Transportation Research Part E

How Does Firm Exit During Geopolitical Conflicts Affect Idiosyncratic Risk? Evidence from the Russia-Ukraine War

--Manuscript Draft--

Manuscript Number:	TRE-D-24-03335R3
Article Type:	VSI: Geopolitical Risks_Jason
Keywords:	firm exit; idiosyncratic risk; Russia-Ukraine war; supply chain geographic diversification; supply chain efficiency; difference-in-differences estimation
Corresponding Author:	Hugo K.S. Lam University of Liverpool Liverpool, UNITED KINGDOM
First Author:	Geng Wang
Order of Authors:	Geng Wang
	Xiaoke Ye
	Yunxiong Li
	Louise Postema
	Olena Skorytska
	Hugo K.S. Lam
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Abstract

While it is well understood that geopolitical conflicts like the Russia-Ukraine war should have a significant impact on firm risk, it is less clear how firm exit during such conflicts may affect firm-specific, idiosyncratic risk. We address this question empirically by investigating the exit decisions of U.S. firms triggered by the Russian invasion of Ukraine in February 2022. Specifically, we identify firms that announced their exits from Russia in February-May 2022 (treated firms) and adopt a difference-in-differences (DiD) approach to compare the changes in idiosyncratic risk between these treated firms and matched control firms that did not make exit announcements. Our DiD results indicate that compared to matched control firms, treated firms have lower idiosyncratic risk after announcing their exit decisions, especially when the exit decisions involve full withdrawal of operations rather than only suspending or scaling back operations. Our results also indicate that the decline in idiosyncratic risk is more pronounced for firms with efficient and geographically diversified supply chains. Additional tests further suggest that supplier geographic diversification plays a more important moderating role than customer geographic diversification. These findings demonstrate the effectiveness of firm exit strategies in mitigating idiosyncratic risk during geopolitical crises but also reveal the key role played by efficient and diversified supply chains in shaping this outcome.

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1. Introduction

The Russian invasion of Ukraine in early 2022 represented a major intensification in global geopolitical tensions, leading to widespread economic sanctions on Russia by governments worldwide. Despite the sanctions, firms operating in Russia were still legally permitted to maintain their operations, provided they were not directly involved in sanctioned activities (Evenett & Pisani, 2023). Nonetheless, many Western firms voluntarily announced their exits from Russia. British Petroleum, for example, was one of the first major corporations to withdraw, exiting within just three days of the conflict's outbreak. Heineken also announced its departure, ultimately selling its Russian operations to a local packaging firm named Arnest for a symbolic one euro, incurring a €300 million loss in the exit process (Doherty, 2023). By May 2022, over 1,000 foreign companies had declared their intentions to partially or fully leave the Russian market (Issa, 2022).

Risk is an important consideration for Western firms when deciding to leave Russia during the invasion of Ukraine. On the one hand, the exit decision may signal alignment with stakeholder expectations and strengthen investor confidence by demonstrating proactive risk management (Sonnenfeld et al., 2022; Li et al., 2024), which could lead to lower firm risk. On the other hand, making an abrupt exit decision when facing the unanticipated geopolitical conflict may encounter significant supply chain disruptions and incur high operational costs (Estrin & Meyer, 2023; Balyuk & Fedyk, 2023), resulting in higher firm risk. Therefore, whether the exit decision will decrease or increase firm risk remains an empirical research question. Moreover, evaluating the impact of exiting Russia on firm risk is essential, given its significant implications for a firm's long-term survival and competitive advantage (Lui et al., 2019).

To date, limited empirical work has investigated how firm exit influences firm risk during the Russia-Ukraine crisis. Extant studies have primarily focused on the economic consequences of this conflict, such as the increase in global inflation and the decrease in GDP growth (Liadze et al., 2023; Steinbach, 2023), as well as how the war itself affects firm risk (Piserà et al., 2024; Soliman & Le Saout, 2024). Although emerging research has started to investigate the outcomes of firm exit decisions amid the Russia-Ukraine conflict (French et al., 2023; Glambosky & Peterburgsky, 2022; Kiesel & Kolaric, 2023), it is mainly concerned with investor reactions to firms' exit decisions rather than examining firm risk implications of these decisions directly. To bridge this research gap, our study explores how Western firms' exit decisions affect their idiosyncratic risk. Grounded in real options theory (ROT), we conceptualize these exits as strategic abandonment options that firms can use to mitigate downside exposure in times of geopolitical uncertainty. However, since exit decisions involve costs such as asset write-downs, idle asset management, and supply chain disruptions (Estrin & Meyer, 2023; Balyuk & Fedyk, 2023), we further investigate how supply chain efficiency and geographic diversification moderate the relationship between firm exit from Russia and risk reduction. This is because firms possessing efficient supply chains are better equipped to rapidly manage operational disruptions and exit-related costs, while those with geographically diversified supply chains benefit from external flexibility and strategic alternatives to mitigate supply chain disruptions (Choi et al., 2023; Lücker et al., 2024). Thus, we set out to investigate the following research questions:

(1) How do Western firms' decisions to exit from Russia during the Russia-Ukraine war affect their idiosyncratic risk?

(2) How do supply chain efficiency and geographic diversification moderate the relationship between the firm exit decisions and idiosyncratic risk?

To address these questions, we first identify 170 U.S. firms that operated in the Russian market and made exit announcements in February-May 2022, which we define as treated firms. We then employ the shortest Mahalanobis distance technique to match treated firms to a pool of potential control firms consisting of all U.S. listed companies without Russian business segments and without exit announcements over the same period. Subsequently, we conduct a Difference in Differences (DiD) estimation to evaluate the changes in idiosyncratic risk between the treated firms and the matched control firms. We focus on idiosyncratic risk because firm exit from Russia is specific to that firm and thus more likely to impact firm-specific, idiosyncratic risk, as opposed to systematic risk that is subject to overall market movements (Goyal & Santa-Clara, 2003; Rego et al., 2009).

Our DiD estimation results show that compared to matched control firms, treated firms have lower idiosyncratic risk after announcing their exit decisions. The reduction in idiosyncratic risk is more pronounced for firms with efficient and geographically diversified supply chains. Our additional tests reveal that supplier geographic diversification exerts a stronger moderating role than customer geographic diversification. Furthermore, our findings highlight that exit strategies are not uniform in their effects: firms that completely exit the Russian market experience the most substantial reduction in idiosyncratic risk, followed by those that suspend or scale back operations. We confirm the robustness of our findings by applying alternative matching procedures, model specifications, and variable measurements.

Our study fills a notable research gap in existing literature, highlighting that firm exits during geopolitical conflicts can significantly reduce idiosyncratic risk. This finding challenges the traditional perception of firm exits as failures, instead reframing them as strategic real options that enable proactive management of uncertainty and preservation of long-term value. Moreover, our study extends ROT to geopolitical contexts, highlighting critical boundary conditions, i.e., supply chain efficiency and geographic diversification, that influence the strategic value of abandonment options. Practically, our results suggest that managers should approach exit decisions strategically rather than reactively, carefully selecting the exit form (full withdrawal, scaling back, or suspension) and actively leveraging operational capabilities such as supply chain efficiency and geographic diversification to reap more risk reduction benefits.

2. Literature Review

2.1. The Russia-Ukraine Conflict

The Russia-Ukraine conflict has generated widespread economic and social impacts globally since its outbreak on 24 February 2022. Scholars across various disciplines have extensively studied these impacts. In the field of Economics, researchers have explored the macroeconomic consequences of the war. For instance, Liadze et al. (2023) estimate that the conflict led to an economic loss amounting to 1% of the global GDP in 2022 and contributed approximately 2% to global inflation during the same period. Steinbach (2023) examines the impacts on international trades, highlighting substantial reallocations in global trade flows because of the conflict. In the Finance field, researchers have investigated how the war has affected both financial and foreign exchange markets. For example, Izzeldin et al. (2023) suggest that the Russia-Ukraine conflict triggered a faster reaction from financial markets, but its effects were less intense than those observed in the 2008 financial crisis or the COVID-19 pandemic.

In addition, the war has also reshaped the operational environment for firms, leading to divergent outcomes across industries. For example, Martins & Cró (2024) suggest a negative and significant stock price reaction for 74 listed airlines at and around the beginning of the military conflict. Conversely, Nerlinger & Utz (2022) find that corporations in the energy industry outperformed the stock market after the Russian invasion. In terms of firm risk, Piserà et al. (2024) show that non-financial firms based in Europe faced a significant increase in systematic risk after the conflict, while Soliman & Le Saout (2024) further demonstrate that the conflict also led to higher idiosyncratic risk for European firms.

2.2. Firm Exit and ROT

Following the Russia-Ukraine conflict, many Western companies declared their decisions to exit from Russia, a wave of departures that Gamble (2022) referred to as "the institutional expression of moral outrage." Recent studies have started to investigate the antecedents and outcomes of these exit decisions. For example, Balyuk & Fedyk (2023) find that companies with higher levels of business involvement in Russia tended to continue their operations, while those with lesser exposure were more likely to exit or halt activities. Basnet et al. (2022) suggest that companies with poor performance in ESG and human rights were less likely to leave Russia. Thams & Dau (2023) explore how CEO political ideologies influenced exit decisions at the onset of the crisis. Additionally, some studies have examined the market responses to firm exit announcements, demonstrating generally favorable investor reactions (Glambosky & Peterburgsky, 2022; Balyuk & Fedyk, 2023; French et al., 2023; Kiesel & Kolaric, 2023).

Traditionally, market exit has been framed in both academic discourse and managerial practice as a signal of failure, often attributed to poor performance or strategic misalignment (Sethuram & Gaur, 2024). However, the scale, speed, and voluntary nature of exits from Russia during the geopolitical crisis suggest that these decisions are not reactive failures but rather proactive, strategic responses to external uncertainty. In this study, we adopt ROT to examine the strategic value of firms' exit decisions. According to Cefis et al. (2022), firm exit from foreign markets can take different forms, most commonly as the cessation of operations or the divestment of foreign capital. Following this definition, we focus on three modes of firm exit as strategic choices made under conditions of heightened uncertainty, including complete divestment (withdrawal), partial divestment (scaling back), or suspension of operations.

Real options are defined as "opportunities to purchase real assets on possibly favorable terms" (Myers, 1977, p.163) and provide firms with the right, but not the obligation, to act under uncertain conditions (Trigeorgis & Reuer, 2017). ROT extends financial options logic to real assets, both tangible and intangible, and identifies several foundational types, including options to defer, grow, alter scale, switch inputs or outputs, and abandon (Trigeorgis, 1996; Trigeorgis & Reuer, 2017). The Russia-Ukraine war introduced significant geopolitical, operational, and reputational uncertainty, intensifying the strategic complexity for Western firms operating in Russia. In this context, a firm's ownership stake in a Russian business unit can be conceptualized as a put option, where retaining the operation corresponds to holding the option and exiting represents its exercise (in the case of scaling back or withdrawing) or deferral (in the case of suspension) (Damaraju et al., 2015). Exercising the abandonment option entails high, often irreversible costs, including asset write-downs, facility closures, and penalties for contract terminations (Estrin & Meyer, 2023; Balyuk & Fedyk, 2023; Zeng et al., 2023). Deferring the option, via suspension, likewise incurs costs, such as asset maintenance, opportunity loss, and supply chain disruptions due to operational pause. ROT suggests that firms capable of managing these exercise and deferral costs more effectively can derive greater strategic value from the options they hold (Chi, 2019).

