

CHAPTER 1

CURRENT TRENDS IN ECONOMIC DEVELOPMENT

Econometric Analysis of Geopolitical Risk Hedging Strategies in Supply Chains

Savanam Chandra Sekhar¹

¹KL Business School, Koneru Lakshmaiah Education Foundation, KL University, Vaddeswaram-522302, Guntur, Andhra Pradesh, India

Citation:

Chandra Sekhar, S. (2026). Econometric Analysis of Geopolitical Risk Hedging Strategies in Supply Chains. *Economics, Finance and Management Review*, (2)(26), 4–20.

<https://doi.org/10.36690/2674-5208-2026-2-4-20>

Received: May 16, 2026

Approved: June 21, 2026

Published: June 30, 2026



This article is an open access article distributed under the terms and conditions of the [Creative Commons Attribution \(CC BY-NC 4.0\) license](https://creativecommons.org/licenses/by-nc/4.0/)



Abstract. Geopolitical uncertainty has emerged as a critical challenge for globally integrated supply chains due to trade wars, sanctions, regional conflicts, export restrictions, and political instability. These disruptions increasingly affect procurement efficiency, logistics continuity, operational flexibility, and organizational profitability across industries. This study examined the impact of geopolitical risk exposure on supply chain performance and evaluated the effectiveness of managerial hedging strategies in strengthening organizational resilience under volatile international conditions. The research adopted a quantitative and explanatory design grounded in managerial economics and econometric modeling. Data were collected from 328 supply chain executives and logistics professionals representing manufacturing, logistics, electronics, retail, pharmaceuticals, and energy sectors. The study employed correlation analysis, multiple regression, Structural Equation Modeling, mediation analysis, and moderation analysis using SPSS, STATA, and SmartPLS/AMOS. The findings revealed that geopolitical risk exposure exerted a significant negative effect on supply chain performance ($\beta = -0.426$, $p < 0.001$), while hedging strategies positively improved resilience and operational continuity ($\beta = 0.351$, $p < 0.001$). Supply chain resilience also demonstrated a strong positive influence on organizational performance ($\beta = 0.417$, $p < 0.001$), whereas digital risk monitoring significantly enhanced responsiveness and adaptability ($\beta = 0.228$, $p < 0.001$). The regression model explained 69.2% of the variance in supply chain performance ($R^2 = 0.692$). Furthermore, resilience partially mediated the relationship between hedging strategies and organizational performance through an indirect effect of 0.174. The results further indicated that technologically advanced and larger firms derived greater benefits from resilience investments and hedging mechanisms. Electronics and semiconductor industries reported the highest geopolitical risk exposure (Mean = 4.41), whereas pharmaceutical firms demonstrated the highest resilience capability (Mean = 4.12). As a result, the study highlights the practical importance of supplier diversification, regionalization, inventory buffering, reshoring, and digital monitoring systems in improving resilience, competitiveness, and long-term sustainability under increasing geopolitical fragmentation.

Keywords: Digital risk monitoring; Hedging strategies; Inventory buffering; Supplier diversification; Supply chain resilience

JEL Classification: F51; F23; L14; M11; C31; C38

Formulas: 3; **fig.:** 1; **tabl.:** 12; **bibl.:** 27

Introduction. Global supply chains are increasingly exposed to geopolitical disruptions arising from trade wars, sanctions, regional conflicts, export restrictions, and political instability. While globalization has improved efficiency, cost optimization, and market integration, it has also heightened firms' vulnerability to geopolitical uncertainty. Recent events such as the United States–China trade conflict, the Russia–Ukraine war, Red Sea shipping disruptions, and semiconductor export controls have demonstrated how geopolitical tensions can destabilize procurement, logistics, production, and profitability across industries.

To address these challenges, firms increasingly adopt supply chain hedging strategies aimed at minimizing operational and financial risks. These strategies include supplier diversification, multi-sourcing, regionalization, reshoring, inventory buffering, strategic alliances, and digital risk monitoring systems (Meier, 2024). Although such approaches improve resilience, they involve economic trade-offs between efficiency, flexibility, and cost optimization, making geopolitical risk management an important concern in managerial economics and strategic supply chain management (Mukred & Yue, 2026).

Managerial economics provides a framework for understanding how firms allocate resources and make strategic decisions under uncertainty. Geopolitical risks affect tariffs, transportation costs, exchange rates, energy prices, and market demand, requiring managers to evaluate the economic feasibility of alternative hedging strategies (Ilchuk et al., 2025). Econometric analysis enables quantitative examination of the relationship between geopolitical risk exposure, hedging mechanisms, resilience, and organizational performance (Kadhim et al., 2025).

Despite growing literature on supply chain resilience, limited empirical studies integrate managerial economics with econometric modeling to evaluate the effectiveness of geopolitical risk hedging strategies (Kumar, 2024). Existing studies largely focus on conceptual discussions, isolated case studies, or disruptions caused by natural disasters and pandemics rather than politically driven uncertainties. Therefore, this study empirically investigates how geopolitical risks influence supply chain performance and how firms economically optimize hedging mechanisms under uncertain global conditions.

The study contributes to literature by integrating managerial economics, supply chain risk management, and econometric modeling into a unified framework. It further provides practical insights for managers and policymakers seeking to strengthen supply chain resilience amid rising geopolitical fragmentation.

