

Research on Changes in International Energy Trade Pattern under the Russia-Ukraine Conflict

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Abstract. The impact of the conflict between Russia and Ukraine on world energy markets has received great attention. Some researchers have found that the Russia-Ukraine conflict has caused an energy crisis to a certain extent. However, there is a lack of overview of the changes in the trade pattern and the scope of its impact. Therefore, through a comprehensive analysis of changes in policies and economic data, this study analyzes the different response measures taken by countries in different regions such as Europe and Asia to deal with the reduction in Russia's exports of major energy products and the fluctuations in international energy prices. This study also analyzes how the mutual sanctions between Russia and Western countries have contributed to the shift of Russia's energy export focus to the Asia-Pacific region and the diversification of Western countries' energy supply. Research results show that energy trade is at risk of being affected by geopolitical factors such as regional conflicts and mutual sanctions. The Russia-Ukraine conflict has strengthened the attention of countries on energy security issues. The research also highlights the implications for future policies and actions, providing an understanding of emerging trends in the future. Economically, this study, based on past data, emphasizes the inevitability of the Russia-Ukraine conflict affecting energy fluctuations and affirms that the Russia-Ukraine conflict is conducive to global new energy transformation and sustainable development in the long term.

Keywords: Russia-Ukraine conflict; energy fluctuations; mutual sanctions; new energy transformation.

1. Introduction

The roots of the current Russia-Ukraine conflict can be traced back to the emergence of the Party of Regions after Leonid Kuchma left office and the 2004 Orange Revolution [1]. In early 2014, with the development of the colour revolution in Ukraine and Russia's control of the Crimea region, serious problems in Russia's relations with Ukraine began to surface. In February 2015, France, Germany, Russia and Ukraine tried to end the violence through the Minsk Agreement, but failed. With the intervention of North Atlantic Treaty Organization (NATO) countries and Russia's military deployment on the border, on February 24, 2022, Russian President Vladimir Putin announced the beginning of a comprehensive land, sea and air invasion of Ukraine. As of November 2023, the war has reached a stalemate after the Ukrainian counterattack failed.

The ongoing confrontation between Russia and Ukraine has increased uncertainty for global commerce and increased the volatility of Russia's energy trade. Russia is one of the world's most important energy suppliers, the production share of crude oil and condensate accounts for approximately 13% of the world's total, and it is also an important supplier of 30% of Europe's crude oil and 35% of natural gas imports [2]. However, affected by geopolitical factors, the European Council gradually adopted a series of economic sanctions against Russia to weaken Russia's ability to finance wars. The threat to Russian exports from US and EU sanctions and energy reserves from Ukraine has led to a sharp contraction of the Russian economy, even in the short term, as estimated by Mahlstein et al., Russia's trade embargo losses are also as high as 14% of real GDP [3]. Not only that, the impact of the Russia-Ukraine conflict is spreading from Europe to the world, causing an imbalance in the world's energy supply. International oil and natural gas prices have risen sharply, and coal consumption has reached a record high. Many developing countries have to continue to increase the use of coal power.

This study will briefly introduce Russia's important position in the global energy pattern, and based on the sanctions policies of Europe and the United States against Russia and Russia's response measures, taking coal, crude oil, natural gas, and electricity as examples to analyze data changes in the international trade market of Russian energy products at different time points, thereby conducting a comprehensive analysis of the political and economic levels of the impact of the Russia-Ukraine conflict on the international energy trade pattern. The conflict between Russia and Ukraine has led to changes in the global energy landscape, highlighting the importance and vulnerability of energy as a strategic resource to the national economy and security. As the international situation becomes increasingly complex, how to maintain economic and energy security is crucial. This study is of great significance for designing effective government measures and promoting sustainable economic development under the Russia-Ukraine conflict.

2. Russia's Important Position in the Global Trade Pattern

Industry always plays an important role in the development of the Russian economy [4]. Its main industrial sectors are based on Russia's abundant resources. Russia's coal, oil, and natural gas reserves are among the best in the world. Its coal reserves account for 12% of the world's total reserves, and its coal varieties are complete. Russia is one of the countries with the richest oil resources in the world and the third largest oil producer in the world [4]. At the same time, Russia is also the country with the longest natural gas pipeline and the largest export volume in the world, and is known as the "Kingdom of Natural Gas" [4].

Russia supplies about 11% of the world's oil and 19% of its natural gas and is also an important energy supplier to Europe [5]. According to the United States, the number of European countries importing coal from the Russian Federation in 2022 will account for 75.67% of the total number of countries [5]. Europe is also highly dependent on Russian natural gas and oil [5]. In addition, Russia also exports electricity to the CIS, China, Mongolia and other countries. This shows that Russia plays an important role in the global economy and is a major supplier to many commodity markets.

3. Sanctions Strategies of the United States and EU Countries Against Russia

U.S. sanctions against Russia began with the 2012 Magnitsky Act by the U.S. Congress, which mainly punished Russian officials responsible for the 2009 arrest of Magnitsky's lawyers at the Moscow Sailor Night detention center, banning them from entering the United States and using the U.S. banking system. It is also a human rights bill that was later promoted globally in 2014.

