

EFFECTS OF ECONOMIC AND GEOPOLITICAL RISKS ON THE SUPPLY CHAIN: AN ECONOMETRIC ANALYSIS

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ABSTRACT

Purpose- The lockdowns and restrictions imposed as part of the response to the COVID-19 pandemic, which first emerged in China, the Russia-Ukraine conflict and its broader geopolitical implications, and tensions in other geographies have exacerbated an already problematic global supply chain situation. While freight markets have limited direct contact with Russia and Ukraine, global logistics have exposed supply chains to an increasing number of risk factors, including airspace restrictions, uncertainty about the future path of consumer demand, and China's ongoing interventions regarding the COVID-19 process. The effects of various economic and geopolitical risks on the supply chain are the main analysis subject of this study.

Methodology- In accordance with the scope of the study, the causality analysis suggested by Toda Yamamoto was applied between the Baltic Dry Cargo Index (BALDIC) and Brent oil prices (BRENT). In the study, data covering the period 2020:1-2023:12 at monthly frequency was used. In order to examine the relationship between Baltic Dry Cargo Index (BALDIC) and Brent oil prices (BRENT), data regarding the causality analysis proposed by Toda and Yamamoto are shared in tables. Extended Dickey-Fuller (ADF) unit root test was used to analyze the data. The results are presented in tables and interpreted.

Findings- The effects of risks, conflicts and crises that arise in different ways in different geographies on the supply chain are examined in detail with country examples. The problems experienced by countries against supply chain problems, steps taken towards solutions, the effects of crises experienced in the supply chain, and future scenarios are presented in detail in different regions. This study clearly states that geopolitical tensions and the pandemic have dealt a significant blow to the supply chain, and that the disruptions in the supply chain have reached a level that will leave countries helpless

Conclusion In the study, the relationship between the Baltic Dry Index (BALDIC) and Brent oil prices (BRENT) was empirically examined. Contrary to studies in the literature, no significant causality relationship was found between the two variables. In the study, it was emphasized that the cost increases in the supply chain and transportation axis were not due to oil prices, but geopolitical and economic risks. Geopolitical and economic risks arise from pandemics, political instability at international borders, trade conflicts and legislative changes. Increases in risks, tariffs, trade restrictions and sanctions disrupt supply chains, increase costs and hinder market access. The increase in risks experienced in recent years has been a determinant in the disruption of supply chains and the increase in costs.

Keywords: Economics, supply chain, Toda Yamamoto, geopolitical risk, cost of economic risk

JEL Codes: A10, E00, R40

1. INTRODUCTION

Global supply chains play a critical role in today's complex business world. These chains are directly affected by various external factors such as geopolitical events, natural disasters and economic fluctuations. This study aims to examine how risk management in global supply chains is shaped, especially under the influence of geopolitical, natural and economic factors.

Geopolitical factors include the dynamics of relations between countries and the resulting trade policies. These policies have a direct impact on the efficiency and security of supply chains. For example; trade wars, embargoes and political instability cause significant problems in supply chains. Economic factors refer to the effects of global and local economic conditions on supply chains. Various factors such as inflation, exchange rates, and economic crises negatively affect supply chain costs and operational efficiency. The combination of these three main factors creates significant risks for supply chains, and managing these risks becomes more essential for businesses.

The tension experienced in the geopolitical environment, the US-China trade war, the COVID-19 pandemic, and the Russia-Ukraine war have significant impacts on global supply chains. Understanding what may happen in the future regarding geopolitical developments is critical for companies to remain competitive. Assessing geopolitical trends and risks is becoming an increasingly important risk reduction strategy for businesses worldwide. Therefore, how geopolitical changes can affect supply chains, global data, people and capital flows is expressed from a multi-faceted perspective.

Open economies generally have higher economic and productivity growth than closed economies. However, some countries allow geopolitical concerns to override economic concerns and pursue policies that lead to a contraction in globalization. Examples include Brexit, US tariffs on imports from the European Union, the South Korea-Japan trade dispute, and the US-China trade war.

These geopolitical challenges come on top of numerous other disruptions in supply chains, including pandemics and natural disasters. One way to assess the impact of geopolitical risks is to look at different scenarios that predict what could happen over the next 10 years and test how they would affect global operations. At this level, two baseline scenarios focus on the US-China relationship.

The “strategic competition” scenario sees China and the United States use restrictive trade practices to gain advantage in high-tech industries of national importance, while exhibiting mutual restraint and cooperation in others. One of the biggest concerns under this scenario is that traded goods have military applications, historically referred to as “dual use.” Importing such goods increases the risk of corporate and government espionage. For example, chips stored in a server could be used to infiltrate a user’s computer systems. Exporting them therefore increases the risk of providing a foreign government with military capabilities it would not otherwise have.

