Geopolitical Risks and Global Supply Chain Networks*

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Abstract

This study examines how geopolitical risks reshape global supply chain networks. We show that rising geopolitical risks impair the performance of supplier firms in the affected economies and their international customers. These customers are more inclined to terminate existing supply relationships and diversify their suppliers across a broader range of economies, favoring new suppliers with lower geopolitical risks and closer proximity. In response, affected supplier firms attempt to establish subsidiaries in their customers' economies or in the economies of their customers' new suppliers to preserve these relationships. Overall, our results suggest that geopolitical risks contribute to the reconfiguration of global supply chains and prompt international expansion through subsidiaries as firms adapt to disruptions.

Keywords: Geopolitical Risks, Global Supply Chains, Propagation, Supply Chain Resilience, Subsidiaries

JEL Classification: D80, F02, F23, G32, L14

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1 Introduction

Supply chain management is becoming increasingly influenced by geopolitical factors. [1] The ongoing conflicts, such as the Russia-Ukraine war, the Israel-Hamas conflict, and the Red Sea crisis, have not only caused significant internal turmoil within the nations involved but also sent ripples of disruption throughout the global community. From surging shipping costs to restricted access to essential materials and resources, the repercussions are multifaceted. To ensure the resilience of supply chain operations, it is imperative for firms to proactively integrate global political dynamics into their risk management strategies.[2]

According to Caldara and Iacoviello (2022), geopolitical risk is the *threat*, *realization*, and *escalation* of adverse events associated with wars, terrorism, and any tensions among states and political actors that affect the peaceful course of international relations. In line with this definition, several unique aspects distinguish geopolitical risks from other related concepts in existing literature. For example, compared to economic policy uncertainty of Baker et al. (2016), geopolitical risks inherently capture events that are less likely to be economically driven or attributed to the political and regulatory system, and have the potential to increase economic policy uncertainty. Trade policy uncertainty (e.g., Handley (2014) and Caldara et al. (2020)), as another related concept, concerns specifically the uncertainty surrounding trade agreements, tariffs, quotas, and other government policies that regulate trade flows across international borders. Regarding the implications for global supply chains, geopolitical risks are often sudden, severe, and can have an immediate and dramatic effect on supply chains. Economic policy uncertainty or trade policy uncertainty, however, can often be tracked and anticipated through political processes and economic indicators. Geopolitical risks can affect multiple countries and regions simultaneously, leading to widespread disruptions in the supply chain, in comparison to localized policy or trade policy uncertainties. The effects of geopolitical risks can also be long-lasting, as they may lead to a reconfiguration of international

[1] See `https://www.gisreportsonline.com/r/supply-chain-risk-management/` for details.

[2] See `https://www.resilinc.com/blog/geopolitical-supply-chain-risks-2024/` for details.

relations and trade patterns. These features make geopolitical risks particularly challenging to manage, requiring firms to be agile and resilient in their supply chain strategies. Despite extensive media coverage and policy discussions on how geopolitical risks are reshaping global supply chains, much of the research relies on descriptive analyses (Mukunde, 2023). In this paper, we empirically examine how geopolitical risk propagates through global supply chains and how upstream and downstream firms respond to these risks.

A key challenge in this line of research at a global scale is finding an appropriate measure that consistently tracks real-time geopolitical tensions as perceived by the media, the public, investors, and policymakers over time. Caldara and Iacoviello (2022) fill this gap in the literature by constructing news-based indices of geopolitical risk (GPR), which is the frequency of articles mentioning adverse geopolitical events in major newspapers, calculated daily and monthly for both global and economy-specific contexts, starting from 1900. Consistent with the aforementioned definition, the GPR index encompasses the threat, realization, and escalation of adverse geopolitical events. Therefore, higher GPR values indicate higher current intensity of negative events (e.g., more wars), higher probability of negative events in the future, or higher expected intensity of future negative events (Iacoviello et al., 2024) . As shown in Caldara and Iacoviello (2022) , the GPR index captures distinct information about geopolitical events that is not reflected in related economic and geopolitical data. The next section contains a more detailed discussion of the construction and a visual inspection of the index.

Using global supply-chain relationship data covering 15,690 suppliers and 14,924 customers, with a total of 281,139 supplier-customer pairs from 44 economies over the period from 2003 to the first quarter of 2024, we first ask how geopolitical risks affect the overall performance of suppliers and customers. We show that a one-standard-deviation increase in geopolitical risk in the supplier's economy results in a 70.4% reduction in the supplier's quarterly ROE relative to the sample mean. The effect is greater than that of climate risk, as documented by Pankratz and Schiller (2024). They find that a one-standard-deviation increase in heat

exposure results in a 13.8% decrease in operating income relative to assets. For customer firms, when the average geopolitical risk of a firm's suppliers increases by one standard deviation, the firm's quarterly ROE decreases by 22.2% of the sample mean. The indirect transmission effect of geopolitical risk, at approximately 31.5%, is notably higher than the 4.6% effect transmitted through heat exposure in Pankratz and Schiller (2024). These results suggest that geopolitical risks exert a detrimental impact on firm performance, with this adverse effect transmitting along the supply chain. This is consistent with previous research on the negative ripple effects of natural disasters (Barrot and Sauvagnat, 2016),cyberattacks (Crosignani et al., 2023), climate risks (Pankratz and Schiller, 2024), and credit risks (Cortes et al., 2019; Costello, 2020; Agca et al., 2022) along supply chains.

Next, we investigate how geopolitical risk affects the dynamics of supply chain relationships. We define an unexpected geopolitical risk shock as a situation where a supplier's quarterly geopolitical risk exceeds the average level experienced in the three years prior to establishing the supply relationship. A similar approach can be found in Pankratz and Schiller (2024). We show that the occurrence of such a shock in a quarter raises the likelihood of terminating the supplier relationship by 4%. This result indicates that geopolitical risk can disrupt the stability of global supply chains.

How do downstream customers respond to geopolitical risk shocks experienced by their upstream suppliers? We show that when a supplier is hit by a geopolitical risk shock, downstream customers tend to seek new suppliers and diversify the geographical origins of their supply sources. Specifically, when a supplier experiences an unexpected geopolitical risk shock, the number of suppliers for the customer increases by 0.756 in the subsequent quarter; the number of supplier economies increases by 0.077. To examine the profiles of these new suppliers, we consider a new supplier entering between the last four quarters of an active supply relationship and the two quarters following termination to be a replacement for the former supplier if the first two digits of the SIC codes for both the new and former suppliers match. Figure 2 provides an illustrative example. We find that the new suppliers

following an unexpected geopolitical risk shock tend to have lower geopolitical risk, come from different economies than the former suppliers, and are geographically closer to the customer. In fact, similar patterns can be observed in real-world examples. Following the outbreak of the Russia-Ukraine conflict, European economies have started to reduce their dependence on Russian energy and shifted towards sourcing energy from the Middle East, Africa, and North America. This shift not only alters the global supply-demand dynamics of the energy market but also presents new challenges to the stability of energy supply chains.

How do upstream suppliers respond to geopolitical risk shocks and the termination of supply chain relationships? We identify whether an upstream supplier has established a subsidiary during the period from the last four quarters of an active supply relationship through the two quarters following termination. Figure 3 provides an illustrative example. We show that geopolitical risk shocks prompt upstream suppliers to establish subsidiaries either in the economies where their former customers are based, or closer to their former customers than the original distance between the parent suppliers and those customers. Furthermore, affected upstream suppliers also attempt to establish subsidiaries either in the economies of their former customers' new suppliers or closer to these new suppliers. Figure 4 provides an illustrative example. A similar real-world example is observed in the case of Iran's energy sector. In response to sanctions from Western economies, Iran's energy firms forged new supply chains through partnerships with Asian economies and set up subsidiaries in these regions to maintain the flow of energy exports.

This paper contributes to three strands of literature. The first is the literature on the propagation of adverse shocks through supply chains, which has been documented in the contexts of severe events such as natural disasters (Barrot and Sauvagnat, 2016; Boehm et al., 2019; Carvalho et al., 2021), cyber risks (Crosignani et al., 2023), pandemics (Bonadio et al., 2021), and credit shocks (Alfaro et al., 2021; Agca et al., 2022; Cortes et al., 2019; Costello, 2020) However, the propagation of geopolitical risks through supply chain networks remains underexplored. Earlier research on the effects of geopolitical risks primarily focuses on the

energy sector.[3] With recent advancements in the measurement of geopolitical risk, Caldara and Iacoviello (2022) begin to expand the scope of empirical analysis. At the macro-level, they find that higher geopolitical risk predicts lower investment and employment, as well as higher disaster probability and larger downside risks. At the firm-level, geopolitical risk is associated with lower corporate investment. Iacoviello et al. (2024) further show that geopolitical risks are closely linked to rising inflation, with differing effects across economies and historical periods. We investigate the international ramifications of geopolitical risks by providing firm-level micro evidence on how geopolitical risks propagate through global supply chains and how firms adapt to geopolitical risk shocks. Therefore, our paper also adds to the broader literature on the role of firm-level economic networks.[4] We confirm the importance of production networks in explaining shock propagation.

