



UNIVERSIDADE CATÓLICA PORTUGUESA

Mitigating Strategies in the Supply Chain Automotive Industry

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Resumo

À medida que o setor automóvel continua a evoluir, as estratégias operacionais utilizadas há uma década estão sujeitas a ser substituídas ou adaptadas. Esta evolução exige um ajuste correspondente na abordagem, de forma a mitigar os riscos geopolíticos enfrentados pelos fabricantes de automóveis. Como tal, estratégias que eram eficazes há uma década podem agora estar desatualizadas e, desta forma serem insuficientes para enfrentar os desafios contemporâneos.

Atualmente há uma quantidade suficiente de literatura sobre estratégias de mitigação dentro das cadeias de abastecimento. No entanto, acerca da indústria automóvel, falta consenso na literatura atual sobre as estratégias a serem utilizadas ao enfrentar riscos geopolíticos. Portanto, este estudo tem como objetivo responder à seguinte questão de pesquisa: Quais são os conflitos geopolíticos mais influentes que afetam a cadeia de abastecimento da indústria automóvel e quais estratégias poderiam mitigá-los.

Para este propósito, este estudo apresenta uma revisão abrangente das estratégias de mitigação para riscos geopolíticos na cadeia de abastecimento automóvel. A partir de uma revisão sistemática da literatura e da utilização de dados secundários, o estudo analisa vários riscos geopolíticos enfrentados pela indústria automóvel, incluindo aqueles decorrentes de eventos como a guerra comercial entre os EUA e a China e o conflito entre Rússia e Ucrânia. Através de uma análise das respostas e estratégias específicas da indústria, a pesquisa esclarece a interconexão de eventos geopolíticos, disrupções na cadeia de abastecimento e tomada de decisões organizacionais.

Esta pesquisa conclui que a estratégia ótima para as empresas varia dependendo da sua estrutura organizacional. Fabricantes de automóveis

multinacionais podem considerar a opção de "nearshoring" como a estratégia mais aconselhável, aproveitando os benefícios da proximidade e os custos reduzidos de transporte. Por outro lado, empresas do setor automóvel não multinacionais são aconselhadas a priorizar a colaboração como meio de mitigar os riscos geopolíticos na cadeia de abastecimento.

Palavras-chave: Risco geopolítico; Indústria automóvel; Cadeia de abastecimento; Estratégias de mitigação; Guerra comercial EUA-China; Conflito Rússia-Ucrânia.

Abstract

The automotive industry, with a history spanning over a century, has witnessed significant changes in its supply chain dynamics over time. Consequently, the strategies employed to mitigate risks within this industry have evolved accordingly.

As the automotive sector continually evolves, operational strategies employed a decade ago are subject to replacement or adaptation. This evolution needs a corresponding adjustment in the approach to mitigating geopolitical risks faced by automakers. Strategies that were effective a decade ago may now be outdated and insufficient to address contemporary challenges.

Currently, there is sufficient literature on mitigating strategies within supply chains. However, within the automotive industry, there is a lack of consensus in current literature regarding the optimal strategies to employ when confronting geopolitical risks. Therefore, this study aims to answer the following research question: Which are the most influential geopolitical conflicts impacting the automotive supply chain and logistics and which strategies could mitigate them.

For this purpose, this study presents a comprehensive review of mitigation strategies for geopolitical risks in the automotive supply chain. Drawing upon a systematic literature review, with the use of secondary data, the study analyzes various geopolitical risks faced by the automotive industry, including those arising from events such as the US-China trade war and the Russia-Ukraine conflict. Through an examination of industry-specific responses and strategies, the research sheds light on the interconnectedness of geopolitical events, supply chain disruptions, and organizational decision-making.

This research concludes that the optimal strategy for companies varies depending on their organizational structure. Multinational automakers may find

nearshoring to be the most advisable strategy, leveraging proximity benefits and reduced transportation costs. On the other hand, non-multinational entities are advised to prioritize collaboration as a means to mitigate geopolitical risks in the supply chain.

Key-words: Geopolitical risk; Automotive industry; Supply chain; Mitigation strategies; US-China trade war; Russia-Ukraine war.

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Abbreviations

FDI – Foreign Direct Investment

AAI – Automotive and Auto Parts Industry

JIT – Just-In-Time

ESG – Environmental, Social and Governance

GDP – Gross Domestic Product

IMT – International Monetary Fund

EU – European Union

M&A – Mergers and Acquisitions

LAC – Latin American and Caribbean

AMDA – Mexican Association of Automotive Distributors

TBL – Triple Bottom Line

Introduction

Over the past few decades, supply chain managers have pursued various strategies including offshoring, outsourcing, and lean principles to gain a competitive edge. These approaches have effectively integrated flexibility, efficiency, cost reduction, and resource utilization. However, this transition has inadvertently increased uncertainty and diminished the significance of supply chain resilience. Following years of reliance on offshoring, which greatly expanded global supply chains, the occurrence of significant geopolitical events highlighted the fragility of operational resilience. The Covid-19 pandemic, the trade tensions between the US and China, and the ongoing conflict between Russia and Ukraine emerged as the three pivotal geopolitical disruptions reshaping operational paradigms (Haren & Simchi-Levi, 2020; Kilpatrick, 2022).

In 2018, the US government implemented tariffs on approximately \$250 billion worth of Chinese imports, followed by additional tariffs on goods valued at around \$125 billion in 2019. In retaliation, China imposed corresponding tariffs on US imports. These tariffs, enacted in 2018 and 2019, remain in force, exerting a disruptive influence on companies' operations and prompting substantial revisions to their supply chains. Consequently, bilateral trade between the two countries has been significantly affected (Bhaumik, 2023).

In 2019, the trade volume between the US and China experienced a decline of over 10 percentage points. The recorded trade deficit amounted to \$345.6 billion, reflecting a 17.6% (\$73.9 billion) reduction, with US exports to China decreasing by \$13.5 billion compared to 2018, and imports from China decreasing by \$87.4 billion (Bureau of Industry and Security U.S. Department of Commerce, 2019). Following tariff implementation, imports in the US displayed relative stability, largely due to trade diversion.

The reduction in imports from China seems to have been offset by trade diversion, notably evidenced by a significant rise in US imports from Mexico for certain goods subject to tariffs. After the imposition of a \$16 billion tariff list in August 2018, a substantial decrease of nearly \$850 million in imports from China was counterbalanced by an approximate \$850 million increase from Mexico (Cerutti et al., 2019).

Chinese multinationals adapted their operations in response to the tariff shock. Mexico has emerged as the primary recipient of Chinese Foreign Direct Investment (FDI) in the Automotive and Auto Parts Industry (AAI) since 2010. Chinese companies predominantly focus on the AAI sector in Mexico, with new investments and joint ventures being the most prevalent entry modes. Notably, all Chinese FDI in the AAI originated after 2010, with 97.45% occurring since 2015 (Mendoza-Velázquez & Rendón-Rojas, 2021).

Another unforeseen event significantly impacted the industry in the first half of 2022. The war sparked by the invasion of Ukraine by Russian troops, along with sanctions imposed on Russia, led to disruptions in supply chains and transportation links (Guénette et al., 2022), as well as production losses for European companies. While the COVID-19 pandemic served as an opportunity for companies to enhance their supply chain resilience (Belhadi et al., 2021; Mendoza-Velázquez & Rendón-Rojas, 2021), the situation arising from the war introduced new uncertainties and challenges.