The “decoupling” scenario presents a more contentious U.S.-China relationship in which reducing interdependence across most industries is more urgently pursued. While neither scenario is likely to play out exactly as described, each scenario provides a reasonably plausible outline of how the geopolitical landscape could change over the next 10 years. It raises complex questions about current supply chains, cross-border operations, and flows.

The COVID-19 pandemic and the war between Russia and Ukraine have once again emphasized that the world is as interconnected as it is. The people, companies and transportation networks that order and produce goods; deliver them to warehouses, stores and even doors have been significantly affected by bottlenecks in global supply chains. Increasing costs in the supply chain will also affect the types, quantities and speed of access to store shelves. The impact of increasing household bills and inflation will inevitably reduce demand to some extent. This study reveals that the impact of economic and geopolitical risks and the global pandemic on supply chains is inevitable and that the crisis in supply chains has a negative impact on global trade and logistics. In this study, the fact that no causal relationship was found between the Baltic Dry Index and Brent Oil prices analyzed using the causality analysis predicted by Toda-Yamamoto supports the conclusion that economic and geopolitical risks have an impact on increasing costs in the supply chain.

In this study, risk management practices in global supply chains will be considered as a literature review and how these risks are defined, assessed and managed will be examined in the literature. In addition, how geopolitical, natural and economic factors are integrated into these processes and how risk management strategies are developed will be discussed in detail. This analysis aims to provide a comprehensive view of the challenges faced by supply chains, supported by academic literature and econometric analysis.

2. LITERATURE REVIEW

There are many studies examining various aspects of supply chain applications. Articles on geopolitical risk management in supply chains contribute to the understanding and effective management of risks within a sustainable framework. There are important studies in this field that contribute to the literature on supply chain risk management.

Kara and Firat (2015) discussed the uncertainties and risks that arise in supply chains that are becoming increasingly complex under the influence of factors such as globalization, increasing competition conditions, intensification of relationships between supply chain partners and developments in technology. Risk events have affected companies in different countries and have highlighted the importance of early detection of risks and effective intervention. The article examines in detail the major supply chain disruption events frequently cited in the supply chain literature, analyzing the causes, timing, locations, and sectors affected by these events and their consequences.

Orel and Akkan (2018) discussed supply chain management, which has an increasing importance in the business world. In this regard, the results of research conducted worldwide show that supply chain disruptions or interruptions are among the important types of risks. The vulnerability of supply chains to external factors such as climate change, economic crises and natural disasters increases the importance of studies in this area.

Eriçok (2020) aims to deeply examine the effects of the global economic slowdown on supply chains. The challenges faced by the global economy, such as trade wars, geopolitical tensions, Brexit uncertainty and the COVID-19 pandemic, have had

significant impacts on supply chains. This study is designed to understand these effects and how risk management strategies in supply chains adapt to these changes.

Özgüner and Aytekin (2021) focused on the critical importance of supplier relationships in supply chains operating at risk. In terms of the effective operation of supply chains and the reduction of risks, the role played by suppliers in the rapid delivery of basic elements such as raw materials and semi-finished products to production points was examined. This study contributes to businesses to effectively combat supply chain risks and reduce the effects of risks. In addition, this study provides a basis for conducting similar research in different regions and making inter-regional comparisons.

By monitoring geopolitical risks, businesses can reduce their risks and increase their brand reputation. They can create long-term value for both their operations and activities. When looking at the studies in this field, it is seen that researchers (Carter & Rogers, 2008; Ho et al., 2015; Nisar et al., 2022; Seuring & Beske, 2014; Shekarian et al., 2022) have conducted a comprehensive literature review and attempted to create a conceptual theory to demonstrate the relationships between environmental, social and economic performance in a supply chain.

Nimmy et al. (2022) conducted that included the use of various tools and techniques such as risk assessments, risk mapping, and scenario planning to develop risk management, contingency plans, and risk reduction strategies in logistics. They argue that they aim to strike a balance between minimizing the impact of identified risks and optimizing operational efficiency.

Risk and crisis management are essential components of effective logistics operations, as the industry is inherently exposed to a multitude of uncertainties and potential disruptions. Amin et al. (2022) provide a comprehensive overview of risk and crisis management practices in the logistics sector, highlighting their significance in ensuring smooth and resilient supply chain operations.