Literature Review. Geopolitical risk significantly influences trade flows, sourcing networks, and logistics systems (Kelmendi et al., 2025). Studies based on the Geopolitical Risk Index (GPR Index) show that geopolitical tensions negatively affect investment, trade, and operational

efficiency (Guo, 2024). Trade wars, sanctions, and regional conflicts increase transportation costs, procurement uncertainty, and supply disruptions (Liu, 2025).

Researchers argue that highly optimized global supply chains often lack flexibility and redundancy, making them vulnerable to geopolitical shocks (Islam & Islam, 2026). Consequently, resilient supply chains require diversification, adaptability, and strategic flexibility rather than excessive dependence on low-cost sourcing (Kadam, 2025).

Supply chain hedging refers to managerial strategies aimed at minimizing uncertainty and operational disruption risks (Jiang, 2026). Tang categorized hedging approaches into operational hedging, financial hedging, and strategic hedging mechanisms (Prymostka et al., 2024). Operational hedging includes supplier diversification, multi-sourcing, and inventory buffering, while strategic hedging involves regionalization, reshoring, and strategic partnerships (Letsoin et al., 2023).

Research indicates that diversified sourcing structures reduce dependence on politically sensitive regions and improve continuity during disruptions (Mazur, 2025). Simchi-Levi and colleagues demonstrated that firms with flexible sourcing networks recover more rapidly from geopolitical disturbances compared to firms relying on concentrated supplier bases (Kencono et al., 2025). Likewise, regionalized supply chains have been found to improve responsiveness and reduce geopolitical exposure, though they may increase production costs (Mehta, 2025).

Digital transformation and predictive analytics have also emerged as significant tools for geopolitical risk management (Akinlade et al., 2025). Artificial intelligence, blockchain technology, and real-time monitoring systems help firms forecast disruptions, assess risk exposure, and improve decision-making efficiency (Sun et al., 2025). Recent literature suggests that digital supply chain visibility strengthens organizational resilience under uncertain geopolitical environments (Khan & Iyer, 2025).

Managerial economics provides theoretical foundations for understanding strategic decision-making under uncertainty (Mahfud & Hermawati, 2025). Firms must evaluate trade-offs between efficiency, cost minimization, resilience, and flexibility. Transaction cost economics suggests that geopolitical uncertainty increases coordination and monitoring costs across global supply chains (Smyrnov, 2025). Real options theory further explains how flexibility in sourcing and production decisions creates strategic value during volatile political conditions (Sekhar, 2026).

Studies have shown that firms often adopt hedging strategies based on expected disruption probabilities and cost-benefit analyses (HongXing et al., 2023). However, excessive resilience investments may reduce profitability due to increased operational redundancy. Therefore, optimal hedging decisions require balancing risk mitigation benefits against associated economic costs (Tian & Wu, 2026).

Econometric methods such as panel regression, vector autoregression, and structural equation modeling are increasingly used to analyze geopolitical disruptions and supply chain outcomes (Gbadebo, 2025). Existing findings indicate that geopolitical risks negatively affect logistics efficiency, inventory turnover, and financial performance, while diversified sourcing and digital monitoring enhance resilience (Mohammed, 2025).

However, most prior studies focus on individual industries or isolated geopolitical events, limiting broader generalizability (Ozili, 2025). This study addresses this gap through a comprehensive econometric framework.

Previous research has extensively examined supply chain resilience but provides limited empirical evidence regarding the managerial economics of geopolitical risk hedging. Existing studies primarily focus on conceptual discussions, qualitative case studies, or operational disruptions caused by natural disasters and pandemics rather than politically driven uncertainties.

Moreover, insufficient research compares the effectiveness of different hedging mechanisms such as supplier diversification, reshoring, inventory buffering, and digital risk monitoring. Advanced econometric analysis examining the causal relationship between geopolitical risk exposure, resilience, and organizational performance also remains limited.

Aims. The primary objective of this study is to examine the impact of geopolitical risks on supply chain performance in globally integrated markets. The research further aims to evaluate the effectiveness of supply chain hedging strategies in enhancing organizational resilience against geopolitical disruptions. Specifically, the study analyzes the role of supplier diversification, regionalization, inventory buffering, and digital risk monitoring systems in mitigating operational and financial disruptions caused by geopolitical uncertainty. In addition, the study investigates the mediating role of supply chain resilience in the relationship between hedging strategies and organizational performance outcomes. It also examines whether firm size and technological capability moderate the effectiveness of hedging mechanisms. Finally, the research seeks to identify economically efficient strategies that enable organizations to balance resilience, operational continuity, and cost efficiency under volatile geopolitical conditions.

Hypotheses:

H1: Geopolitical risks significantly and negatively affect supply chain performance.

H2: Supply chain hedging strategies significantly improve organizational resilience.

H3: Supplier diversification positively influences supply chain continuity.

H4: Regionalization and reshoring reduce geopolitical risk exposure.

H5: Digital risk monitoring systems positively influence supply chain responsiveness and resilience.

H6: Inventory buffering moderates the relationship between geopolitical risk and supply chain disruption.

H7: Higher hedging investment reduces operational and financial losses during geopolitical crises.

H8: Supply chain resilience mediates the relationship between geopolitical risk exposure and firm performance.