Further issues arose from this war, such as supply chain problems, notably a scarcity of spare parts, primarily stemming from the concentration of automotive electrical wire production in Ukrainian factories. As well as shortage of raw materials, such as palladium and nickel sourced from Russia, essential for component manufacturing (e.g. batteries). Additionally, the disruption in neon gas supply from Ukraine, a by-product of large-scale steel production, poses challenges for semiconductor manufacturing (Teer et al., 2023). Moreover, since

2022, companies have grappled with escalating raw material and energy prices, exacerbated by the war (Křenková et al., 2023).

Moreover, in the aftermath of the Ukraine invasion, many foreign automotive companies decided to halt operations in Russia. As a result, only 11 out of the initial 60 foreign automaker firms have opted to maintain their presence in the country, leaving only Russian and Chinese firms remaining (Aris, 2022).

Furthermore, Russia augmented its imports from China. The export of passenger cars from Chinese manufacturers to Russia experienced a significant 6.4-fold year-on-year surge, reaching nearly \$4.6 billion during the January-June 2023 period (Stolyarov & Marrow, 2023a). Concurrently, Chinese manufacturers have been expanding their production operations in Russia (Aris, 2024; Gupta, 2023).

In dire circumstances such as this, agile responses to new conditions enabled companies to swiftly and effectively fulfill their obligations. Western firms promptly adjusted to the situation by transferring production to alternative facilities, expanding existing ones, reorganizing production operations, and modifying production schedules (Křenková et al., 2023). Simultaneously, these automakers redirected exports to other countries, such as China and Turkey.

Hence, it is clear that strategies employed by automakers or countries varied in each situation, underscoring the importance of comprehending the reasons behind these differences and the specific events that unfolded.

The aim of this study is to address the following research question:

- *“Which are the most influential geopolitical conflicts impacting the automotive supply chain and logistics and which strategies could mitigate it”*

For this purpose, the thesis is structured into 4 parts. In the first part, a literature review will be conducted in the field of the research topic, mentioning the key concepts and theories. Hence, the literature review will focus on a brief

description of the automotive industry, recent geopolitical events, how such geopolitical events disrupted the supply chain and strategies to mitigate such disruption.

The second part focuses on the research method, describing and justifying the chosen methodology for conducting the research, as well as outlining the techniques employed for data collection and analysis. In order to address the research question, a qualitative approach will be adopted in this research.

The third section entails the discussion, which involves linking the existing literature with the responses of automakers/countries to the geopolitical events mentioned, thereby comparing theoretical insights with real-world outcomes.

Finally, the fourth section presents the primary conclusions of this research, along with the limitations encountered during its execution and potential avenues for future research on this topic.

Chapter 1

Literature Review

1.1 Automotive industry and its major components

The automotive industry typically makes use of the Just-In-Time (JIT) supply chain, this model was pioneered in Japan and popularized by Toyota in the 1970s. This model allows to avoid excess inventory by ordering products and raw materials only when needed to minimize costs and maximize efficiency. To make the JIT model function, the quality and supply of raw materials, manufacturing of goods, and customer demand for them must all be in harmony (Sali & Sahin, 2016). Thus, if any of the chain's links breaks, stalls, or falls out of alignment, the impact on the world's supply chains can be felt rapidly (Insights, 2022).

Automotive manufacturers are shifting away from internal combustion engines and large-scale manufacturing in favor of zero-emission, carbon-neutral electric or autonomous vehicles powered by electric or hydrogen. Current cars are vastly different from those of the past, and various factors contribute to this (Insights, 2022).

Technological integration is a key hallmark, nowadays, vehicles are equipped with advanced features such as onboard computers, sensors, and connectivity. These technologies aid in the development of advanced driving assistance systems, entertainment systems, and communication capabilities. Furthermore, safety requirements and consumer expectations have evolved, resulting in the incorporation of a wide range of safety features, such as airbags, ABS, ESC, collision avoidance systems, and others.

Moreover, materials and light weighting are prominent topics, with advanced materials including high-strength steel, aluminum, and composites being used. These improve fuel efficiency and overall vehicle performance. With current vehicles including electric powertrains, battery technologies, and regenerative braking systems, the rise of electric and hybrid technology is revolutionizing the industry.

Thus, the automotive supply chain has become more complex and globalized, due to the increasing complexity of manufacturing vehicles. Components and materials are sourced from a network of suppliers worldwide. This globalization introduces challenges related to logistics, coordination, and risk management.

As per research conducted by Transport Intelligence, the transformation of the entire powertrain is anticipated to bring about significant modifications in the automotive supply chain (Manners-Bell et al., 2019). These changes extend to the types of components involved, the logistics methods employed for their transportation, the origin and destination markets, and the tiered structure of automotive supply chains. The implications of these transformations are substantial, prompting a reevaluation of how the automotive supply chain is organized (Material Handling and Logistics, 2019).

Moreover, the current landscape of the automotive industry is fostering a rise in the parallel economy (Troianoski & Ewing, 2023). Additionally, shortages in critical components, such as semiconductors (Pató et al., 2022), are exacerbating the bullwhip effect (Haren & Simchi-Levi, 2020). Consequently, there is a surge in both supply and demand for used vehicles (Jármúipar.hu, 2022).

1.2 Supply chain risks

The concept of supply chain resilience refers to a supply chain's capacity to prevent and absorb disruptions, ultimately returning to pre-disturbance performance levels (Hendry et al., 2019). The integrity of supply chain resilience is susceptible to supply chain risks, potentially leading to disruptive events in the supply chain.

Supply chain risks can be classified as micro or macro. Micro risks are internal to the company and are typically connected with production risk, supply risk, infrastructure risk, and demand risk. Macro risks, on the other hand, are relatively infrequent external events that are typically more damaging to the supply chain than micro risks (Ho et al., 2015). Natural and man-made dangers are illustrations for macro risks. Natural hazards are caused by natural disasters such as earthquakes, floods, hurricanes, or fires, which can have devastating consequences for a company's supply chain (Chopra & Sodhi, 2004, 2014; Pettit et al., 2013). Whereas man-made risks originate from armed conflicts like war, acts of terrorism, trade barriers disrupting international commerce, and political instability (Johnson & Haug, 2021).

This research focuses on macro-level man-made risks, with a focus on geopolitical events, including trade barriers and war. This emphasis is consistent with the broader goals of supply chain management, which often revolve around improving cost-efficiency, speed, and dependability in day-to-day operations. However, it is critical to note that supply chain sustainability extends beyond operational concerns to include global issues such as environmental conservation, human rights, and the reduction of corruption risks (Varzandeh et al., 2023). To achieve this goal, the Triple Bottom Line (TBL) framework emerges as a comprehensive method for assessing a company's performance across these critical domains. The TBL framework ensures that companies evaluate their success not solely based on financial gains but also consider their broader societal and environmental footprint (Carter & Rogers, 2008).

Focusing on the environmental conservation, according to a recent McKinsey study, “78 percent of US consumers say that a sustainable lifestyle is important to them” (Frey S et al., 2023), but executives state that one of the main difficulties of the environmental, social, and governance (ESG) initiatives (i.e. ESG criteria is a subset of the broader TBL framework) is the inability to generate sufficient consumer demand for sustainable products. Consequently, “there are many stories of companies launching new products incorporating ESG-related claims only to find that sales fell short of expectations” (Frey S et al., 2023). Furthermore, it has been shown that measuring sustainability at country level is not an easy task (Böhringer & Jochem, 2007). On top of that, it has also been stated that classifying sustainability into three groups of Economic, Environmental, and Social is too broad from an operational point of view (Eslami et al., 2019).

Thus, as outlined, expanding the thesis to comprehensively integrate environmental sustainability would prove to be too much of a challenge. Therefore, this research focuses on an operational point of view.

Typically, the most influential countries within the industry are those with the largest GDP. Consequently, geopolitical conflicts among these nations often result in a more significant ripple effect. In 2017, the US government initiated an investigation into China’s unfair trade practices, although it was only in 2018 that the real problems began (Bown, 2020).