Second, we contribute to understanding how firms influence their subsidiaries and the factors that drive the creation of new subsidiaries. Previous research has explored the motives behind the establishment of subsidiaries for tax avoidance (Bilicka, 2019; Guvenen et al., 2022; Tørsløv et al., 2023), responding to financial crises (Biermann and Huber, 2024), and addressing climate risks (Gibson, 2019; Bartram et al., 2022). Our paper reveals that supplier firms, in response to geopolitical risks, establish subsidiaries within the economies of their customers or those of their customers' new suppliers, thereby highlighting the significant role of geopolitical risks in firm expansion across geographies. A related literature documents that the subsidiary networks created by multinational companies (MNCs) are pivotal to the interconnectedness of the global economy.[5] Ownership networks of MNCs, through supply chain linkages between subsidiaries and internal capital markets, act as one mechanism for the transmission of economic downturns across borders (Bena et al., 2022). We differ by showing that geopolitical risk shocks, an important non-economic factor, can reshape the

[3]See, for example, Liu et al. (2019), Bouoiyour et al. (2019), and Su et al. (2021) , among others.

[4]See, for example, Hertzel et al. (2008), Acemoglu et al. (2012), Di Giovanni et al. (2018), Bernard et al. (2019), Herskovic et al. (2020) and Kopytov et al. (2024), among others. See also Carvalho (2014) and Carvalho and Tahbaz-Salehi (2019) for surveys of this literature.

[5]See Yeaple (2013) and Antràs and Yeaple (2014) for surveys of the MNCs literature.

ownership networks of MNCs as they adapt to global supply chain disruptions. Our emphasis is to understand the role of international geographic dispersion in mitigating, rather than spreading, the effects of such shocks.

Third, this paper contributes to the literature on how risk and uncertainty affect corporate investment and export behaviors. Existing studies have explored the effects of policy uncertainty (Gulen and Ion, 2016) , trade policy uncertainty (Handley, 2014) , supply chain risks (Ersahin et al., 2024), pandemic risks (Ding et al., 2021), political risks (Hassan et al., 2019), and Brexit-related uncertainty (Hassan et al., 2024) on corporate investment choices. We contribute by examining how geopolitical risks influence firms' decisions to diversify their international sourcing and to establish subsidiaries, thereby maintaining supply chain resilience. Recent theoretical work by Grossman et al. (2023) takes a first step in understanding the optimal government policies amid global supply chain disturbances, specifically, whether to promote international diversification or to encourage sourcing from safer locations. Our findings on corporate adaptive strategies, despite abstracting away from policy factors, may provide empirical references for policy design.

The remainder of the paper is organized as follows. Section 2 presents data sources, variable constructions, and summary statistics. Section 3 presents empirical strategy and results. Section 4 offers concluding remarks.

2 Data, Variables, and Summary Statistics

2.1 Global Supply Chains

We obtain global firm-level supply chain data from FactSet Revere, , covering the period from 2003 to the first quarter of 2024. FactSet Revere compiles supply chain data from annual reports, SEC filings, investor presentations, and various other platforms. It is considered the only publicly accessible database providing comprehensive global firm-level supply chain data and is widely recognized in finance research (Dai et al., 2021; Pankratz and Schiller, 2024).

Given that this study examines the transmission of geopolitical risks across international borders, we exclude observations involving entities from the same economy. For each supply chain relationship, observations begin in the formation quarter and continue through the termination quarter, or to the first quarter of 2024 if the relationship remains active. Our final dataset comprises 15,690 suppliers, 14,924 customers, 281,139 supplier-customer pairs, and 1,426,268 pair-quarter observations.

2.2 Geopolitical Risk Index

We use economy-level measures of the geopolitical risk index from Caldara and Iacoviello (2022), covering 44 economies from 1985 onwards. Economy-specific geopolitical risk is constructed by news mentions of adverse geopolitical events together with an economy's name, capital, or major cities in major English-language newspapers. [6] These indexes measure each economy's exposure to geopolitical threats and acts. Available monthly, we average the data to determine quarterly geopolitical risk levels for each economy in our study. Figure 1 plots the global-level geopolitical risk from 2003 to the first quarter of 2024. Notable spikes are observed in 2003 and 2022. The 2003 peak is mainly due to the 9/11 aftermath and Iraq invasion, while the 2022 rise is largely driven by the Russia-Ukraine conflict.

[Insert Figure 1 Here]

2.3 Other Data

Financial data comes from Worldscope. Subsidiary establishment data is from BvD Orbis. Geographical distance data is from the CEPII Gravity Database. To ensure comparability, all financial figures are converted to U.S. dollars. All continuous variables are winsorized at the 1st and 99th percentiles.

[6] Specifically, the recent GPR index is constructed by automated text searches across the electronic archives of 10 newspapers, including the *Chicago Tribune,* the *Daily Telegraph*, the *Financial Times*, the *Globe and Mail*, the *Guardian*, the *Los Angeles Times*, the *New York Times*, *USA Today*, the *Wall Street Journal*, and the *Washington Post*. See Caldara and Iacoviello (2022)) Section I.B for details about the measurement.

2.4 Summary Statistics

[Insert Table 1 Here]

Table 1 presents the summary statistics for suppliers, customers, and their relationships at the quarter level. At the supplier-quarter level, the average geopolitical risk (S GPR) is 0.966, with a standard deviation of 1.051, indicating considerable variation among suppliers. The average total assets is $12.79 billion, with a standard deviation of $97.46 billion, indicating notable disparities in asset scale.

At the customer-quarter level, the average geopolitical risk (S Aver GPR) is 0.755, with a standard deviation of 0.916. The average total assets is $19.7 billion, with a standard deviation of $136.5 billion. Notably, customers' total assets is 1.5 times those of suppliers. This contrasts with the 12-fold disparity in Pankratz and Schiller (2024), likely due to our longer sample period and broader coverage of economies, with a focus on cross-border supply chains.

At the supplier-customer pair level, the average duration of a relationship up to a given quarter (Relationship Age) is 9.178 quarters. The maximum duration of a relationship (Relationship Age Max) has an average of 17.76 quarters. 34.8% of relationship-quarter level observations are in their final year—the last four quarters (Last Year).

[Insert Table A2 Here]

Appendix Table A2 presents the distribution of suppliers and customers across economies. In our sample, the U.S. has the largest number of customers and suppliers. China, Japan, and Korea follow. In contrast, some economies, such as Argentina and Hungary, have relatively fewer participants. This variation reflects the diverse degrees of global supply chain participation, likely linked to economic size and trade networks.

[Insert Table A3 Here]

Table A3 presents the top 30 unique supplier-customer relationships by economy. The U.S. and Japan exhibit the most extensive connections with 8,301 supplier-customer pairs and 4,705 customer-supplier pairs, indicating a strong supply chain interdependence. The U.S. also shows significant ties with suppliers in China, totaling 5,213 pairs. Asian economies are notably interlinked. China and Japan, for example, have 2,675 supplier-customer pairs. Furthermore, different economies play varied roles in supply chain relationships, with some primarily acting as suppliers and others as customers.

3 Empirical Strategy and Results

In this section, we examine how geopolitical risks reshape global supply chain networks and how firms adapt to such disruptions, focusing on four key aspects. First, we examine how geopolitical risks affect supplier performance and whether these effects are transmitted to downstream customers. Second, we investigate the effects of geopolitical risk shocks on supplier-customer dynamics. Third, we analyze how downstream customers respond to geopolitical risk shocks encountered by their upstream suppliers. Finally, we examine how upstream suppliers can counteract geopolitical risk shocks and reestablish connections in response to downstream customers' strategies.

3.1 Transmission of Geopolitical Risks Through Supply Chains

3.1.1 Geopolitical Risk and Supplier Performance

In this section, we investigate how geopolitical risk affects the performance of supplier firms. Given that geopolitical risk is measured at the economy level, we employ the following regression equation, with the basic unit of analysis being firm-quarter data, following the approach of Crosignani et al. (2023) and Pankratz and Schiller (2024):

$$Y_{i,t} = \alpha + \beta \times GPR_{i,t} + \text{Fixed Effects} + \epsilon_{i,t} \tag{1}$$

where the index i refers to the firm, and t represents the time period (e.g., a specific quarter). $Y_{i,t}$ represents the performance of either suppliers or customers at time t. $GPR_{i,t}$ denotes the intensity of geopolitical risk in the economy where the supplier firm i is located. If $Y_{i,t}$ reflects customer performance, $GPR_{i,t}$ is the average geopolitical risk of all suppliers of that customer for the given quarter. The geopolitical risk index provided by Caldara and Iacoviello (2022) is reported monthly, so we use the three-month average to represent the geopolitical risk intensity for the quarter. Fixed effects include supplier firm fixed effects interacted with fiscal quarter effects and industry-size bucket-year quarter effects. The size buckets refer to Crosignani et al. (2023), where firms are divided into quintiles based on total assets within the same quarter. Standard errors are clustered at the firm level.