Articles on Sustainable Risk Management in Supply Chains contribute to the understanding and effective management of risks within a sustainable framework. There are studies in this field that contribute to the literature on supply chain risk and performance management. (Aman et al, 2023; Jamalnia et al., 2023; Reshad et al., 2023;)

Samir et al. (2023) stated that when sustainable supply chain management, risk management and digital supply chain management are combined, businesses will be in a stronger position to achieve sustainability goals, manage risks and increase operational efficiency. Digital supply chain management aims to optimize the operations of businesses with digital technologies. Technologies such as data analytics, artificial intelligence, automation and the internet of things (IoT) allow businesses to run their business processes more effectively and efficiently. Thanks to this transformation, businesses can access the capacity to better monitor, analyze and predict supply chain activities. Blockchain and IoT facilitate traceability, transparency and real-time data sharing, ensuring that sustainability criteria are effectively followed. (Samir et al., 2023)

Qin, Su, Umar, Lobonç, and Manta (2023) discussed the critical importance of the stability of global supply chains for sustainable development around the world. In their study, they deeply examined the impact of factors such as the Southern Oscillation Index (SOI) and Geopolitical Risk (GPR) on global supply chains. The main purpose of the research is to understand whether these factors cause disruptions in the global supply chain and the nature of these disruptions.

3. THE EFFECTS OF THE RUSSIA-UKRAINE CONFLICT ON THE SUPPLY CHAIN

The war between Russia and Ukraine is expected to disrupt top-tier suppliers, further weakening global supply chains. Supply chains are being tested once again by extraordinary events due to war. The days when supply chain disruptions could be treated as one-off events, with companies struggling to reduce disruption to their operations and maintain the flow of goods, funds and information throughout their supply chains, are long gone. War and conflict between the two countries reinforce the need for most organizations to have more resilient supply chains.

The most pressing vulnerabilities include Europe's heavy reliance on natural gas and crude oil from Russia, as well as its reliance on both Russia and Ukraine for key agricultural products. According to the Food and Agriculture Organization of the United Nations, Russia and Ukraine account for more than 25% of world wheat trade, more than 60% of global sunflower oil, and 30% of global barley exports. Russia is also a major global exporter of fertilizer, meaning that any supply shortages or restricted access could impact crop yields globally (FAO, 2022).

It's not just oil and agricultural products that are under stress. As Deloitte notes in its report, "Russia's primary reason for weighing on supply chains is that it is a major exporter of some of the world's most important commodities." (Deloitte, 2020a).

Russia is a major source of 35 critical minerals that the US Department of the Interior (DOI) considers vital to the country's economic and national security interests, including 30% of the world's supply of platinum-group elements (including palladium). These include 13% titanium and 11% nickel. Russia is a major source of neon, which is used to etch circuits on silicon wafers. Palladium, a critical component of catalytic converters for cars, has increased in price by 80% since the conflict began. Additionally, as a result of the war, LMC Automotive has lowered its light vehicle sales forecast in Europe by 2 million units per year for the next two years (Vuksic, 2022).

The interconnectedness of economies and businesses is both exacerbating and, to some extent, masking the growing supply chain crisis. According to Dun & Bradstreet, there are fewer than 15,000 Tier 1 suppliers in Russia. However, there are 7.6 million Tier 2 supplier relationships with Russian organizations worldwide. More than 374,000 businesses, 90% of which are based in the US, trust Russian suppliers. Deloitte's annual survey of purchasing leaders shows that 70% believe they have a good view of risks at Tier 1 suppliers, while only 15% have the same confidence about Tier 2 and beyond (Deloitte, 2020b).

Successful leaders will need to take decisive action to respond to the immediate risks of this crisis and stabilize supply chains. They will also take the long view, recognizing that this crisis will amplify many of the fundamental and structural changes in global supply chains that were already accelerating as we emerge from the COVID-19 pandemic.

4. GLOBAL REFLECTION OF THE FOOD SUPPLY CRISIS WITH COUNTRY EXAMPLES

Wheat and corn account for almost 30% of all calories in the world, or simply all food (in various forms). Ukraine and Russia together export about 27% of all wheat and 14% of all corn in the world. Wheat is perhaps the most important commodity in terms of global food security. Ukraine alone exports about 9% of all wheat and 13% of all corn in the world. Ukraine leads in canola seed with 10%, and in barley with 12%, Russia leads.

The Middle East and North Africa (Egypt, Yemen, Israel, Indonesia, Bangladesh, Ethiopia, Libya, Lebanon, Tunisia, Morocco, Pakistan, Saudi Arabia, Türkiye) are the main buyers of wheat and corn, which poses a food security problem for these countries. In total, more than 400 million people worldwide are dependent on grain supplies from Ukraine alone.

Egypt: More than 32.5% of its citizens live below the poverty line, making malnutrition and hunger an urgent problem in Egypt.

Yemen: The rate of malnutrition among women and children in Yemen is extremely high. With 1.2 million pregnant or breastfeeding women and 2.3 million children under the age of 5 receiving treatment for acute malnutrition, the country is among the highest in the world.

Indonesia: 14.3% of the population lives below the poverty line, with 19.4 million unable to meet their nutritional needs.

Bangladesh: 40 million people are food insecure and 11 million suffer from chronic hunger.

Ethiopia: 5.9 million people are in acute food need.