Thus, as these economies have the two biggest GDP in the world and have regionally selected the Pacific basin as a trade target area, the implications of a US-China trade war would be significantly higher than any other trade war in terms of their influence on third parties. Therefore, “the global trade distortion that would result from a trade war between two major economies is even more pronounced in a US-China trade war” (Şengul, 2023).

Moreover, internally, within each country, the automotive industry poses a great importance as “US and Chinese economies both rely heavily on the automotive

industry” (Bhaumik, 2023). In the US the sector, directly, employs more than 1.7 million people, adding that *“the sector is a major consumer of a variety of other industries”* (Bhaumik, 2023), which translates to a net employment of nearly 8 million jobs. Furthermore, these 8 million jobs *“yield \$500 billion plus in annual wages and generate more than \$70 billion in tax revenues”* (Bhaumik, 2023).

In China the automotive industry gathers even more influence, which has been the world’s largest automotive market since 2008, according to (Bhaumik, 2023).

In 2018, the US Trade Representative alleged that *“China required foreign firms to engage in joint ventures with local companies, which resulted in the forcible or below-market transfer of technology from US intellectual property–holders as a quid pro quo for access to the Chinese market”* (Bown, 2020). From then on, a trade war between a country from the G8 and the BRICS began, which is the widely famous and problematic trade war between USA and China.

Ex-President Trump has been vocal about US trade policy since he ran for office. The former president was particularly dissatisfied with China's trade relations. Since 2018, the Trump administration has carried out protectionist trade policies, including the implementation of taxes on certain imported products into the United States.

The first set of tariffs were introduced on July 6, the United States initiated its first wave of China-specific tariffs by imposing a 25% tariff on imports totaling \$34 billion. Subsequently, a second round of tariffs was implemented on August 23, targeting an additional \$16 billion worth of imports with the same 25% tariff rate. The escalation continued with a third round of tariffs introduced on September 24, imposing a 10% tariff on an additional \$200 billion worth of imports. Furthermore, it was announced that this tariff rate would be raised to 25% starting from January 1, 2019. With these three rounds of tariffs in 2018, the cumulative value of imports subject to tariffs reached \$250 billion, representing

nearly half of the total US imports from China within the manufacturing sector (Chen et al., 2023; Jiang et al., 2023; Lee & Nguyen, 2023).

China responded by imposing tariffs to imported goods from the US, *“China’s retaliatory tariffs covered 50 billion dollars’ worth of imports from the US: China’s new 25% tariffs were implemented in July and August covering 34 billion dollars and 16 billion dollars of imports. China unleashed another round of tariffs in September, imposing new 5% and 10% comprising 60 billion dollars of China’s imports”* (Chen et al., 2023; Jiang et al., 2023; Lee & Nguyen, 2023).

The imposition of tariffs by both countries has stayed constant over time, with a few variations, despite a shift in power in the US administration, protectionist tariffs have persisted (Batbaylı et al., 2021).

On top of the on-going tariff war that was mentioned, another macro-level man-made risk that has and is disturbing the supply chain of the automotive industry is the Russia-Ukraine war.

On February 21, 2022, Russia officially recognized two regions in eastern Ukraine (Donetsk People’s Republic and Luhansk People’s Republic) as independent states and promised them military support. This promise was fulfilled on February 24, 2022, and the Russian government’s military actions were referred to as special military operation, which led to several countries, including the United States, the United Kingdom, Canada, Australia, Japan, Germany, and the European Union, as well as Singapore, Taiwan, South Korea, New Zealand, Norway, and Switzerland, to express significant objection to these acts (Gurkov & Morley, 2021).

The more noticeable automotive industry within these two countries is in Russia. However, it is important to state that Russia’s automotive industry differs notably from the U.S. and China due to the developmental path of the automotive industry. The sector in Russia evolved *“through the combined efforts of foreign investors and the host country’s government”* (Gurkov et al., 2023). For instance, in

China the industry evolved through *“significant expansions of locally owned companies following early foreign greenfield investments”* (Gurkov et al., 2023), whereas Russia *“saw the quick selective acquisition of several local firms and the installation of new fully owned production facilities by foreign investors”* (Gurkov et al., 2023).

The Russian automotive industry has experienced various developments, with many notable events. Following a tumultuous decade in the aftermath of the dissolution of the Soviet Union in 1991, Russia actively encouraged Western automakers to establish manufacturing facilities. Incentives, including subsidies, were provided to those engaged in local operations such as stamping, welding, and painting (Stolyarov & Marrow, 2023a). This led to a series of significant developments including the signing of new car assembly contracts and extensions with local companies like Ford (2006), Volkswagen (2011), Kia, Hyundai, BMW, and GM; establishment of joint ventures for truck (Volvo, 2003) and car production (GM, 2001; Ford, 2012); installation of wholly-owned manufacturing facilities by companies such as Ford (2002), Volkswagen (2007), GM (2008), Volvo Trucks (2009), Nissan (2009), Hyundai (2010), Peugeot-Citroen, and Mitsubishi (2010), as well as the establishment of facilities by foreign companies producing car components.

Furthermore, there has been a combination of "retrenchment" and divestments, encompassing the reconstruction of previously built car assembly plants, namely, Peugeot-Citroen and Mitsubishi in 2015; installation of plants by first, second, and third-tier suppliers of auto components from 2012 until 2019; gaining full control over important Russian assets or increasing stakes in some companies (the increase of the stake of Daimler AG) in KAMAZ (Russian truck manufacturer) in 2014; the takeover of AvtoVAZ (Russian automobile manufacturer) by Renault in 2015, and the installation of new car assembly plants (Daimler AG, 2019; Lifan (Chinese automobile and motorcycle manufacturer),

2019); alongside the development of private industrial parks, since 2015, by foreign-owned automakers, namely, Volkswagen and AutoVAZ. Moreover, instances of closure or divestment of assembly plants by U.S. automakers, including GM in 2015 and 2019, and Ford in 2019 (Gurkov & Morley, 2021).

1.3 Effects of risks in the Supply Chain

The automotive industry is widely influenced by other industries, the main reason for that is that for the manufacturing of a car a plethora of materials is required. For instance, plastics and polymers that are used in vehicles are produced with crude oil, thus a shortage of crude oil caused by geopolitical conflicts influences the price and time that it takes to produce a car. Through this example (more could have been done, since lubricants, fluids and tires are all deployed in a car, which are also produced with crude oil) it is possible to see how complex the automotive industry actually is, noticing that crude oil plays a big part in this industry due to the wide variety of its uses and applications, *“the spillover effects of crude oil price fluctuations on other commodity markets cannot be underestimated”* (Zhang et al., 2023).

It is crucial to recognize that the trade war has a long-term impact on the dynamics of the automobile sector, as it has not only harmed bilateral commerce but has also transformed global supply networks, influencing the global competitive landscape for automakers (Bhaumik, 2023). Moreover, such war has and may produce nefarious effects for other countries, as *“the rising geopolitical rivalry between the United States and China may allow little room in the future for diverging policies among Western allies”* (Janeba, 2023).

Furthermore, due to interdependency, the US can force its allies into policies that concern its own interests, thus extending a sanction to an

extraterritorial/secondary sanction. The countries that endure the secondary sanctions have some policy options to bypass the sanction, although, historically, the success of the policies is very limited (Janeba, 2023).

In addition, countries have another option to counter extraterritorial, which are blocking statutes, although, once more, the result of this option seems ineffective, *“because the value that could have been recovered in European courts if a European firm had pursued trade with Iran and been sanctioned by the US is smaller than losing access to the US market”* (Janeba, 2023).