[Insert Table 2 Here]

According to the regression results shown in Table 2, we find that an increase in geopolitical risk significantly and adversely affects supplier performance, whether measured by revenue, ROE, or operating income, even after controlling for various fixed effects. Taking Column (2) as an example, the study finds a significant negative correlation between geopolitical risk (S_GPR) and supplier ROE (S_ROE), with a coefficient of -0.349 and a standard error of 0.114. Specifically, when the geopolitical risk in a supplier's economy increases by one standard deviation (1.051), the supplier's ROE decreases by approximately 0.367% (1.051*0.349), which accounts for 70.4% of the average ROE of 0.521. This finding suggests that an increase in geopolitical risk substantially weakens the profitability of suppliers. This conclusion is consistent with the findings of Caldara and Iacoviello (2022), who also noted that rising geopolitical risks can lead to economic downturns and reductions in investment.

3.1.2 Supplier Geopolitical Risk and Customer Performance

To further examine the transmission of geopolitical risk along the supply chain, we present the regression results in Table 3. The dependent variable $Y_{i,t}$ represents the performance of

the customer, while the independent variable is the average geopolitical risk of all suppliers to that customer. Taking Column (2) as an example, when the geopolitical risk faced by the customer's suppliers increases by one standard deviation (0.916), the customer's ROE decreases by approximately 0.224% (0.916*0.244), which is equivalent to 22.3% of the average ROE (1.007) (0.224/1.007). The results suggest that geopolitical risks faced by suppliers significantly and adversely affect customer performance, indicating that risks are transmitted along the supply chain. However, the transmission strength decreases from 70.4% to 22.3%. This finding aligns with Crosignani et al. (2023), who observed that cyber risks propagate through supply chains, and Pankratz and Schiller (2024), who found that climate risks also transmit along supply chains, with the negative effects gradually diminishing.

Furthermore, to examine the transmission of geopolitical risk along the supply chain, we present the regression results in Table 3. Here, the dependent variable $Y_{i,t}$ represents the performance of the customer, while the independent variable is the average geopolitical risk of all suppliers to that customer. The results show that the geopolitical risk faced by suppliers significantly and negatively affects customer performance, indicating that risks are transmitted along the supply chain. This finding is consistent with Crosignani et al. (2023), who observed that network risks propagate through the supply chain.

[Insert Table 3 Here]

3.1.3 Robustness: Considering Economic Policy Uncertainty

Appendix Table A4 and Table A5 investigate the effect of geopolitical risk on supplier performance, taking into account the influence of Economic Policy Uncertainty (EPU). The reason for not including these results in the baseline is primarily due to the fact that EPU data is available for only 27 economies, whereas GPR data covers 44 economies, offering a richer dataset. The EPU data is derived from Gulen and Ion (2016), and other trade policy uncertainties are classified under the EPU framework. However, EPU does not provide comprehensive data at a broader, economy-level dimension.

From these two tables, we find that, even when considering EPU, GPR consistently has a negative effect on supplier performance. More importantly, EPU does not propagate along the supply chain, whereas GPR does. The reason lies in the fact that EPU is more related to domestic policies, with relatively limited impact on cross-border trade relations. On the other hand, GPR, being geopolitical in nature, has a much broader influence across international borders.

[Insert Table A4 Here]

[Insert Table A5 Here]

3.2 Geopolitical Risk Shocks and Supply Relationships

In this section, we examine how unanticipated geopolitical risks affect supply relationships. Following the equation setup of Pankratz and Schiller (2024), we perform a relationship-quarter level regression. The regression equation is specified as follows:

$$\text{LastYear}_{ij,t} = \alpha + \beta_1 \times \textit{GPR_Shock}_{ij,t} \textit{ or } \textit{GPR_before}_{ij,t} + \text{Fixed Effects} + \epsilon_{ij,t} \qquad (2)$$

where the index i represents the supplier, j represents the customer, and t denotes the time period (e.g., a specific quarter). The dependent variable, $\text{LastYear}_{ij,t}$, is defined as 1 if the supply relationship is in its final four quarters, and 0 otherwise. Our key independent variables are $\textit{GPR_Shock}_{i,t}$ and $\textit{GPR_before}_{ij,t}$. Here, $\textit{GPR_Shock}_{ij,t}$ is defined as 1 if the supplier's geopolitical risk in quarter t exceeds the average geopolitical risk over the three years prior to the establishment of the relationship ($\textit{GPR_before}_{ij,t}$), and 0 otherwise (for robustness checks, we also use the average geopolitical risk over the five or ten years prior to the relationship). Fixed effects include supplier-customer relationship fixed effects, as well as supplier and customer industry-size bucket-year quarter effects. The size bucket classification follows Crosignani et al. (2023), dividing firms into quintiles based on total assets within the

same quarter. Standard errors are clustered at the relationship level or double-clustered at the relationship and quarter levels.

[Insert Table 4 Here]

Table 4 presents the regression results analyzing the effect of unanticipated geopolitical risk on the termination of supplier relationships. In Columns (1) and (2), the coefficient for $GPR_Shock_{i,t}$ is consistently positive and statistically significant at the 1% level, with a magnitude of 0.019. This suggests that an unanticipated geopolitical risk shock increases the likelihood of supplier relationship termination by approximately 1.9 percentage points. The coefficient remains significant regardless of the clustering method used, whether it is clustered at the relationship level (Column (1)) or at both the relationship and quarter levels (Column (2)).

In contrast, the coefficient for $GPR_before_{i,t}$ is not significant in all specifications, suggesting that pre-existing geopolitical risks do not have a statistically significant effect on the likelihood of supplier relationship termination.

Our results show that when an unexpected geopolitical risk shock occurs in a given quarter, the likelihood of the supplier relationship terminating increases by 4% (0.019/0.348), whereas already existing geopolitical risks do not significantly alter the likelihood of relationship termination. This finding aligns with Pankratz and Schiller (2024), who argue that due to the learning and adaptive functions inherent in supply chain relationships, previously identified risks do not notably influence relationship outcomes.

3.2.1 Robustness: Alternative Definitions of Geopolitical Risk Shocks

Appendix TableA6 presents the robustness checks by applying different definitions of geopolitical risk shocks to examine their effects on supplier relationship termination.

We introduce two new definitions of geopolitical risk shocks: 1) GPR_Shock_5year: This variable captures geopolitical risk shocks that exceed the average geopolitical risk of the

previous five years before the supplier-customer relationship; 2) GPR_Shock_3year_max: This variable defines the geopolitical risk shocks as exceeding the maximum value of the past three years prior to the relationship.

The results indicate that regardless of whether the shock is defined based on the five-year average or the three-year maximum, the coefficients for geopolitical risk shocks (e.g., 0.021, 0.025) remain positive and are statistically significant at the 1% level. This implies that geopolitical risk shocks significantly increase the likelihood of supplier relationship termination under both definitions.

Overall, these robustness checks demonstrate that the model's results are robust to different definitions of geopolitical risk shocks, providing strong evidence for the stability and consistency of our findings.

[Insert Table A6 Here]

3.3 Customer Responses to Geopolitical Risk Shocks

3.3.1 Diversification in Suppliers

In this section, we explore how geopolitical risks faced by suppliers influence the downstream customers' strategic decisions. As established earlier, geopolitical risks negatively effect the performance of downstream customers. The next logical question is: How do these customers respond? Do they diversify their supplier base or broaden the geographic scope of their suppliers? What are the characteristics of the new suppliers compared to the existing ones? To address these questions, we establish the following panel regression model:

$$\text{Outcome}_{i,t+1} = \alpha + \beta \times \textit{Shock_sum}_{i,t} + \text{Fixed Effects} + \epsilon_{i,t} \tag{3}$$

In this equation, i refers to the customer, and t represents the time period (e.g., a specific quarter). The dependent variables include the number of suppliers (*sup_num*) and the diversity of supplier economies (*sup_ctry*) for customer i in quarter $t+1$. The key explanatory

variable, $Shock_sum_{i,t}$, is defined as the sum of *GPR_Shock* for all suppliers of customer i in quarter t. A higher value of *Shock_sum* indicates a greater exposure of the customer to unexpected supply risks due to geopolitical tensions.

[Insert Table 5 Here]

Table 5 presents the effect of suppliers' unexpected geopolitical risk on customers' decisions to diversify their supplier base. Specifically, customers respond to geopolitical risk shocks by either increasing the number of suppliers or expanding the geographical diversity of their supplier sources.

The regression results, as shown in Table 5, reveal that customers tend to increase their number of suppliers and diversify the geographic origins of their suppliers in response to higher geopolitical risks faced by their current suppliers. This strategy appears to buffer their operations from the challenges posed by geopolitical risks. In Column (1), a one-unit increase in unexpected geopolitical risk raises the number of suppliers by 0.756. In Column (2), the number of supplier economies increases by 0.077.