2.3. Idiosyncratic Risk

A firm's total equity risk is commonly conceptualized as the variability of its stock returns (Sharpe, 1964; Markowitz, 1999). This risk can be further divided into two parts: idiosyncratic (unsystematic) risk, which is specific to the firm and independent of broader market fluctuation; and systematic risk, which captures the portion of a firm's return variability linked to overall market movements (Goyal & Santa-Clara, 2003; Rego et al., 2009). Therefore, systematic risk captures the impact of macroeconomic events, such as inflations or changes in interest rates, that affect the entire market (Rego et al., 2009). In contrast, idiosyncratic risk stems from factors unique to the firm, such as internal operations or product launches, that primarily affect the company itself (Shin & Stulz, 2000). Idiosyncratic risk constitutes a significant portion of total risk, making it a crucial consideration for both investors and managers (Goyal & Santa-Clara, 2003).

Firms with high idiosyncratic risk often face challenges in maintaining stable cash flow and sustaining long-term growth (Li et al., 2021). As such, addressing idiosyncratic risk is critical for a firm's strategic management and operational stability. Recognizing this, prior studies have extensively investigated various factors such as corporate governance and ownership structure that may affect a firm's idiosyncratic risk (Ferreira & Laux, 2007; Fareed et al., 2022; Geeta & Prasanna, 2016). For example, Ferreira & Laux's (2007) research on corporate governance policy suggests that firms with lower levels of antitakeover provisions experience greater firm-specific risk. Geeta & Prasanna's (2016) find that firms under family control tend to exhibit higher levels of idiosyncratic risk. Some studies have also examined how firms' operational and strategic decisions, such as mergers and acquisitions, product market diversifications, and sustainability initiatives, may affect their idiosyncratic risks (Mishra & Modi, 2013; Li et al., 2021; Lam, 2018; Nguyen et al., 2019; Sun & Govind, 2017). However, little is known about how firms' exit decisions during geopolitical conflicts may affect idiosyncratic risk, an important question that will be investigated in this study.

2.4. Supply Chain Risk and Geopolitical Issues in the OSCM Literature

Supply chain risk is an important research topic (Ho et al., 2015). Although internal sources of supply chain risk have been widely studied, external risks, particularly those arising from geopolitical tensions, remain relatively underexplored in the literature, despite their significant influences on global supply chain management (Fan & Xiao, 2023; Zhu et al., 2025). In particular, geopolitical disruptions exacerbate business uncertainty, elevate reputational risk due to sensitive geographic presence, and cause widespread supply chain challenges, including disruptions in sourcing and logistics, difficulty in forecasting, and erosion of trust among supply chain partners (Zhu et al., 2025; Sonnenfeld et al., 2022).

Nevertheless, operations and supply chain management (OSCM) scholars have examined the outcomes of prominent geopolitical events such as Brexit, the U.S.-China trade war, and the Russia-Ukraine war. For example, prior OSCM studies have suggested that the U.S.-China trade war introduced profound uncertainty into global trade (Handley and Limão, 2022), adversely affecting operational costs, profitability (Fan et al., 2022), firm value (Huang et al., 2023; Rogers et al., 2024), and buyer-supplier relationships (Fan et al., 2024). Brexit also created significant operational and strategic challenges, impacting supply availability, cost structures, and location decisions in manufacturing networks (Moradlou et al., 2021; Hendry et al., 2019). For instance, Roscoe et al. (2020) explore how companies of different sizes adapted to the heightened uncertainty brought on by Brexit, while Hendry et al. (2019) examine local supply chain preparedness and responses. More recently, Russia's invasion of Ukraine has triggered unprecedented global sanctions on Russia, reshaping geopolitical dynamics and emphasizing the critical need for systematic approaches to exit planning and supply chain reconfigurations in Russia (Srai et al., 2023). El Baz et al. (2025) highlight how wartime disruptions create vulnerabilities in supply chains, including the rise of illicit networks exploiting logistical bottlenecks and infrastructure weaknesses.

Despite the growing body of research on geopolitical risk in OSCM, supply chains' potential moderating roles remain underexplored, particularly in the context of firm exit during wartime. To address this gap, our study investigates how two key supply chain attributes, efficiency and geographic diversification, moderate the relationship between firm exit strategies and idiosyncratic risk.

3. Hypothesis Development

3.1. Relationship between Firm Exit and Idiosyncratic Risk

In high-uncertainty environments, ROT conceptualizes exit as an abandonment option, granting firms the right, rather than the obligation, to disengage from value-destroying markets (Trigeorgis & Reuer, 2017). Exercising or deferring this option enables firms to manage downside risk flexibly in response to unfolding external shocks, despite related costs. First, the

Russia-Ukraine war introduced substantial reputational risk for Western firms maintaining operations in Russia. The war triggered an exogenous shift in stakeholder expectations, intensifying moral and ethical scrutiny from investors, consumers, and the public (Ó Laoghaire, 2024). Continued presence in Russia risked "naming and shaming" by Western media and activist groups, leading to brand damage, investor divestment, and loss of consumer goodwill (Preble & Early, 2024; Sonnenfeld et al., 2022). Given that stakeholder alignment with ethical values is increasingly seen as a source of firm value (Carroll, 2004; Jamali, 2008; Wang et al., 2016), exiting Russia can be viewed as an exercise of the abandonment option that curtails escalating reputational costs. Empirical studies confirm that firms announcing exits experienced positive market responses (Balyuk & Fedyk, 2023; Kiesel & Kolaric, 2023), while consumers generally perceive such decisions favorably (Ganesan & Mallapragada, 2024; Case, 2022). For example, a recent survey suggests that 75% of Americans agree that U.S. firms should cut their ties and cease their operations in Russia (Case, 2022). Therefore, U.S. firms' exit from Russia helps reduce reputational uncertainty and align with stakeholder expectations, thereby reducing idiosyncratic risk (Albuquerque et al., 2019; Mishra & Modi, 2013).

Moreover, ROT posits that firms should exercise abandonment options when the external environment becomes excessively volatile and the expected costs of remaining outweigh potential benefits (Damaraju et al., 2015; Trigeorgis & Reuer, 2017). Geopolitical risk has been significantly exacerbated by the Russia-Ukraine war, thereby elevating operational uncertainty for firms with exposure to the region. Investors typically view firms entangled in geopolitical crises as riskier investments, which manifests in increased stock price volatility and heightened sensitivity to political developments (Apergis et al., 2018; Ren et al., 2023). Moreover, the complexity of international sanctions against Russia increases firms' exposure to regulatory uncertainty, raising the risk of inadvertent violations and costly legal consequences (Verdier, 2022). In such contexts, ROT suggests that firms can preserve value by strategically exercising or deferring abandonment options to reduce their downside exposure. Exit announcements serve as clear signals to markets and stakeholders that firms are proactively managing geopolitical and regulatory risks. By disengaging from operations in politically unstable environments, firms can reduce operational volatility, avoid sanction-related liabilities, and reallocate resources toward more stable markets. Thus, firm exit from Russia not only stabilizes performance outlooks but also enhances investor confidence, ultimately leading to lower idiosyncratic risk (Early & Peterson, 2023). Given these ROT-grounded arguments, we propose that:

Hypothesis 1 (H1). A U.S. firm's exit from Russia during the Russia-Ukraine war has a *negative impact on its idiosyncratic risk.*

3.2. Moderating Effects of Supply Chain Efficiency and Geographic Diversification

We first consider the moderating effect of supply chain efficiency. It reflects the speed of a firm to optimize resources, skills, and technologies to reduce cost structures, increase cash generation, and enhance firm performance (Krasnikov & Jayachandran, 2008; Jacobs et al., 2016; Lücker et al., 2024; Nikfarjam et al., 2015). Extant studies have shown that efficient supply chains enable firms to reduce risk by curbing various costs in an effective way (Li et al., 2021). Drawing upon ROT, we argue that supply chain efficiency influences the link between firm exit and idiosyncratic risk by reducing exercise and deferral costs of the abandonment options.

On the one hand, exercise and deferral costs are substantial, such as asset write-downs, facility closures, and termination of local contracts (Balyuk & Fedyk, 2023). These immediate cash outflows may reduce a firm's cash holding in the short term. Efficient supply chain operations enable firms to cut physical storage costs and unlock capital that was formerly invested in inventory (Kulchania & Thomas, 2017). This can lead to a healthier financial position, making them more resilient to the short-term financial shocks associated with market exit and asset write-downs. Consequently, firms with efficient supply chains can better absorb these immediate costs, preventing sudden financial strain that could otherwise make the firms distressed and risky.

On the other hand, firm exit may cause significant supply chain disruptions, including logistical delays and shortages of critical inputs. When such disruptions occur, efficient supply chains equip firms with greater response capacity, enabling them to deal with the disruptions rapidly and effectively through optimal resource utilization, proper coordination, and streamlined communication with supply chain partners (Khan et al., 2009; Munir et al., 2020). In essence, supply chain efficiency amplifies the strategic value derived from abandonment options, enhancing firms' ability to capitalize on exit decisions and resulting in a greater reduction in idiosyncratic risk. Accordingly, we propose that:

Hypothesis 2 (H2). The negative impact of firm exit on idiosyncratic risk is more pronounced for firms with efficient supply chains.

We then focus on the role played by supply chain geographic diversification. Prior research emphasizes the importance of having geographically diversified supply chains, spanning suppliers and customers across multiple countries, to effectively mitigate operational disruptions (Lin et al., 2021; Tang, 2006). For instance, Tang (2006) highlights the importance of building a flexible and diversified supplier base to manage supply chain disruptions. Lin et al. (2021) further argue that building not only a diversified supplier base but also a diversified customer base is crucial for enhancing resilience and managing supply chain disruptions. They find that both higher supply-base and customer-base diversifications led to higher firm profitability amid the coronavirus outbreak. Similarly, Ke et al. (2022) show that customer diversification across countries enhanced inventory efficiency during the COVID-19 crisis.

Building on these prior studies, we conceptualize supply chain geographic diversification as the geographic spread of a firm's supply chain partners and ground our hypothesis development from the flexibility perspective. ROT emphasizes strategic flexibility and firms' capability to exercise switching options when confronting uncertainty (Sakhartov and Folta, 2014; Trigeorgis, 1996). Supply chain geographic diversification reflects the firm's external flexibility through the availability of multiple sourcing alternatives, providing strategic switching options that help firms mitigate supply chain disruptions effectively when exiting volatile markets (Suryawanshi & Pankaj, 2022; Lin et al., 2021; Ivanov & Dolgui, 2019). In the context of exiting Russia, firms inevitably face significant exercise and deferral costs, including supply shortages and reduced revenue streams. Firms with geographically diversified supply chains possess valuable switching options, allowing them to shift sourcing activities to alternative suppliers or reallocate market focus to alternative customers in different regions (Lin et al., 2021). Specifically, firms with diversified suppliers across different geographical locations can quickly shift their procurements to alternative suppliers, reducing delays or additional costs (Fan & Xiao, 2023). This flexibility helps firms reduce the risk of operational disruptions and lower their operational uncertainties (Shekarian & Parast, 2021). Likewise, companies that serve a broad range of customers across markets gain flexibility by reducing reliance on revenue from any single region (Lin et al., 2021). When leaving Russia, firms lose Russian customers and associated revenues, but firms with a geographically diversified customer base can compensate for this loss by leveraging demands in other markets.