As previously stated, the imposition of tariffs on an array of items, notably automobiles and their components, have become a symbol of the trade war between the United States and China. These tariffs have significantly impacted bilateral trade between the two countries (Bhaumik, 2023). According to the Bureau of Industry and Security, in 2019, the trade level between U.S. and China decreased significantly with an over 10 percentage points (Bureau of Industry and Security U.S. Department of Commerce, 2019). Furthermore, the recorded trade deficit was \$345.6 billion, a 17.6% (\$73.9 billion) decrease with U.S. exports to China going down \$13.5 billion compared to 2018 and imports from China going down \$87.4 billion compared to the previous year. Moreover, the global impact of the trade was clear, according to the International Monetary Fund (IMF), after peaking at almost 4% in 2017, global GDP dipped to roughly 3.2% in late 2018, as activity slowed amid an escalating trade war and US-China tariff disputes (Cerutti et al., 2019). Therefore, suggesting that such trade war has consequences that extend well beyond individual trade figures and impacts the overall global economic climate, thus creating a ripple effect beyond the two countries involved (Bhaumik, 2023).

Furthermore, the trade war between the United States and China has had a negative welfare impact on the United States and China in the order of 1.02% and 1.7%, respectively, whereas other countries suffer small but positive welfare

impacts due to trade diversion effects (BBC, 2023). In China, all sectoral outputs except agriculture fall, resulting in a \$317 billion (1.35%) drop in real GDP in the US and a \$427 billion (1.41%) drop in China. Despite the fact that trade divergence from the United States and China contributes to the little positive impact on real GDP for other countries, global real GDP declines by \$374 billion (0.3%) (Itakura, 2020).

Focusing on the automobile sector, since the start of the trade war in 2018, the industry has been the target of an abundance of tariffs imposed by both parties, which has had a negative impact on overall automotive and parts' trade between the US and China, causing a 27 per cent decrease in total trade in the first half of 2019 (United States Census Bureau). Moreover, the escalation of hostilities and threats of further tariffs have led to uncertainty and instability in the sector, leading to a number of challenges for automakers. This instability, also had an effect on consumers because the tariffs on automobiles and their components would raise vehicle costs, resulting in decreased production and sales (United States Census Bureau).

According to Wu, Wood, Oh and Jang (2021, p. 3516-3533), indirect tariff growth rates resulting from the US–China trade war exhibited varied impacts on distinct countries within the automobile industry. Australia witnessed a modest increase of 1.63%, while Brazil experienced a more restrained growth rate of 0.34%. Canada faced a substantial impact, registering a growth rate of 18.88%, and China itself observed a notable increase of 23.78%. The European Union was affected with a growth rate of 2.25%, and Indonesia experienced a marginal uptick of 0.59%. India recorded a growth rate of 0.37%, while Japan faced a more significant impact with a rate of 3.73%. South Korea experienced a growth rate of 0.84%, and Mexico observed an increase of 2.99%. Russia faced a moderate impact with a growth rate of 1.01%. The United States recorded a substantial impact, with a remarkable growth rate of 295.45%. These growth rates specifically delineate

the indirect tariff impacts within the automotive industry. It is noteworthy that, in contrast to the automotive industry, labor-intensive sectors with short value chains, such as the textile, agriculture, and food industries, have not witnessed a considerable surge in third-party involvement (Wu et al., 2021).

The repercussions of the ongoing Ukraine-Russia conflict for the manufacturing industry have been damaging, including the automotive industry, as operations in Russia suffered from it.

Following Russia's instigation of the war in Ukraine, Western nations such as the European Union (EU), the United States, the United Kingdom, and Canada imposed sanctions aimed primarily at limiting Russia's financial access. These actions included freezing the central bank's assets and barring major Russian banks from using the international financial communications system Swift. These actions caused disruptions in payments for Russian oil and gas, prompting the UK government to claim that Western financial sanctions have depleted \$350 billion (£275 billion) of Russia's \$604 billion foreign currency reserves (BBC, 2023).

Additionally, western countries have attempted to reduce Russia's revenue from oil and gas. To achieve this, the EU suspended Russian coal imports and barred refined oil imports. Simultaneously, the US and the UK banned all Russian oil and gas imports. Germany stepped in, putting a halt to the Nord Stream 2 gas pipeline from Russia. Moreover, both the EU and the G7 (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States) imposed a cap price of \$60 per barrel for Russian crude oil in December 2022 (BBC, 2023). Consequently, since 2022, Russia shifted its natural resource exports to other countries. For instance, it's possible to observe significant changes in oil exports, as depicted in figure 1 (IEA 50, 2024), which measures exports in millions of barrels per day. Additionally, the total exports of this natural resource exhibit minimal variation.

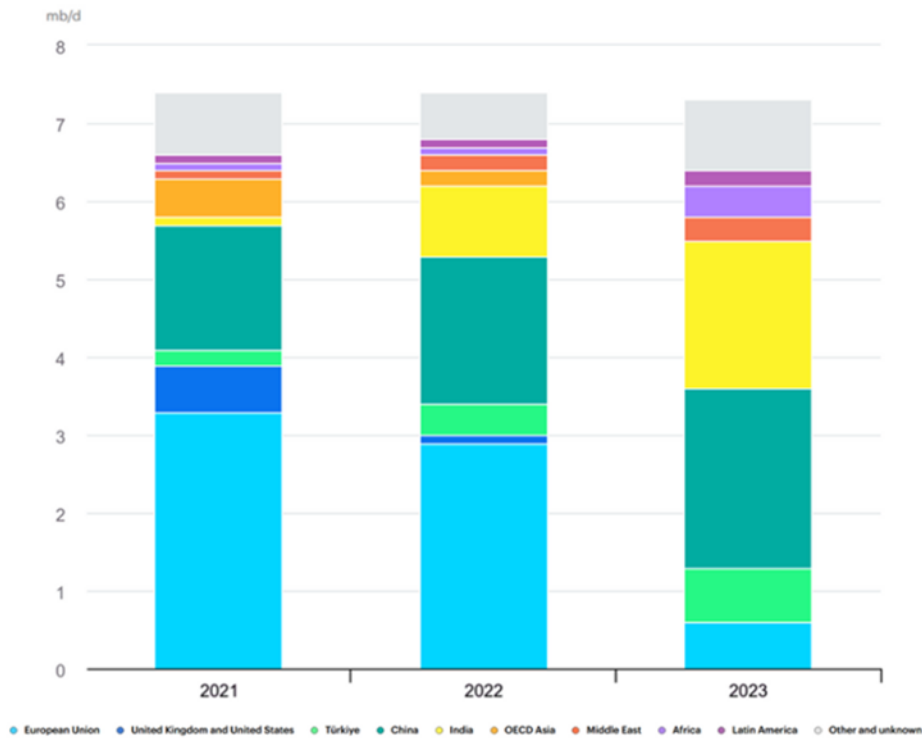


Figure 1: Average Russian oil exports by country and region

Along with this, foreign manufacturing corporations in Russia have stopped working, leading to a significant upset for the economy of the country.

According to Statista (2023), in 2021, nearly 1.4 million vehicles were produced in the country, while in 2022 Russia's car industry posted its worst showing since the collapse of the Soviet Union, with production slumping 67%, due to the sanctions imposed by Western countries. According to the Rosstat federal statistics department (governmental statistics agency in Russia), Russian factories produced 450,000 passenger automobiles in 2022. Prior to 2022, the worst year for Russian automobile manufacturing since the Soviet Union's demise in 1991 was 2009, in the aftermath of the global financial crisis that spurred in the US, when Russian factories produced about 600,000 passenger cars, according to statistics from analytical firm ASM-Holding (Reuters, 2022). What 's more, according to Bloomberg, perhaps no industry in Russia was hit harder by President Vladimir Putin's invasion of Ukraine in late February, with light vehicle output falling by

over 97% three months later and car sales falling by more than 80% when the crisis peaked in May and June (Abelsky, 2022).