3.3.2 Characteristics of New Suppliers

Next, we examine the characteristics of the new suppliers when customers decide to add more suppliers in response to geopolitical risk shocks. We construct a dataset at the former supplier-customer-new supplier level. Specifically, we identify a new supplier if it begins supplying to a customer within the period spanning the last four quarters of an existing supplier's relationship and the two quarters following the end of that relationship. Furthermore, we consider the new supplier to be a replacement if its primary SIC code matches the first two digits of the former supplier's SIC code. Figure 2 provides an illustrative depiction of our definition of new suppliers.

[Insert Figure 2 Here]

To investigate the characteristics of new suppliers, this paper employs the following regression model:

$$\text{New_Supplier_Characteristic}_{i,j,k} = \alpha + \beta \times \textit{GPR_Shock}_{i,j} + \text{Fixed Effects} + \epsilon_{i,j,k} \quad (4)$$

In this regression, i represents the original supplier, j denotes the customer, and k stands for the new supplier. The dependent variables compare characteristics between new and former suppliers. These characteristics include whether the new supplier has lower geopolitical risk compared to the former supplier (*Down_GPR*), whether the new supplier is from a different economy than the former supplier (*Diff_Ctry*), and whether the new supplier is geographically closer to the customer than the former supplier (*Down_Dist*). The key explanatory variable is whether the former supplier faced an unexpected geopolitical risk shock (*GPR_Shock*). Fixed effects include the former supplier's industry-quarter effects, customer industry-quarter effects, former supplier's economy effects, and customer economy effects. Standard errors are clustered at the level of the former supplier-customer relationship.

[Insert Table 6 Here]

Table 6 presents the effect of unexpected geopolitical risk faced by former suppliers on the characteristics of new suppliers. The regression results show that geopolitical risk shocks faced by former suppliers significantly alter the characteristics of new suppliers. Column (1) shows that as the geopolitical risk of former suppliers increases, new suppliers tend to have lower geopolitical risk uncertainty, with a *GPR_Shock* coefficient of 0.146, significant at the 1% level. The results in Columns (2) and (3) indicate that customers are more likely to choose new suppliers from different economies (coefficient = 0.019) and those geographically closer (coefficient = 0.023), both significant at the 1% level.

We find that a geopolitical risk shock to the former supplier leads customers to select new suppliers with lower geopolitical risks, from different economies, and with shorter distances to the customer. These findings suggest that customers respond to heightened geopolitical

risks by diversifying their supplier base, increasing the number of supplier economies, and shortening supply distances to mitigate risk.

3.4 Supplier Responses to Geopolitical Risk Shocks

3.4.1 Establishing New Overseas Subsidiaries

In this section, we examine how upstream suppliers respond to geopolitical risk shocks. Previously, we discussed how downstream customers react to such risks. If a supplier seeks to maintain its supply relationships despite increasing geopolitical risks, it may do so by establishing more overseas subsidiaries as a means of mitigating these risks and continuing to serve its existing customers. To explore this, we construct multiple levels of data and perform the following analyses.

First, we use supplier-quarter panel data and establish the following regression equation:

$$\text{Outcome}_{i,t} = \alpha + \beta \times GPR_{i,t} + \text{Fixed Effects} + \epsilon_{i,t} \tag{5}$$

In this equation, i refers to the Supplier, and t represents the time period (e.g., a specific quarter). Here, the dependent variables include whether the supplier establishes an overseas subsidiary (*Subsidiary_Yes*) and the number of overseas subsidiaries established (*Subsidiary_Count*). The key explanatory variable is the geopolitical risk (*GPR*) faced by the supplier.

[Insert Table 7 Here]

Table 7 presents the regression results examining whether suppliers respond to geopolitical risks by establishing or increasing the number of overseas subsidiaries. The key independent variable in both columns is *GPR*, representing the geopolitical risk faced by the suppliers.

In Column (1), the dependent variable is *Subsidiary_Yes*, which takes a value of 1 if the supplier establishes an overseas subsidiary in a given period. The coefficient on *GPR* is

positive and statistically significant at the 1% level, with a magnitude of 0.073, indicating that suppliers are more likely to establish overseas subsidiaries when geopolitical risks rise. This suggests that suppliers may establish overseas subsidiaries as a strategic response to mitigate the challenges posed by geopolitical uncertainties.

In Column (2), the dependent variable is *Subsidiary_Count*, representing the total number of overseas subsidiaries established. Here, the coefficient on *GPR* is also positive and significant at the 1% level, with a magnitude of 0.068. This implies that as geopolitical risks increase, suppliers are more likely to expand the number of their overseas subsidiaries, further diversifying their operational presence across different regions.

Overall, our findings indicate that an increase in a supplier's geopolitical risk significantly increases both the likelihood of establishing overseas subsidiaries and the number of subsidiaries formed. This suggests that suppliers strategically expand their international presence to reduce the challenges posed by geopolitical risks

3.4.2 Establishing New Overseas Subsidiaries Closer to Former Customers

Next, we explore the relationship between these newly established overseas subsidiaries and the supplier's existing customers. We construct a dataset at the former supplier-customer-new subsidiary level. Specifically, we identify a match if a new overseas subsidiary is established within the last four quarters of an existing supply relationship or within two quarters after the relationship ends. Figure 3 provides an illustrative depiction of the newly established subsidiaries and their relationships with customers.

[Insert Figure 3 Here]

To analyze the relationship between the establishment of subsidiaries and customers, this paper employs the following regression model:

$$\text{Customer_Subsidiary_Relation}_{i,j,k} = \alpha + \beta \times \textit{GPR_Shock}_{i,j,k} + \text{Fixed Effects} + \epsilon_{i,j,k} \quad (6)$$

In this equation, i refers to the original supplier, j denotes the customer, and k represents the new subsidiary established by the supplier. The dependent variables include whether the new subsidiary is in the same economy as the customer (Com_Ctry), and whether the distance between the new subsidiary and the customer is shorter than that between the former supplier and the customer ($Down_Dist$). The explanatory variable is whether the former supplier faced an unexpected geopolitical risk shock (GPR_Shock). Fixed effects include industry-quarter effects for the former supplier and customer, and economy fixed effects for both the former supplier and the customer. Standard errors are clustered at the former supplier-customer relationship level.

[Insert Table 8 Here]

Table 8 presents the regression results analyzing the relationship between suppliers' newly established overseas subsidiaries and their proximity to customers following unexpected geopolitical risk shocks. The sample comprises former supplier-customer-new subsidiary observations.

Column (1) shows that an increase in geopolitical risk significantly raises the probability that a newly established subsidiary will be located in the same economy as the customer, with a coefficient of 0.019 and a standard error of 0.007, statistically significant at the 1% level. In Column (2), the results indicate that geopolitical risk also significantly increases the likelihood that the new subsidiary will be geographically closer to the customer, with a coefficient of 0.028 and a standard error of 0.010, also significant at the 1% level.

These findings suggest that suppliers tend to respond to geopolitical risk shocks by establishing subsidiaries either in the same economy as their customers or closer to them geographically. The regression includes fixed effects for supplier industry-year-quarter and customer industry-year-quarter, and standard errors are double-clustered at the relationship and first relationship-quarter levels to account for heteroscedasticity and autocorrelation.

3.4.3 Establishing New Overseas Subsidiaries Closer to Former Customers' New Suppliers

Lastly, we investigate the relationship between newly established overseas subsidiaries and new suppliers. We extend the former supplier-customer-new supplier dataset to include new subsidiaries established during the six-quarter period, creating a new dataset at the former supplier-customer-new supplier-new subsidiary level. Figure 4 provides an illustrative depiction of the newly established subsidiaries and their relationships with new suppliers.

[Insert Figure 4 Here]

To investigate the relationship between the establishment of subsidiaries and new suppliers, this paper utilizes the following regression model:

$$\text{NewSupplier_Subsidiary_Relation}_{i,j,m,n} = \alpha + \beta \times \textit{GPR_Shock}_{i,j,m,n} + \text{Fixed Effects} + \epsilon_{i,j,m,n} \tag{7}$$

where the index i represents the original supplier, j represents the customer, m refers to the new supplier, and n denotes the new subsidiary established by the original supplier. The dependent variables examine whether the new subsidiary and new supplier are in the same economy (*Com_Ctry_New_Sub*), and whether the distance between the new subsidiary and new supplier is shorter than that between the new supplier and the customer (*Close_New_Supplier*). The key explanatory variable is the unexpected geopolitical risk shock faced by the former supplier (*GPR_Shock*). Fixed effects and standard errors follow the same structure as in the previous regression.

[Insert Table 9 Here]

Table 9 examines the relationships between former suppliers, new suppliers, and newly established overseas subsidiaries, analyzing how unexpected geopolitical risks faced by former suppliers affect these new relationships.