Supply chain geographic diversification thus reflects a proactive risk management strategy, where higher diversification enhances a firm's capacity to spread risks across its supply chain operations (Lin et al., 2021; Fan & Xiao, 2023; Hitt et al., 2006). Consistent with ROT, higher supply chain geographic diversification enhances a firm's ability to capitalize on switching options, thereby amplifying the strategic benefits associated with exercising or deferring abandonment options in highly uncertain environments. Accordingly, we propose that:

H3: The negative impact of firm exit on idiosyncratic risk is more pronounced for firms *with geographically diversified supply chains.*

Figure 1 presents a research model summarizing the three hypotheses of this study.

[Insert Figure 1 here]

4. Methods

We test our proposed hypotheses based on a matched DiD regression analysis of secondary panel data constructed from multiple sources. First, we explain our data collection procedures, followed by a discussion on the measures of our dependent and independent variables. Next, we justify our matching approach and specify the DiD regression model.

4.1. Data Collection

Our dataset is constructed using longitudinal secondary data gathered from various sources. To quantify idiosyncratic risk, we extract firms' daily stock price information from the CRSP database. We gather accounting data from the Compustat database to construct a list of control variables. We collect supply chain data from FactSet Revere, which covers around 1 million global supply chain relationships of large, mostly listed, companies. FactSet Revere uses a proprietary research method to identify these relationships via various secondary sources such as companies' annual reports, news reports, investor presentations, press releases, and public websites (Boehm & Sonntag, 2022; Drobetz et al., 2021).

We manually collect the exit announcements of U.S. firms included in the S&P 1500 index because these firms' data are more publicly available for us to measure idiosyncratic risk and other research variables. The S&P 1500 is widely recognized as a comprehensive indicator of the U.S. equity market, covering approximately 90% of total market capitalization and commonly employed in the analysis of firm behavior (e.g., Lee et al., 2017; Gentry et al., 2021). For each S&P 1500 firm, we conduct a manual search across public websites, social media platforms, and prominent media outlets to identify any announcements regarding its exit from Russia. We limit our search to a three-month period after the Russian invasion (i.e., from 24 February 2022 to 24 May 2022). This timeframe represents the initial period of heightened corporate responses to the conflict, during which many firms publicly declared their decisions to leave Russia (Issa, 2022). The frequency of exit announcements gradually tapered off after this period (Balyuk & Fedyk, 2023). We search the exit announcements from multiple sources (e.g., public websites, social media, and news outlets) to identify the earliest date when a firm announced its exit decision. After an extensive search, we are able to identify 194 of the S&P 1500 companies that had announced their exit decisions between 24 February 2022 and 24 May

2022. Appendix A1 displays the industry distribution of these 194 firms. The following are two examples of firms' exit announcements:

- Emerson Electric announced on 5th April 2022 that it had decided to withdraw from the Russian market and was exploring strategic options to divest Metran, its manufacturing subsidiary based in Russia.
- On 21st March 2022, Air Products and Chemicals announced its plan to safely and responsibly divest its business operations in Russia and confirmed that it would no longer pursue new business opportunities in the country.

4.2.Measurements

Idiosyncratic Risk (IR). Following prior studies (e.g., Mishra et al., 2013; Lam, 2018; Ayton et al., 2022), we quantify a firm's idiosyncratic risk by calculating the standard deviation of the residuals derived from the Market model. As our research focuses on firm exits announced in a three-month period (i.e., February-May 2022), we measure idiosyncratic risk monthly (rather than annually) to offer a more precise estimation of the impact of firm exits on idiosyncratic risk.

We first construct a Market model to estimate a firm's alpha and bata coefficients (i.e., $\hat{\alpha}_i$ and $\hat{\beta}_i$) in 2021, one year prior to the Russian invasion, as shown in equation (1). This ensures that the coefficient estimation is not affected by the invasion.

$$R_{i,d} - rf_m = \hat{\alpha}_i + \hat{\beta}_i(RM_d - rf_m) + \hat{\varepsilon}_{i,d}\,, \tag{1}$$

where i, d, are m, are firm, day, and month indexes, respectively. $R_{i,d}$ is firm i's daily stock returns in 2021. rf_m indicates the monthly risk-free return (proxied by one-month U.S. treasury bill rate) in 2021. RM_d is the daily market return (proxied by the daily CRSP value-weighted return index) in 2021.

We then use $\hat{\alpha}_i$ and $\hat{\beta}_i$ obtained from equation (1) to estimate the daily residuals ($\hat{\varepsilon}_{i,d,m}$) in each month over our event window (further explained in Section 4.4) based on the Market model shown in equation (2).

$$\hat{\varepsilon}_{i,d,m} = \left(R_{i,d,m} - rf_m\right) - \hat{\alpha}_i - \hat{\beta}_i\left(RM_{d,m} - rf_m\right), \tag{2}$$

where i, d, and m, are firm, day, and month indexes, respectively. $R_{i,d,m}$ is the daily stock return of firm i in month m over our event window. $RM_{d,m}$ is the daily CRSP value-weighted return index in month m, while rf_m is the one-month U.S. treasury bill rate in month m. As a result, firm i's idiosyncratic risk in month m ($IR_{i,m}$) is computed as the standard deviation of $\hat{\varepsilon}_{i,d,m}$ over the same month m.

Supply Chain Efficiency (SC Efficiency). Following the common practice adopted in prior research (e.g., Wang, 2019; Lam, 2018), we use cash conversion cycle of a firm to gauge how efficient its supply chain is. This is because a firm's cash conversion cycle captures the time required for the firm to transform cash outflows to suppliers into cash inflows from customers, integrating inventory management, accounts receivable, and accounts payable into a unified measure of supply chain efficiency (Farris II and Hutchison, 2002; Lo et al., 2009). We compute the cash conversion cycle of firm *i* in year *t* ($cash\ conversion\ cycle_{i,t}$) as follows:

$$cash\ conversion\ cycle_{i,t} = 365 \times \left(\frac{inv_{i,t} + inv_{i,t\text{-}1}}{2 \times cogs_{i,t}} + \frac{ar_{i,t} + ar_{i,t\text{-}1}}{2 \times renv_{i,t}} - \frac{ap_{i,t} + ap_{i,t\text{-}1}}{2 \times cogs_{i,t}} \right), \tag{3}$$

where *i* and *t* are firm and year indexes, respectively, while *inv*, *ar*, *ap*, *cogs*, and *renv* represent inventory, accounts receivable, accounts payable, cost of goods sold, and revenue, respectively. We further standardize the cash conversion cycle to account for possible inter-industry differences. Since a shorter cash conversion cycle implies a more efficient supply chain (Lam, 2018), we use reverse coding and obtain the measure for firm *i*'s supply chain efficiency in industry *j* (two-digit SIC code) and year *t* ($SC\ Efficiency_{i,j,t}$) in equation (4).

$$SC\ \ Efficiency_{i,j,t} = -\frac{cash\ conversion\ cycle_{i,j,t} - mean\ of\ cash\ conversion\ cycle_{j,t}}{standard\ deviation\ of\ cash\ conversion\ cycle_{j,t}} \tag{4}$$

Supply Chain Geographic Diversification (SC Geo Diversification). Prior supply chain management studies have conceptualized diversification at the supply chain level as the degree to which a firm's suppliers or customers are geographically widespread (e.g., Sharma et al., 2020; Fan et al., 2022; Lin et al., 2021). We track the geographic distribution of a firm's supply chain by counting the countries where its suppliers and customers operate. This number can be used as an indicator of supply chain geographic diversification. In the additional analysis, we further decompose supply chain geographic diversification into supplier geographic diversification (i.e., the number of countries with suppliers) and customer geographic diversification (i.e., the number of countries with customers).

Control Variables. We incorporate an extensive set of control variables to minimize possible omitted variable bias that will lead to inconsistent estimations. Following previous studies (Fama & French, 1993; Farris II & Hutchison, 2002; Corbett et al., 2005; Hendricks et al., 2009; Lam, 2018; Durnev et al., 2004), we include several control variables that may influence a firm's idiosyncratic risk: the book-to-market ratio (Bm), firm size (Size), leverage (Leverage), Tobin's Q (Tobin's Q), and return on assets (ROA). The detailed measurements of these variables are documented in Table 1. Additionally, we incorporate firm fixed effects to account for time-invariant firm characteristics and year fixed effects to control for unobserved temporal factors that could influence firm-specific risk.

[Insert Table 1 here]

4.3. Matching Approach

A firm's decision to leave Russia is an endogenous behavior (Alam et al., 2023). This endogeneity may introduce selection bias if our research only includes U.S. firms that operated in the Russian market and made exit announcements during the Russia-Ukraine war, which we define as treated firms. We address this endogeneity by matching the treated firms to control firms without exit announcements. Specifically, our initial pool of potential control firms consists of all CRSP companies without Russian business segments and without exit announcements. We include all CRSP companies as potential control firms to ensure the initial control firm pool is large enough for us to select appropriate control firms whose characteristics are similar to those of the treated firms. We focus on control firms without Russian business segments because these firms were not subject to the endogenous decision of whether to stay in or leave Russia during the war, providing relatively clean counterfactuals and estimations.

However, a possible limitation of using this group of control firms is that these firms may differ from the treated firms in terms of their exposure to the Russian market. Thus, as a robustness check, we further restrict the pool of potential control firms to those U.S. firms with operations in Russia but without exit announcements during the Russia-Ukraine war. However, it should be noted that not many U.S. firms decided to stay in the Russian market after the war started, significantly reducing the size of the control firm pool and affecting matching quality. Nevertheless, the test results from this alternative control group remain consistent, as documented in Section 5.3.

Our matching approach is based on the shortest Mahalanobis distance (King & Nielsen, 2019) calculated using three variables including the book-to-market ratio, market capitalization, and idiosyncratic risk. We include the first two factors in the matching process, as Fama and French (1993) identify growth opportunities and firm size as key risk factors influencing stock performance. Additionally, we include idiosyncratic risk to ensure that treated and control firms exhibited similar levels of firm-specific risk prior to exit announcements. As we focus on the exit announcements made in 2022 and to avoid the influence of firms' exit decisions on the matching outcomes, we conduct the matching based on the book-to-market ratio and market capitalization measured in 2021 and idiosyncratic risk measured in December 2021 (please note that we measure idiosyncratic risk monthly rather than annually, as explained in Section 4.2). To account for possible industry heterogeneity, we require that each treated firm and matched control firm belong to the same four-digit SIC code as of December 2021. Should a control firm not be located at the four-digit SIC classification, we apply the same matching approach at the three-digit SIC level (Lam et al., 2019).

