in total) via media APIs and web scraping protocols. Additional market-level financial data were obtained from S&P Global Market Intelligence. Data for each bank span approximately 750 trading days, producing a total panel of approximately 56,250 bank-day observations.

The ASEAN Geopolitical Risk Index was constructed in four sequential stages. First, raw textual data were collected from the 25 media sources using automated scraping and API retrieval, yielding over 50,000 news articles relevant to geopolitical events. Second, text preprocessing was performed, including tokenization, stop-word removal, and lemmatization to prepare the corpus for analysis. Third, sentiment and conflict-event classification were conducted using an NLP model fine-tuned on a labelled ASEAN-context corpus, producing article-level risk scores across four dimensions: Territorial Conflict (weight = 0.35), Economic Tensions (weight = 0.30), Political Instability (weight = 0.20), and Diplomatic Tension (weight = 0.15). Fourth, article-level scores were aggregated to a daily country index and then to a composite ASEAN-5 index using asset-weighted averaging. The index's psychometric properties were validated through confirmatory factor analysis; all factor loadings exceed 0.78, and all Cronbach's alpha values exceed 0.85, confirming construct validity and internal consistency.

Hypothesis testing proceeds in three analytical stages. The primary estimation employs panel Vector Autoregression (VAR) to capture the dynamic, possibly bidirectional relationships between the geopolitical risk index and each banking risk indicator over a two-lag structure, selected via the Akaike Information Criterion. Granger causality tests assess the directional precedence of geopolitical risk over banking outcomes. The second stage uses Fixed Effects (FE) panel regression, preferred over Random Effects based on Hausman test results, to estimate contemporaneous and lagged effects while controlling for inflation, interest rates, exchange rates, and GDP growth. Heteroskedasticity-robust standard errors are applied throughout. The robustness of primary results is verified using System Generalized Method of Moments (GMM), which accounts for the dynamic persistence of banking risk indicators. AR(1) and AR(2) tests and Hansen J-tests confirm model specification validity. The third analytical stage employs a Diebold-Yilmaz spillover framework to construct a variance-decomposition-based spillover matrix, quantifying directional and net risk transmission among NPL, LDR, BOPO, and the geopolitical risk index. Spillover dynamics are further decomposed by geopolitical stress regime (low, medium, and high) to test the non-linear escalation posited in H5. All analyses use daily-frequency data to detect short-horizon transmission dynamics that lower-frequency approaches would obscure.

3. RESULTS

3.1. Descriptive statistics

Table 1 presents the summary statistics for all research variables pooled across the 75 banks and the 2022–2024 study period. Panel A (dependent variables) reveals that the average NPL ratio of 3.42% (SD = 1.86) exhibits positive skewness (1.23), indicating the presence of a subset of banks with considerably elevated credit risk. The LDR average of 87.65% signals a high regional intermediation intensity, while the BOPO mean of 76.32% (SD = 8.76) reflects moderate operational efficiency with relatively contained inter-bank variation.

The ASEAN Geopolitical Risk Index (Panel B) registers a mean of 42.67 with a notably large standard deviation of 15.89, reflecting the marked volatility in regional geopolitical conditions during the study period. The maximum value of 89.76 coincides with peak episodes of territorial and diplomatic tension, while the minimum of 12.34 corresponds to relatively quiescent periods. Macroeconomic control variables (Panel C) display significant cross-country heterogeneity: inflation ranges from 1.23% to 9.87% with a mean of 4.87%, exchange rate changes exhibit the widest dispersion (SD = 3.67, range: –5.67% to 8.89%), and GDP growth averages 4.12% with moderate variability.

Table 1. Descriptive statistics of research variables (N = 75 banks; 2022–2024)

Variable	Mean	SD	Min	Max	Skewness	Kurtosis
Panel A: Dependent Variables						
NPL (%)	3.42	1.86	0.87	8.94	1.23	4.12
LDR (%)	87.65	12.43	62.31	112.45	0.45	2.89
BOPO (%)	76.32	8.76	58.94	93.67	0.32	2.54
Panel B: Independent Variable						
Geopolitical Risk Index	42.67	15.89	12.34	89.76	0.78	3.45
Panel C: Control Variables						
Inflation (%)	4.87	2.34	1.23	9.87	0.89	3.12
Interest Rate (%)	4.23	1.56	2.15	7.45	0.67	2.78
Exchange Rate (%)	2.45	3.67	−5.67	8.89	0.34	2.95
GDP Growth (%)	4.12	1.89	0.98	7.23	0.56	2.67

Notes: NPL = Non-Performing Loans; LDR = Loan-to-Deposit Ratio; BOPO = Cost-to-Income Ratio; SD = standard deviation.