The regression results, presented in Table 9 , show that geopolitical risk shocks to the former supplier lead to a greater likelihood of establishing overseas subsidiaries in the same economy as the new supplier or closer to the new supplier, thereby reducing the distance between the supplier and customer. Specifically, in Column (1), a one-unit increase in *GPR_Shock* raises the likelihood of a newly established overseas subsidiary being located in the same economy as the customer by 3.4 percentage points (coefficient = 0.034). In Column (2), the likelihood of the new supplier and subsidiary being geographically closer to the customer increases by 6.7 percentage points (coefficient = 0.067). These results suggest that former suppliers respond to geopolitical risks by establishing overseas subsidiaries closer to their customers to strengthen relationships and mitigate any potential disruptions.

4 Conclusions

Using global supply-chain relationship data covering 15,690 suppliers and 14,924 customers, with a total of 281,139 supplier-customer pairs from 44 economies over the period from 2003 to the first quarter of 2024, we examine the propagation of geopolitical risks through global supply chains and firms' strategic responses to these risks. We show that rising geopolitical risks impair the performance of supplier firms in the affected economies and their international customers. These customers are more inclined to terminate existing supply relationships and diversify their sourcing across a broader range of economies. These new suppliers tend to have lower geopolitical risk and closer proximity. In response, affected supplier firms attempt to establish subsidiaries either in their customers' economies or in the economies of their customers' new suppliers to preserve these relationships. Overall, our results suggest that geopolitical risks contribute to the reconfiguration of global supply chains and prompt international expansion through subsidiaries as firms adapt to disruptions.

We contribute to the literature on shock propagation through supply chains, the role of firm subsidiaries and ownership networks in risk management, and the impact of risk

and uncertainty—particularly geopolitical risk—on corporate strategies. We highlight the importance of firms proactively managing geopolitical risks to enhance supply chain resilience. Policymakers may also find these insights valuable when designing policies that support firms in navigating geopolitical uncertainties.

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Figures

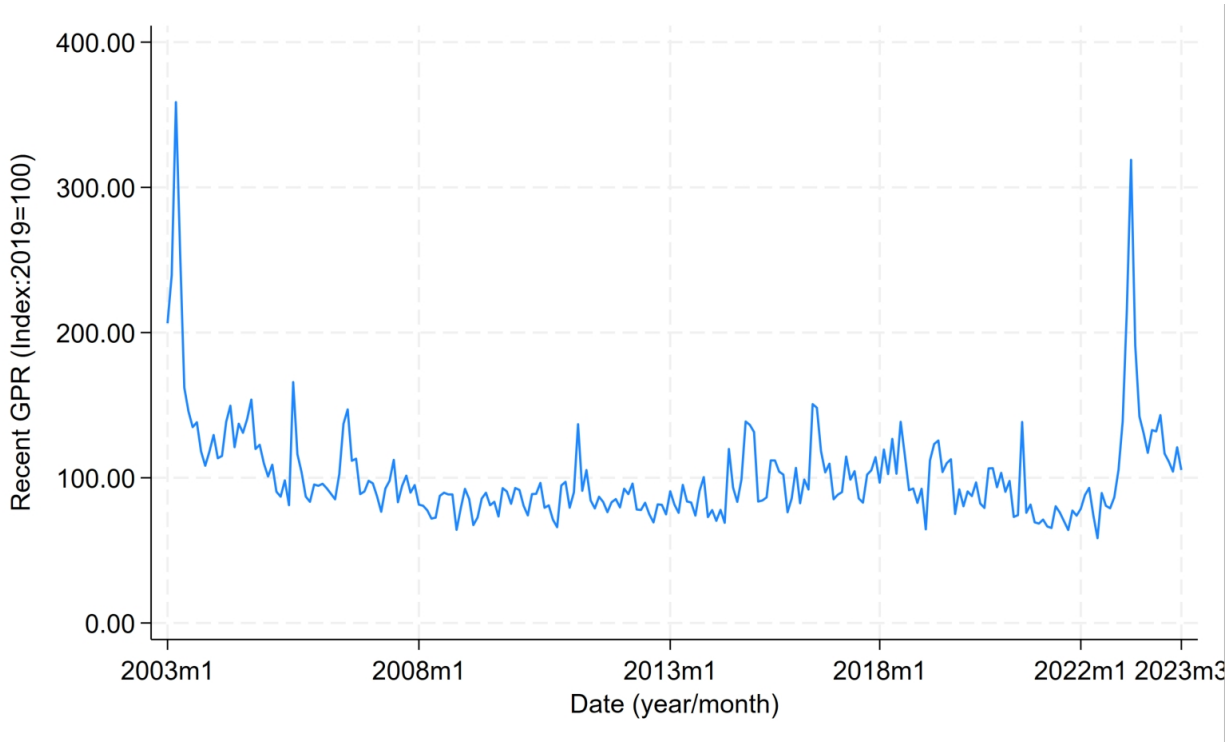


Figure 1: Global Geopolitical Risk from 2003 to Q1 2024

Note: This figure presents the global geopolitical risk levels spanning from 2003 to the first quarter of 2024. The data is sourced from Caldara and Iacoviello (2022).

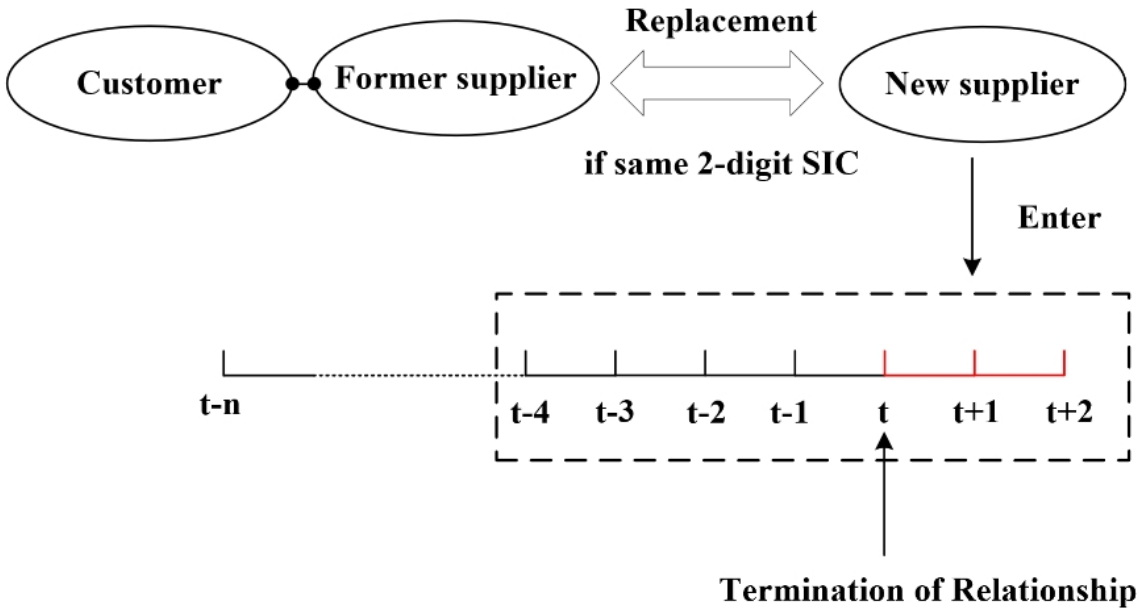


Figure 2: Customers Replace Former Suppliers

Note: This figure illustrates the relationship between newly defined suppliers and former suppliers as established in this study. Specifically, if a customer ends a supply relationship with a former supplier at period t, and the customer engages with a new supplier whose first two digits of the SIC code match that of the former supplier within the window of t-4 to t+2 periods, the two suppliers are considered to be in a "replacement" relationship.