For the 194 treated firms that announced their decisions to leave Russia, we successfully identify control firms for 187 of them based on the matching procedures discussed above. Table A2 in the Appendix displays the pre-event (i.e., prior to the exit announcements) characteristics of the treated and matched control firms in terms of IR, Bm, Size, Leverage, Tobin's Q, and ROA. Table A3 further compares the treated firms' IR with that of the matched control firms over a five-month pre-event period, showing no significant difference in IR for each of these five months. An event-study-based DiD approach is employed to evaluate the quality of our matching, with corresponding results documented in Table 5 and discussed in Section 5.1.

4.4. DiD Regression Specification

We first specify a baseline DiD regression model, as shown in equation (5), to test H1 regarding the impact of firm exit on idiosyncratic risk. Please note that the regression analysis is conducted at the monthly level instead of the annual level.

$$IR_{i,m+1} = \alpha + \beta_1 Treated_i \times Post_m + X_{i,t-1} + \sigma_i + \gamma_t + \varepsilon_{i,m}\,, \tag{5}$$

where i, m, and t are firm, month, and year indexes, respectively. $IR_{i,m+1}$ indicates firm i's idiosyncratic risk in month *m+1*. $Treated_i$ is coded as one for treated firms with exit announcements and zero for matched control firms without such announcements. $Post_m$ is coded as one for months (0, 12) where month 0 is the month of exit announcements, and zero for months (-5, -1). This means that we include a period of 18 months as our event window, ranging from five months before an event (-5, -1) to 12 months after the same event (0, 12). The five-month pre-event window gives us a sufficient period to compare the difference between the treated and matched control firms prior to the exit announcements. On the other hand, as it may take time for a firm's exit decision to affect its idiosyncratic risk, we use a 12-month post-event window to better capture the full impact due to the exit decision. The use of a 12-month period also aligns with the full-year financial reporting cycle of our sample firms and is consistent with prior research (Lam et al., 2019). $X_{i,t-1}$ represents a list of control variables measured in year *t-1*, while σ_i and γ_t are the firm and year fixed effects, respectively. We test H1 based on β_1 (i.e., the coefficient of the DiD term), which indicates the effect of firm exit on idiosyncratic risk. If β_1 is statistically significant and negative, we can conclude that compared to their matched counterparts, the treated firms exhibit lower idiosyncratic risk after announcing their decisions to leave Russia, providing support for H1.

We then add the moderator variable to the DiD regression analysis for testing H2 and H3 regarding supply chain efficiency and geographic diversification's moderating effects, as shown in equation (6).

$$IR_{i,m+1} = \alpha + \beta_1 Treated_i \times Post_m + \beta_2 Treated_i \times Post_m \times Moderator_{i,t-1} + \beta_3 Moderator_{i,t-1} + X_{i,t-1} + \sigma_i + \gamma_t + \varepsilon_{i,m}\ , \tag{6}$$

where i, m, and t are firm, month, and year indexes, respectively. $Moderator_{i,t-1}$ indicates firm i's supply chain efficiency (or supply chain geographic diversification), measured in year *t-1*. We use supply chain efficiency and geographic diversification in year *t-1* to avoid the possible influences of firm exits on the measurements of these moderators. We rely on β_2 (i.e., the coefficient for the DiD term's interaction with the moderator) to determine the moderating effects and test H2 and H3. For example, if β_2 is statistically significant and negative, we can conclude that supply chain efficiency (geographic diversification) plays a negative moderating role in the relationship between firm exit and idiosyncratic risk, supporting H2 (H3).

5. Results

5.1. Main Analyses

A total of 170 treated firms are retained for the DiD regression analysis, down from the 187 firms reported in Section 4.3 due to missing data for some firms. We then construct an unbalanced panel based on these 170 treated firms and their matched control firms over the 18-month event window, resulting in 5708 firm-month observations for estimating equation (5) and 5401 firm-month observations for estimating equation (6). Table 2 outlines the descriptive statistics for all variables included in the DiD analysis, while Table 3 displays their correlations, with the maximum correlation value equal to 0.5. We compute the Variance Inflation Factor (VIF) for all independent variables, resulting in values ranging from 1.1 to 1.7, which are well below the commonly accepted threshold of 10. Therefore, both the correlation and VIF values suggest that there is minimal risk of multicollinearity in our model.

[Insert Tables 2 and 3 here]

Column 1 of Table 4 documents the baseline DiD regression results based on equation (5). The coefficient of the DiD term (i.e., Treated×Post) is significantly negative (b = -0.157, $p < 0.01$). This suggests that compared to companies without exit announcements, those announcing exit decisions experience a significant reduction in idiosyncratic risk after their announcements, corresponding to an average decrease of 8.79% (0.157/1.787). Thus, H1 is supported.

[Insert Table 4 here]

We conduct a month-by-month event-study type DiD regression to validate the quality of our matching method and to track how firm exit influences idiosyncratic risk over time. Table 5 details the results. We use pre1 (i.e., one month before the exit announcement) as the reference group in this regression analysis. During the five-month pre-event window (i.e., pre5-pre2), idiosyncratic risk levels between treated firms and their matched controls do not differ significantly, confirming the parallel trend assumption and demonstrating the quality of our matching approach. On the other hand, following the exit announcement, a significant decline in idiosyncratic risk emerges in the third month (post3) and persists consistently through the subsequent nine months (post4–post12), suggesting a sustained effect.

[Insert Table 5 here]

The moderating effects based on equation (6) are presented in Columns 2 and 3 of Table 4. As shown in Column 2, when the moderator is SC efficiency, the interaction between the DiD term and moderator is significant and negative (b = -0.059, $p < 0.05$), meaning that firms operating efficient supply chains are more effective in mitigating idiosyncratic risk through their exit strategies. Thus, H2 is supported. Similarly, when SC geo diversification becomes the moderator in Column 3, the moderating effect is also significantly negative (b = -0.009, $p < 0.1$), supporting H3.

5.2. Additional Tests

We perform additional tests to address several key questions arising from our research findings: Do different types of exit strategies have similar impacts on idiosyncratic risk? Do firm exits also affect income stream uncertainty? Do supplier geographic diversification and customer geographic diversification play different roles in moderating the firm exit-idiosyncratic risk relationship?

5.2.1. The impacts of different types of exit strategies

While Table 4 consistently suggests that firm exit does have a negative impact on idiosyncratic risk, it is unclear whether different types of exit strategies such as complete withdrawal, scaling back, and suspension of operations during the Russia-Ukraine conflict have similar impacts on idiosyncratic risk. To answer this question, we first read firms' exit announcements carefully and classify them into three different types: complete withdrawal, scaling back, and suspension of operations. We then conduct the DiD regression analysis for each exit type separately. The test results, documented in Table 6 (Columns 1 to 3), suggests that all three types of exit strategies have significantly negative impacts on idiosyncratic risk ($p < 0.05$), but the magnitude of the impact is largest for complete withdrawal ($b = -0.387$), followed by suspension of operations ($b = -0.165$) and scaling back ($b = -0.135$).

[Insert Table 6 here]

5.2.2. The impact on income stream uncertainty

Our research focuses on idiosyncratic risk as perceived by investors, but consumers may also react to firms' exit announcements, which could influence firm risk from a demand perspective. Following Palmer and Wiseman (1999), we use income stream uncertainty to capture this demand perspective. Specifically, we measure income stream uncertainty based on two proxies: the variance of quarterly ROA and the variance of quarterly earnings per share (EPS), both over a four-quarter period. We then rerun the DiD regression model with income stream uncertainty as the dependent variable. The test results in Table 6 (Columns 4 and 5) indicate that firms' exit announcements do not influence income stream uncertainty significantly ($p > 0.1$). This finding suggests that consumers and investors may have different views on the risk implications of firms' exit decisions, which is worth further investigation. It should also be noted that the measurements of income stream uncertainty based on quarterly accounting data may be less sensitive to short-term exit announcements, leading to less significant test results compared with those based on daily stock returns.

5.2.3. Difference between supplier and customer geographic diversifications

A logical question stemming from our test results regarding the moderation effect of SC geo diversification is whether upstream and downstream SC geo diversifications play different moderating roles. To further investigate the moderation effects of supplier and customer geographic diversifications, we first follow prior studies (e.g., Fan et al., 2022; Lin et al., 2021) to measure a firm's supplier (customer) geo diversification as the number of countries from which it has suppliers (customers). We then rerun the regression model by interacting the DiD term with supplier geo diversification and customer geo diversification, respectively. The test results in Table 6 (Columns 6 and 7) show that supplier geo diversification exhibits a significant and negative moderating effect ($b = -0.014$, $p < 0.05$), whereas the moderation effect of customer geo diversification is not significant ($b = -0.001$, $p > 0.1$). Overall, these findings suggest that supplier geographic diversification plays a more critical role than customer geographic diversification in moderating the impact of firm exit on idiosyncratic risk.

5.3.Robustness Tests

We also conduct several tests to assess the robustness of our findings to different event windows, additional time and industry fixed effects, different matching approaches, alternative variable measurements and additional control variables. Overall, our main findings remain consistent across different robustness tests. We next discuss these robustness tests in detail, documenting the results related to the direct impact of firm exit in Table 7 (H1), and those related to moderating roles in Table 8 (H2 and H3).

[Insert Tables 7 and 8 here]

5.3.1. Alternative event windows

We first examine our test results' sensitivity to different event windows. First, we shorten the post-event period from 12 months to 5 months to align it more closely with the pre-event period, resulting in an event window of (-5, 5). We also extend the original post-event period from 12 months to 21 months (the longest period available based on our data) to check whether the impact of firm exit on idiosyncratic risk is consistent over a longer period (i.e., -5, 21). Table 7 (Columns 1 and 2) displays that the DiD coefficients remain negative and significant for both event windows ($p < 0.1$), indicating that the risk effects of exiting the Russian market remain consistent over different time frames.

5.3.2. Alternative time fixed effects

We incorporate quarter and month fixed effects, respectively, into the DiD model to account for any time-specific factors at the quarterly and monthly levels that might influence our results. As shown in Table 7 (Columns 3 and 4), the DiD coefficients are still significantly negative ($p < 0.05$) after adding the quarter and month fixed effects. We also apply the procedure recommended by Wooldridge (2016) to de-season the dependent variable. Specifically, we first estimate the DiD model using seasonal (quarter) dummy variables and then subtract the residuals from the dependent variable to remove the effect of seasonality. The test results in Table 7 (Column 5) remain consistent, suggesting that seasonal factors do not significantly affect our main finding.

5.3.3. Account for industry heterogeneity

Recognizing that the influence of firm exit on idiosyncratic risk could vary by industry, we add industry-year fixed effects to the DiD model to account for any industry-specific variations over time. Our findings hold when industry-year fixed effects are included, as demonstrated in Table 7 (Column 6). Furthermore, we rerun the DiD model by removing firms in the business services industry (SIC code = 73) as the risk implications of firm exit in this industry may be quite different from other industries with more tangible assets (e.g., manufacturing). The test results are qualitatively similar despite a reduced sample size, as shown in Table 7 (Column 7).