Lebanon: 22% of Lebanese households are food insecure.

Libya: 83% of people live on less than \$1.25 per day. 699,000 people are food insecure.

Pakistan: 20.5% of the population is undernourished. 44% of children under 5 are reported to be stunted. - Iraq: 2.4 million people are reported to be in acute need of food and livelihood support.

The end of grain exports from Ukraine means that if this war continues, Ukraine will not be able to supply the remaining 6 million tons of wheat and 15 million tons of corn to the world. If exports from Russia are also terminated, it means that Russia will not be able to supply approximately 8 million tons of wheat.

Large production and export deficits are inevitable in the future. While winter crops (wheat) can be found in the soil in Ukraine and in good condition, their yields are significantly reduced if spring fertilization is not done on time. In many regions, it is not physically possible to produce because of military activities. The limitation of fuels and mineral fertilizers due to restrictions in ports also makes farming activities in other relatively safe regions difficult. The planting of spring crops (corn, feed barley, sunflower) should normally start in March-April, but it is observed that a negative picture has emerged due to the war.

The withdrawal of major international suppliers of agricultural machinery and other inputs from Russia will have a significant negative impact on yields in the country and Russia will not be able to export grain in the near future, making grain production much less attractive to farmers in the coming years. Due to the expected decreases in yields, exports from Ukraine and Russia are bound to face serious obstacles if the war continues. Under these conditions, in the best case scenario, a short end to the war would still make some exports possible. Under the scenario where the war continues continuously, the world will be deprived of approximately 38 million tons of corn, 10.5 million tons of barley and 60 million tons of wheat, or grain exports will fall. Oil crops (soy and rapeseed) and vegetable oils only make the situation worse. It will take at least 2-3 years to return to pre-war levels (Glauber and Laborde, 2022).

A major global humanitarian crisis is being caused by war. Hundreds of millions of people face food insecurity, while many low-income grain importing countries are also threatened by a major humanitarian crisis.

5. CHINA IN THE SUPPLY CHAIN AXIS

China, the world's second largest economy and a leading provider of manufacturing services, has been grappling with a series of troubling developments in its ever-growing export markets. Since 2018, the ongoing 'trade war' initiated by the US has

destabilized industries worldwide. These developments have disrupted China's position as the heart of global supply chain systems. Rising tariffs, political tensions and the resulting economic slowdown have placed reactivity, change management and strategic planning at the forefront of the country's supply chain management (SCM) functions, along with a continued focus on digital transformation. Despite the ongoing tariff onslaught that shows no signs of slowing down, China's domestic power and global influence have made its economy surprisingly stable. These include a strategically weak Yuan, strong domestic markets and the country's decision to send exports that depend on the US to other Asian countries to circumvent tariffs.

Downtown Shanghai has been in a negative position as US-based companies have moved their sourcing offices to neighboring countries such as Bangladesh and Vietnam. The slowing economy has led companies in Shanghai to digital transformation, such as omnichannel e-commerce and supply chains. Their goal is to create digital supply chain systems. They note that there has been a significant impact on the B2B sector and sourcing function in Suzhou. Companies in Suzhou are trying to keep costs as low as possible because they are unsure of how their future revenues will be affected by the increased tariffs. The trade war has forced Chinese companies to review and further optimize their supply chains and sourcing strategies. If Chinese companies need to export to the US and continue manufacturing in China, the only way to counter the increase in tariffs is to reduce costs, starting with raw material prices. (ICAO, 2022)

China's supply chain industry favors employers who have a conservative outlook on the job market. Widespread cost reductions are evident in the market. This highlights the importance of skill development when it comes to salary increases, flexible working hours, and other benefits. The domestic focus has also led to fewer opportunities for foreign workers. It is observed that companies need to offer exceptional packages and benefits to attract the right local candidates in the market. (Statista, 2020)

As Chinese companies look to keep costs down in the digital transformation era, they will have an advantage in identifying ideal suppliers, negotiating terms and conditions, and having an existing network of useful contacts. Stakeholder management and soft skills, which are directly related to being successful in this function, will also help set the candidate apart. Soft skills, such as stakeholder management and the ability to work with local colleagues, are in high demand in most Supply Chain functions, covering both leadership and mid-level roles.

6. SUPPLY CHAIN AND THE USA

In 2021, as a result of the COVID-19 pandemic, global supply chains and shipments have slowed down, causing shortages around the world. Consumer patterns are also affected by this process. The reasons for the global supply chain crisis, which has also caused an economic slowdown, include employees getting sick due to COVID-19, and obligations and restrictions affecting the availability of staff. (Tanyas, 2020).