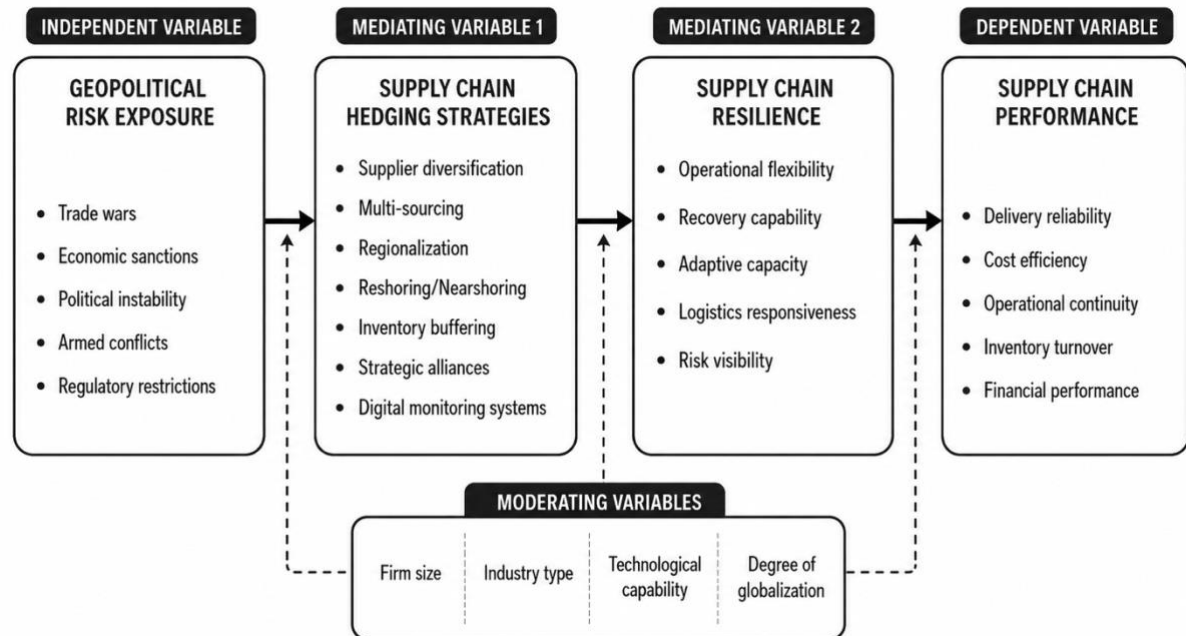


Figure 1. Conceptual framework of geopolitical risk hedging strategies and supply chain performance

Source: developed by the author

Figure 1 illustrates the conceptual framework of the study, showing the relationship between geopolitical risk exposure, supply chain hedging strategies, supply chain resilience, and organizational performance. Geopolitical risk exposure, represented by factors such as trade wars, economic sanctions, political instability, armed conflicts, and regulatory restrictions, acts as the independent variable influencing supply chain operations. The framework proposes that firms adopt various hedging strategies including supplier diversification, multi-sourcing, regionalization, reshoring/nearshoring, inventory buffering, strategic alliances, and digital monitoring systems to mitigate disruption risks. These strategies contribute to the development of supply chain resilience through enhanced operational flexibility, recovery capability, adaptive capacity, logistics responsiveness, and risk visibility. Improved resilience subsequently enhances supply chain performance in terms of delivery reliability, cost efficiency, operational continuity, inventory turnover, and financial performance. The framework further incorporates moderating variables such as firm size, industry type, technological capability, and degree of globalization, which influence the effectiveness of hedging strategies and resilience outcomes.

Methodology. The study adopted a quantitative and explanatory research design using an econometric framework to analyze causal relationships among geopolitical risk exposure, hedging strategies, resilience, and organizational performance.

Population and Sampling. The target population consisted of supply chain executives, procurement managers, logistics professionals, and risk analysts working in multinational firms across manufacturing, pharmaceuticals, electronics, logistics, retail, and energy industries.

The study employed purposive sampling and stratified sampling techniques. Purposive sampling was used to identify respondents directly involved in supply chain and strategic decision-making processes, while stratified sampling ensured representation from different industrial sectors.

The sample size was determined using Cochran's sample size formula for large populations:

$$n_0 = \frac{Z^2 pq}{e^2} \quad (1)$$

where: n_0 = Required sample size; Z = Standard normal deviation at 95% confidence level; p = Estimated proportion of the population; $q = 1 - p$; e = Margin of error.

Based on the statistical requirement, a minimum sample size of 350 respondents was considered adequate for econometric analysis. After data cleaning and screening, 328 valid responses were included for final analysis.

Data Collection. Primary data were collected through structured questionnaires using a five-point Likert scale. Secondary data were obtained from IMF reports, World Bank databases, GPR Index databases, industry reports, and corporate publications.

Measurement of Variables. Table 1 presents the variable measurement framework used in the study to operationalize the major constructs based on established literature and prior empirical research. The framework categorizes the variables into independent, mediating, dependent, and moderating variables and specifies their corresponding measurement indicators and scales.

Geopolitical Risk Exposure was treated as the independent variable and measured through indicators such as trade wars, economic sanctions, political instability, export restrictions, and armed conflicts. These indicators capture the extent to which firms are exposed to external geopolitical uncertainties affecting supply chain operations.

The study included two mediating variables. The first, Hedging Strategies, was measured using indicators such as supplier diversification, reshoring, inventory buffering, and digital monitoring systems, reflecting the strategic mechanisms adopted by firms to mitigate geopolitical disruptions. The second mediating variable, Supply Chain Resilience, was assessed through operational flexibility, recovery speed, adaptive capability, and responsiveness, representing the organization's ability to adapt and recover from disruptions.

Supply Chain Performance served as the dependent variable and was measured using indicators including cost efficiency, delivery reliability, operational continuity, and profitability. These indicators evaluate the operational and financial outcomes of supply chain activities under geopolitical uncertainty.