5.3.4. Alternative matching approaches

We also adopt alternative matching approaches to select control firms for our treated firms with exit announcements. Specifically, we first perform matching only based on industry classification (four-digit SIC code) and firm size (market capitalization), two important factors emphasized by Barber & Lyon (1996), obtaining consistent test results as shown in Table 7 (Column 8). Next, we restrict our control firm pool to those firms with operations in Russia but without exit announcements during our investigation period. Despite a significantly smaller sample size, the test results remain consistent when we use this alternative pool of control firms and perform matching based on the book-to-market ratio, market capitalization, leverage, and idiosyncratic risk, as shown in Table 7 (Column 9).

5.3.5. Alternative measures of dependent variable

We also measure the dependent variable, IR, alternatively. First, we divide the variance of $\hat{\varepsilon}_{i,d,m}$ obtained from equation (2) by a firm's total stock volatility in each month to obtain a relative measure of IR (Durnev et al., 2004; Ferreira & Laux, 2007). Second, instead of using the Market model, we calculate IR based on the three-factor model proposed by Fama & French (1993), which takes account of not only market returns but also firm size and growth opportunity. The DiD test results with these two alternative measures of IR as the dependent variable remain consistent, as presented in Table 7 (Columns 10 and 11).

5.3.6. Additional control variables

We further refine our DiD model by adding additional control variables, thereby ensuring that the findings are not biased by other firm-specific factors. Specifically, following Lam (2018), we add three additional controls: R&D intensity, marketing intensity, and ESG score, which could influence a firm's exposure to idiosyncratic risk. R&D intensity is measured as the ratio of R&D expenses to sales. Marketing intensity is calculated by subtracting R&D expenses from SG&A expenses and dividing the result by sales. ESG score is obtained from Asset4 directly (Dai et al., 2021). The coefficient of the DiD term continues to be negative and statistically significant ($p < 0.01$) after adding these control variables, as shown in Table 7 (Column 12).

5.3.7. Alternative measures of supply chain efficiency and geographic diversification

We measure supply chain efficiency and geographic diversification alternatively and obtain consistent moderation results, as shown in Table 8. First, we follow Johnson & Templar (2011) by measuring SC efficiency using the cash generation ratio, which is defined as net cash inflow from operating activities over sales. Table 8 (Column 1) suggests that the interaction between the DiD term and this alternative efficiency measure remains significantly negative ($p < 0.05$). Second, to control for the influence of supply chain size, we scale a firm's SC geographic diversification by its total number of suppliers and customers. Table 8 (Column 2) still shows a negative and significant moderation effect for this alternative diversification measure ($p < 0.1$). Finally, we also scale supplier geographic diversification and customer geographic diversification by a firm's supplier number and customer number, respectively, obtaining consistent test results in Table 8 (Columns 3 and 4). Specifically, it shows that supplier geographic diversification still plays a significant moderating role ($p < 0.05$), but the moderation effect of customer geographic diversification is not significant ($p > 0.1$).

6. Conclusion and Discussion

In conclusion, this study examines the impact of firm exit from Russia following the Russia-Ukraine conflict on idiosyncratic risk and how supply chain efficiency and geographic diversification moderate the impact. Adopting a DiD estimation approach, we compare the idiosyncratic risk changes between 170 treated firms that announced their exit decisions and matched control firms that did not make such announcements. Our DiD analysis shows a negative impact of firm exit on idiosyncratic risk. In addition, we find that firms with efficient and diversified supply chains experience greater idiosyncratic risk reduction after announcing their exit decisions. Our results remain consistent across various robustness checks.

Our additional analysis further suggests that supplier geographic diversification exhibits a stronger moderating effect on the firm exit-idiosyncratic risk relationship than customer geographic diversification. This may be because firm exits during geopolitical conflicts are more likely to face immediate supply and operational disruptions rather than shifts in customer demands or preferences (Estrin & Meyer, 2023; Balyuk & Fedyk, 2023), making supplier geographic diversification more important than customer geographic diversification in helping firms to mitigate the risks arising from their exit decisions.

Another interesting finding from our additional analysis is that complete withdrawal, as a full exercise of the abandonment option, yields the greatest reduction in idiosyncratic risk, followed by suspension and scale back operations. While prior studies have argued that staged divestments create more value than complete divestments due to their ability to preserve strategic flexibility (Damaraju et al., 2015; Zingales, 1995), our findings add new insights in the context of geopolitical crises. The real options logic behind staged divestments emphasizes the benefit of partially exercising the abandonment option while retaining the possibility to reinvest or scale up if uncertainty resolves favorably (Damaraju et al., 2015; Zingales, 1995). However, our results suggest that under extreme geopolitical uncertainty, the value of flexibility may be outweighed by the reputational, legal, and operational costs of remaining partially exposed.

6.1. Implications for Research

There is no doubt that geopolitical conflicts such as the Russia-Ukraine war should have a significant influence on firm risk, as demonstrated empirically by Piserà et al. (2024) and Soliman & Le Saout (2024). However, little empirical evidence has been documented on how firms' exit decisions during geopolitical conflicts may affect firm risk. Our study addresses this research gap by empirically investigating how firm exits from Russia amid the Russia-Ukraine conflict affect idiosyncratic risk. Future research might build on this study by investigating how firm risk is shaped by alternative strategic decisions (e.g., reshoring; Cheng et al., 2024) during other geopolitical conflicts (e.g., the U.S.-China trade war; Fan et al., 2022), revealing new insights and enriching the firm risk literature.

Moreover, our research further investigates the roles of supply chain efficiency and geographic diversification in shaping the relationship between firm exit and idiosyncratic risk. While prior studies in the OSCM domain have extensively examined the significance of these two dimensions (e.g., Choi & Krause, 2006; Fan & Xiao, 2023; Lam, 2018; Lin et al., 2021; Hendricks et al., 2009), their relevance has not been thoroughly explored in the firm exit context. Furthermore, our additional analysis shows that while firms with a geographically diversified supplier base benefit more from their exit decisions in terms of risk reduction, customer geographic diversification does not moderate the firm exit-idiosyncratic risk relationship. This suggests that not all supply chain capabilities are equal in shaping the impact of firm exit on idiosyncratic risk. We thus encourage researchers to further consider how other supply chain factors might play different moderating roles in the context of firm exit. For example, future research can explore whether the risk reduction impact of firms' exit decisions depends on their relationships with supply chain partners (Villena et al., 2009) as well as their positions in the supply chain networks (Kim and Zhu, 2018).

Finally, we apply ROT to explain firms' exit decisions under geopolitical uncertainty. While ROT has been widely employed to explain the value of flexibility in strategic investments, relatively little research has examined its relevance to exit decisions (Damaraju et al., 2015; Tong & Reuer, 2007). Exits from fully owned foreign subsidiaries, often marginally profitable or even loss-making (Duhaime & Grant, 1984; Ravenscraft & Scherer, 1991), involve significant sunk costs and irreversible commitments. As such, they provide a clean empirical setting to test the predictions of ROT regarding the value of put options. Building on Damaraju et al. (2015), our study further enhances the literature by exploring how different exit modes vary in strategic value. Our findings reveal that full withdrawal yields the greatest reduction in idiosyncratic risk, followed by partial or deferred exits (e.g., scaling back or suspensions). This challenges the argument that greater flexibility is always a better option for value enhancement (Damaraju et al., 2015) and suggests instead that the nature of uncertainty matters. In reputationally sensitive and politically charged contexts, decisive action may outperform gradualism, making irreversible commitment more protective of firm value than flexibility. In addition, by focusing on the moderating roles of supply chain efficiency and geographic diversification, we highlight firm-level operational capabilities as important boundary conditions for realizing the value embedded in real options. This integrates OSCM perspectives into the ROT framework.

6.2. Implications for Practices

Firm exit during geopolitical conflicts is a challenging decision. While leaving the affected countries or areas can reduce a firm's exposure to potential geopolitical risks and avoid reputational damage (Sonnenfeld et al., 2022; Li et al., 2024), an exit decision may lead to significant supply chain disruptions and incur high operational costs (Estrin & Meyer, 2023; Balyuk & Fedyk, 2023). Moreover, firm exits from foreign markets have been commonly viewed as "failures" (Sethuram & Gaur, 2024), making it even more difficult for firms to embrace the exit decision and admit their "failures". However, our findings challenge this perception and provide empirical evidence that firm exit can be a value-enhancing strategy in volatile geopolitical contexts. Specifically, our analysis reveals that firms exiting Russia during the Russia-Ukraine war experienced, on average, a 9% reduction in idiosyncratic risk. These results suggest that exit should not be viewed narrowly as a retreat or failure, but rather as a strategic real option that allows firms to limit downside exposure and preserve long-term value in the face of heightened uncertainty. This framing not only helps legitimize exit decisions internally but may also assist managers in gaining support from risk-averse investors and boards who might otherwise be hesitant to endorse such moves.

Recognizing exit as a strategic option is only the starting point. Managers must also adopt specific risk mitigation strategies when exiting high-risk regions. First, they should proactively assess the form of exit, full withdrawal, scaling back, or suspension, as each carries different impacts for risk exposure and operational continuity. Our findings indicate that full withdrawal delivers the strongest risk-reduction benefit. Second, managers must prepare their supply chains to absorb exit-related financial costs and disruptions. This includes investing in supply chain efficiency to absorb the costs of firm exit, and in supply chain geographic diversification to ensure access to alternative suppliers and markets in other regions. Particularly, firms should develop and maintain a geographically diversified supplier base. This enables rapid switching and reduces dependence on any single region, especially important when geopolitical risks escalate. Finally, firms should embed exit planning into broader geopolitical risk management frameworks. This may involve scenario planning, real-time monitoring of political risk indicators, and developing modular supply chains that can be reconfigured quickly when geopolitical threats emerge. As the Russia-Ukraine war demonstrated, firms may have only a narrow window to act; over 1,000 multinationals made exit decisions within three months of the invasion (Issa, 2022). Speed, flexibility, and operational readiness are thus critical.

6.3. Limitations

Our study has several limitations. First, we focus on firm exits in the specific context of the Russia-Ukraine crisis, which represents a unique geopolitical conflict and may limit the generalizability of our findings. Thus, future research could explore how firm exit decisions in other geopolitical conflicts or crises affect idiosyncratic risk. Examining exits from regions affected by different geopolitical events, such as trade wars, economic sanctions, or domestic political instability, can offer deeper insights into the impact of firm exits under varying geopolitical conditions.

Moreover, this research captures the exit decisions of large and publicly listed companies because their stock prices are available for us to measure firm risk. However, this focus could constrain the relevance of our conclusions for small businesses or non-public firms who may have different resources and risk profiles in making exit decisions. Thus, future research could investigate how the exit strategies of small and privately held companies influence firm risk based on non-stock price measures (Lui et al., 2019).

Finally, this study only considers the exit decisions of U.S.-based companies, which means it may not fully capture how non-U.S. firms respond to the Russia-Ukraine conflict. Future research could extend to companies in other countries or regions. Yousaf et al. (2022), for example, find that the Russia-Ukraine conflict has affected European and Asian regions most significantly. Thus, researchers may investigate firms headquartered in Europe or Asia to assess whether the impact of firm exit on idiosyncratic risk differs based on firms' geographic locations and market exposures.