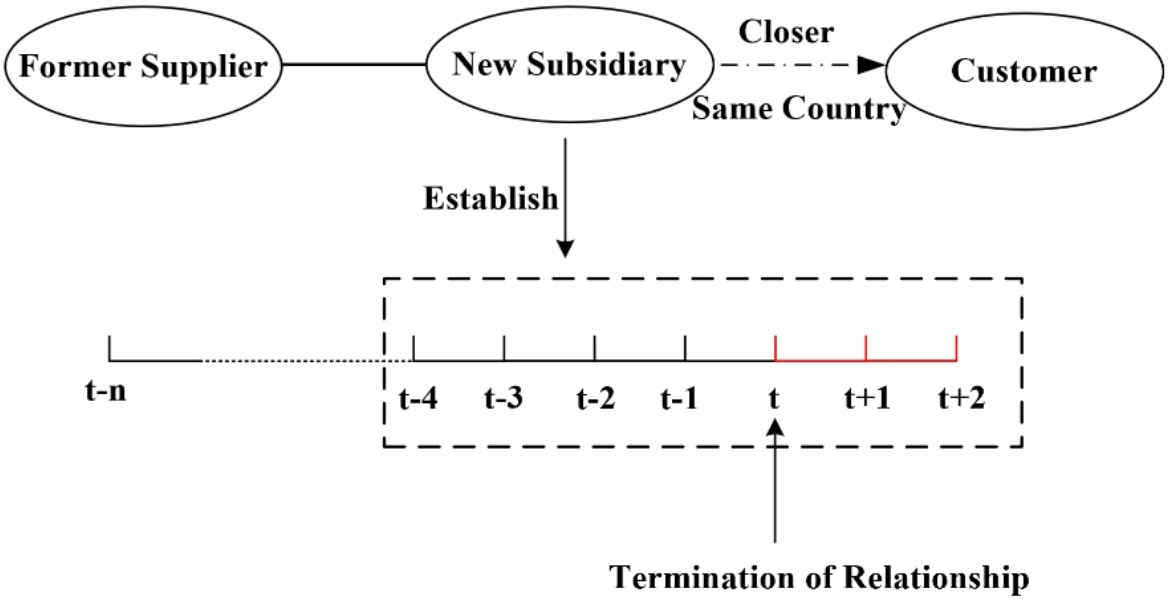


Figure 3: Former Suppliers Establish New Subsidiaries Closer to Customers

Note: This figure illustrates how this study investigates the relationship between former suppliers and their subsidiaries in relation to customers. Specifically, if a customer ends the supply relationship with a former supplier at period t, and the supplier establishes subsidiaries within the window of t-4 to t+2 periods, these subsidiaries are characterized by their closer proximity to the customers or by being located within the same economy.

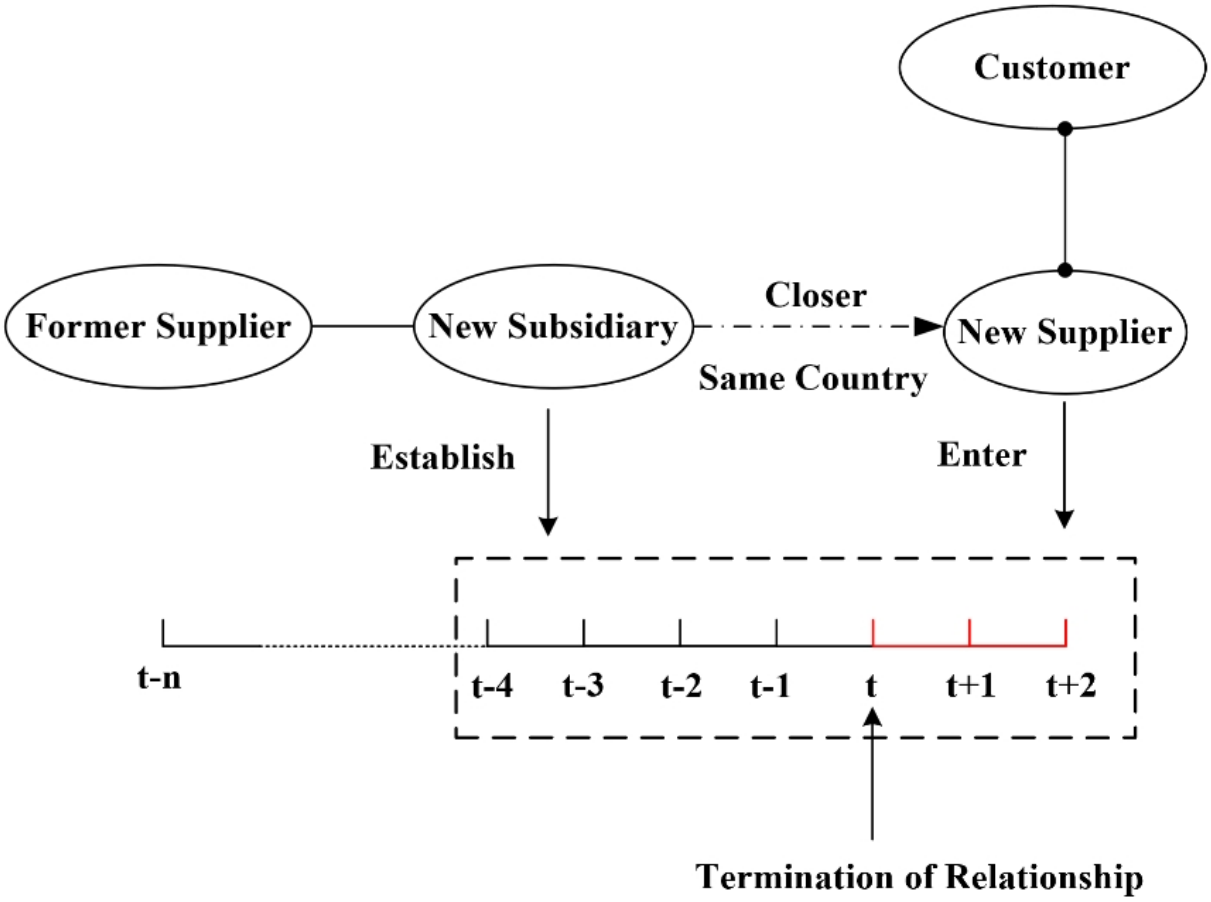


Figure 4: Former Suppliers Establish New Subsidiaries Closer to Customers' New Suppliers

Note: This figure illustrates how the study examines the relationship between subsidiaries established by former suppliers and new suppliers. Specifically, if a customer ends the supply relationship with a former supplier at period t, and engages with a new supplier within the t-4 to t+2 period, where the first two digits of the SIC code of the new supplier match that of the former supplier, we classify them as being in a "replacement" relationship. Additionally, subsidiaries established by the former supplier within the same period are characterized by their closer proximity to the new supplier or by being located within the same economy.

Tables

Table 1: Summary Statistics

Variable	N	Mean	SD	p25	p50	p75
Supplier-quarter level						
S_GPR	251,594	0.966	1.051	0.14	0.43	1.757
S_Oper_Income_Assets (%)	251,594	0.108	6.512	-0.221	1.097	2.546
S_ROE (%)	251,594	0.521	16.97	-0.715	1.857	4.351
S_Revenues_Assets (%)	251,594	21.57	16.8	10.07	18.75	28.78
S_Total_Assets (US Dollar, Bill)	251,594	12.79	97.46	0.145	0.634	3.053
Customer-quarter level						
S_Aver_GPR	241,229	0.755	0.916	0.132	0.325	0.993
C Oper_Income_Assets (%)	241229	0.357	6.188	-0.03	1.164	2.611
C_ROE(%)	241,229	1.007	16.33	-0.384	2.062	4.597
C_Revenues_Assets (%)	241,229	23.22	19.66	9.844	19.2	30.93
C_Total_Assets (US Dollar, Bill)	241,229	19.7	136.5	0.179	0.948	5.102
Sup Num	241,229	5.065	13.28	1	2	4
Sup Ctry	241,229	2.36	2.708	1	1	3
Relationship-quarter level						
Relationship Age (Quarters)	1,426,268	9.178	8.92	3	6	12
Relationship Age Max (Quarters)	1,426,268	17.76	12.98	8	14	24
Last Year	1,426,268	0.348	0.476	0	0	1
GPR Shock	1,426,268	0.51	0.5	0	1	1

Table 2: The Effect of Geopolitical Risk on Supplier Performance

	(1) S_Oper_Income_Assets	(2) S_ROE	(3) S_Revenues_Assets
S_GPR	-0.097***	-0.349***	-0.243***
	(0.036)	(0.114)	(0.085)
Firm x Fiscal-Qtr	YES	YES	YES
Industry-Size Bucket-Year Qtr	YES	YES	YES
Observations	251,594	251,594	251,594
Adjusted R-squared	0.590	0.184	0.694

Notes: The unit of analysis in this table is supplier-year-quarter observations. The primary focus is on examining the effect of geopolitical risk on the financial performance of the suppliers themselves. Fixed effects include supplier firm fixed effects interacted with fiscal quarter effects and industry-size bucket-year quarter effects. The size buckets refer to Crosignani et al. (2023), dividing firms into quintiles based on total assets within the same quarter. Standard errors are clustered at the firm level.

Table 3: The Effect of Supplier Geopolitical Risk on Customer Performance

	(1) C_Oper_Income_Assets	(2) C_ROE	(3) C_Revenues_Assets
S_Aver_GPR	-0.052***	-0.244***	-0.153***
	(0.019)	(0.060)	(0.055)
Firm x Fiscal-Qtr	YES	YES	YES
Industry-Size Bucket-Year Qtr	YES	YES	YES
Observations	241,229	241,229	241,229
Adjusted R-squared	0.596	0.177	0.747

Note: The unit of this table is customer-year-quarter observations. The table investigates the effect of average geopolitical risk faced by customer suppliers on their financial performance. Fixed effects include customer company fixed effects interacted with fiscal quarter effects, and industry-size bucket-year quarter effects. The size bucket classification follows Crosignani et al. (2023), dividing firms into quintiles based on total assets within the same quarter. Standard errors are clustered at the firm level.