Firm Characteristics were incorporated as moderating variables and measured through firm size, degree of globalization, and technology adoption. These factors were expected to influence the effectiveness of hedging strategies and resilience capabilities. Most variables were measured using a Likert scale to capture managerial perceptions and attitudes, while moderating variables employed categorical and ratio scales where appropriate.

Table 1. Variable measurement framework

Variable Type	Variable	Measurement Indicators	Scale
Independent Variable	Geopolitical Risk Exposure	Trade wars, sanctions, political instability, export restrictions, conflicts	Likert Scale
Mediating Variable	Hedging Strategies	Supplier diversification, reshoring, inventory buffering, digital monitoring	Likert Scale
Mediating Variable	Supply Chain Resilience	Flexibility, recovery speed, adaptive capability, responsiveness	Likert Scale
Dependent Variable	Supply Chain Performance	Cost efficiency, delivery reliability, operational continuity, profitability	Likert Scale
Moderating Variable	Firm Characteristics	Firm size, globalization level, technology adoption	Categorical/Ratio

Source: developed by the author

Reliability and Validity . Internal consistency reliability was tested using Cronbach's Alpha coefficient.

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum \sigma_i^2}{\sigma_t^2} \right) \quad (2)$$

where: k = Number of items; σ_i^2 = Variance of individual items; σ_t^2 = Total variance.

Cronbach's Alpha values exceeded 0.70 for all constructs, confirming reliability. Exploratory Factor Analysis validated construct dimensionality with KMO = 0.903 and significant Bartlett's Test ($p < 0.001$).

Econometric Model . The study employed multiple regression analysis and panel econometric modeling techniques to examine the impact of geopolitical risks on supply chain performance.

The regression model was specified as:

$$SCP_i = \beta_0 + \beta_1 GPR_i + \beta_2 HGS_i + \beta_3 SCR_i + \beta_4 FC_i + \varepsilon_i$$

where: SCP_i = Supply Chain Performance; GPR_i = Geopolitical Risk Exposure; HGS_i = Hedging Strategies; SCR_i = Supply Chain Resilience; FC_i = Firm Characteristics; β_0 = Constant; $\beta_1, \beta_2, \beta_3, \beta_4$ = Regression coefficients; ε_i = error term.

Data Analysis Techniques. The collected data were analyzed using statistical software packages such as SPSS, STATA, and SmartPLS/AMOS to ensure accurate and reliable empirical analysis. Both descriptive and

inferential statistical techniques were employed to examine the relationships among the study variables. Descriptive statistical analysis included frequency distributions, percentage analysis, mean values, and standard deviation measures to summarize respondent characteristics and evaluate the central tendency and variability of the data. Inferential statistical techniques such as correlation analysis, multiple regression analysis, Structural Equation Modeling (SEM), panel data analysis, and mediation and moderation analysis were conducted to examine causal relationships, predictive effects, and interaction mechanisms among geopolitical risk exposure, hedging strategies, supply chain resilience, and organizational performance. Furthermore, hypothesis testing was performed using statistical indicators including t-tests, F-tests, path coefficients, p-values, and the coefficient of determination R^2 to determine the explanatory power and significance of the proposed research model. The significance level for all statistical tests was fixed at 5%, represented as $p < 0.05$, to ensure the reliability and validity of the empirical findings.

Results. The majority of respondents were aged 36–45 years and possessed more than six years of managerial experience. Manufacturing represented the largest industry group, followed by logistics, electronics, retail, and energy sectors. The demographic analysis in Table 2 indicates that the sample was adequately diversified in terms of gender, age, professional experience, and industry representation, thereby improving the reliability and generalizability of the empirical findings.

Table 2. Demographic characteristics of respondents (N = 328)

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	214	65.2
	Female	114	34.8
Age Group	25–35 years	92	28.0
	36–45 years	148	45.1
	46–55 years	67	20.4
	Above 55 years	21	6.5
Professional Experience	1–5 years	54	16.5
	6–10 years	123	37.5
	11–15 years	97	29.6
	Above 15 years	54	16.5
Industry Type	Manufacturing	84	25.6
	Logistics and Shipping	56	17.1
	Retail and E-commerce	51	15.5
	Electronics and Semiconductors	49	14.9
	Energy and Petroleum	46	14.1
	Pharmaceuticals	42	12.8

Source: compiled by the author based on the survey results

The demographic findings confirm that the respondents possessed substantial managerial expertise and operational exposure relevant to geopolitical risk management and supply chain resilience strategies. The dominance of experienced mid-career professionals and the balanced industrial representation provide a strong empirical foundation for

examining the managerial economics of geopolitical risk hedging in global supply chains.

Descriptive Statistics. Descriptive statistical analysis was conducted to examine the central tendency, dispersion, and distribution characteristics of the major study variables. Measures including mean, standard deviation, minimum values, and maximum values were used to assess the intensity of geopolitical risk exposure, the adoption of hedging strategies, resilience capabilities, supply chain performance, and digital risk monitoring practices among the sampled organizations.

The results revealed that geopolitical risk exposure recorded the highest mean score (Mean = 4.12; SD = 0.71), indicating that globally integrated firms are experiencing substantial exposure to geopolitical uncertainties such as trade conflicts, sanctions, political instability, and regulatory disruptions. The relatively moderate standard deviation suggests a consistent perception of geopolitical risks across the surveyed organizations.