References

Alam, M. A. U., Devos, E., & Feng, Z. (2023). Firm reaction to geopolitical crises: Evidence from the Russia-Ukraine conflict. *Journal of Financial Research*, *46*, S163-S182.

Albuquerque, R., Koskinen, Y., & Zhang, C. (2019). Corporate social responsibility and firm risk: Theory and empirical evidence. *Management Science*, *65*(10), 4451-4469.

Apergis, N., Bonato, M., Gupta, R., & Kyei, C. (2018). Does geopolitical risks predict stock returns and volatility of leading defense companies? Evidence from a nonparametric approach. *Defence and Peace Economics*, *29*(6), 684-696.

Ayton, J., Krasnikova, N., & Malki, I. (2022). Corporate social performance and financial risk: Further empirical evidence using higher frequency data. *International Review of Financial Analysis*, *80*, 102030.

Balyuk, T., & Fedyk, A. (2023). Divesting under pressure: US firms' exit in response to Russia's war against Ukraine. *Journal of Comparative Economics*, 51(4), 1253-1273.

Barber, B. M., & Lyon, J. D. (1996). Detecting abnormal operating performance: The empirical power and specification of test statistics. *Journal of Financial Economics*, *41*(3), 359-399.

Basnet, A., Blomkvist, M., & Galariotis, E. (2022). The role of ESG in the decision to stay or leave the market of an invading country: The case of Russia. *Economics Letters*, *216*, 110636.

Boehm, J., & Sonntag, J. (2023). Vertical integration and foreclosure: Evidence from production network data. *Management Science*, *69*(1), 141-161.

Carroll, A. B. (2004). Managing ethically with global stakeholders: A present and future challenge. *Academy of Management Perspectives*, *18*(2), 114-120.

Case, W. (2022). Americans overwhelmingly want companies to take action against Russia over Ukraine invasion. Available at: https://pro.morningconsult.com/instant-intel/russia-ukraine-invasion-companies-take-action (Accessed on 28 August 2024).

Cefis, E., Bettinelli, C., Coad, A., & Marsili, O. (2022). Understanding firm exit: a systematic literature review. *Small Business Economics*, *59*(2), 423-446.

Cheng, M. P., Tang, C., Lo, C. K., Yeung, A. C., & Lam, H. K. (2025). Return to the United States: impact of reshoring announcements and reshoring risks on market valuation. *Management Science*, *71*(4), 3253-3282.

Chi, T., Li, J., Trigeorgis, L. G., & Tsekrekos, A. E. (2019). Real options theory in international business. *Journal of International Business Studies*, *50*, 525-553.

Choi, T. Y., & Krause, D. R. (2006). The supply base and its complexity: Implications for transaction costs, risks, responsiveness, and innovation. *Journal of Operations Management*, *24*(5), 637-652.

Choi, T. Y., Netland, T. H., Sanders, N., Sodhi, M. S., & Wagner, S. M. (2023). Just-in-time for supply chains in turbulent times. *Production and Operations Management*, *32*(7), 2331-2340.

Corbett, C.J., Montes-Sancho, M.J. & Kirsch, D.A. (2005). The financial impact of ISO 9000 certification in the United States: An empirical analysis. *Management Science*, *51*(7), 1046–1059.

Damaraju, N. L., Barney, J. B., & Makhija, A. K. (2015). Real options in divestment alternatives. *Strategic Management Journal*, *36*(5), 728-744.

Dai, R., Liang, H. & Ng, L. (2021). Socially responsible corporate customers. *Journal of Financial Economics*, *142*(2), 598–626.

Doherty, B. (2023). Business in Russia: Why some firms haven't left. Available at: https://www.bbc.com/worklife/article/20230918-business-in-russia-why-some-firms-havent-left (Accessed on 28 August 2024).

Drobetz, W., Ehlert, S., & Schröder, H. (2021). Institutional ownership and firm performance in the global shipping industry. *Transportation Research Part E: Logistics and Transportation Review*, *146*, 102152.

Durnev, A., Morck, R., & Yeung, B. (2004). Value-enhancing capital budgeting and firm-specific stock return variation. *The Journal of Finance*, *59*(1), 65-105.

Early, B. R., & Peterson, T. M. (2023). The enforcement of US economic sanctions and global de-risking behavior. *Journal of Conflict Resolution*, 00220027231214748.

El Baz, J., Evangelista, P., Jebli, F., & Sweeney, E. (2025). Towards an understanding of illegal supply chain design in conflict areas: the case of the grain supply chain in Ukraine. *International Journal of Operations & Production Management*, ahead-of-print. https://doi.org/10.1108/IJOPM-03-2024-0264.

Estrin, S., & Meyer, K. E. (2023). Why it's so difficult for companies to leave Russia. Available at: https://blogs.lse.ac.uk/businessreview/2023/03/28/why-its-so-difficult-for-companies-to-leave-russia/ (Accessed on 30 October, 2024)

Evenett, S. J., & Pisani, N. (2023). Geopolitics, conflict, and decoupling: evidence of Western divestment from Russia during 2022. *Journal of International Business Policy*, *6*(4), 511-540.

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, *33*(1), 3-56.

Fan, D., & Xiao, C. (2023). Firm-specific political risk: a systematic investigation of its antecedents and implications for vertical integration and diversification strategies. *International Journal of Operations & Production Management*, *43*(6), 984-1007.

Fan, D., Ma, P., Cui, L., & Yiu, D. W. (2024). Locking in overseas buyers amid geopolitical conflicts. *Journal of Operations Management*, *70*(5), 756-792.

Fan, D., Zhou, Y., Yeung, A. C., Lo, C. K., & Tang, C. (2022). Impact of the US–China trade war on the operating performance of US firms: The role of outsourcing and supply base complexity. *Journal of Operations Management*, *68*(8), 928-962.

Fareed, Z., Wang, N., Shahzad, F., Shah, S. G. M., Iqbal, N., & Zulfiqar, B. (2022). Does good board governance reduce idiosyncratic risk in emerging markets? Evidence from China. *Journal of Multinational Financial Management*, *65*, 100749.

Farris II, M. T., & Hutchison, P. D. (2002). Cash-to-cash: the new supply chain management metric. *International Journal of Physical Distribution & Logistics Management*, *32*(4), 288-298.

Ferreira, M. A., & Laux, P. A. (2007). Corporate governance, idiosyncratic risk, and information flow. *The Journal of Finance*, *62*(2), 951-989.

French, J. J., Gurdgiev, C., & Shin, S. (2023). When doing the right thing doesn't pay: Impact of corporate decisions on Russian market participation in the wake of the Ukraine-Russia war. *Finance Research Letters*, *58*, 104468.

Gamble, J. (2022), Putting ESG in action starts with the G. Available at: https://fortune.com/2022/04/20/esg-sec-cyber-environment-leadership-corporate-governance-investing-jamie-gamble/ (accessed on 28 August 2024).

Ganesan, S., & Mallapragada, G. (2024). Navigating Geopolitical Turmoil: Corporate Responses to the War in Ukraine and Its Impact on Consumer Mindset. *Journal of Public Policy & Marketing*, 07439156241244738.

Geeta, R., & Prasanna, K. (2016). Impact of family ownership on idiosyncratic risk. *International Journal of Corporate Governance*, *7*(4), 325-352.

Gentry, R. J., Harrison, J. S., Quigley, T. J., & Boivie, S. (2021). A database of CEO turnover and dismissal in S&P 1500 firms, 2000–2018. *Strategic Management Journal*, *42*(5), 968-991.

Glambosky, M., & Peterburgsky, S. (2022). Corporate activism during the 2022 Russian invasion of Ukraine. *Economics Letters*, *217*, 110650.

Goyal, A., & Santa-Clara, P. (2003). Idiosyncratic risk matters!. *The Journal of Finance*, *58*(3), 975-1007.

Handley, K., & Limão, N. (2022). Trade policy uncertainty. *Annual Review of Economics*, *14*(1), 363-395.

Hendricks, K. B., Singhal, V. R., & Zhang, R. (2009). The effect of operational slack, diversification, and vertical relatedness on the stock market reaction to supply chain disruptions. *Journal of Operations Management*, *27*(3), 233-246.

Hendry, L. C., Stevenson, M., MacBryde, J., Ball, P., Sayed, M., & Liu, L. (2019). Local food supply chain resilience to constitutional change: the Brexit effect. *International Journal of Operations & Production Management*, *39*(3), 429-453.

Hitt, M. A., Tihanyi, L., Miller, T., & Connelly, B. (2006). International diversification: Antecedents, outcomes, and moderators. *Journal of Management*, *32*(6), 831-867.

Ho, W., Zheng, T., Yildiz, H. & Talluri, S. (2015). Supply chain risk management: a literature review. *International Journal of Production Research*, *53*(16), 5031-5069.

Huang, Y., Lin, C., Liu, S., & Tang, H. (2023). Trade networks and firm value: Evidence from the US-China trade war. *Journal of International Economics*, *145*, 103811.

Issa, T. M. (2022). Over 1,000 foreign companies left Russia since Feb. 24: Report. Available at: https://english.alarabiya.net/business/2022/05/31/Over-1-000-foreign-companies-left-Russia-since-Feb-24-Report (Accessed on 30 October 2024).

Ivanov, D., & Dolgui, A. (2019). Low-Certainty-Need (LCN) supply chains: a new perspective in managing disruption risks and resilience. *International Journal of Production Research*, *57*(15-16), 5119-5136.

Izzeldin, M., Muradoğlu, Y. G., Pappas, V., Petropoulou, A., & Sivaprasad, S. (2023). The impact of the Russian-Ukrainian war on global financial markets. *International Review of Financial Analysis*, *87*, 102598.

Jacobs, B. W., Kraude, R., & Narayanan, S. (2016). Operational productivity, corporate social performance, financial performance, and risk in manufacturing firms. *Production and Operations Management*, *25*(12), 2065-2085.

Jamali, D. (2008). A stakeholder approach to corporate social responsibility: A fresh perspective into theory and practice. *Journal of Business Ethics*, *82*, 213-231.

Johnson, M., & Templar, S. (2011). The relationships between supply chain and firm performance: The development and testing of a unified proxy. *International Journal of Physical Distribution & Logistics Management*, *41*(2), 88-103.

Ke, J. Y. F., Otto, J., & Han, C. (2022). Customer-Country diversification and inventory efficiency: Comparative evidence from the manufacturing sector during the prepandemic and the COVID-19 pandemic periods. *Journal of Business Research*, *148*, 292-303.

Khan K, A., Bakkappa, B., Metri, B. A., & Sahay, B. S. (2009). Impact of agile supply chains' delivery practices on firms' performance: cluster analysis and validation. *Supply Chain Management: An International Journal*, *14*(1), 41-48.

Kiesel, F., & Kolaric, S. (2023). Should I stay or should I go? Stock market reactions to companies' decisions in the wake of the Russia-Ukraine conflict. *Journal of International Financial Markets, Institutions and Money*, 89, 101862.

Kim, D. Y., & Zhu, P. (2018). Supplier dependence and R&D intensity: The moderating role of network centrality and interconnectedness. *Journal of Operations Management*, *64*, 7-18.