Russia had 60 foreign automakers in its market (producing and/or selling) and was home to 34 auto manufacturing facilities, that produced cars, trucks, vans, buses and engines, and due to the war, most plants have ceased operations, such occurrence led to share prices of many automakers with significant operations in the region to have dropped. The list of players features Volkswagen [Including Audi and Porsche], Mercedes-Benz Daimler, BMW [including Mini], Honda, Toyota, Renault, Volvo, Nissan, Land Rover, and Ford. Adding that the production is disrupted across Eastern Europe too, with Hyundai, Volkswagen, and Toyota in Czech Republic; Stellantis in Belarus; Ford, Volkswagen, and Stellantis in Poland; Kia, Peugeot, Land Rover, Audi, Porsche, Seat, Skoda, Volkswagen in Slovakia (Silberg, 2022). The combined total loss of ceasing operations in Russia for the brands is in the billions. Besides that, of the 60 foreign brands that were operating in Russia only Chinese car brands remained (Aris, 2022).

1.4 Strategies for Mitigating Supply Chain Risks

Geopolitical risk has been a constant across industries regardless of the time, since it has been present throughout generations. In past years, the most obvious political risks originated from World War I and World War II, however, the nature of the risks and strategies deployed were much different than present times.

Expanding on this through the lens of evolution, industries transform over time due to various factors, such as: workforce changes, technological advancements, and shifts in regulations impact on how businesses operate.

Globalization alters supply chains, and consumer preferences drive innovation. Economic conditions and sustainability concerns also play a role, alongside political and geopolitical influences. These factors collectively contribute to the differentiation of industries across time. Hence, it is difficult to utilize examples from different generations, due to the evolving landscape.

However, as various industries share commonalities and dependencies, it proves beneficial to explore distinct sectors. Additionally, when analyzing the same time frame, it is likely that geopolitical risks are shared among these industries. Hence, it is advantageous to examine different sectors within the same time frame, particularly the most recent one.

Globalization and sustainability processes have opened up new markets for natural raw materials, and outsourcing of sourcing has emerged as the best alternative for manufacturing enterprises seeking large quantities of high-quality resources at reasonable prices (Matyushok et al., 2021). However, the complexity of supply logistics becomes apparent during geopolitical risks, highlighting the need for manufacturing enterprises to equip themselves with appropriate systems for the best management of the resources deployed from an operational excellence (Ma et al., 2021) and circular economy perspective.

In the most recent time frame, it is possible to find various geopolitical risks. Previously, US-China trade war and Russia-Ukraine war were mentioned and extensively analyzed; however, within the same time frame, there are more geopolitical risks besides those, such as Covid-19 and Brexit. The industries affected by geopolitical disruptions (e.g. Brexit, US-China trade war, and the Covid-19 pandemic) encompass a wide range, including automotive, chemical, clothing/apparel, consumer goods, heavy engineering, manufacturing (including aerospace, furniture, and medical instruments), oil and gas, pharmaceutical, technology (including consumer electronics) and many others.

According to Roscoe, Aktas, Petersen, Skipworth, Handfield and Habib (2022, p. 1407-1434), the major perceived geopolitical disruption risks in the supply chain feature order delays, compliance, currency volatility, customs/tariff risks, increased costs, labor risk, lack of regulatory alignment, material and equipment availability and supply continuity. Moreover, according to its findings, almost every perceived geopolitical disruption risk was shared across two or more industries, with the exception of currency volatility. The automobile industry was present in “customs/tariff risks” and in “lack of regulatory alignment”. Equally, in “customs/tariff risks”, every industry was present. Hence, it is possible to state that industries are interlinked (Roscoe et al., 2022).

After identifying the perceived geopolitical disruption risks in the supply chain, firms within the industries mentioned and others deploy a strategy in order to mitigate the geopolitical risk that spurred.

Among the strategies that firms usually deploy, there is the Reshoring and Nearshoring strategy; the difference between these is simple. Reshoring involves the return of operations, such as manufacturing, to the company's home. On the other hand, nearshoring, focuses on relocating operations to a nearby or geographically close location. Both strategies are responses to considerations such as supply chain risks, cost dynamics, and the need for increased operational agility, which emphasizes proximity benefits such as reduced transportation costs, when compared to offshoring, and faster response times. These two strategies are becoming increasingly popular, since the factors that first drove manufacturing companies to relocate are no longer as strong (Barbieri et al., 2020). Besides that, the labor cost differential between the west and emerging nations has reduced over time, and these countries' labor and environmental policies have become increasingly similar to those of more industrialized nations (Fernández-Miguel et al., 2022).

However, within certain industries, the implementation of a strategy like reshoring proves challenging. This difficulty arises either due to the unavailability of essential raw materials domestically or the prohibitively high costs associated with replicating manufacturing facilities, consequently, companies use nearshoring, which is a form of offshoring (Fernández-Miguel et al., 2022).

If neither of these two options works, then companies may opt to deploy Friend-shoring. This strategy consists of migration of industrial operations to friendly, albeit distant, countries that have the same value system and political alignment (Ciravegna & Michailova, 2022).

An alternative strategy to the ones already mentioned is to “*Grin and bear it*” (Roscoe et al., 2022). This strategy refers to a situation where a company chooses to endure or tolerate challenging circumstances without taking immediate or drastic actions to address the issues. Instead of proactively addressing problems or adapting to changes, the company continues with its current approach, often accepting short-term difficulties or external pressures. Manifestation of this strategy is apparent as companies confront various challenges, such as government-imposed tariffs and other complexities within the supply chain. Despite these pressures, the companies elect to maintain the status quo, continuing their customary operations without implementing substantial changes. This choice may stem from factors such as supplier concentration, significant sunk costs, and perceived cost-effectiveness of preserving the existing supply chain structure or a belief that the current approach will eventually weather the challenges.

Within the spectrum of strategies, there are additional approaches that can complement those previously outlined. These include Collaboration, Collaborative Technologies, Circular Economy and Building Redundancy (Singh et al., 2023).

Collaboration refers to the concept of all supply chain stakeholders at different tiers working together to achieve shared objectives to prevent potential threats due to disruption. This involves close cooperation and coordination among various entities within the supply chain, such as suppliers, manufacturers, distributors, and retailers, to collectively address challenges and mitigate risks that may arise from disruptions. The concept of visibility gains importance in this strategy (Pató et al., 2022).

Collaborative Technologies relies on technology-driven networks and digital ecosystems. By utilizing advanced technologies like big data, cloud computing, wireless technologies, blockchain, and sensors, supply chain partners aim to improve coordination, automate processes, and share real-time information. This approach enhances resilience and adaptability during disruptions through improved decision-making and supply chain visibility.

Circular Economy focuses on sourcing resources from materials or products at the end of their life cycle. This includes practices like recycling and extending product life, contributing to sustainability and resilience. Organizations adopting circular economy principles seek to reduce environmental impact and enhance their ability to withstand disruptions in the supply chain.

Lastly, Building Redundancy involves the reservation of buffer capacity to meet customer demand with minimized stock-outs. This approach focuses on maintaining higher buffers, including capacity and inventory, to address disruptions and uncertain events. It enhances supply chain resilience by enabling organizations to navigate unexpected fluctuations in demand or disruptions effectively. The strategy also aids in reducing lead times and improving responsiveness to customer needs.