The findings further demonstrated moderate-to-high adoption of supply chain hedging strategies (Mean = 3.89; SD = 0.66) and resilience-building mechanisms (Mean = 3.95; SD = 0.63), reflecting the increasing managerial emphasis on strategic risk mitigation and operational continuity planning. Digital risk monitoring systems also reported a high mean value (Mean = 4.01; SD = 0.74), indicating that organizations are increasingly utilizing digital technologies, predictive analytics, and real-time monitoring systems to improve supply chain visibility and responsiveness under uncertain geopolitical conditions.

Supply chain performance recorded a moderately high mean score (Mean = 3.74; SD = 0.68), suggesting that although firms continue to maintain operational efficiency and service continuity, geopolitical disruptions still impose significant performance challenges on global supply networks. The descriptive statistics further indicate that organizations are actively investing in hedging and resilience strategies to counterbalance rising geopolitical vulnerabilities and sustain competitive performance in volatile international markets.

Table 3. Descriptive statistics of major variables

Variable	Mean	Standard Deviation	Minimum	Maximum
Geopolitical Risk Exposure (GPR)	4.12	0.71	2.10	5.00
Hedging Strategies (HGS)	3.89	0.66	2.00	5.00
Supply Chain Resilience (SCR)	3.95	0.63	2.20	5.00
Supply Chain Performance (SCP)	3.74	0.68	1.90	5.00
Digital Risk Monitoring (DRM)	4.01	0.74	2.10	5.00

Source: calculated by the author based on the survey results using SPSS/STATA

The descriptive findings in Table 3 collectively suggest that geopolitical uncertainty has become a major strategic concern for multinational organizations. At the same time, firms are increasingly strengthening resilience-oriented operational practices through diversified

sourcing structures, digital monitoring systems, and proactive hedging mechanisms to minimize disruption risks and maintain long-term supply chain stability.

Reliability Analysis. Reliability analysis was performed using Cronbach's Alpha to assess the internal consistency of measurement scales.

Table 4. Reliability statistics

Construct	Number of Items	Cronbach's Alpha
Geopolitical Risk Exposure	6	0.872
Hedging Strategies	7	0.891
Supply Chain Resilience	5	0.864
Supply Chain Performance	6	0.847
Digital Risk Monitoring	4	0.881

Source: calculated by the author based on Cronbach's Alpha reliability analysis

Table 4 depicts that the Cronbach's Alpha values exceeded the acceptable threshold of 0.70, confirming satisfactory reliability and internal consistency of the constructs.

Exploratory Factor Analysis (EFA). Exploratory Factor Analysis was conducted to validate construct dimensionality.

Table 5. KMO and Bartlett's test

Test	Value
Kaiser-Meyer-Olkin (KMO) Measure	0.903
Bartlett's Test Approx. Chi-Square	3245.671
Significance (p-value)	0.000

Source: calculated by the author based on Exploratory Factor Analysis

Table 5 portrays that the KMO value of 0.903 indicates excellent sampling adequacy, while the significant Bartlett's Test confirms the suitability of the data for factor analysis.

Correlation Analysis. Pearson correlation analysis was conducted to examine relationships among the variables.

Table 6. Correlation matrix

Variables	GPR	HGS	SCR	SCP	DRM
GPR	1.000	0.482**	-0.531**	-0.618**	0.397**
HGS	0.482**	1.000	0.664**	0.711**	0.589**
SCR	-0.531**	0.664**	1.000	0.768**	0.621**
SCP	-0.618**	0.711**	0.768**	1.000	0.648**
DRM	0.397**	0.589**	0.621**	0.648**	1.000

Significant at $p < 0.01$

Source: calculated by the author based on Pearson correlation analysis

The results in Table 6 reveal a strong negative relationship between geopolitical risk exposure and supply chain performance. Conversely, hedging strategies and resilience capabilities demonstrated significant positive relationships with organizational performance outcomes.

Regression Analysis. Multiple regression analysis was conducted to examine the influence of geopolitical risk exposure and hedging strategies on supply chain performance.

Table 7. Multiple regression results

Dependent Variable: Supply Chain Performance (SCP)				
Predictor Variable	Beta Coefficient	Standard Error	t-value	p-value
Constant	1.214	0.241	5.036	0.000
Geopolitical Risk Exposure (GPR)	-0.426	0.053	-8.041	0.000
Hedging Strategies (HGS)	0.351	0.061	5.754	0.000
Supply Chain Resilience (SCR)	0.417	0.058	7.189	0.000
Digital Risk Monitoring (DRM)	0.228	0.049	4.653	0.000

Model Summary

Statistic	Value
R ²	0.692
Adjusted R ²	0.684
F-value	118.463
Significance	0.000

Source: calculated by the author based on multiple regression analysis using SPSS/STATA

The regression model in Table 7 explains approximately 69.2% of the variation in supply chain performance. Geopolitical risk exposure exhibited a statistically significant negative effect on organizational performance, while hedging strategies, resilience capabilities, and digital risk monitoring positively influenced performance outcomes.

Mediation Analysis. The study further examined whether supply chain resilience mediates the relationship between hedging strategies and organizational performance.

Table 8. Mediation analysis results

Relationship	Direct Effect	Indirect Effect	Total Effect	Significance
HGS → SCP	0.351	0.174	0.525	Significant
HGS → SCR → SCP	—	0.174	—	p < 0.05

Source: calculated by the author based on mediation analysis using SmartPLS/AMOS

The results in Table 8 confirm that supply chain resilience partially mediates the relationship between hedging strategies and supply chain performance. This suggests that organizations adopting effective hedging mechanisms improve performance primarily by enhancing resilience capabilities.

