WORLD'S SUPPLY CHAIN DISRUPTION AND THE ENERGY CONFLICT BETWEEN RUSSIA AND UKRAINE

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Abstract

This study applies a business cycle-based methodology to the energy sector to examine how the war between Ukraine and Russia affects vitality cycles. To evaluate the war's effects on energy cycles, we do regression analysis and analyze the impulse response function in generalized form using Russian economic policy. This article offers a way to look at intricate circumstances, including several aspects. The quantitative research approach is used for this article. Uncertainty variables are generated using data from Google searches as a measure of conflict. Our assessment shows significant variations in the price cycles of fossil and renewable energy. The cycle of prices for renewables is more persistent, suggesting a constrained reaction to the conflict shock. By comparison, the pricing cycle of fossil fuels demonstrates more notable and long-lasting fluctuations in regimes with elevated and depressed volatility. These results demonstrate the diverse effects of the war between Russia and Ukraine on the fossil energy market, suggesting possible interruptions to supply networks and heightened market sensitivity. Notably, under all market settings, fossil energy prices show a greater reactivity to the crisis between Russia and Ukraine.

Keywords: Ukraine, Russia, Energy, Production, War.

Introduction

The escalating energy crisis between Russia and Ukraine is causing major disruptions to the global supply chain ecosystem. Unrest in geopolitics and disagreements over energy supply lines have harmed international trade, which has led to a domino effect of economic issues. Vulnerabilities

have been identified in several industries because of supply chain interdependencies and the European nations' dependence on Russian natural gas. This conflict-driven instability has shown the fragility of integrated supply networks, presenting hitherto unheard-of difficulties for businesses attempting to maintain operational stability and continuity. The impacts of this war extend well beyond national boundaries, establishing a situation in which supply chain resilience is crucial. Extended hostilities between Russia and Ukraine have caused a catastrophic humanitarian crisis that jeopardizes geopolitical stability and has harmed global supply chains. There is a global food crisis as a result of the conflict's interruption of the supply chain, rising prices, and product shortages. The world economy has been significantly impacted by these upheavals. The gap between the two countries has gotten wider as a result of Russia's reaction to Ukraine's shift toward the "West." Prior to the war, Russia was a significant global supplier of goods, particularly natural gas. However, the cost of commodities like coal and oil has gone up because of trade restrictions brought on by Western economic sanctions and political issues with Russia.

The fact that the disruption of these networks has also produced turmoil in other areas, such as production, manufacturing, shipping, and trade, is detrimental to international supply chains and associated parties. Similar incidents that have had a noteworthy effect on international supply chains include the COVID-19 pandemic, the US-China trade dispute, and the global financial crisis of 2007–2008. An organization's supply chain and stock stability may be impacted by international tensions, which have lately revealed the detrimental impact of the Ukrainian-Russian war on the world stock exchange. Scholars have also looked at how the conflict has impacted other stock markets. The impact of this debate on global supply chain firms—that is, those defined as upstream and downstream organizations by industry and country—has not received much attention in the literature thus far. Moreover, the strategic development of resilient and sustainable supplier and customer management is hampered by the infrequent discussion of supply chain vulnerability and ESG (environmental, social, and governance) disclosures in the context of conflict. The Russian-Ukrainian scenario is causing disruptions to businesses globally. There is a global food crisis as a result of the conflict's interruption of the supply chain, rising prices, and product shortages. These changes have had a big impact on the world economy. The reaction of Russia to Ukraine's move toward the "West" has increased the depth of the divide between the two nations. Before the conflict, Russia was a major worldwide provider of commodities, including natural gas. However, the cost of commodities like coal and oil has gone up because of trade restrictions brought on by Western economic sanctions and political issues with Russia. The fact that the disruption of these networks has also produced turmoil in other sectors, including production, manufacturing, transportation, and so on, is terrible for worldwide supply networks, related stakeholders, and commerce. (Li, Y. 2024).