Table 2. Country-level descriptive statistics: mean values (2022–2024)

Country	NPL (%)	LDR (%)	BOPO (%)	GeoRisk Index	Bank Sample (n)
Indonesia	3.87	89.45	78.34	45.67	21
Malaysia	2.98	85.17	74.26	41.28	16
Singapore	2.12	82.04	71.25	38.89	12
Thailand	3.47	88.92	77.82	43.95	14
Philippines	3.79	91.37	79.56	44.12	12

Notes: GeoRisk Index = ASEAN Geopolitical Risk Index (annual mean).

Table 2 reports country-level mean values. Singapore exhibits the strongest risk performance, with the lowest NPL (2.12%), the lowest BOPO (71.25%), and the lowest geopolitical risk exposure (38.89), consistent with its position as a globally integrated financial center characterized by deep capital markets and robust institutional governance. Indonesia and the Philippines present the highest credit risk and operational inefficiency, reflecting greater commodity dependence, larger informal economic sectors, and more complex trade linkage structures. The Philippines records the highest LDR (91.87%), indicating an aggressive intermediation posture with attendant funding-stress vulnerability.

3.2. ASEAN Geopolitical Risk Index construction

Table 3 reports the psychometric and factor-analytic properties of the four index dimensions. All factor loadings range from 0.789 to 0.867, all KMO values exceed 0.78, and all Cronbach's alpha coefficients exceed 0.85, collectively confirming adequate sampling adequacy, convergent validity, and internal consistency. The Territorial Conflict dimension receives the highest assigned weight (0.35), reflecting its centrality in ASEAN geopolitical dynamics, with its three constituent indicators, territorial disputes, sovereignty violations, and military incidents, showing strong loadings (0.823-0.867). The Economic Tensions dimension (weight = 0.30) captures sanctions, investment restrictions, and technological barriers, while the Political Instability dimension (weight = 0.20) encompasses regime changes, civil unrest, and terrorism risk. The Diplomatic Tension dimension (weight = 0.15) registers the lowest loadings (0.789-0.834), consistent with its status as a secondary rather than primary transmission vector.

Temporal analysis (Table 4) reveals a monotonically increasing trend in the composite index across all five countries over 2022–2024, consistent with the documented escalation of regional and global geopolitical tensions. Indonesia consistently records the highest values (38.45 to 52.89) and the greatest volatility (CoV = 0.284), while Singapore maintains the lowest levels (32.36 to 43.45) and the smallest CoV (0.258). The year-on-year increase in standard deviations for each country confirms that geopolitical risk became not only more intense but also more volatile over time.

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Table 3. ASEAN Geopolitical Risk Index: dimensional structure and validity statistics

Dimension / Indicator	Dim. Weight	Factor Loading	KMO	Cronbach α
1. Territorial Conflict				
Territorial Dispute	0.35	0.867	0.842	0.891
Sovereignty Violation		0.845	0.834	0.885
Military Incident		0.823	0.812	0.878
2. Economic Tensions				
Trade Sanctions	0.30	0.856	0.838	0.887
Investment Restrictions		0.834	0.825	0.882
Technology Barriers		0.812	0.808	0.874
3. Political Instability				
Regime Change	0.20	0.845	0.832	0.886
Demonstrations & Riots		0.823	0.815	0.879
Terrorism		0.801	0.798	0.865
4. Diplomatic Tension				
Ambassador Recall	0.15	0.834	0.821	0.883
Treaty Cancellation		0.823	0.812	0.876
Confrontational Statements		0.789	0.785	0.858

Notes: KMO = Kaiser-Meyer-Olkin measure of sampling adequacy. All Cronbach's α values were computed from within-dimension item sets.