The crisis has escalated due to cargo transportation being stuck at the port and personnel shortages in the supply chain. The global chip shortage has affected the supply chain crisis, especially as it relates to the automotive and electronics sectors. The increased economic spending in North America during the Christmas and holiday season in 2021, along with the spread of the Omicron variant of COVID-19, has further exacerbated supply and supply. The effects of supply chain crises have contributed to the ongoing food security issues with the pandemic and have played a role in the 2022 food crises.

In early 2020, the COVID-19 pandemic slowed down the global supply chain as manufacturers suspended operations until safety measures were taken. Global trade continued at reduced capacity and has not fully recovered. New challenges in 2021, including the Delta variant and reduced access to COVID-19 vaccines in developing countries, have further weakened the recovery in global manufacturing, although wealthier, vaccinated economies such as the US and Europe have transitioned to new manufacturing models. (WTO, 2022).

By mid-2021, major U.S. ports were inundated with historic amounts of incoming cargo. Terminal personnel were left without the bandwidth to process the cargo, leading to long wait times. Container ships began to sit outside ports for days or even weeks. This increase has spread inland as rail and trucking services struggle to cope with the increased loads and labor shortages. The U.S. trucking industry was already experiencing driver shortages before the pandemic, with high turnover and below-average compensation. While there are sufficient shipping containers available to meet global needs, containers have created a supply gap, given the supply positions held in transit and misaligned in different parts of the supply chain (UTIKAD, 2020).

When the COVID-19 pandemic began shutting down manufacturing facilities, it set off a chain reaction of disruption for many companies that had adopted lean principles on their production lines. Then, as demand for consumer goods and medical supplies like personal protective equipment skyrocketed, facilities were unable to keep up with demand. This situation also caused a huge backlog. Due to supply issues, China's Commerce Minister advised its citizens to stock up on food. In the United States, there were shortages of shelves and stock in areas such as electronics, jewelry, clothing, pet supplies, and home and garden items.

7. DISRUPTIONS IN THE SUPPLY CHAIN AND THE IMPACT OF THE ENERGY CRISIS ON THE EUROPEAN UNION

Europe is faced with a serious energy supply problem. While domestic energy production is decreasing, the dependence on Russia, a major supplier, for natural gas reserves is striking. The global demand for liquefied natural gas, especially the war between Russia and Ukraine, has brought about serious supply problems as China, enduring an energy crisis caused by COVID-19-related outages, has doubled its imports to compensate for the lack of domestic coal production. The EU is no longer the largest market for oil-rich countries such as Qatar, shifting its focus to East Asian customers. The Russia-Ukraine war has emerged as a problem that has led to higher costs for EU energy imports.

Among countries in Europe, the UK has been perhaps one of the worst hit by the energy crisis. After wholesale gas prices rose globally, 25 energy companies in the UK went bankrupt. In October 2021, Ofgem, the country's energy regulator, raised the price cap on household gas and electricity bills by 12% to £1,277 to help the sector. However, some companies have failed because they were unable to pass on the wholesale price increase to consumers (BBC News, 2022).

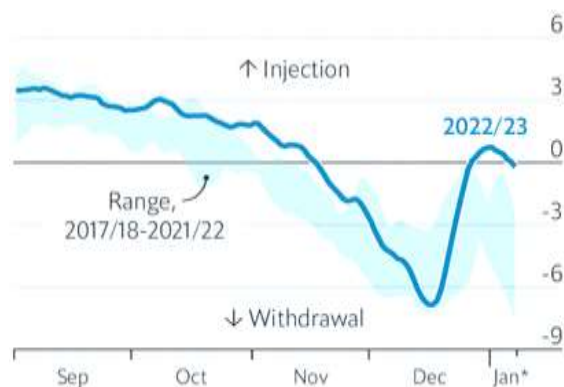
Due to the cost of energy company failures in the UK, citizens have had to pay higher bills. It is not just the rising gas prices that the UK has to deal with. The oil shortage caused by the lack of tankers to carry fuel has forced the government to announce a temporary visa scheme that will allow 5,000 HGV drivers to come to the UK to ease this crisis (Euronews,2022).

Natural gas prices have soared in Europe as countries emerge from COVID-19 lockdowns, adding fuel to consumers' bills. The cost is four times higher in Europe than in previous years. Governments are trying to provide subsidies and lower taxes to protect consumers. (Figure 1.)

Figure 1: EU Daily Change in Gas * Storage Volume, TWh

What crisis?

EU, daily change in gas-storage volume, TWh
Seven-day moving average



Source: The Economist, 2023

One of the EU's concerns is the storage of natural gas. Traders are expecting a potential supply crunch for the winter months, with inflation reaching a record high of 5.1% in eurozone countries, driven by inflation of 28.6% in the energy sector. Currently, Europe continues to struggle with this rising supply-side inflation. Despite the increase in policy interest rates during the years of high inflation, inflation has not decreased at the desired pace. Risks in supply chains have also affected the macroeconomic picture.