Background Information about Energy in the War

The origins of the Russia-Ukraine War may be precisely traced back to the breakup of the Soviet Socialist Republics' Union in 1991, both historically and geopolitically. The breakup of the USSR

resulted in the independent country of Ukraine, which in turn hampered ties between Ukraine and Russia. Past conflicts between the two nations have been caused by disagreements over topics including territorial disputes, cultural distinctiveness, and the state of the Ukrainian Russian-speaking population (Kuzio, 2002). The contentious position of Crimea, an independent area with connections to both Russia and Ukraine historically, made matters worse. The taking over of Crimea by Russia in 2014 set off the conflict in 2022 and resulted in further escalation. At this crucial juncture, a notable divergence in the development of relations between Russia and Ukraine was initiated. Because of Western countries' criticism of Russia's actions and the subsequent imposition of economic sanctions, conflicts in geopolitics between the Western and Eastern blocs erupted once more. This took me back to the Second World War. Russia was Ukraine's principal trading partner for a considerable amount of time, but in recent times, this relationship has deteriorated significantly. In the end, China surpassed Russia in terms of trade with Ukraine. Prior to its invasion of Crimea, Russia sought to include Ukraine in its single market, the Eurasian Economic Union, which is now made up of Kyrgyzstan, Belarus, Kazakhstan, and Armenia.

Disruption of the Energy Supply

Several European nations are experiencing energy shortages due to the situation in Ukraine; this has disrupted natural gas shipments from Russia to Europe. For example, lower gas supplies in several European countries during the height of the winter season in 2022 raised costs and raised worries about energy security. The Russia-Ukraine war has caused enormous disruptions and uncertainty in energy flows both locally and worldwide, which has had an influence on the global energy crisis. Critical energy infrastructure became vulnerable in 2022 as a result of the rising tensions, which led to a decrease in natural gas and electricity supply to European nations that largely depended on Russian exports. Due to this disruption, energy prices have fluctuated and global market volatility has grown, forcing importing countries to look for other energy sources and concentrate on home production and renewable energy. As nations vie with respect to energy resources and put energy safety first, geopolitical tensions have increased, spurring initiatives to strengthen resilience and create backup plans. The complex consequences of the conflict between Russia and Ukraine on the world energy crisis highlight the need for proactive measures to enhance energy security, reduce vulnerabilities, and foster international cooperation in order to build a more resilient and sustainable future (Ateed, 2024).

Effects on Production and Manufacturing:

Early in 2022, as the conflict intensified, worries about disruptions to the energy supply arose since European countries depended on Russian natural gas carried through Ukrainian pipelines. There was a lower supply of gas and higher prices as a result of this supply uncertainty. As a result, manufacturers encountered hitherto unheard-of difficulties, particularly those in energy-intensive industries (G. Di Bella, 2022). The research group expressed concern that the aircraft's cancellation or rerouting might possibly cause supply disruptions in other regions or have a domino effect. Market for Capital Economics (UK). In the event that input materials and fuels—such as steel, aluminum, platinum, and sunflower oil—are not delivered on schedule, factories in Europe,

Russia, and Ukraine face the possibility of shutting down. As tensions have risen and oil prices have surged, transportation costs have also gone up. Moreover, Ukraine has historically supplied 40% of the world's krypton gas and 50% of its neon gas, two vital byproducts used in the production of electronic circuits. Due to supply disruptions brought on by the ongoing conflict, manufacturers are unable to receive this item, which makes it very difficult for them to deal with component shortages, delayed deliveries, and higher raw material costs. This suggests that companies that depend on chips, such as automakers, might likewise see manufacturing delays. Certain Japanese and Korean companies assert that they have access to the resources, but, according to The Nikkei, the rush to find suppliers outside of Eastern Europe is causing shortages and increased costs for industrial gases such as neon and xenon. Neo-neon gas is now hard to come by outside of Ukraine as it must be refined to a 99.99% purity level. Few companies globally, even those with their headquarters in Odessa, can carry out this difficult process. A growing number of carriers are ceasing operations in Russia, which makes up around 62% of all international marine freight capacity, according to Freight Waves.