Table 4. Geopolitical Risk Index by country and year (mean and standard deviation)

Country	2022 Mean (SD)	2023 Mean (SD)	2024 Mean (SD)	CoV
Indonesia	38.45	45.67	52.89	0.284
	(8.63)	(12.34)	(14.56)	
Malaysia	35.67	41.23	46.78	0.265
	(7.82)	(11.45)	(13.23)	
Singapore	32.36	38.89	43.45	0.258
	(6.79)	(10.23)	(12.67)	
Thailand	36.78	43.45	49.89	0.276
	(8.12)	(11.89)	(13.89)	
Philippines	37.82	44.12	50.34	0.279
	(8.45)	(12.12)	(14.12)	

Notes: CoV = Coefficient of Variation (SD/Mean). Values reflect the composite ASEAN Geopolitical Risk Index.

3.3. VAR estimation and Granger causality

Table 5 reports the panel VAR results for the geopolitical risk–banking risk relationships. The contemporaneous effect on credit risk (NPL) is the largest and most precisely estimated across all models ($\beta = 0.324$, $t = 3.267$, $p < 0.01$), declining gradually over the first two lags (t–1: $\beta = 0.287$; t–2: $\beta = 0.198$), confirming sustained but attenuating shock transmission. The moderate liquidity risk (LDR) effect ($\beta = 0.287$, $p < 0.01$) follows an analogous lag pattern, while operational risk (BOPO) records the weakest and most attenuated contemporaneous response ($\beta = 0.198$, $p < 0.05$). Among macroeconomic control variables, GDP growth exhibits the strongest negative relationship with NPL ($\beta = -0.245$, $p < 0.01$), while inflation and interest rates each display significant positive associations with all three risk indicators. Model diagnostics are satisfactory: R-squared values range from 0.589 to 0.678, Durbin-Watson statistics are close to 2.0, and AIC values confirm lag-order adequacy.

The Granger causality results (Table 6) establish a strong, unidirectional precedence of geopolitical risk over all three banking risk indicators. The null hypothesis of non-causality is rejected at the 0.1% level for all three directional tests (GeoRisk → NPL: $F = 15.278$; GeoRisk → LDR: $F = 13.956$; GeoRisk → BOPO: $F = 11.634$), while the reverse-

Table 5. Panel VAR estimation results

Variable	NPL Coef. (t-stat)	LDR Coef. (t-stat)	BOPO Coef. (t-stat)
Panel A: Geopolitical Risk			
GeoRisk(t)	0.324***	0.287***	0.198**
	(3.267)	(3.856)	(2.826)
GeoRisk(t–1)	0.287***	0.245***	0.156**
	(3.507)	(3.274)	(2.654)
GeoRisk(t–2)	0.198**	0.167**	0.112*
	(2.987)	(2.705)	(2.375)
Panel B: Control Variables			
Inflation	0.234***	0.187**	0.145**
	(3.284)	(2.987)	(2.614)
Interest Rate	0.287***	0.234***	0.167**
	(3.426)	(3.193)	(2.826)
Exchange Rate	0.176**	0.198**	0.134**
	(2.907)	(2.816)	(2.513)
GDP Growth	–0.245***	–0.213***	–0.176**
	(–3.254)	(–3.012)	(–2.735)
Panel C: Diagnostics			
R-squared	0.648	0.645	0.579
Adj. R-squared	0.644	0.623	0.527
F-statistic	34,507***	32,395***	28,907***
Durbin–Watson	2.113	2.087	2.145
AIC	3.486	3.618	3.897

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. All models include country and year fixed effects.

direction hypotheses cannot be rejected (all p > 0.20). This asymmetric causality pattern confirms that geopolitical risk functions as a leading indicator of banking stress, not vice versa, and that the temporal ordering implied by the shock-transmission framework is empirically valid.

3.4. Network spillover analysis

The Diebold-Yilmaz spillover matrix (Table 7) quantifies the directional variance-decomposition-based transmission among the four system variables. The total spillover index of 25.92% indicates a moderate systemic interconnectedness. NPL emerges as the dominant net transmitter, contributing 32.68% of spillover to other variables (net: +11.13%), followed by LDR (net: +9.80%). Geopolitical risk, by contrast, is a net receiver (net: –23.63%), confirming its role as the exogenous trigger that seeds credit deterioration, which then amplifies through the network. The substantial off-diagonal elements in the NPL → LDR cell (12.64%) and LDR → BOPO cell (8.90%) trace the credit-to-liquidity-to-operational cascade pathway that constitutes the principal systemic contagion mechanism.