Chapter 2

Research Method

2.1 Research Approach

The research question of this paper revolves around identifying the most influential geopolitical conflicts affecting the automotive supply chain and logistics, as well as exploring strategies to mitigate their impact. To address this inquiry, a qualitative research approach will be employed with the use of secondary data.

Qualitative research embodies an investigative methodology aimed at exploring real-world phenomena, providing in-depth insights (Tenny et al., 2022). It facilitates the elucidation and enrichment of understanding quantitative data (Moser & Korstjens, 2017). Through qualitative data analysis, researchers can preserve a chronological narrative, discern causal relationships between events, and derive profound explanations (Miles & Huberman, 1994).

Secondary data encompasses both raw data and published summaries. For research projects that require national or international comparisons, secondary data often constitutes the primary source for addressing the research question (Saunders et al., 2009). Such data may comprise raw information, minimally processed, or compiled data subjected to some form of selection or summarization (Kervin, 1999).

Given that the objective of this research is to comprehend the influence of geopolitical risks on the automotive industry's supply chain and how automotive firms respond and mitigate these risks, this approach appears most appropriate.

Moreover, collecting primary data pertaining to this subject seems unfeasible, hence the adoption of this approach.

Additionally, this paper is focused in addressing the mentioned purpose by exploring the following key questions:

- How do geopolitical events exert influence on the supply chain dynamics of the automotive industry?
- What are the responses of the automotive industry in the face of geopolitical risks?
- How does the supply chain configuration evolve following adaptations made by automakers?
- To what extent do geopolitical disruptions impact the overall volume of trade in the automotive industry?

2.2 Data Collection

Secondary data will be gathered from a range of sources, including repositories of raw demographic and economic data, as well as worldwide platforms that provide market and consumer data from several nations and industries. In addition, published summaries will be retrieved from academic journal databases, automaker websites, and the internet, as well as publications such as books, conference papers, case studies, reports, and business-related media coverage in newspapers and broadcast channels.

While relying solely on secondary data presents a key drawback of utilizing publicly available information, there are notable advantages to this approach. The pre-existence of secondary data allows for thorough evaluation prior to utilization, facilitating the rejection of unsuitable data and enabling researchers to devote more time to analysis and interpretation. Furthermore, the vast amount

of data accessible via the internet surpasses what a single researcher could feasibly collect independently and within a limited timeframe. Additionally, despite secondary data being originally collected for different purposes, reanalysis may uncover novel insights and previously undiscovered findings (Saunders et al., 2009).

2.3 Data Analysis

The analytical process for all secondary data followed a meticulously structured approach. Initially, data collection was conducted from the aforementioned sources, with a predominant emphasis on the UCP library and online articles. Subsequently, a thorough examination ensued, involving multiple iterations of detailed reading accompanied by the annotation of comments. Pertinent sections were meticulously highlighted and summarized. Following this meticulous process, a comprehensive summary of each article was synthesized, encapsulating the key points manually extracted.

This iterative and cyclical methodology served to systematically distill the vast volume of data, thereby facilitating the extraction of crucial insights. Subsequently, a comparative analysis was undertaken to ascertain the veracity and reliability of data across different sources.

Furthermore, the data was meticulously aggregated, with careful consideration given to recurring themes and concepts. For instance, data pertaining to the US-China relationship, the Russia-Ukraine conflict, and strategies for mitigating geopolitical risk were meticulously collated and organized.

Moreover, the aggregated data was meticulously arranged in chronological order, facilitating a coherent narrative elucidating the evolution, growth, and repercussions of the geopolitical events under scrutiny.

Finally, the interpreted data underwent comprehensive scrutiny to identify and delineate connections and patterns, thereby providing a nuanced understanding of the subject matter. Adding that most of the analyzed secondary data is present in the Discussion.

Chapter 3

Discussion

This chapter aims to establish a correlation between the supply chain risks and corresponding mitigation strategies presented in the literature review with the pragmatic responses adopted by companies when confronted with these risks.

Likewise, this chapter aims to address the research question. Given that the initial segment of the research question has been addressed in the literature review, the focal aim will be directed towards the latter component of the research question, namely:

- *“Which are the most influential geopolitical conflicts impacting the automotive supply chain and logistics and which strategies could mitigate it”*

Hence, this chapter will present and assess the strategies and actions implemented by automotive companies to mitigate geopolitical risks, specifically arising from the USA-China conflict and the Russia-Ukraine war.

Initially, addressing the conflict between the USA and China is crucial. As elucidated earlier, this conflict primarily revolves around tariffs, exerting a significant influence on global imports, exports, and supply chains. In response to these tariff impositions, companies commonly adjust sales strategies in diverse markets or tweak export prices. Nevertheless, the prospect of finding new importers in alternative countries can be financially burdensome. Along with it, if exporting firms face constraints within their profit margins, the feasibility of reducing export prices becomes a challenge (Lee & Nguyen, 2023).

Domestic Chinese exporting firms have a narrow profit margin. This limitation is a pivotal factor that hindered their capacity to modify export prices. Additionally, the absence of diverse sales channels and networks poses

challenges in adjusting sales strategies across various markets. However, Chinese multinational corporations possess the flexibility to adjust prices due to their high productivity. These entities also benefit from having multiple production facilities spanning various countries, facilitating a significant reduction in the expenses associated with building a sales network. Moreover, Chinese multinationals not only have the capability to relocate production along their horizontal production chains to overcome capacity constraints but also leverage internal capital markets linked with their parent firms to secure additional funds in the face of liquidity constraints (Jiao et al., 2021).

Chinese multinational corporations exhibited a more robust response to the tariff shock than their domestic counterparts, boasting approximately an 8% higher revenue growth post-trade war. This observation suggests that organizations endowed with operational flexibility adeptly navigated trade uncertainties, showcasing positive reactions as early as one year following the tariff event (Lee & Nguyen, 2023). Added to it, in reaction to the trade war, Chinese multinationals proactively adjusted their operations to counter the impacts of the tariff shock (Flaen et al., 2020). Influenced by the tariff effects, such as the minimum wage increase in China, multinationals also increased outward FDI (Fan et al., 2018) and refined labor allocation between headquarters and foreign subsidiaries in response to the adverse effects of domestic policy changes (Ahn et al., 2022).

In 2020, according to the Economic Commission for Latin America and the Caribbean, China surpassed the United States as the primary country of origin for cross-border Mergers and Acquisitions (M&A). The Chinese investment in the automotive industry in Latin American and Caribbean (LAC) countries, notably in Mexico, has experienced substantial growth and diversification. According to the Mexican Secretariat of Economy, Chinese FDI in LAC saw a notable shift, with the relative share of Chinese investment in raw materials

decreasing from 81.39% in 2000-2004 to 51.43% in 2015-2020. Meanwhile, the share of manufacturing significantly increased, including the automotive sector. In the case of Mexico, the automotive industry has been a focal point for Chinese investment, with Chinese direct investors predominantly entering through new projects in the auto parts and automotive industry. Mexico has been the primary destination for Chinese FDI directed to the Automotive and Auto Parts Industry (AAI) since 2010. Chinese companies in Mexico primarily engage in the AAI, with new investments and joint ventures being the most common entry modes. In this regard, 100% of the Chinese FDI in the AAI originated after 2010 and from this, 97.45% has been produced since 2015 (Velásquez & Vázquez, 2022).