(Orhan, 2022). Upstream supply networks provide businesses with the intermediate inputs they need for production. Supply chains can be disrupted by natural disasters, pandemics, wars, changes in governmental policy, or transportation-related incidents, as demonstrated by the preceding occurrences. International supply chains are not just more vulnerable than they were a few years ago, but hybrid threats are also proliferating and evolving into new shapes, such as supply chain weaponization (Zheng, S.; Acharya, 2023).

Many global production networks have grown too complicated and brittle due to massive production outsourcing, offshoring, frequently inadequate investment in resilience, and the absence of robustness-promoting regulations (Baldwin & Freeman, 2022).

The energy crisis between Russia and Ukraine has had a significant impact on the industrial and production sectors worldwide, particularly those that depend on stable energy prices and uninterrupted supply chains. The industrial and automotive industries, which heavily rely on stable energy costs and dependable access, provide an appropriate example of this effect. Manufacturers have been forced to reconsider their supply chain strategy in response to these difficulties. Some have tried to reduce the risk of future disruptions by diversifying their supply base or looking for alternate energy sources. The ongoing energy dispute between Russia and Ukraine has highlighted the need for enterprises to strengthen their supply networks, maximize energy efficiency, and improve their operational flexibility in order to efficiently traverse unstable geopolitical environments. (Simon W. David, 2022)

Problems with Transportation and Logistics:

A Russian attack on Ukraine in 2022 set off the conflict that led to the seizure of Crimea in 2014. In addition to physical aggression, war has several other impacts that differ globally in scope and location; initially, Ukraine's neighbors, emerging countries, and expanding markets felt the effects

of war. Food is one of the most traded goods in Ukraine, and the conflict in 2022 had a tremendous effect on it. Consequently, economies were compelled to search for collaborators for their food supply networks on other continents. There was a considerable oversupply, which led to a phenomenon where citizens started purchasing more food from exterior of Ukraine.

Supply chain risk management is one of the subjects covered in the field of supply chain management, and its importance is increasing every day. The transportation industry is essential to any country, so it's critical to give careful consideration to the risks involved. The identification, assessment, and management of procurement risks related to the grain of automobile transportation constitute the main objectives. The idea that permanent export routes for Ukrainian agricultural products via EU members should be the focal point of the plenary meeting of the agriculture ministers of Moldova, Georgia, and Ukraine on ensuring food security. The information system for monitoring the safety of the grain supply chain will operate effectively thanks to the suggested technique of evaluating the safety of transport facilities with direct user involvement based on geographic information tools. The differences between European and Ukrainian rails justify the installation of this technology. Each terminal has the capacity to carry up to two million tons of grain each year.

The building of a pipeline for the transportation of vegetable oils comes next. The pipeline will link the unloading terminal in the European ports with the loading terminal located on Ukrainian territory. Based on calculations, this kind of transportation should be able to handle two million tons annually. The lack of enough railway hoppers and associated trucks in EU member states for transportation of grain represents the third issue. 22,400 hoppers are in operation in Ukraine, and Twelve Thousand or so throughout the EU. Therefore, it will be possible to carry up to 10 million tons additional grain annually if there are 3,640 additional of these wagons and 6,000 more trucks. Fourthly, railroad lines must be set aside to allow Ukrainian grain trains with carts adapted to fit regular European tracks to go across German and Polish territory and arrive at the German ports of Rostock and Hamburg, as well as the Polish port of Gdansk. The creation of new export routes is essential to global food security. Specifically, 50% of the production costs of trucks and railway hoppers meant for grain transportation from the EU will be subsidized. Additionally, a complex of terminals and a pipeline for vegetable oils, as well as grain transshipment terminals, will be built. (Rudyk &Maciuk 2023)

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Attempts at Diversification and Supply Chain Resilience:

The global economy is significantly impacted by Russia and Ukraine. This is because they are important suppliers in a number of commodities markets. Specifically, 15% of global commodity exports are made up of coal, gas, and oil from Russia and the EU is both the country's biggest importer and its most import-dependent area. Aside from energy commodities, Russia exports a lot of raw materials that are used to make fertilizer (chemicals), of which potash is one of the main products. It also exports a lot of essential raw materials like palladium, vanadium, and cobalt, which are used to make semiconductors, drones, 3D printing, and batteries. hence having an impact on a number of other industries, including transportation, electrical items, and—most importantly—the automotive industry. Additionally, Russia is the fourth-largest producer of coking coal in the world which is used in the steel industry (Metelli, Mancini, Gerinovics, Gunnella, & Attinasi, 2022). This coal is produced in a dominant manner in Russia.