Table 8 demonstrates the non-linear escalation of spillover intensity across geopolitical stress regimes, providing direct empirical evidence for H5. Under low-risk conditions (index < 30), the NPL → LDR spillover stands at 15.34%; this rises to 23.85% under medium-risk conditions (30-60) and reaches 32.67% under high-risk conditions (>

Table 6. Granger causality test results

Null Hypothesis	F-Statistic	Prob.	Decision
GeoRisk does not Granger-cause NPL	15.278	0.000	Reject H_0
GeoRisk does not Granger-cause LDR	13.956	0.000	Reject H_0
GeoRisk does not Granger-cause BOPO	11.634	0.001	Reject H_0
NPL does not Granger-cause GeoRisk	2.305	0.214	Fail to Reject
LDR does not Granger-cause GeoRisk	1.927	0.335	Fail to Reject
BOPO does not Granger-cause GeoRisk	1.715	0.496	Fail to Reject

Notes: Lag length selected by AIC. H0 denotes the null hypothesis of no Granger causality.

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Table 7. Diebold-Yilmaz spillover matrix (%)

FROM → TO	NPL	LDR	BOPO	GeoRisk	FROM Others
NPL	78.45	12.64	5.67	3.54	21.55
LDR	10.23	75.67	8.90	5.20	24.33
BOPO	6.78	9.34	79.23	4.65	20.77
GeoRisk	15.67	12.45	8.90	62.98	37.02
TO Others	32.68	34.13	23.47	13.39	Total: 25.92
Net Spillover	+11.13	+9.80	+2.70	−23.63	

Notes: Each cell represents the percentage of forecast-error variance of the row variable explained by shocks to the column variable over a 10-day horizon. Diagonal elements represent own-variance shares.

Table 8. Spillover intensity by geopolitical risk regime

Risk Regime	Spillover Path	FROM→TO (%)	Net Effect
Low (< 30)	NPL → LDR	15.34 (12.34 → 8.90)	3.44
Low (< 30)	LDR → BOPO	12.67 (9.23 → 6.78)	2.45
Low (< 30)	BOPO → NPL	10.23 (7.89 → 5.67)	2.22
Medium (30-60)	NPL → LDR	23.85 (18.90 → 13.45)	5.45
Medium (30-60)	LDR → BOPO	19.78 (15.67 → 11.23)	4.44
Medium (30-60)	BOPO → NPL	16.89 (13.45 → 9.78)	3.67
High (> 60)	NPL → LDR	32.67 (25.45 → 18.90)	6.55
High (> 60)	LDR → BOPO	28.90 (22.34 → 16.78)	5.56
High (> 60)	BOPO → NPL	24.56 (19.78 → 14.56)	5.22

Notes: Regimes are defined by the composite ASEAN Geopolitical Risk Index value. FROM → TO columns show gross directional spillover contributions.

60). The near doubling of net spillover magnitudes between low and high regimes (e.g., NPL → LDR net effect increases from 3.44 to 6.55 percentage points) confirms that the banking system's internal connectivity functions as an amplifier of systemic vulnerability under severe geopolitical stress, consistent with the theoretical prediction of non-linear contagion escalation.

3.5. Fixed effects panel regression and heterogeneity analysis

Table 9 presents the full set of FE and RE panel regression estimates. Hausman tests reject the null of no systematic difference between estimators for all three models (χ^2 = 24.567, 21.345, and 18.987; all $p < 0.01$), confirming the presence of bank-specific unobserved heterogeneity correlated with the regressors and validating the preference for FE. Across all three models, the geopolitical risk coefficient is positive and highly significant, with the largest magnitude for NPL (FE: $\beta = 0.345$, $p < 0.01$), followed by LDR ($\beta = 0.289$) and BOPO ($\beta = 0.198$). Macroeconomic controls exhibit consistent effects: GDP growth negatively predicts all banking risks (strongest for NPL: $\beta = -0.256$), while inflation, interest rates, and exchange rate depreciations are positively associated with all three risk

Table 9. Panel data estimation results: fixed effects vs. random effects

Variable	NPL FE	NPL RE	LDR FE	LDR RE	BOPO FE	BOPO RE
GeoRisk	0.345***	0.334***	0.289***	0.276***	0.198**	0.187**
Inflation	0.245***	0.234***	0.198***	0.187***	0.156**	0.145**
Interest Rate	0.267***	0.256***	0.223***	0.212***	0.178**	0.167**
Exchange Rate	0.189**	0.178**	0.167**	0.156**	0.134**	0.123**
GDP Growth	−0.256***	−0.245***	−0.223***	−0.212***	−0.167**	−0.156**
R-squared	0.687	0.674	0.645	0.634	0.589	0.578
Adj. R^2	0.665	0.652	0.623	0.612	0.527	0.556
F / Wald χ^2	35,678***	298.67***	28,987***	276.54***		245.67***
Hausman χ^2	24.567***		21.345***		18.987***	
N (bank-days)	75,000	75,000	75,000	75,000	75,000	75,000

Notes: *** $p < 0.01$; ** $p < 0.05$. t-statistics in parentheses (omitted for brevity). Hausman test favors FE for all models.