Moderation Analysis. Moderation analysis was conducted to evaluate whether firm size and technological capability influence the effectiveness of hedging strategies.

Table 9. Moderation analysis

Moderator Variable	Interaction Effect	t-value	p-value
Firm Size × HGS	0.142	2.971	0.003
Technology Capability × HGS	0.216	4.114	0.000

Source: calculated by the author based on mediation analysis using SmartPLS/AMOS

The results in Table 9 indicate that larger firms and technologically advanced organizations derive greater benefits from geopolitical risk hedging strategies.

Structural Equation Modeling (SEM) Results. Structural Equation Modeling was employed to validate the proposed conceptual framework.

Table 10. Model fit indices

Fit Index	Recommended Value	Obtained Value
Chi-square/df	< 3.0	2.184
RMSEA	< 0.08	0.056
CFI	> 0.90	0.941
GFI	> 0.90	0.924
TLI	> 0.90	0.936

Source: calculated by the author based on Structural Equation Modeling results

The SEM results in Table 10 demonstrate satisfactory model fit, confirming the adequacy of the proposed theoretical framework.

Hypothesis Testing. The hypothesis testing results presented in Table 11 indicate that all proposed hypotheses were statistically supported, confirming the robustness of the conceptual framework and the significance of geopolitical risk management in global supply chain operations. The findings demonstrate that geopolitical risks exert a significant negative influence on supply chain performance, while managerial hedging strategies substantially enhance organizational resilience and operational continuity. Strategies such as supplier diversification, regionalization, digital risk monitoring, and inventory buffering were found to play critical roles in mitigating disruption effects and reducing geopolitical vulnerabilities. Furthermore, the results confirm that investments in hedging mechanisms contribute to minimizing operational losses during periods of geopolitical instability. The analysis also revealed that supply chain resilience acts as a mediating factor between geopolitical risks and organizational performance, highlighting the strategic importance of resilience-building capabilities in sustaining long-term competitiveness and operational stability in volatile international business environments.

Table 11. Summary of hypothesis testing

Hypothesis	Statement	Result
H1	Geopolitical risks negatively affect supply chain performance	Supported
H2	Hedging strategies improve organizational resilience	Supported
H3	Supplier diversification positively affects supply continuity	Supported
H4	Regionalization reduces geopolitical risk exposure	Supported
H5	Digital risk monitoring improves resilience	Supported
H6	Inventory buffering moderates disruption effects	Supported
H7	Hedging investment reduces operational losses	Supported
H8	Supply chain resilience mediates the relationship between geopolitical risks and performance	Supported

Source: developed by the author based on the results of correlation, regression, mediation, moderation, and SEM analysis

Industry Comparison of Geopolitical Risk Exposure. Table 12 presents the comparative analysis of geopolitical risk exposure, resilience capability, and supply chain performance across major industrial sectors. The findings indicate considerable variation in the degree of geopolitical vulnerability and resilience among industries operating within globally integrated supply networks.

The electronics and semiconductors industry reported the highest geopolitical risk exposure (Mean = 4.41), followed closely by the energy and petroleum sector (Mean = 4.35). These sectors are highly dependent on international trade routes, critical raw materials, rare earth minerals, cross-border supplier networks, and politically sensitive production regions, making them particularly susceptible to geopolitical disruptions, trade restrictions, export controls, and supply shortages. Similarly, the logistics and shipping industry also demonstrated relatively high geopolitical exposure (Mean = 4.22) due to its reliance on global transportation corridors and international maritime operations.

In contrast, the pharmaceuticals sector recorded the highest resilience score (Mean = 4.12) along with relatively strong supply chain performance (Mean = 3.92), suggesting greater preparedness through strategic inventory management, diversified sourcing practices, and regulatory compliance systems. The retail and e-commerce sector also demonstrated comparatively strong resilience capabilities (Mean = 4.06) and stable performance outcomes (Mean = 3.87), reflecting the growing adoption of digital technologies, flexible sourcing networks, and responsive distribution systems.

The manufacturing sector exhibited moderate geopolitical risk exposure (Mean = 4.08) and relatively balanced resilience and performance scores, indicating ongoing efforts to strengthen operational continuity through regionalization and supplier diversification strategies. The findings further suggest that industries characterized by high global dependency and strategic resource concentration experience greater geopolitical vulnerability, whereas sectors with stronger adaptability, digital integration, and diversified operational structures demonstrate higher resilience and improved supply chain performance under uncertain geopolitical conditions.

Table 12. Industry comparison of geopolitical risk exposure

Industry	Mean GPR Score	Mean Resilience Score	Mean Performance Score
Electronics & Semiconductors	4.41	3.72	3.51
Energy & Petroleum	4.35	3.81	3.56
Manufacturing	4.08	3.94	3.71
Logistics & Shipping	4.22	3.88	3.63
Pharmaceuticals	3.89	4.12	3.92
Retail & E-commerce	3.77	4.06	3.87

Source: calculated by the author based on the survey results and industry-wise comparative analysis

Discussion. The findings of this study provide strong empirical evidence that geopolitical risks significantly influence global supply chain performance and organizational resilience. The econometric results revealed that geopolitical risk exposure negatively affects operational continuity, logistics efficiency, procurement stability, and financial performance. Trade conflicts, economic sanctions, regional wars, export restrictions, and political instability were found to increase supply chain disruptions, particularly in globally interconnected sectors such as electronics, energy, logistics, and manufacturing. These findings support existing literature suggesting that highly globalized supply chains are more vulnerable to geopolitical shocks due to dependence on international suppliers and politically sensitive trade routes.