Geopolitical tensions are being exacerbated by the protracted economic disputes between the People's Republic of China and the United States, as well as by Russia's continued engagement in Ukraine. These factors are having a big influence on global value chains, especially energy supply networks. Due to these developments, geopolitical variables now have a greater effect on the regulations controlling the energy trade than do economic ones. The data indicates that the US and PRC are gradually detaching from one another in several high-tech domains as a result of trade disagreements. There will be five unique regional energy supply chains formed as a result of the Russian conflict in Ukraine and the numerous sanctions placed on Russia. These changes will alter the patterns of global energy commerce. The present OPEC supply networks, the EU-US, Eurasia, the diamond-shaped supply chain between the US, Japan, Australia, and India, the new supply chain between Russia, Mongolia, and the People's Republic of China, and Eurasia are some examples of these. These partnerships will change the course and nature of the world's energy trade, which might lead to more geopolitical instability. These dynamic processes will most likely influence the governance of climate change and the global energy transition. In order to accelerate the energy transition, it is hoped that the EU's member states will take advantage of the current problems to accelerate the development of renewable energy sources and establish a new green energy supply chain. However, a number of nations postponed the phase-out of coal use and, in fact, increased it by restarting coal-fired power stations due to the strain of the energy crisis and the massive demand for energy following the COVID-19 economic rebound. These one-step, two-step back measures have the potential to postpone the UN's aspirations for carbon neutrality and zero emissions. They may also result in temporary surges in carbon emissions (Xue.j 2023).

Furthermore, because Russia is vital to a wide range of global production due to its strong forward integration in global value chains, disruptions to its trade and production flows resulting from conflict may exacerbate the consequences on worldwide production networks. In actuality, Russia is a significant exporter of services as well as fundamental and intermediate commodities that are utilized by other nations as they establish their export businesses. The Federation's exports comprise around 30% of inputs utilized as intermediate inputs by its trading partners, compared to the world average of about 18%. This is due to the Federation having among the highest forward involvement rates inside supply networks. The nation's engagement in global forward value chains is almost twice as large as its gross worldwide commerce share (2.8% versus 1.5%). Russia's experience in the energy and metals sectors, which are by nature more forward-integrated due to their upstream position in the production process, may help to explain this occurrence. Export interruptions from Russia will have an effect on the economies of the surrounding areas, which rely significantly on these supplies, as well as flow into international value chains for trade via significant international industrial hubs. Virtually all GVCs are impacted by rising energy prices, but those that rely heavily on Russian chemicals and raw materials for export manufacturing would be particularly hard hit.(Risso, D. 2023).

Global Economic Consequences:

Due to their importance as major suppliers in a number of commodities markets, both Russia and Ukraine have a substantial impact on the world economy. Together, Russia and Ukraine export 30% of the world's wheat, 20% of its maize, mineral fertilizer, natural gas, and 11% of its oil. Furthermore, global supply networks depend on the export of metal from Ukraine and Russia. Russia is a significant provider of nickel, which is utilized to create steel and batteries, and the metal palladium is utilized in catalytic converters for automobiles. In addition, Russia and Ukraine make titanium sponge, which is used in the aircraft sector, and are important suppliers of noble gases like argon and neon, which are utilized in the semiconductor industry. Significant worldwide uranium deposits are held by both nations. While neither production nor export amounts have been severely interrupted, the price of a number of these commodities has climbed dramatically since the conflict began (Cormann and Boone, 2022).