Table 10. Heterogeneity of geopolitical risk effects by bank size

Banking Risk	Large Banks (> USD 10B)	Mid-size Banks (USD 5–10B)	Small Banks (< USD 5B)
NPL GeoRisk coef.	0.289***	0.345***	0.412***
	(3.567)	(3.987)	(4.234)
NPL R-squared	0.645	0.687	0.723
LDR GeoRisk coef.	0.234***	0.289***	0.356***
	(3.234)	(3.567)	(3.897)
LDR R-squared	0.612	0.645	0.678
BOPO GeoRisk coef.	0.167**	0.198**	0.245***
	(2.876)	(2.987)	(3.234)
BOPO R-squared	0.567	0.589	0.623

Notes: *** p < 0.01; ** p < 0.05. Bank size categories based on total assets at end-2022.

dimensions. Adjusted R-squared values of 0.665 (NPL), 0.623 (LDR), and 0.527 (BOPO) indicate that the models explain a substantial proportion of within-bank risk variation.

Table 10 reveals a systematic size gradient in geopolitical risk sensitivity. Small banks (assets < USD 5 billion) exhibit NPL coefficients of 0.412 (R^2 = 0.723), compared to 0.289 for large banks (R^2 = 0.645), a difference of 42.6% in effect magnitude. Analogous patterns obtain for LDR and BOPO, with small banks recording the highest coefficients in all cases. This finding is attributable to the resource and diversification constraints of smaller institutions: their loan portfolios are less geographically and sectorally diversified, their funding bases are more concentrated, and their risk-management capacities are less sophisticated, each of which amplifies their sensitivity to the economic uncertainty and funding shocks that accompany geopolitical events.

3.6. Robustness tests

System GMM estimates (Table 11) confirm the robustness of all primary findings. The significant lag coefficients of the dependent variables (NPL: 0.496; LDR: 0.412; BOPO: 0.378) validate the dynamic specification and confirm risk persistence across all three dimensions. Geopolitical risk coefficients under GMM (NPL: 0.334; LDR: 0.278; BOPO: 0.187) are closely aligned with the FE estimates, demonstrating that the primary results are not artefacts of the estimator. AR(1) tests are significant, and AR(2) tests are insignificant across all models, confirming the theoretical autocorrelation structure and the absence of second-order serial correlation that would compromise GMM consistency. Hansen J-test p-values exceed 0.10 in all models (range: 0.234-0.345), affirming the validity of the instrument set. The cross-method comparison in Table 12 shows that geopolitical risk coefficients for NPL vary only between 0.334 and 0.345 across FE, RE, and GMM, a range of approximately 3.3%, confirming the robustness of inference to estimator choice.

Table 11. System GMM robustness estimation results

Variable	NPL (Model 1)	LDR (Model 2)	BOPO (Model 3)
Lagged dependent	0.496***	0.412***	0.378***
	(4.567)	(4.123)	(3.987)
GeoRisk	0.334***	0.278***	0.187**
	(3.897)	(3.456)	(2.987)
Inflation	0.234***	0.189**	0.145**
	(3.567)	(2.987)	(2.765)
Interest Rate	0.256***	0.212***	0.167**
	(3.678)	(3.234)	(2.876)
Exchange Rate	0.178**	0.156**	0.123**
	(2.876)	(2.654)	(2.432)
GDP Growth	−0.245***	−0.212***	−0.156**
	(−3.567)	(−3.234)	(−2.765)
AR(1) test	−2.345**	−2.234**	−2.123**
AR(2) test	0.456	0.423	0.387
Hansen J (p-val.)	45.678	42.345	38.987
	(0.234)	(0.287)	(0.345)

Notes: *** p < 0.01; ** p < 0.05. Two-step System GMM with Windmeijer (2005) robust standard errors.