8. THE ROLE AND IMPORTANCE OF TURKIYE IN THE SUPPLY CHAIN

Due to the change in supplier preferences during the pandemic, countries like Türkiye stand out with their strategic locations and production capabilities. During the first phase of the global pandemic, China suspended its production activities and global markets, including manufacturing giants like Germany, experienced supply shortages. It has been repeatedly emphasized that diversifying suppliers will be of strategic importance for production to continue without interruption. Even during the peak of the pandemic, Türkiye exported and donated vital medical products such as ventilators and face masks to many countries, including developed countries. Türkiye is among the strongest suppliers with its strategic logistics networks, educated workforce and high-quality production capacity.

Companies have focused on the Far East for their global sourcing, looking for low-cost sources, sales growth, advantageous incentives and strategic purchasing targets. Shortly after the COVID-19 crisis period, companies and governments have been focusing on business continuity and supply chain risk and resilience management on a macro scale. This is leading to a shift from globalization to regionalization. (OECD, 2020) Türkiye has shown a decline in the macroeconomic environment and

product market efficiency, while it has made progress in technology adoption, infrastructure and the labor market. The macroeconomic environment and labor market are seen as the areas with the highest potential for development. Many companies are moving production closer to customers, which can be both more cost-effective and sustainability-friendly, leading to diversification of the supply chain, making the business less vulnerable.

If an environment is created where foreign investors can see the way, it is inevitable for Türkiye to become a supply center. Investors focus on two important issues. One is profitable, the other is a safe investment. The only mechanism that can provide safe investment is law and the rule of law. Profitability and the rule of law will directly affect Türkiye becoming a supply center. By taking advantage of such improvements and its large market size, Türkiye will have the opportunity to become an even more attractive place for a regional production, trade and logistics center. (Figure 2.)

Figure 2: Türkiye's Central Position in Supply Chains



Source: Işık, 2012.

The Covid-19 pandemic responds to the 'region-to-region sourcing' approach, which is based on the assumption that a new form of globalization will result in greater regionalization of value chains across 3 major economic areas. Türkiye is central to the equation of North America, the EU and Asia hubs.

9. DATA AND METHODOLOGY

The Baltic Dry Index (BDI) is an economic indicator published daily by the London-based Baltic Exchange. Contrary to its name, it is not limited to the Baltic Sea countries. The index is a value calculated by taking into consideration the tonnage, number, routes, cargo they carry and price of Handysize, Supramax, Panamax and Capesize bulk carriers. If the index is rising, it can be said that there is a boom in world trade; if it is falling, it can be said that there is a decline. Brent oil is a type of sweet light oil first extracted from the North Sea. It is also known as London Brent or Brent Blend. Brent is the leading global price benchmark for Atlantic basin crude oils. It is used to determine the price of two-thirds of the world's internationally traded crude oil supply. It is one of the two main reference prices for oil purchases worldwide. Oil fields in the North Sea are located in very challenging geographical conditions, but the oil extracted in this region is in great demand in the world market thanks to its easy refining and high quality.

In this part of the study, the relationship between the Baltic Dry Index (BAL TIC) and Brent oil prices (BRENT) was examined empirically. In the study, data covering the period 2020:1-2023:12 were used at a monthly frequency depending on the availability of data. The data was accessed from "investing.com Türkiye". In the empirical analysis, the logarithm of the variables was finally taken.

Table 1: Baltic Dry Index (BDI) and Brent Oil Futures (Brent) Rawdata Set

Date	BADI	Brent	Date	BADI	Brent	Date	BADI	Brent	Date	BADI	Brent
1.12.2023	2.094,00	76,91	1.03.2023	1.389,00	79,89	1.06.2022	2.240,00	109,03	1.09.2021	5.167,00	78,31
1.11.2023	2.937,00	80,86	1.02.2023	990,00	83,45	1.05.2022	2.566,00	115,6	1.08.2021	4.132,00	71,63
1.10.2023	1.459,00	85,02	1.01.2023	681,00	85,46	1.04.2022	2.404,00	107,14	1.07.2021	3.292,00	75,41
1.09.2023	1.701,00	92,20	1.12.2022	1.515,00	85,65	1.03.2022	2.358,00	104,71	1.06.2021	3.383,00	74,62
1.08.2023	1.086,00	86,83	1.11.2022	1.355,00	86,97	1.02.2022	2.040,00	97,97	1.05.2021	2.596,00	68,95
1.07.2023	1.127,00	85,43	1.10.2022	1.463,00	92,81	1.01.2022	1.418,00	89,26	1.04.2021	3.053,00	66,76
1.06.2023	1.091,00	75,41	1.09.2022	1.760,00	85,14	1.12.2021	2.217,00	77,35	1.03.2021	2.046,00	62,74
1.05.2023	977,00	72,60	1.08.2022	965	95,64	1.11.2021	3.018,00	69,23	1.02.2021	1.675,00	64,42