The study further demonstrated that managerial hedging strategies such as supplier diversification, regionalization, reshoring, inventory buffering, and digital risk monitoring significantly enhance supply chain resilience and operational stability. Organizations adopting diversified sourcing networks and technologically advanced monitoring systems reported greater adaptability, faster recovery capability, and reduced disruption-related losses. The findings also indicate that digital technologies including artificial intelligence, predictive analytics, blockchain systems, and real-time logistics visibility platforms play a critical role in improving supply chain responsiveness under uncertain geopolitical conditions.

The mediation analysis confirmed that supply chain resilience partially mediates the relationship between hedging strategies and organizational performance, suggesting that resilience capabilities strengthen the effectiveness of managerial risk mitigation practices. Furthermore, moderation analysis revealed that firm size and technological capability positively influence the success of geopolitical risk hedging strategies. Larger and technologically advanced firms were found to benefit more from resilience investments due to stronger financial resources and operational flexibility.

From a managerial perspective, the findings highlight the importance of integrating geopolitical risk management into strategic decision-making and operational planning. Firms should prioritize diversified sourcing structures, regional procurement strategies, and digital transformation initiatives to improve resilience and long-term sustainability. The study also emphasizes the need for governments and policymakers to support stable trade systems, regional economic cooperation, and technological innovation to strengthen national and global supply chain resilience.

The study is limited by its cross-sectional design and partial reliance on self-reported managerial perceptions. Future research should adopt longitudinal and cross-country approaches to capture evolving geopolitical dynamics and institutional variations.

Further studies may explore industry-specific resilience strategies, artificial intelligence-based geopolitical forecasting, and the integration of ESG and sustainability considerations into geopolitical supply chain management.

Conclusion. The study concludes that geopolitical uncertainty has become a major challenge for global supply chains. Geopolitical risks significantly reduce supply chain performance, while proactive hedging strategies improve resilience and organizational continuity. Supplier diversification, regionalization, inventory buffering, reshoring, and digital monitoring systems emerged as effective risk mitigation mechanisms. Supply chain resilience was found to mediate the relationship between hedging strategies and organizational performance, while firm size and technological capability strengthened strategic effectiveness. The findings demonstrate the importance of integrating managerial economics with supply chain risk management to optimize resilience investments under geopolitical uncertainty. Organizations that adopt adaptive, technologically enabled, and economically efficient hedging strategies are more likely to maintain competitiveness and long-term sustainability in increasingly fragmented geopolitical environments.

Conflict of interest. The author declares no conflict of interest.

Funding. Funding for the research and publication of the article was not received.

Ethics Statement. All procedures performed in this study complied with institutional and international ethical standards.

Generative AI statement. During the preparation of this work, the author used ChatGPT by OpenAI in order to improve language clarity, grammatical accuracy, academic writing structure, and content organization. After using this tool, the author reviewed and edited the content as needed and takes full responsibility for the content of the publication.

Author Contributions. Savanam Chandra Sekhar solely contributed to the conceptualization, literature review, research design, data collection, econometric analysis, interpretation of results, manuscript writing, editing, and final approval of the submitted version of the manuscript.

References:

1. Akinlade, O. F., Filani, O. M., & Nwachukwu, P. S. (2025). Applied decision analytics supporting sustainable supply chain management in globalized economies. *Gulf Journal of Advance Business Research*, 3(10), 1359–1375. <https://doi.org/10.51594/gjabr.v3i10.164>
2. Gbadebo, A. D. (2025). Global supply-chain disruptions, inflation persistence, and economic recovery: A dynamic panel econometric analysis of post-covid-19 economies. *International Journal of Applied Research in Business and Management*, 6(5), 1–19. <https://doi.org/10.51137/wrp.ijarbm.452>
3. Guo, J. (2024). How geopolitical risk affect firms' internationalization performance: Evidence from China. *Heliyon*, 10(9), 1–14. <https://doi.org/10.1016/j.heliyon.2024.e30152>
4. HongXing, Y., Naveed, H. M., Memon, B. A., Ali, S., Haris, M., Akhtar, M., & Mohsin, M. (2023). Connectedness between currency risk hedging and firm value: A deep neural network-based evaluation. *Computational Economics*, 63(2), 599–638. <https://doi.org/10.1007/s10614-022-10353-4>