Table 4: The Effect of Geopolitical Risk Shocks on Relationship Termination

	(1)	(2)	(3)	(4)
	$\text{LastYear}_{ij,t}$	$\text{LastYear}_{ij,t}$	$\text{LastYear}_{ij,t}$	$\text{LastYear}_{ij,t}$
$GPR_Shock_{i,t}$	0.019***	0.019***		
	(0.001)	-0.004		
$GPR_before_{i,t}$			-0.026	(0.026)
			0.017	(0.016)
Relationship FE	YES	YES	YES	YES
Sup_Industry-Size Bucket-Year Qtr	YES	YES	YES	YES
Cus_Industry-Size Bucket-Year Qtr	YES	YES	YES	YES
Cluster	Relationship	Relationship Quarter	Relationship	Relationship Quarter
Observations	1,426,268	1,426,268	1,426,268	1,426,268
Adjusted R-squared	0.577	0.577	0.577	0.577

Note: The unit of this regression is supplier-customer-year-quarter observations. The table examines the effect of unexpected geopolitical risk and realized geopolitical risk on the termination of supplier relationships. The variable "last_year" is defined as 1 if it corresponds to one of the last four quarters of the supplier relationship. Fixed effects include supplier-customer relationship fixed effects, and supplier and customer industry-size bucket-year quarter effects. The size bucket classification follows Crosignani et al. (2023), dividing firms into quintiles based on total assets within the same quarter. Standard errors are clustered at the relationship level or double-clustered at the relationship and quarter levels.

Table 5: Customers Diversify Supplier Sources to Mitigate Geopolitical Risks

	(1)	(2)
	F.sup_num	F.sup_ctry
Shock_Sum	0.756***	0.077***
	(0.049)	(0.007)
Firm x Fiscal-Qtr	YES	YES
Industry-Size Bucket-Year Qtr	YES	YES
Observations	208,814	208,814
Adjusted R-squared	0.772	0.736

Note: The unit of this regression is customer-year-quarter observations. The table examines the effect of suppliers' unexpected geopolitical risk on the customer's decision to choose suppliers in the next period. The variable "shock_sum" is defined as the cumulative unexpected geopolitical risk faced by all suppliers of a customer in that quarter. The variable "sup_num" represents the number of suppliers a customer has, and "sup_ctry" denotes the number of economies from which the customer's suppliers originate. Fixed effects include customer company fixed effects interacted with fiscal quarter effects, and industry-size bucket-year quarter effects. The size bucket classification follows Crosignani et al. (2023), dividing firms into quintiles based on total assets within the same quarter. Standard errors are clustered at the firm level.

Table 6: Characteristics of New Suppliers

	(1) Down_GPR	(2) Diff_Ctry	(3) Down_Dist
$GPR_Shock_{i,t}$	0.146***	0.019***	0.023***
	(0.008)	(0.006)	(0.008)
Sup_Industry-Size Bucket-Year Qtr	YES	YES	YES
Cus_Industry-Size Bucket-Year Qtr	YES	YES	YES
Sup_Ctry	YES	YES	YES
Cus_Ctry	YES	YES	YES
Observations	120,194	120,194	120,194
Adjusted R-squared	0.346	0.329	0.228
Mean of Y	0.428	0.695	0.341

Note: The unit of this regression is former supplier-customer-new supplier observations. The table examines the effect of unexpected geopolitical risk faced by former suppliers on the characteristics of new suppliers. A new supplier is defined as one that is established by the customer within the last two quarters of the supplier relationship and up to four quarters after its termination, with the new supplier belonging to the same SIC two-digit industry classification as the former supplier. The variable "Down_GPR" is defined as 1 if the geopolitical risk uncertainty of the new supplier is lower than that of the former supplier, and 0 otherwise. The variable "Diff_Crty" is defined as 1 if the new supplier is from a different economy than the former supplier, and 0 otherwise. The variable "Down_Dist" is defined as 1 if the new supplier is geographically closer to the customer compared to the former supplier, and 0 otherwise. Fixed effects include Sup_Industry-Year Qtr, Cus_Industry-Year Qtr, Sup_Ctry, and Cus_Ctry. Standard errors are double clustered at the relationship and first relationship-quarter levels.

Table 7: Suppliers Expand Overseas Subsidiaries to Mitigate Geopolitical Risks

	Subsidiary_Yes	Subsidiary_Count
$GPR_Shock_{i,t}$	0.073***	0.068***
	(0.029)	(0.021)
Firm x Fiscal-Qtr	YES	YES
Industry-Size Bucket-Year Qtr	YES	YES
Observations	198,683	198,683
Adjusted R-squared	0.169	0.236

Note: The unit of analysis for this regression is customer-year-quarter observations. This table examines whether a supplier's own geopolitical risk increases the likelihood and number of overseas subsidiaries they establish. The key variables include an indicator variable Subsidiary_Yes epresenting whether an overseas subsidiary is established and a count variable Subsidiary_Count representing the number of overseas subsidiaries. The main explanatory variable is the supplier's geopolitical risk (GPR). The regression includes fixed effects such as customer company fixed effects interacted with fiscal quarter effects and industry-size bucket-year quarter effects. The size bucket classification follows Crosignani et al. (2023), which divides firms into quintiles based on total assets within the same quarter. Standard errors are clustered at the firm level.

Table 8: Closer to Customers with New Overseas Subsidiaries

	(1)	(2)
	Com_Ctry	Down_Dist
$GPR_Shock_{i,t}$	0.019***	0.028***
	(0.007)	(0.010)
Sup_Industry-Size Bucket-Year Qtr	YES	YES
Cus_Industry-Size Bucket-Year Qtr	YES	YES
Sup_Ctry	YES	YES
Cus_Ctry	YES	YES
Observations	248,826	248,826
Adjusted R-squared	0.508	0.64
Mean of Y	0.091	0.57

Note: The unit of this regression is former supplier-customer-newly established overseas subsidiary observations. The table examines the effect of unexpected geopolitical risk faced by former suppliers on the characteristics of newly established subsidiaries. A newly established overseas subsidiary is defined as one set up by the former supplier within the last two quarters of the supplier relationship and up to four quarters after its termination. The variable "Com_Ctry" is defined as 1 if the newly established overseas subsidiary is in the same economy as the customer, and 0 otherwise. The variable "Down_Dist" is defined as 1 if the newly established overseas subsidiary is geographically closer to the customer compared to the former supplier, and 0 otherwise. Fixed effects include Sup_Industry-Year Qtr, Cus_Industry-Year Qtr, Sup_Ctry, and Cus_Ctry. Standard errors are double clustered at the relationship and first relationship-quarter levels.

Table 9: Closer to Customers' New Suppliers with New Overseas Subsidiaries

	(1) Com_Ctry_New_Sub	(2) Close_New_Supplier
$GPR_Shock_{i,t}$	0.034**	0.067***
	(0.013)	(0.024)
Sup_Industry-Size Bucket-Year Qtr	YES	YES
Cus_Industry-Size Bucket-Year Qtr	YES	YES
Sup_Ctry	YES	YES
Cus_Ctry	YES	YES
Observations	73,178	73,178
Adjusted R-squared	0.39	0.492
Mean of Y	0.05	0.408

Note: The unit of this regression is former supplier-customer-new supplier-newly established overseas subsidiary observations. The table examines the effect of unexpected geopolitical risk faced by former suppliers on the relationships with new suppliers and newly established overseas subsidiaries. A newly established overseas subsidiary is defined as one set up by the former supplier within the last two quarters of the supplier relationship and up to four quarters after its termination. The variable "Com_Ctry_New_Sub" is defined as 1 if the newly established overseas subsidiary is in the same economy as the customer, and 0 otherwise. A new supplier is defined as one that is established by the customer within the last two quarters of the supplier relationship and up to four quarters after its termination, with the new supplier belonging to the same SIC two-digit industry classification as the former supplier. The variable "Close_New_Supplier" is defined as 1 if the newly established overseas subsidiary and the new supplier are in the same economy, and 0 otherwise. The variable "Down_Dist" is defined as 1 if the newly established overseas subsidiary is geographically closer to the new supplier compared to the former supplier, and 0 otherwise. Fixed effects include Sup_Industry-Year Qtr, Cus_Industry-Year Qtr, Sup_Ctry, and Cus_Ctry. Standard errors are double clustered at the relationship and first relationship-quarter levels.