Moreover, Mexico stands as the second-largest consumer of Chinese automobiles, following Russia. Recent data from the Mexican Association of Automotive Distributors (AMDA) indicates a notable surge in the market share of Chinese car brands, escalating by nearly 6% in September and capturing 19.4% of total sales in the initial nine months of 2023. The majority of these vehicles are imported. The surge in demand has been so substantial that, in October, authorities in Michoacán reported a shortage of trailers to unload Chinese cars from ships, resulting in significant traffic congestion. Additionally, out of the cars manufactured in Mexico, 90% are destined for export, leaving only 10% for domestic sales. However, given the inadequate supply to meet domestic demand, 60% of the total cars purchased in the country are imported (Cota, 2023).

In the United States, post-tariff imposition, imports exhibited a relative stability attributed to trade diversion. The aggregated bilateral data for the US suggests the occurrence of trade diversion, where the decline in imports from China appears to have been mitigated by an upswing in imports from alternative countries. Notably, there was a significant increase in US imports from Mexico for certain goods subjected to the imposed tariffs. Following the implementation of the \$16 billion tariff list in August, a substantial decline of nearly \$850 million

in imports from China was almost entirely offset by an approximately \$850 million increase from Mexico, resulting in an overall state of US imports that remained broadly unchanged (Cerutti et al., 2019).

Additionally, the lowest point in the past decade for exports from China to the USA occurred in 2023 (United States Census Bureau).

The Russia-Ukraine war yielded distinct consequences compared to the USA-China tariff war, particularly considering the unique landscape of the automotive industry in Russia as opposed to the USA or China. Historically, foreign brands have dominated Russia's automotive industry. Even so, the dynamics of the industry in this country have undergone significant changes in the aftermath of the war.

Following the invasion of Ukraine, numerous foreign automotive companies opted to cease operations in Russia. Prior to the conflict, there were 60 foreign automotive companies operating within Russia. However, as a consequence of the war, only 11 out of the initial 60 have chosen to remain in the country (Aris, 2022). Despite the notable exodus of companies from Russia, the government did not facilitate the departure of these entities. In December 2022, the foreign investments subcommittee of the Ministry of Finance outlined stringent requirements for asset sales by companies from 'unfriendly countries.' These regulations mandate that the seller offers a discount of at least 50% on the assessed market value and subsequently pays a "voluntary" transfer fee ranging from 5% to 10% of the sale price to the Russian federal budget (Economist Intelligence Unit, 2023).

The strict requirements prompted companies to sell their assets at reduced prices. Volkswagen, for instance, announced the sale of shares in its Russian unit, Volkswagen Group Rus, to Avilon, a Russian auto dealer group, in a deal valued at 125 million euros (\$140.3 million) (Stolyarov & Marrow, 2023b). The assets involved in the sale encompassed VW's Kaluga production plant, boasting an

annual production capacity of 225,000 vehicles, as well as its distribution and after-sales businesses, along with local subsidiaries like Volkswagen Components and Services, Scania Leasing, Scania Finance, and Scania Insurance (Economist Intelligence Unit, 2023). Despite the transaction amounting to only 125 million euros, there were instances where companies sold their businesses for even less. In May 2022, Renault sold its entire Russian business, including its stake in the market leader AvtoVAZ, for just Rb1 (approximately 1 US cent), while Nissan parted with its business for a mere €1 in October 2022 (Economist Intelligence Unit, 2023).

Besides, the eleven foreign companies that opted to stay in the country are of Chinese origin, including Chery, Geely, Haval, Jac, Faw, Dongfeng, Changan, Exeed, Gac, Foton, and Omoda (Aris, 2022). Capitalizing on the exit of Western players, Chinese carmakers are making substantial inroads into the Russian market (Aris, 2024; Gupta, 2023). The exports of passenger cars from Chinese manufacturers to Russia witnessed a remarkable 6.4-fold year-on-year increase, reaching nearly \$4.6 billion in the January-June 2023 period (Stolyarov & Marrow, 2023a).

Even though the trade of Western foreign vehicles has come to a halt, there remains a demand for luxury items. Russian car dealerships, no longer officially affiliated with Western brands, are independently organizing imports, often involving hundreds of cars at a time (Troianoski & Ewing, 2023). These indirect imports constituted 12 percent of the 626,300 new passenger cars sold in Russia in 2022 (Ведомости, 2023). Following the withdrawal of many Western companies from Russia, President Putin's government actively encouraged unauthorized imports of their goods from other countries. The Russian trade ministry published a list of numerous companies whose products could be imported without their makers' consent, including Apple, Audi, Volvo, and Yamaha. For instance, Russians are importing cars through Dubai in the United

Arab Emirates, and because cars shipped to the Middle East are typically made for warm climates, accessory shops are experiencing a surge in business as they outfit these vehicles for winter weather (Troianoski & Ewing, 2023).

The new trade routes predominantly traverse countries that maintain friendly relations with Moscow. Western analysts and officials have identified Turkey, China, and former Soviet republics like Armenia and Kazakhstan as nations redirecting Western goods to Russia (Sawson, 2023). Notably, car exports from the European Union to Russia experienced a significant decline to approximately 1 billion euros in 2022, down from 5 billion euros in 2021. However, E.U. exports to Kazakhstan increased nearly fourfold, surpassing 700 million euros, and exports to the Emirates grew by approximately 40 percent, reaching 2.4 billion euros. Armenia reported that its car imports more than quintupled, amounting to \$712 million in the last year (Troianoski & Ewing, 2023).

Furthermore, at the organizational level, Skoda undertook the strategic move of transferring its production from Ukraine to the Czech Republic, while simultaneously expanding capacities in various European and North African facilities, including Romania and Morocco (Škoda Storyboard, 2022). Audi, in response to the challenges, had to implement a reorganization of production operations in Hungary (Sudár, 2022). The Mercedes factory in Hungary had to adjust its production schedule from three shifts to two in specific production areas (Járműipar.hu, 2022). Additionally, like many automotive enterprises, the war's disruptive influence on European businesses primarily manifested in sourcing issues, with supply chain challenges revolving around a scarcity of essential spare parts (Křenková et al., 2023).

Hence, through this analysis, it's evident that companies promptly responded to geopolitical risks, primarily opting for nearshoring and reshoring strategies. Western automotive firms quickly adjusted to the risk and so did the market through trade diversion. Moreover, the examination of secondary data reveals

that China preemptively increased its FDI in the automotive sector while implementing the mentioned strategies.

Conclusion

This research aimed to comprehensively analyze the repercussions of risks and disruptions on the supply chain within the automotive industry, as well as exploring strategies for mitigation both at the organizational and national levels.

For this purpose, the exploration and analysis of geopolitical risks and mitigation strategies within the automotive industry are considered highly pertinent. This research topic holds significant relevance due to the widespread use of these mitigation strategies by automotive companies. Understanding how these firms respond to supply chain risks and disruptions offers valuable insights into their operational behavior. The chosen strategies wield a profound impact on the company's supply chain dynamics, consequently influencing national economies and other industries interconnected with the automotive sector. Therefore, examining these strategies provides crucial insights into the broader implications of supply chain disruptions in the automotive industry.

In this regard, I envision this research contributing significantly to the body of knowledge, benefiting stakeholders involved in decision-making processes within the automotive industry. It also aims to provide valuable insights for individuals seeking to deepen their understanding of mitigation strategies and the geopolitics of the supply chain, particularly in the context of the automotive sector.

This research involved a systematic literature review, where numerous relevant articles were carefully examined. Through this process, a deep understanding was gained of the thinking behind various decisions made in both operational and financial aspects. Moreover, the outcomes of these decisions and their implications for the supply chain dynamics within the automotive industry

were observed. The primary conclusions of this research, which have contributed to addressing the proposed research question, will be presented next.