4. DISCUSSION

The empirical findings reported in this study provide a coherent and internally consistent account of geopolitical risk transmission across the

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ASEAN banking system. Crucially, the results not only extend the existing literature but also resolve several empirical inconsistencies that have characterized prior work.

The strong and precisely estimated positive effect of geopolitical risk on credit risk (NPL) clarifies the variably reported relationship identified in prior studies. Olalere and Mukuddem-Petersen (2023) and Cheong and Lee (2009) documented divergent effect sizes for analogous hypotheses, leaving the magnitude and reliability of the geopolitical–credit risk nexus in doubt. The present study attributes this heterogeneity primarily to measurement error: global geopolitical indices, by failing to capture region-specific narratives and conflict dimensions such as the ongoing South China Sea territorial dispute, ASEAN-specific diplomatic ruptures, and region-centered trade coercion dynamics, introduce systematic attenuation bias that deflates estimated coefficients and reduces statistical power. By contrast, the ASEAN Geopolitical Risk Index constructed here internalizes these regional specificities, yielding a sharper and more reliable signal that accounts for the substantially clearer and stronger statistical relationship observed. This explanation is consistent with the measurement-error critique advanced by Beck Aguilera et al. (2023) and provides a direct empirical justification for the investment in region-specific index construction.

Regional socio-political conditions have a significant impact on banking performance. This risk is inversely related to the performance of Islamic banks (Yunan et al., 2024). Political volatility reduces bank liquidity (Adeneye et al., 2025). Political risk reduces a bank's ability to meet short-term needs. As political risk increases, bank liquidity decreases. Regional political uncertainty encourages third parties to withdraw their funds from the bank, resulting in reduced bank liquidity.

Geopolitical risks not only affect liquidity risk and credit risk but also operational risk. Political risk is a key determinant in shaping banking risk (Shabir et al., 2023; Olalere & Mukuddem-Petersen, 2023) and thus influences a bank's financial stability. An increase in political risk will disrupt a bank's stability (Al-Shboul et al., 2020; Nadia et al., 2024; Topcu & Can, 2025). This means that geopolitical shocks will determine the banking sector's ability to perform its functions as an intermediary efficiently. Banking stability is highly dependent on liquidity risk, credit risk, and the quality of banking assets. Thus, geopolitical risks will determine how banks manage these risks (Ashraf, 2017). To improve their performance, banks must consider the level of risk they face, in accordance with the principle of "high risk–high return." When seeking to increase profits, the bank's risk exposure will automatically rise as well.

The liquidity risk results, showing a significant positive effect of geopolitical risk on the LDR ($\beta = 0.287$), are consistent with the flight-to-quality mechanism documented by Hung (2022). During geopolitical episodes, risk-averse depositors and institutional funders reallocate resources away from perceived riskier banking institutions, increasing loan-to-deposit ratios for affected banks as funding outflows exceed loan portfolio contractions. The modestly smaller magnitude compared to the NPL effect is consistent with the theoretical expectation that credit impairment constitutes the primary first-round channel, while liquidity stress reflects a secondary, contagion-driven amplification. The two-to-three-day transmission lag identified in the network analysis is interpretable as the time required for funding market participants to process and respond to geopolitical signals, a period consistent with the informational and contractual frictions in ASEAN wholesale funding markets.

The attenuated operational risk response (BOPO: $\beta = 0.198$) and its cross-country heterogeneity warrant specific interpretation. Operational risk is, in part, a discretionary expense category: cybersecurity investments, compliance infrastructure, and risk management systems can be ramped up with a strategic delay that is absent from the non-discretionary channels of credit impairment and deposit withdrawal. The finding that Singapore and Malaysia exhibit superior operational resilience and lower BOPO responses to geopolitical shocks is consistent with their more advanced institutional frameworks, deeper regulatory capacity, and greater revenue diversification, as anticipated by the moderating factors identified in Yu (2025). This heterogeneity underscores that the Uncertainty-Based

Transmission channel is filtered through national-level institutional structures, explaining the divergent country-specific findings in earlier literature.

The bank size heterogeneity results (Table 10) contribute a specific and actionable finding to the unresolved debate on moderating factors. Small banks' substantially higher geopolitical risk sensitivity, a 42.6% larger NPL coefficient relative to large banks, reflects the well-established vulnerability of less-diversified, more concentrated financial institutions to aggregate uncertainty shocks. This finding distinguishes the present study from prior ASEAN banking risk research, which typically assumed homogeneous responses across the institution-size distribution. The implication that uniform macroprudential capital buffers systematically underprotect small institutions against geopolitical stress is of direct relevance to banking supervisors across the ASEAN-5.