Appendix

Table A1: Variable Definitions and Data Sources

Variables	Definition	Source
S_GPR	Supplier's geopolitical risk	Caldara and Iacoviello(2022)
S_Oper_Income_Assets	Supplier's operating income scaled by lagged total book assets and multiplied by 100	Wolrdscope
S_ROE	Supplier's Net Income scaled by the average of last year's and current year's common equity	Wolrdscope
S_Revenues_Assets	Supplier's Revenue scaled by lagged total book assets and multiplied by 100	Wolrdscope
S_Total_Assets (US Dollar, Bill)	Supplier's book value of assets (AT) in billions of USD	Wolrdscope
C_Oper_Income_Assets	Customer's operating income scaled by lagged total book assets and multiplied by 100	Wolrdscope
C_ROE	Customer's Net Income scaled by the average of last year's and current year's common equity	Wolrdscope
C_Revenues_Assets	Customer's Revenue scaled by lagged total book assets and multiplied by 100	Wolrdscope
S_Aver_GPR	Supplier's average geopolitical risk	Caldara and Iacoviello(2022)
C_Total_Assets (US Dollar, Bill)	Customer's book value of assets (AT) in billions of USD	Wolrdscope
Sup_Num	Average number of suppliers a customer has in a quarter	FactSet Revere
Sup_Ctry	Average number of economies a customer's suppliers are sourced from in a quarter	FactSet Revere
Relationship Age Max	Maximum duration of a supply relationship (quarters)	FactSet Revere
Last Year	Indicator variable: equals 1 if the supply relationship is in the last 4 quarters, otherwise 0	FactSet Revere

Continued on next page

Table A1 – *Continued from previous page*

Variables	Definition	Source
GPR Shock	Indicator variable: equals 1 if the supplier's geopolitical risk is greater than in the 3 years before establishing the relationship, otherwise 0	FactSet Revere

Table A2: Distribution of Supplies and Customers Across Economics

Name	Num_of_Customer	Num_of_Supplier
Argentina	21	10
Australia	312	277
Belgium	42	50
Brazil	255	213
Canada	838	696
Switzerland	72	62
Chile	112	95
China	1807	2699
Colombia	37	22
Germany	293	310
Denmark	68	63
Egypt	50	36
Spain	69	79
Finland	100	108
France	149	164
United Kingdom	409	404
Hong Kong	124	129
Hungary	9	4
Indonesia	358	344
Israel	267	251
India	88	145
Italy	144	150
Japan	1703	1713
Korea	1194	1393
Mexico	76	71
Malaysia	108	108
Netherlands	99	98
Norway	166	162
Peru	57	52
Philippines	107	65
Poland	151	146
Portugal	22	20
Russian	96	71
Saudi Arabia	76	50
Sweden	264	326
Thailand	271	260
Tunisia	4	
Türkiye	151	148
Taiwan	917	808
Ukraine	17	7
United States of America	3584	3699
Venezuela	5	3
Viet Nam	95	76
South Africa	72	60

Table A3: Top 30 Unique Supplier-Customer Relationships by Economy Pair

Supplier_region_name	Customer_region_name	Num_of_Pair
United States of America	Japan	8301
China	United States of America	5213
Japan	United States of America	4705
United States of America	Canada	3848
Canada	United States of America	3543
United States of America	United Kingdom	3257
United States of America	Germany	3249
United Kingdom	United States of America	3117
United States of America	China	2915
United States of America	Korea	2829
United States of America	Taiwan	2742
Korea	United States of America	2681
China	Japan	2675
Germany	United States of America	2159
United States of America	France	2087
Taiwan	United States of America	2023
Israel	United States of America	1739
France	United States of America	1599
China	Germany	1561
Korea	Japan	1554
United States of America	Australia	1453
Japan	Taiwan	1404
China	Korea	1250
Japan	Korea	1248
Australia	United States of America	1247
China	Taiwan	1245
United States of America	Netherlands (Kingdom of the)	1176
Taiwan	Japan	1066
United States of America	Israel	964
Japan	China	939
United States of America	Switzerland	933

Table A4: Robustness Check: The Effect of Geopolitical Risk on Supplier Performance Considering EPU

	(1) S_Oper_Income_Assets	(2) S_ROE	(3) S_Revenues_Assets
S_GPR	-0.108***	-0.264**	-0.327***
	(0.041)	(0.131)	(0.092)
S EPU	-0.001***	-0.002***	0.000
	(0.000)	(0.001)	(0.001)
Firm x Fiscal-Qtr	YES	YES	YES
Industry-Size Bucket-Year Qtr	YES	YES	YES
Observations	201,507	201,507	201,507
Adjusted R-squared	0.603	0.185	0.694

Note:The unit of analysis in this table is supplier-year-quarter observations. This table illustrates the effect of Geopolitical Risk (GPR) on supplier performance, considering the effect of Economic Policy Uncertainty (EPU). Fixed effects include supplier firm fixed effects interacted with fiscal quarter effects and industry-size bucket-year quarter effects. The size buckets refer to Crosignani et al. (2023), dividing firms into quintiles based on total assets within the same quarter. Standard errors are clustered at the firm level.

Table A5: Robustness Check: The Effect of Supplier Geopolitical Risk on Customer Performance Considering EPU

	(1) C_Oper_Income_Assets	(2) C_ROE	(3) C_Revenues_Assets
S_Aver_GPR	-0.052***	-0.244***	-0.153***
	(0.019)	(0.060)	(0.055)
S_Aver_EPU	0.000	0.001	0.001
	(0.000)	(0.001)	(0.001)
Firm x Fiscal-Qtr	YES	YES	YES
Industry-Size Bucket-Year Qtr	YES	YES	YES
Observations	208,841	208,841	208,841
Adjusted R-squared	0.597	0.177	0.751

Note: The unit of this table is customer-year-quarter observations. The table investigates the impact of average geopolitical risk faced by customer suppliers on their financial performance. Fixed effects include customer company fixed effects interacted with fiscal quarter effects, and industry-size bucket-year quarter effects. The size bucket classification follows Crosignani et al. (2023), dividing firms into quintiles based on total assets within the same quarter. Standard errors are clustered at the firm level.

Table A6: Robustness Check: The Effect of Geopolitical Risk Shocks on Relationship Termination

	(1)	(2)	(3)	(4)
	$\text{LastYear}_{ij,t}$	$\text{LastYear}_{ij,t}$	$\text{LastYear}_{ij,t}$	$\text{LastYear}_{ij,t}$
$GPR_Shock_5year_{i,t}$	0.021***	0.020***		
	(0.002)	(0.002)		
$GPR_Shock_3year_max_{i,t}$			0.025***	0.024***
			(0.003)	(0.003)
Relationship FE	YES	YES	YES	YES
Sup_Industry-Size Bucket-Year Qtr	YES	YES	YES	YES
Cus_Industry-Size Bucket-Year Qtr	YES	YES	YES	YES
Cluster	Relationship	Relationship Quarter	Relationship	Relationship Quarter
Observations	1,426,268	1,426,268	1,426,268	1,426,268
Adjusted R-squared	0.579	0.578	0.577	0.576

Note:The unit of this regression is supplier-customer-year-quarter observations. The table examines the effect of geopolitical risk shock based on different definitions. Columns (1) and (2) define the shock as the supplier's geopolitical risk exceeding the 5-year average prior to the relationship. Columns (3) and (4) define the shock as the supplier's geopolitical risk exceeding the maximum value from the prior 3 years. Fixed effects and clustering remain consistent with the main regression.

Anecdotal Evidence #1: Diversification in Global Supply Chains

In response to growing geopolitical risks, global companies are increasingly diversifying their import sources and seeking alternative suppliers to enhance supply chain resilience. The "China Plus One" strategy, for example, has become a preferred approach for many companies, who are gradually expanding their manufacturing operations to economies like India, Vietnam, and Indonesia. This strategy aims to address the escalating geopolitical tensions between the U.S. and China, by establishing production bases outside of China, enabling companies to introduce more resilience into the global supply chain and reduce dependence on a single economy.[7]

Moreover, ongoing tensions in the Middle East have further exposed the vulnerabilities of global supply chains, prompting companies to reassess and adjust their logistics routes. To mitigate the risks of conflict in the Red Sea region, many companies are opting to bypass the Mediterranean and transport goods via African routes, which increases shipping costs but effectively reduces the risk of supply chain disruptions. These strategies highlight how businesses are actively seeking diversification and resilience to ensure the stability and continuity of their supply chains amid uncertainty.[8]

Anecdotal Evidence #2: Establishment of Subsidiaries

In response to rising geopolitical risks, some Chinese technology companies have adopted the strategy of establishing subsidiaries in Southeast Asia to mitigate potential disruptions and continue providing products and services to the global market. For instance, Chinese tech giants such as Huawei and Tencent have set up subsidiaries and research centers in Singapore and other Southeast Asian economies. These initiatives not only help reduce the uncertainty caused by geopolitical tensions but also enhance their competitiveness in the Southeast Asian market. [9]

Iranian energy companies have also responded to increasing geopolitical risks by collaborating with Asian economies to establish new supply chain channels and set up subsidiaries in these regions to ensure the continuity and stability of their energy exports. Additionally, Iran has used a so-called "shadow fleet" to transport oil to China and has utilized the United Arab Emirates as a transit hub to navigate these risks. [10]

[7] See this article from *SupplyChainInsights* for details.
[8] See this article from *Quointelligence* for details.
[9] See this article from *Financial Times* for details.
[10] See this article from *Deutsche Welle* for details.