1.04.2023	1.576,00	80,33	1.07.2022	1.895,00	103,97	1.10.2021	3.519,00	83,72	1.01.2021	1.452,00	55,04
1.12.2020	1.366,00	51,82	1.11.2020	1.227,00	47,88	1.10.2020	1.283,00	37,94	1.09.2020	1.725,00	42,3
1.08.2020	1.488,00	45,66	1.07.2020	1.350,00	43,52	1.06.2020	1.799,00	41,27	1.05.2020	504	37,84
1.04.2020	635	26,48	1.03.2020	626	26,35	1.02.2020	535	49,67	1.01.2020	487	56,62

In this study, the causality analysis proposed by Toda and Yamamoto (1995) was used to examine the relationship between the Baltic Dry Index (BALTIC) and Brent oil prices (BRENT). The advantage of this method developed by Toda and Yamamoto (1995) is that it allows causality findings through the VAR model, independent of the cointegrated relationship between the series.

In the Toda-Yamamoto causality test, regardless of the stationarity of the time series, the VAR model is created using the level values. In this test consisting of two stages, first the optimal lag length is determined and the maximum integration degree (dmax) is determined for the series in question. The determination of the appropriate lag length for the VAR model is made using criteria such as Akaike and Hannan-Quinn. Thus, the extended VAR model containing the lag length k+dmax is estimated together with the determination of the optimal lag length k and the maximum integration degree dmax. In the second stage, Wald tests are applied to the obtained k-lag VAR coefficient matrix and as a result, inferences based on Granger causality can be made.

In the analysis, firstly, Extended Dickey-Fuller (ADF) unit root test was used to determine the stationarity levels of the variables. The results of the ADF unit root tests applied to the levels and first differences of the variables are presented in the table.

Table 2: ADF Unit Root Test Results for Levels and Differences of Variables

Variables	Lag Length	t-Statistics
BALTIK	1	-2.88078
BRENT	0	-1.90431
ΔBALTIK	1	-9.06236*
ΔBRENT	0	-5.74151*

Notes: *It shows that the existence of a unit root with a null hypothesis at the 5% significance level is rejected. Latency lengths were determined using the Akaike Information Criteria (AIC). "Δ" indicates that the 1st difference of the series is taken.

According to the results of the ADF unit root test shown in Table 1, the Baltic Dry Index (BALTIC) and Brent oil prices (BRENT) variables were determined as first-order stationary variables. The models established for the Toda-Yamamoto causality test are adapted to the study as follows:

$$BALTIK_t = \alpha_1 + \sum_{i=1}^{k+d \max} \beta_{1i} BRENT_{t-i} + \sum_{i=1}^{k+d \max} \theta_{1i} BALTIK_{t-i} + \varepsilon_{1t} \quad (1)$$

$$BRENT_t = \alpha_2 + \sum_{i=1}^{k+d \max} \beta_{2i} BALTIK_{t-i} + \sum_{i=1}^{k+d \max} \theta_{2i} BRENT_{t-i} + \varepsilon_{2t} \quad (2)$$

Accordingly, k was determined as "1" and dmax was determined as "1" with the help of the VAR model and the extended VAR(3) model was estimated with the seemingly unrelated regression method. The causality analysis results obtained with the help of this model are shown in Table 2.

Table 3: Toda-Yamamoto Causality Analysis Results

Zero Hypothesis	k+dmax	MWALD Statistics
BALTIK \nrightarrow BRENT	2	2.54509**
BRENT \nrightarrow BALTIK	2	3.73119**

* This indicates that the null hypothesis is rejected at the 5% significance level. The lag length k is set to 1.

According to the results in Table 2, no causality relationship was found between the Baltic Dry Index (BALTIC) and Brent oil prices (BRENT) variables.

10. FINDINGS AND DISCUSSIONS

As a result of the COVID-19 pandemic, global supply chains and shipments have slowed down, causing shortages worldwide and affecting consumer habits. The economic slowdown, the COVID-19 cases that caused workers to become infected, and the restrictions that negatively affected staff availability have brought about a significant test for all countries. In cargo transportation, many products have been stuck at ports due to staff shortages.

The global chip crisis has contributed to a supply chain crisis, particularly in the auto and electronics sectors. The surge in spending in North America, combined with the spread of the Omicron variant of COVID-19, has exacerbated already tight supplies.

The long-term effects of supply chain crises have contributed to ongoing food security issues related to the pandemic, including food crises. India, the United States, and Brazil stand out as the hardest-hit countries in the supply chain, with significant shortages across many different product categories. Supply chain disruptions have been particularly difficult to overcome and contain, putting these countries at a disadvantage in global trade.