The non-linear spillover escalation documented in Tables 7 and 8 constitutes perhaps the most novel finding of this study. Standard linear VAR models and single-risk regressions, as employed in prior work by Pradhan et al. (2025), Zahra et al. (2021), and Suripto (2022), would fail to detect the regime-dependent intensification of cross-risk contagion revealed here. The near-doubling of NPL → LDR net spillover magnitude between low- and high-geopolitical-risk regimes (3.44% versus 6.55%) empirically validates the theoretical prediction from Systemic Contagion Theory that interconnected financial systems exhibit non-linear amplification under severe stress. This finding has direct implications for stress testing frameworks: calibrating capital and liquidity buffers using linear models will systematically underestimate systemic vulnerability in high-geopolitical-stress scenarios.

Geopolitical risks also influence loan interest rates. Political shocks will have an impact on disrupting the supply chain of goods. (Huang, 2025). Supply chain disruptions will affect inflation, so that people's power decreases. Thus, geopolitical risk greatly determines credit risk (Cai et al., 2026; Demiralay et al., 2024; Singhal et al., 2024; Luca et al., 2025). Thus, geopolitical shocks will have an impact on banking systemic risks (Gabbiadini et al., 2025; Yuan et al., 2026). Geopolitical risk greatly influences overall banking risk, including liquidity risk, credit risk, and operational risk. This means that geopolitical risks have a very big impact on the banking world and are systemic or cannot be avoided; banks only try to reduce the impact of these risks on banking risk.

CONCLUSION

This study set out to examine how geopolitical risk transmits into credit, liquidity, and operational dimensions of banking stability across the ASEAN-5 economies, using high-frequency panel data from 75 commercial banks over the 2022–2024 period. The findings establish that geopolitical risk is a statistically and economically significant determinant of all three banking risk categories, with credit risk constituting the dominant first-round transmission channel ($\beta = 0.324$), liquidity risk representing a structurally conditioned secondary channel ($\beta = 0.287$), and operational risk reflecting a delayed, institutionally moderated adaptive response ($\beta = 0.198$). Granger causality tests confirm that this relationship is unidirectional: geopolitical risk predicts banking stress, not the reverse.

The network spillover analysis reveals a credit-to-liquidity contagion mechanism with a characteristic lag of two to three trading days and demonstrates that spillover intensity escalates non-linearly with geopolitical stress severity, a regime-dependent dynamic that linear models systematically miss. Bank size emerges as a critical moderator: small banks are approximately 42.6% more sensitive to geopolitical shocks in their credit risk dimension than large banks, attributable to lower diversification, greater funding concentration, and weaker risk-management infrastructure. Singapore and Malaysia's superior resilience relative to Indonesia and the Philippines reflects the role of institutional quality, financial depth, and economic diversification as structural dampeners of geopolitical transmission.

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The principal contributions of this study are threefold. Theoretically, it integrates Uncertainty-Based Risk Transmission and Systemic Contagion Theory into a coherent transmission framework empirically validated at high frequency. Methodologically, it introduces the first ASEAN-specific geopolitical risk index and demonstrates that regional index precision resolves the measurement-error problem inherent in global proxies. Empirically, it provides the first evidence of non-linear, regime-dependent cross-risk contagion in the ASEAN banking system, with implications for macroprudential stress testing and early warning system design. For practitioners, the findings suggest that differentiated capital and liquidity requirements, particularly for small, less-diversified banks, and the integration of a regional geopolitical risk index into supervisory monitoring frameworks would meaningfully enhance the ASEAN financial system's resilience to geopolitical disruptions.

Future research should extend this framework in several directions: expanding the sample to include ASEAN-10 economies to assess whether transmission patterns differ systematically across less financially developed members; disaggregating the geopolitical risk index by event type to identify which conflict dimensions carry the greatest banking-system threat; and incorporating financial technology adoption as a potential moderator of operational risk transmission in an era of accelerating digitalization.

AUTHOR CONTRIBUTIONS

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Funding acquisition: Suripto.
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Methodology: Suripto, Supri Yanto, Putri Irmala Sari.
Project administration: Suripto, Supri Yanto.
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Visualization: Suripto, Putri Irmala Sari.
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