King, G., & Nielsen, R. (2019). Why Propensity Scores Should Not Be Used for Matching. *Political Analysis*, 27(4), 435–454.

Krasnikov, A., & Jayachandran, S. (2008). The relative impact of marketing, research-and-development, and operations capabilities on firm performance. *Journal of Marketing*, *72*(4), 1-11.

Kulchania, M., & Thomas, S. (2017). Cash reserves as a hedge against supply-chain risk. *Journal of Financial and Quantitative Analysis*, *52*(5), 1951-1988.

Lam, H. K. S. (2018). Doing good across organizational boundaries: Sustainable supply chain practices and firms' financial risk. *International Journal of Operations & Production Management*, *38*(12), 2389–2412.

Lam, H. K. S., Ding, L., Cheng, T. C. E., & Zhou, H. (2019). The impact of 3D printing implementation on stock returns: A contingent dynamic capabilities perspective. *International Journal of Operations & Production Management*, *39*(6/7/8), 935–961.

Lasfer, M., & Ye, X. (2023). Corporate insiders' exploitation of investors' anchoring bias at the 52-week high and low. *Financial Review*, *59*(2), 391-432.

Lee, J. M., Hwang, B. H., & Chen, H. (2017). Are founder CEOs more overconfident than professional CEOs? Evidence from S&P 1500 companies. *Strategic Management Journal*, *38*(3), 751-769.

Li, G., Li, N., & Sethi, S. P. (2021). Does CSR reduce idiosyncratic risk? Roles of operational efficiency and AI innovation. *Production and Operations Management*, *30*(7), 2027-2045.

Li, H., Li, Z., Park, Z., Wang, Y., & Wu, J. (2024). To Comply or Not to Comply: Understanding Developing Country Supply Chain Responses to Russian Sanctions. *Available at SSRN*

4817589.

Liadze, I., Macchiarelli, C., Mortimer-Lee, P., & Sanchez Juanino, P. (2023). Economic costs of the Russia-Ukraine war. *The World Economy*, *46*(4), 874-886.

Lin, Y., Fan, D., Shi, X., & Fu, M. (2021). The effects of supply chain diversification during the COVID-19 crisis: Evidence from Chinese manufacturers. *Transportation Research Part E: Logistics and Transportation Review*, *155*, 102493.

Lo, C. K. Y., Yeung, A. C. L., & Cheng, T. C. E. (2009). ISO 9000 and supply chain efficiency: Empirical evidence on inventory and account receivable days. *International Journal of Production Economics*, 118(2), 367–374.

Lücker, F., Timonina-Farkas, A., & Seifert, R. W. (2024). Balancing Resilience and Efficiency: A Literature Review on Overcoming Supply Chain Disruptions. *Production and Operations Management, Forthcoming*. https://doi.org/10.1177/10591478241302735.

Lui, A. K., Lo, C. K., & Ngai, E. W. (2019). Does mandated RFID affect firm risk? The moderating role of top management team heterogeneity. *International Journal of Production Economics*, *210*, 84-96.

Markowitz, H. M. (1999). The early history of portfolio theory: 1600–1960. *Financial Analysts Journal*, *55*(4), 5-16.

Martins, A. M., & Cró, S. (2024). Mayday! Mayday! The airlines stock returns are failing. Analysis of the impact of Russia–Ukraine war. *Journal of Economic Studies*, *51*(6), 1182-1198.

Mishra, S., & Modi, S. B. (2013). Positive and negative corporate social responsibility, financial leverage, and idiosyncratic risk. *Journal of Business Ethics*, *117*, 431-448.

Mishra, S., Modi, S.B. & Animesh, A. (2013) The relationship between information technology capability, inventory efficiency, and shareholder wealth: A firm-level empirical analysis, *Journal of Operations Management*, *31*(6), 298–312.

Moradlou, H., Reefke, H., Skipworth, H., & Roscoe, S. (2021). Geopolitical disruptions and the manufacturing location decision in multinational company supply chains: a Delphi study on Brexit. *International Journal of Operations & Production Management*, *41*(2), 102-130.

Munir, M., Jajja, M. S. S., Chatha, K. A., & Farooq, S. (2020). Supply chain risk management and operational performance: The enabling role of supply chain integration. *International Journal of Production Economics*, *227*, 107667.

Myers, S. C. (1977). Determinants of corporate borrowing. Journal of Financial Economics, *5*(2), 147-175.

Nerlinger, M., & Utz, S. (2022). The impact of the Russia-Ukraine conflict on energy firms: A capital market perspective. *Finance Research Letters*, *50*, 103243.

Nguyen, P., Ben Zaied, Y., & Pham, T. P. (2019). Does idiosyncratic risk matter? Evidence from mergers and acquisitions. *The Journal of Risk Finance*, *20*(4), 313-329.

Nikfarjam, H., Rostamy-Malkhalifeh, M., & Mamizadeh-Chatghayeh, S. (2015). Measuring supply chain efficiency based on a hybrid approach. *Transportation Research Part D: Transport and Environment*, *39*, 141-150.

Ó Laoghaire, T. (2024). Let Slip the Dogs of Commerce: The Ethics of Voluntary Corporate Withdrawal in Response to War. *The Journal of Ethics*, *28*(1), 27-52.

Palmer, T. B., & Wiseman, R. M. (1999). Decoupling risk taking from income stream uncertainty: A holistic model of risk. Strategic Management Journal, 20(11), 1037-1062.

Piserà, S., Chiaramonte, L., Paltrinieri, A., & Pichler, F. (2024). Firm systematic risk after the Russia–Ukraine invasion. *Finance Research Letters*, *64*, 105489.

Preble, K. A., & Early, B. R. (2024). Enforcing economic sanctions by tarnishing corporate reputations. *Business and Politics*, *26*(1), 102-123.

Rego, L. L., Billett, M. T., & Morgan, N. A. (2009). Consumer-based brand equity and firm risk. *Journal of Marketing*, *73*(6), 47-60.

Ren, X., Cao, Y., Liu, P. J., & Han, D. (2023). Does geopolitical risk affect firms' idiosyncratic volatility? Evidence from China. *International Review of Financial Analysis*, *90*, 102843.

Rogers, Z. S., Golara, S., Abdulsalam, Y., & Rogers, D. S. (2024). Protect me not: The effect of tariffs on U.S. supply networks. *Journal of Purchasing and Supply Management*, *30*(1), 100897.

Roscoe, S., Skipworth, H., Aktas, E., & Habib, F. (2020). Managing supply chain uncertainty arising from geopolitical disruptions: evidence from the pharmaceutical industry and brexit. *International Journal of Operations & Production Management*, *40*(9), 1499-1529.

Sakhartov, A. V., & Folta, T. B. (2014). Resource relatedness, redeployability, and firm value. *Strategic Management Journal*, *35*(12), 1781-1797.

Sethuram, S., & Gaur, A. (2024). Foreign divestment: the missing piece in international business scholarship. *Journal of International Business Studies*, 1-10.

Sharma, A., Pathak, S., Borah, S. B., & Adhikary, A. (2020). Is it too complex? The curious case of supply network complexity and focal firm innovation. *Journal of Operations Management*, 66(7–8), 839–865.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, *19*(3), 425-442.

Shekarian, M., Parast, M.M. (2021). An Integrative approach to supply chain disruption risk and resilience management: A literature review. *International Journal of Logistics Research and Applications*, *24*(5), 427-455.

Shin, H. H., & Stulz, R. M. (2000). Firm Value, Risk, and Growth Opportunities. *NBER Working Paper*, (w7808).

Soliman, A., & Le Saout, E. (2024). The impact of the war in Ukraine on the idiosyncratic risk and the market risk. *Finance Research Letters*, *60*, 104895.

Sonnenfeld, J., Tian, S., Zaslavsky, S., Bhansali, Y., & Vakil, R. (2022). It pays for companies to leave Russia. Available at SSRN, 4112885.

Srai, J. S., Graham, G., Van Hoek, R., Joglekar, N., & Lorentz, H. (2023). Impact pathways: unhooking supply chains from conflict zones—reconfiguration and fragmentation lessons from the Ukraine–Russia war. *International Journal of Operations & Production Management*, *43*(13), 289-301.

Steinbach, S. (2023). The Russia–Ukraine war and global trade reallocations. *Economics Letters*, *226*, 111075.

Sun, W., & Govind, R. (2017). Product market diversification and market emphasis: Impacts on firm idiosyncratic risk in market turbulence. *European Journal of Marketing*, *51*(7/8), 1308-1331.

Suryawanshi, P., & Dutta, P. (2022). Optimization models for supply chains under risk, uncertainty, and resilience: A state-of-the-art review and future research directions. *Transportation Research Part E: Logistics and Transportation Review*, 157, 102553.

Tang, C.S. (2006). Robust strategies for mitigating supply chain disruptions. *International Journal of Logistics: Research and Applications*, *9*(1), 33-45.

Thams, Y., & Dau, L. A. (2023). Do liberal and conservative-leaning CEOs approach de-internationalization differently? Zooming in on the onset of the 2022 Russia/Ukraine crisis. *Journal of World Business*, *58*(5), 101475.

Trigeorgis, L. (1996). *Real options: Managerial flexibility and strategy in resource allocation*. MIT press.

Trigeorgis, L., & Reuer, J. J. (2017). Real options theory in strategic management. *Strategic Management Journal*, *38*(1), 42-63.

Verdier, P. H. (2022). Sanctions Overcompliance: What, Why, and Does It Matter?. *North Carolina Journal of International Law*, *48*, 471.

Villena, V. H., Revilla, E., & Choi, T. Y. (2011). The dark side of buyer–supplier relationships: A social capital perspective. *Journal of Operations Management*, *29*(6), 561-576.

Wang, B. (2019). The cash conversion cycle spread. *Journal of Financial Economics*, *133*(2), 472-497.

Wang, H., Tong, L., Takeuchi, R., & George, G. (2016). Corporate social responsibility: An overview and new research directions: Thematic issue on corporate social responsibility. *Academy of Management Journal*, *59*(2), 534-544.

Wooldridge, J.M. (2016) Introductory Econometrics: A Modern Approach, 6th edn. Cengage Learning.

Yousaf, I., Patel, R., & Yarovaya, L. (2022). The reaction of G20+ stock markets to the Russia–Ukraine conflict “black-swan” event: Evidence from event study approach. *Journal of Behavioral and Experimental Finance*, *35*, 100723.

Zeng, K., Xu, Y., & Xie, Z. (2023). Local sourcing embeddedness, manufacturing relocation, and firm attitudes toward the US-China trade war: A survey analysis of China-based MNC subsidiaries. *Business and Politics*, *25*(2), 91-116.

Zhu, M., Miao, S., Lam, H. K., Liang, C., & Yeung, A. C. (2025). Navigating through geopolitical risk: the role of supply chain concentration. *International Journal of Operations & Production Management*, *45*(5), 1032-1065.