Due to the interdependence of the international economy, the disruptions brought forth by Russia and Ukraine's energy dispute have broader economic ramifications. Supply chain disruptions, delays, and increased costs can affect consumer purchasing, raise the global inflation rate, and even trigger localized economic downturns. The confrontation between Ukraine and Russia has resulted in humanitarian disasters. Moreover, the damage to the global economy is already apparent and may become worse before getting better. Russia's invasion of Ukraine on February 24 has wreaked havoc on people, houses, and infrastructure, casting doubt on the region's capacity to recover from the COVID-19 pandemic. Globally, people are feeling the impacts.

Ukraine and Russia are major producers of commodities. Prices have skyrocketed globally as a result of the interruptions, particularly for natural gas and oil. Food costs have reached record highs

due to the 30% worldwide market share of wheat, which is exported by Russia and Ukraine. People will be impacted by the war in three main ways. Firstly, rising costs for necessities like food and energy will keep inflation high, devaluing salaries and placing pressure on demand. Second, there will be an unprecedented increase in the number of refugees arriving, disrupting commerce, supply networks, and remittances—especially for the local economy. Third, asset values will be impacted by a drop in investor and corporate confidence. Tighter financial conditions and a capital flight from underdeveloped countries might result from this (Kammer et al., 2022).

In the six months after the war began, natural gas prices in Europe have increased by about 120–130%, while coal prices have increased by 95–97% in the same time frame. Since the assault, the prices of crude oil, soybeans, and maize—of which Russia is the top producer—have all increased. Fertilizers were already costly due to the epidemic's increased demand, mostly for crops and animal feed. In a similar vein, hoarding various goods at home caused a scarcity that was exacerbated by the current shipping issue. The bulk of fertilizer comes from Russia and Ukraine, and the war's effects on land degradation and economic constraints have raised serious concerns about fertilizer exports, which have affected the supply of food and grains. The conflict led to the closure of many ports, raising the cost of shipping. The need to redirect ships worsened the situation for the global supply chain by causing traffic jams and delays in the transfer of cargo. In addition, the restrictions and fines led to a shift in transit from rail to sea, which put greater strain on supplies and made containers scarcer. Consequently, between February and May of 2022, the cost of many essentials, including grains, increased by around 60% (P. Alexander, 2023)

Conclusion

The geopolitical tensions surrounding the oil crisis between Russia and Ukraine have highlighted the vulnerability of the world's supply chains. Businesses across a range of industries are reevaluating how they build supply networks to make them more resilient to unforeseen shocks, emphasizing how important innovation, adaptability, and diversity are in the visage of geopolitical uncertainty. The invasion of Ukraine by Russia in February 2022 shocked the whole globe. The most significant consequences of the conflict between Russia and Ukraine are the lives lost and the humanitarian catastrophe caused by the enormous number of displaced and trapped people. However, there are also a number of noteworthy repercussions on the world economy. Despite their comparatively low output levels, Russia and Ukraine produce and export significant amounts of energy, minerals, and agricultural commodities. Significant financial and economic shocks have already been brought on by the fighting, most notably in the commodities markets, where the price of wheat, gas, and oil has surged. In the first year, there might be a serious recession in Russia and a drop in global GDP growth of about one percentage point if financial markets and commodities prices continue to fluctuate as they have since the beginning of the war. Furthermore, they may cause global consumer price inflation to rise by 2.5 percentage points. Increased domestic food production, a shift away from protectionism, and international assistance for logistics will help the country's most affected by a disruption in food supply from Russia and Ukraine. The fight has demonstrated just how important it is to lessen dependency on Russia for vital energy sources.

Policymakers should reassess the viability of market design and provide publicly supported incentives to accomplish the green transition in order to ensure energy security. The outcome of the war confirms the increasingly dire state of the world economy, which is bolstered by rising food, fuel, and fertilizer prices in addition to rising financial instability, a retreat from sustainable development, complex global supply chain reorganizations, and rising trade expenses. In order to secure a more inclusive and equitable recovery and a sustainable future, authorities must continue to prioritize enhancing energy efficiency and the green transition while fortifying social safety systems to safeguard the most vulnerable, including refugees. To increase stability during these trying times, they also need to enhance institutions and macroeconomic policy buffers.

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