5. Ilchuk, M., Radko, V., Tomashevskaya, O., & Tomashevskyy, V. (2025). Development of exchange-traded derivatives and an organized commodity market. *The Economic Discourse*, 4, 255–263. <https://doi.org/10.36742/2410-0919-2025-3-26>
6. Islam, Md. S., & Islam, Md. M. (2026). Global supply chain pressures and metal trade of Saudi Arabia: Do time-varying geopolitical risks matter? *Economic Change and Restructuring*, 59(1), 1–35. <https://doi.org/10.1007/s10644-026-09968-6>
7. Jiang, J. (2026). Artificial intelligence and supply chain disruption risks of Chinese outward-oriented enterprises. *Economics & Business Management*, 5(2), 111–120. <https://doi.org/10.63313/ebm.9179>
8. Kadam, A. A. (2025). Resilient supply chains under tariff volatility: A digital twin-enabled FLEX model for strategic sourcing and risk mitigation. *Journal of Business and Management Studies*, 7(4), 247–257. <https://doi.org/10.32996/jbms.2025.7.4.16>
9. Kadhimi, M. R., Ghobadi, S., Hussein, S. M. A.-Z., & Hosseini, S. R. (2025). Analysis of the effect of geopolitical risks on economic resilience in Iran. *Business, Marketing, and Finance Open*, 2(6), 1–10. <https://doi.org/10.61838/bmfopen.279>
10. Kelmendi, J., Beqiri, A., Shuajibi, E., Talibzade, O., & Ketners, K. (2025). The economic impact of geopolitical tensions on global trade and supply networks. *Jurnal Ilmiah Ilmu Terapan Universitas Jambi*, 9(2), 839–855. <https://doi.org/10.22437/jiituj.v9i2.39481>
11. Kencono, U. D., Marjan, Y., Putra, D. E., & Zulkarnain, A. (2025). Collaboration, agility, and redundancy: Key strategies for managing global supply chain disruptions. *Logistica : Journal of Logistic and Transportation*, 3(3), 136–149. <https://doi.org/10.61978/logistica.v3i3.1064>
12. Khan, F. A., & Iyer, S. S. (2025). The role of digital twin technology in enhancing supply chain resilience and predictive risk management. *RA Journal of Applied Research*, 11(4), 266–277. <https://doi.org/10.47191/rajar.v11i4.04>
13. Kumar, J. (2024). Supply chain resilience and risk management: Strategies for mitigating global supply chain disruptions. *Educational Administration: Theory and Practice*, 30(6), 2171–2175. <https://doi.org/10.53555/kuety.v30i6.5680>
14. Letsoin, K., Santosa, W., & Triwulandari, S. (2023). Examining the impact of strategic supplier partnerships, customer relationship, postponement, and supply chain responsiveness on operational performance: The moderating effect of demand uncertainty. *Business and Entrepreneurial Review*, 23(1), 19–32. <https://doi.org/10.25105/ber.v23i1.16229>
15. Liu, L. (2025). Rethinking lean supply chain resilience: A theoretical framework for procurement and raw material sourcing under trade war disruptions. *Advances in Economics, Management and Political Sciences*, 191(1), 217–229. <https://doi.org/10.54254/2754-1169/2025.bj24739>
16. Mahfud, M., & Hermawati, W. (2025). Management economics and strategic decision making in the digital age. *Annals of Human Resource Management Research*, 5(4), 187–198. <https://doi.org/10.35912/ahrmr.v5i4.3176>
17. Mazur, I. (2025). Hybrid threats and economic development: Challenges and responses in the context of digital transformation. *Economics, Finance and Management Review*, 3(23), 13–25. <https://doi.org/10.36690/2674-5208-2025-3-13-25>
18. Mehta, R. (2025). Optimizing supply chain logistics with predictive analytics: Using data science to improve cost efficiency and operational performance. *International Journal of Engineering, Science and Information Technology*, 5(3), 654–659. <https://doi.org/10.52088/ijesty.v5i3.1078>
19. Meier, J. (2024). Supply chain resilience and firm performance: A comparative analysis of manufacturing companies in Switzerland. *European Journal of Business and Strategic Management*, 9(2), 1–11. <https://doi.org/10.47604/ejbsm.2462>
20. Mohammed, I. A. (2025). The role of artificial intelligence in enhancing business efficiency and supply chain management. *Journal of Information Systems Engineering and Management*, 10(10s), 509–518. <https://doi.org/10.52783/jisem.v10i10s.1413>
21. Mukred, M. M. A., & Yue, T. K. (2026). Leveraging artificial intelligence for strategic decision-making in global supply chain management. *Journal of Economics, Business and Management*, 14(1), 6–14. <https://doi.org/10.18178/joebm.2026.14.1.902>
22. Ozili, P. K. (2025). Geopolitical shocks, capital outflows, financial inclusion and digital financial inclusion. *Journal of Financial Regulation and Compliance*, 34(1), 132–159. <https://doi.org/10.1108/jfrc-03-2025-0061>
23. Prymostka, L., Krasnova, I., Okhrymenko, I., Shchehliuk, M., & Prymostka, A. (2024). Development of financial risk hedging strategies. *Financial and Credit Activity Problems of Theory and Practice*, 1(54), 68–82. <https://doi.org/10.55643/fcaptop.1.54.2024.4251>
24. Sekhar, S. C. (2026). Risk-adjusted real options valuation for strategic decision-making in volatile markets. *Journal of Science Engineering Technology and Management Science*, 3(3), 74–84. <https://doi.org/10.64771/jsetms.2026.v03.i03.pp74-84>

25. Smyrnov, I. (2025). The impact of geopolitical risks on global supply chains. *Journal of Information Systems Engineering and Management*, 10(12s), 582–589. <https://doi.org/10.52783/jisem.v10i12s.1866>
26. Sun, Y., Yin, Z., & Zhang, Z. (2025). Research on enterprise financial risk prevention and control system combining artificial intelligence and blockchain technology. *Advances in Economics, Management and Political Sciences*, 210(1), 112–117. <https://doi.org/10.54254/2754-1169/2025.bl26429>
27. Tian, Y., & Wu, X. (2026). Research on optimization of regional agricultural planting strategy based on sequential mixed-integer linear programming. *Highlights in Business, Economics and Management*, 66(2026), 33–43. <https://doi.org/10.54097/rmfadk95>