Table 1. Variable measurements

Variable	Measurement	Reference	Data source
IR	Monthly standard deviation (×100) of the residuals obtained from the Market model.	Mishra et al. (2013)	CRSP
SC efficiency	Standardized cash conversion cycle (reverse coded).	Farris II & Hutchison, (2002); Hendricks et al. (2009)	Compustat
SC geo diversification	Number of countries from which a firm has suppliers and customers.	Fan et al. (2022)	FactSet Revere
Bm	The book-to-market ratio calculated as the ratio of book value over the market value of equity.	Fama & French (1993); Lasfer and Ye (2023)	Compustat
Size	Natural logarithm of total assets.	Fama & French (1993)	Compustat
Leverage	Long term debt plus debt in current liability over total assets.	Ferreira and Laux (2007)	Compustat
Tobin's Q	Market value of equity plus book value of debt-deferred tax over book value of total assets.	Durnev et al. (2004)	Compustat
ROA	Return on assets calculated as the net income after taking out preferred dividend, over the total assets.	Corbett et al. (2005)	Compustat

Table 2. Descriptive statistics

Variables	N	Mean	SD	p25	Median	p75
IR	5708	1.787	1.023	1.153	1.538	2.115
Bm	5708	0.359	0.378	0.094	0.240	0.480
Size	5708	9.048	1.782	7.945	9.192	10.561
Leverage	5708	0.328	0.235	0.179	0.308	0.425
Tobin's Q	5708	3.041	2.753	1.364	2.090	3.468
ROA	5708	0.063	0.096	0.024	0.065	0.105
SC efficiency	5401	0.007	0.927	-0.472	-0.000	0.577
SC geo diversification	5708	4.425	4.329	1.000	3.000	7.000

Table 3. Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) IR	1.00								
(2) Bm	0.22***	1.00							
(3) Size	-0.35***	-0.05***	1.00						
(4) Leverage	0.00	-0.25***	0.06***	1.00					
(5) Tobin's Q	-0.06***	-0.50***	-0.14***	0.05***	1.00				
(6) ROA	-0.36***	-0.31***	0.18***	0.08***	0.40***	1.00			
(7) SC efficiency	-0.03***	-0.06***	0.18***	0.12***	0.00	-0.05***	1.00		
(8) SC geo diversification	-0.06***	-0.12***	0.13***	-0.01	0.09***	0.07***	0.01	1.00	
(9) Treated×Post	-0.10***	-0.04***	0.28***	0.05***	-0.04***	0.09***	0.06***	0.12***	1.00

Notes: *** p<0.01, ** p<0.05, and * p<0.1.

Table 4. DiD regression results

Variables	(1) Baseline DiD model (H1)	(2) Include SC efficiency as Moderator (H2)	(3) Include SC geo diversification as Moderator (H3)
Treated×Post	-0.157***	-0.162**	-0.109*
	(0.040)	(0.057)	(0.057)
Treated×Post×Moderator		-0.059**	-0.009*
		(0.018)	(0.005)
Moderator		0.085***	0.017
		(0.024)	(0.013)
Bm	0.429*	0.406*	0.412*
	(0.243)	(0.205)	(0.232)
Size	0.022	-0.051	-0.029
	(0.148)	(0.147)	(0.147)
Leverage	0.473	0.394	0.803
	(0.423)	(0.487)	(0.763)
Tobin's Q	0.055*	0.055	0.055*
	(0.031)	(0.033)	(0.031)
ROA	-0.551	-0.960	-0.638
	(0.386)	(0.333)	(0.469)
Constant	1.201	1.905	1.498
	(1.363)	(1.270)	(1.307)
Observations	5708	5401	5708
R^2	0.483	0.457	0.470
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Notes: *** p<0.01, ** p<0.05, and * p<0.1. Standard errors are in parentheses.

Table 5. Event-study type DiD regression results

Variables	Event-study type DiD model
Treated×Post	
pre5	-0.084
	(0.097)
pre4	0.162
	(0.101)
pre3	-0.033
	(0.092)
pre2	0.076
	(0.057)
post0	-0.075
	(0.075)
post1	-0.027
	(0.096)
post2	0.021
	(0.098)
post3	-0.168**
	(0.077)
post4	-0.066
	(0.082)
post5	-0.222**
	(0.097)
post6	-0.277***
	(0.074)
post7	-0.186**
	(0.083)
post8	-0.185**
	(0.092)
post9	-0.263***
	(0.085)
post10	-0.243**
	(0.097)
post11	-0.237**
	(0.094)
post12	-0.207*
	(0.121)
Constant	1.844***
	(0.037)
Observations	5,720
R^2	0.482
Controls	No
Firm FE	Yes
Year FE	Yes

Notes: *** p<0.01, ** p<0.05, and * p<0.1. Standard errors are in parentheses. pre1 is used as the reference group.

Table 6. Additional tests

Variables	(1) Complete withdrawal sample	(2) Scaling back sample	(3) Suspension of operations sample	(4) Income stream uncertainty (ROA)	(5) Income stream uncertainty (EPS)	(6) Supplier geo diversification moderation	(7) Customer geo diversification moderation
Treated×Post	-0.387**	-0.135**	-0.165***	0.127	0.194	-0.079*	-0.144***
	(0.164)	(0.056)	(0.042)	(0.117)	(0.125)	(0.040)	(0.045)
Treated×Post×Supplier geo diversification						-0.014**	
						(0.007)	
Treated×Post×Customer geo diversification							-0.001
							(0.001)
Observations	833	1548	3327	5702	5702	5708	5708
R^2	0.487	0.467	0.428	0.633	0.987	0.497	0.470
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *** p<0.01, ** p<0.05, and * p<0.1. Standard errors are in parentheses.

Table 7. Robustness test results: main impact

Variables	(1) Use (-5, 5) as the event window	(2) Use (-5, 21) as the event window	(3) Include quarter fixed effects	(4) Include month fixed effects	(5) De-season dependent variable	(6) Include industry-year fixed effects
Treated×Post	-0.135***	-0.083*	-0.121***	-0.102**	-0.084**	-0.161***
	(0.043)	(0.048)	(0.041)	(0.042)	(0.040)	(0.040)
Observations	3494	7700	5708	5708	5,708	5707
R^2	0.512	0.500	0.487	0.513	0.513	0.493
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	No	No	No
Quarter FE	No	No	Yes	No	No	No
Month FE	No	No	No	Yes	Yes	No
Industry-Year FE	No	No	No	No	No	Yes

Variables	(7) Remove business services industry	(8) Perform industry-size matching	(9) Alternative control firms	(10) Compute relative IR	(11) Measure IR based on three-factor model	(12) Include additional controls
Treated×Post	-0.092**	-0.152***	-0.121**	-0.183***	-0.101***	-0.151***
	(0.036)	(0.041)	(0.057)	(0.041)	(0.035)	(0.039)
R&D intensity						1.129***
						(0.402)
Marketing intensity						-1.921*
						(1.071)
ESG score						0.259
						(0.393)
Observations	4502	5778	1206	5708	5708	5534
R^2	0.499	0.468	0.556	0.450	0.480	0.468
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: *** p<0.01, ** p<0.05, and * p<0.1. Standard errors are in parentheses.

Table 8. Robustness test results: moderating effects

Variables	(1) Measure SC efficiency as cash generation ratio	(2) Scale SC geo diversification by total number of suppliers and customers	(3) Scale supplier geo diversification by total number of suppliers	(4) Scale customer geo diversification by total number of customers
Treated×Post	-0.117***	-0.106***	-0.089*	0.024
	(0.038)	(0.034)	(0.055)	(0.084)
Treated×Post×SC efficiency	-0.208**			
	(0.102)			
Treated×Post×SC geo diversification		-0.022*		
		(0.012)		
Treated×Post×Supplier geo diversification			-0.103**	
			(0.044)	
Treated×Post×Customer geo diversification				-0.326
				(0.204)
Observations	5653	5708	5708	5708
R^2	0.453	0.431	0.509	0.480
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: *** $p<0.01$, ** $p<0.05$, and * $p<0.1$. Standard errors are in parentheses.

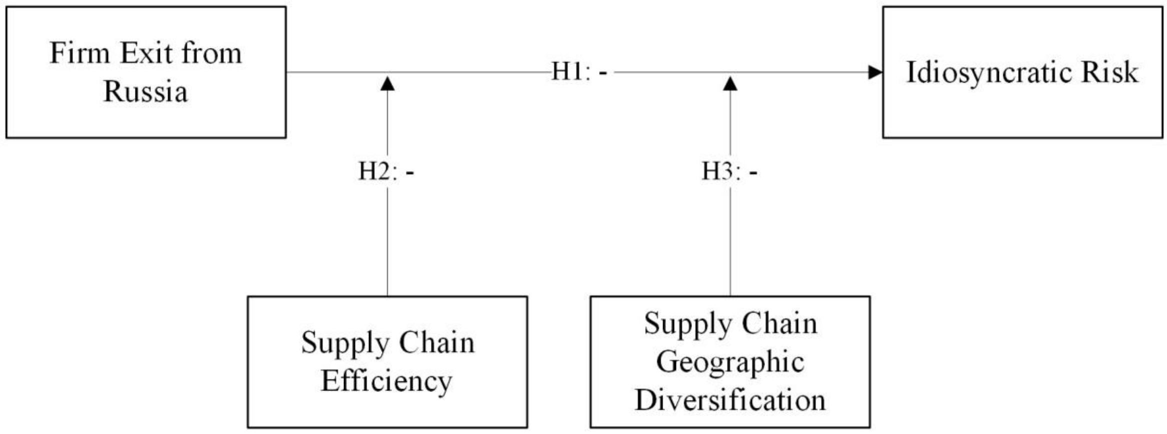

Figure 1. Research Model

Appendix

Table A1. Industry distribution of firms with exit announcements

SIC Code	Industry Description	Frequency	Percentage
30-39	Manufacturing	56	28.87%
20-29	Chemicals, Foods, Petroleum	43	22.16%
70-79	Hospitality, Recreation, and Business Services	41	21.13%
60-69	Financial Services	22	11.34%
40-49	Transportation and Communication	14	7.22%
50-59	Retail	10	5.15%
10-19	Mining	4	2.06%
90-99	Nonclassifiable and Other Services	2	1.03%
01-09	Agriculture, Forestry, and Fishing	1	0.52%
80-89	Professional Services	1	0.52%
Total		194	100%

Table A2. Pre-event characteristics of treated and control firms

Variables	Treated firms		Control firms	
	Mean	SD	Mean	SD
IR	1.783	0.879	1.850	0.838
Bm	0.306	0.344	0.307	0.209
Size	9.731	1.323	8.340	1.578
Leverage	0.322	0.139	0.308	0.221
Tobin's Q	3.137	2.500	3.180	2.972
ROA	0.062	0.088	0.045	0.117

Table A3. Comparison of pre-event IR between treated and control firms

Month	Treated firms		Control firms		Mean Difference	*p*-value
	Mean	SD	Mean	SD		
-5	1.600	0.655	1.691	0.561	-0.090	0.186
-4	1.856	0.962	1.956	0.920	-0.099	0.347
-3	1.675	0.826	1.746	0.665	-0.071	0.396
-2	1.829	1.060	1.987	0.931	-0.158	0.158
-1	1.768	0.993	1.935	0.088	-0.167	0.151