In addition to the huge human losses and destruction, Russia's invasion of Ukraine – the 'breadbasket of Europe' – has triggered energy and food supply challenges, exacerbating the vulnerabilities of existing food systems already weakened by climate change and the COVID-19 pandemic. It has raised fears of an unprecedented global food crisis, similar to or worse than the 2008 crisis, with ripple effects on security, migration and political instability. The supply shock provoked by the blockade of Ukrainian exports, combined with record prices for energy and essential commodities, has led many countries to adopt export restrictions, fuelling market shocks and speculative operations, creating unpredictability in global food supplies.

As the war continues and the stakes rise, fears of food shortages in this hybrid war are growing. It is at the top of the international political agenda. The influence of the international community, including the UN- Türkiye brokered grain corridor agreement to lift export restrictions from Black Sea ports, has allayed fears of an imminent widespread global food crisis. However, some food importers and food aid-dependent countries are highly vulnerable to food price and currency volatility.

The simultaneous crises that emerged for different reasons in different geographies continue to have an impact on supply chains. The crises experienced in supply chains support global price increases and supply-side inflation, deepen hunger crises in African countries, and the impacts of food, energy, logistics, economy and social issues are the top agenda items for all countries on a global scale.

The solution to ongoing supply chain issues appears to be either an increase in capacity or a decrease in demand. The freight fleet is also expected to expand more rapidly after a more constrained capacity situation since the COVID-19 pandemic. In air transport, the recovery in capacity is likely to be linked to the return of commercial airline flights, especially for intercontinental capacity. On the demand side, the recovery in stocks seen in many importing countries is likely to help this process. Increasing pressures on consumer budgets will also slow import demand.

11. CONCLUSION AND IMPLICATIONS

Geopolitical risk represents the potential impact of international political events on the economic and business environment. It encompasses multifaceted risks arising from the geopolitical dynamics of nations, including political conflict, wars, pandemics, economic policy changes, social upheavals, and environmental factors. Flexibility is critical to responding to geopolitical uncertainties. This approach reduces reliance on a single source and provides alternatives in the event of disruptions. Adopting flexible logistics solutions can help overcome logistics challenges created by geopolitical changes.

With the pandemic, the direction of the determinants in the supply chain has changed. While the reality in the literature states that the increase in energy prices has the biggest impact on the supply chain, it now reveals that geopolitical and economic risks affect the supply chain.

In January 2024, container shipping rates were significantly increased due to US and UK airstrikes in Yemen. The geopolitical developments have triggered fears of long-term disruptions to Red Sea trade. Most container ships have been forced to avoid the Suez Canal, a vital trade route that handles 12% of global trade. Ships have been forced to reroute around Africa's Cape of Good Hope, increasing transit time and costs.

The Shanghai Containerized Freight Index, which reflects container shipment rates from Chinese ports, has increased by 114% since mid-December 2023. Rates for routes to Europe and the US West Coast have also increased sharply. This shift is causing global shipping challenges, causing major industry players to face rising costs and delays.

The creation of new routes in supply chains adds approximately 10 days and \$1 million in fuel costs per Asia-Europe voyage. Major importers are experiencing product shortages and delays. The overall reduction in available ship space on major trade routes is leading to higher shipping rates and surcharges. This is contributing to rising global inflation for a wide range of global goods.

This study reveals how risk management in global supply chains evolves under the influence of geopolitical, logistic and economic factors and the importance of the impact of these risks. The results of the econometric analysis conducted within the scope of the research emphasize how sensitive supply chains are to such external effects and the necessity of taking proactive measures against these risks.

Geopolitical events and economic changes directly affect the decision-making processes and operations of supply chains. Therefore, it is recommended that companies constantly monitor these factors and develop flexible risk management strategies. It was also concluded that supply chains should be diversified and strengthened to increase resilience against natural disasters and other unexpected events.

It is recommended that supply chain managers adopt a more comprehensive and integrated approach to reduce uncertainties and ensure the continuity of supply chains. Geopolitical events and economic changes directly affect the decision-making processes and operations of supply chains. Therefore, it is recommended that companies constantly monitor these factors and develop flexible risk management strategies. It was also concluded that supply chains should be diversified and strengthened to increase resilience against pandemics, natural disasters and other unexpected events.

It is recommended that supply chain managers adopt a more comprehensive and integrated approach to reduce uncertainties and ensure the continuity of supply chains. Companies and policymakers need to continually develop and implement new strategies to effectively manage supply chain risks. Because changes in energy prices are not the only factors that affect supply chains.

Natural disasters, health crises, unexpected factors that suddenly emerge exacerbate the effects of geopolitical risks. This study states that external factors have a primary effect on supply chain costs. In this respect, this study can contribute to the shaping of future practices. The suggestions presented in this study increase the knowledge in the field of geopolitical risk management and form a basis for future research.

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