The automotive industry initially embraced the JIT model, pioneered by Toyota, to streamline operations and boost efficiency. This approach allowed manufacturers to minimize inventory costs, reduce waste, and optimize production schedules. However, the sustainability of this model is now in question. When risks or disruptions arise, such as those inherent in the JIT model, companies face shortages and are ill-prepared to address potential disruptions (Insights, 2022). A recent example within the automotive sector is the semiconductor shortage. Insufficient semiconductor stocks triggered a bullwhip effect throughout the supply chain, halting production and rendering already manufactured vehicles unsellable due to the missing component. This led to price hikes for new vehicles, prompting a surge in the second-hand car market as companies sought to maintain operations and consumers sought affordable alternatives.

Geopolitical risks and disruptions have compelled nations to rethink their supply chains. In response to imposed tariffs and geopolitical tensions, the USA demonstrated resilience by diversifying its import sources. Notably, the country shifted focus towards importing from other nations, the preferred being Mexico. This strategic move aimed to maintain operational proximity, enabling tighter control over the supply chain and fostering a less globally dependent network. The country opted to source goods from a neighboring country in order to mitigate the supply chain disruption.

In response to tariffs, China swiftly boosted its FDI in Mexico's automotive industry, shifting manufacturing operations to the Latin American country. Additionally, Mexico stands as the second-largest importer of Chinese automobiles, following Russia. Consequently, China has adopted a nearshoring strategy, elevating Mexico's significance in its trade dynamics.

Russia underwent significant transformations in its automotive industry landscape. With the departure of firms from the country, there emerged a void in the industry that needed filling. China emerged as the country steadfastly supporting Russia and stepping in to fill the vacuum left by western countries. In this scenario, Russia and China employed a collaborative strategy to address the changes in Russia's automotive industry landscape, it involved bolstering investment and trade ties, enabling China to play a crucial role in revitalizing Russia's automotive sector.

The automotive firms that exited Russia faced significant supply chain risks, prompting them to adapt swiftly. To maintain production levels and meet demand, these firms adjusted their manufacturing processes in alternative factories. Additionally, some companies expanded their existing facilities. Simultaneously, these firms increased inventory levels to mitigate potential disruptions in the supply chain.

Nevertheless, despite the abrupt reduction in the supply of cars by western automotive companies, there remained demand for these vehicles in Russia. Consequently, through the parallel economy, the supply of these cars persisted, resulting in a notable increase in the parallel economy sector.

It can be observed that both nearshoring and reshoring strategies were frequently utilized. Nearshoring emerged as the more prevalent strategy, largely due to the logistical challenges associated with bringing operations back to the home country. Additionally, opting for nearshoring over reshoring tends to have a lesser negative impact on the environment, as it involves shorter supply chains. Reshoring, on the other hand, was predominantly adopted by companies exiting Russia. These firms, facing time constraints, had to resort to this strategy. Moreover, as these companies chose not to engage in commercial activities in the country they left, reshoring was a better alternative. In such cases, nearshoring was deemed less feasible due to higher transportation costs.

Furthermore, companies also deployed the strategy of building redundancy. Automotive companies, realizing the fragility of the JIT model, chose to integrate this strategy with others. As a result, automakers are moving away from the JIT model and accepting higher costs in stock management to achieve greater efficiency and operational resilience in the supply chain.

The collaboration strategy was notably adopted, particularly by Russia and China after the departure of western countries from Russia. This partnership involved close cooperation and coordination between Chinese companies and Russia. Through this strategy, Chinese automakers gained access to vital information necessary for their expansion into Russia encompassing suppliers, manufacturers, distributors, and retailers. The concept of visibility becomes crucial in this collaboration as it enables a more efficient and effective exchange of information and decision-making process.

In conclusion, on one hand, if an automotive manufacturer operates as a multinational entity spanning across multiple countries across continents, the recommended strategy for mitigating risks throughout the supply chain is nearshoring. Multinational corporations within the automotive sector, typically, possess extensive supplier networks spanning diverse geographic regions, and maintain operational presence in numerous countries, which encompasses manufacturing to sales. Furthermore, these multinational automakers aspire to sustain operations in all countries where they are currently active. However, when confronted with geopolitical risks, nearshoring represents the most effective approach, facilitating the preservation of sales in regions affected by geopolitical disruptions, while maintaining proximity with manufacturing, and minimizes transportation expenses, thereby exerting a lesser adverse impact on sustainability compared to reshoring.

On the other hand, when engaging with firms exclusively operating in specific regions or even countries that dominate particular geographic areas (such as

China's operations in Russia), collaboration between suppliers and manufacturers emerges as a viable strategy. For instance, in a scenario where a company only operates in a country or is the only firm that operates in a country, then it does not have a plethora of suppliers to operate in that specific region, which means there can be a great deal of visibility between supplier and manufacturer, hence the strategy of collaboration stands out from the rest. Additionally, it is because of visibility that collaboration is not possible for multinationals, companies cannot afford to be vulnerable to their partners, which would endanger the operational resilience of its supply chain.

Next, the main conclusions drawn from this research will be presented, which helped to answer the proposed research question.

Firstly, after a period of relative stabilization in the geopolitical landscape following World Wars I and II, new geopolitical risks emerged, shedding light on the intricate nature of present-day supply chains. These chains have evolved to become significantly more globalized and technologically advanced compared to previous decades, thereby exposing vulnerabilities in popular strategies, particularly offshoring and JIT.

Secondly, the motivations that once propelled automotive firms towards offshoring as their primary strategy have diminished in strength. Factors such as the substantial labor cost differentials between the west and emerging nations have narrowed over time. Moreover, the labor and environmental policies of these emerging nations have increasingly converged with those of more industrialized nations.

Thirdly, not all automotive companies operate as multinationals; some focus solely on producing and selling automobiles within a single country or specific region. Therefore, optimal strategies vary from multinationals and domestic automotive firms. Consequently, certain strategies may be irrelevant or impractical for automotive companies to adopt.

Hence, this thesis concludes that the optimal strategy for companies varies based on their organizational structure. For multinational automakers, nearshoring emerges as the advisable strategy. Conversely, for non-multinational entities, collaboration is recommended.

Limitations and Further Research

This research acknowledges certain limitations. One such limitation pertains to the sole utilization of secondary data, relying solely on publicly accessible information. Initially, the industry selection criteria prioritized sectors with extensive data availability and significant contributions to national GDP. Nonetheless, supplementing the paper with primary data could have enriched the analysis, enabling cross-referencing of information.

Furthermore, one may consider as a limitation the lack of unanimity in opinions regarding the optimal strategy for mitigating supply chain risks. For instance, Křenková, Procházka and Tůry (2023, p. 313-334) present contrasting views on this issue compared to Singh, Hamid, and Garza-Reyes (2023, p. 787-802). Nonetheless, this disparity fostered critical thinking in assessing the observed literature.

For the realization of this paper, two geopolitical conflicts were chosen instead of one. The first geopolitical risk mentioned is the older of the two, having started longer before, consequently, there is plenty of available data. However, the other geopolitical risk mentioned is more recent, meaning there is not yet an abundance of available data for analysis.

Therefore, further research on this topic is warranted. Presently, there is limited availability of data regarding the latest mentioned geopolitical event, which refers to the Russia-Ukraine war. Obtaining additional data would not

only enhance understanding of the current geopolitical landscape but also provide insights into the ongoing geopolitical development.

Gaining insights into China's implementation and expansion of operations in Russia, as well as the current outcomes of this collaboration, would be valuable. Given the significant economic impact of the automotive industry in the world, understanding the potential effects of the recent geopolitical events on automakers is essential for devising successful strategies to maintain operations and competitiveness across the supply chain.

Statement

During the preparation of this study, the author used:

CHATGPT to retrieve suggestions;

QUILLBOT to enhance the quality of writing.

The author is solely responsible for the publication's content, having reviewed and edited it as necessary.

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