In 2014, Russia occupied Crimea and planned a "referendum on joining Russia". In order to get Russia to return Crimea to Ukraine, the United States, together with the European Union, Canada, and other countries, imposed more severe sanctions on Russian individuals and companies. This includes visa restrictions and property freezing for Russia's major economic oligarchs, relevant government officials, Russian officials and military officers involved in the occupation of Crimea, and local pro-Russian officials in Crimea. It also prohibits large Russian state-owned enterprises, commercial enterprises owned by some oligarchs, military-industrial enterprises from conducting various financing and investment businesses from the international financial market; prohibits them from obtaining relevant technology and equipment from the West; and carries out necessary suppression on Russia's arms exports. In particular, the "Countering America's Enemies with Sanctions Act" introduced by the United States uses secondary sanctions to force companies and individuals in other countries to be unable to purchase Russian equipment.

In February 2022, after Ukraine launched a special military operation, Russia came under unprecedented sanctions pressure from Western countries. The main purpose of the multiple sanctions imposed on Russia by the United Kingdom, the United States, Europe, Australia, Canada, Japan and other countries is to restrict Russia's funds, and the effect is also significant: half of Russia's foreign exchange reserves, worth a total of US\$350 billion, have been frozen [6]. The EU also said that about

70% of the assets of Russian banks have been frozen [6]. In addition, sanctions include but are not limited to the implementation of export controls and import restrictions: prohibiting the export of weapons manufacturing technology to Russia, prohibiting the import of oil and natural gas from Russia, etc. Trade restrictions also include imposing price ceilings on Russian oil, banning shipping routes, and sanctioning any wealthy businessmen with ties to Russian authorities. To this day, the United Kingdom, the United States, and the European Union are still imposing new sanctions on Russia, mainly around boycotts of companies: suspending or reducing the operations of foreign companies in Russia, even in areas that are not subject to sanctions [6].

4. Impact on Major International Energy Products

The mutual sanctions between Western countries and Russia, as well as Europe's difficult energy "de-Russianization", have brought the global energy trade pattern into a period of deep adjustment. Before the military conflict between Russia and Ukraine, Russia was the world's largest energy exporter, but the conflict caused huge fluctuations in the export volume and price of Russia's main energy products.

4.1. Oil and natural gas

Table 1. Ranking of Russia's major oil exporters in 2021

CmdDesc	Period	ReporterDesc	FlowDesc	PartnerDesc	Qty	QtyUnitAbbr
Petroleum oils and oils obtained from bituminous minerals; crude	2021	Russian Federation	Export	European Union	108115759875	kg
Petroleum oils and oils obtained from bituminous minerals; crude	2021	Russian Federation	Export	China	71018796790	kg
Petroleum oils and oils obtained from bituminous minerals; crude	2021	Russian Federation	Export	Belarus	15621834300	kg
Petroleum oils and oils obtained from bituminous minerals; crude	2021	Russian Federation	Export	Rep. of Korea	13544972050	kg
Petroleum oils and oils obtained from bituminous minerals; crude	2022	Russian Federation	Export	USA	7366718463	kg

Source: UN Comtrade Database

Table 2. Ranking of Russia's major natural gas exporters in 2021

CmdDesc	Period	ReporterDesc	FlowDesc	PartnerDesc	Qty	QtyUnitAbbr
Petroleum gases and other gaseous hydrocarbons	2021	Russian Federation	Export	European Union	4450774360	kg
Petroleum gases and other gaseous hydrocarbons	2021	Russian Federation	Export	Japan	5758050300	kg
Petroleum gases and other gaseous hydrocarbons	2021	Russian Federation	Export	China	5059124730	kg
Petroleum gases and other gaseous hydrocarbons	2021	Russian Federation	Export	United Kingdom	2585741860	kg
Petroleum gases and other gaseous hydrocarbons	2022	Russian Federation	Export	Rep. of Korea	1865032500	kg

Source: UN Comtrade Database

As shown in table 1, judging from Russia's crude oil export rankings in 2021, the European Union, China, Belarus, South Korea, and the United States are the main exporting countries of Russian crude

oil. As shown in table 2, the European Union, Japan, China, the United Kingdom, and South Korea are the main exporting countries of Russian natural gas. The implementation of sanctions by European countries and the United States, Japan, and South Korea will narrow Russian oil and natural gas export channels and affect Russian oil and natural gas exports. The Center for Energy and Clean Air Research, an independent Finnish think tank, released a report stating that Russia is losing approximately 160 million euros per day after the EU's ban and price limit on Russian shipping crude oil. Russia is also gradually adjusting production and reducing output in the face of declining market demand and the implementation of counter-sanctions. According to BP data, Russia's oil production is about 1.3 million barrels per day lower than the 2022 forecast [7]. Considering that Russia's annual oil production accounts for nearly 13% of the world's total production, it also has the world's largest natural gas reserves and contributes about 17% to global production, the reduction in Russia's oil and natural gas supply is of great significance to the market. It is undoubtedly a big impact, and it is reasonable for the spread of panic to stimulate uncontrolled rises in oil and natural gas prices. For Europe, which has a high dependence on Russian natural gas exports and is highly sensitive to natural gas prices, it is inevitable that European natural gas prices will fluctuate due to the geopolitical conflict between Russia and Ukraine.

In the event of geopolitical conflict, crude oil supplies can be disrupted. According to the International Monetary Fund (IMF) price change percentage, the Russia-Ukraine war caused WTI crude oil prices to increase by 70.72% and Brent crude oil prices by 73.36% during the event window. During a period of historically low inventory levels, the impact of inventory depletion will intensify, causing oil prices to continue to rise [8]. The same is true for natural gas prices. It is expected that there will be no more major new global natural gas supplies in the short term. Therefore, the European market and the Asian market need to compete for limited natural gas resources, resulting in fluctuations in natural gas prices.

4.2. Coal and Electricity

Rising natural gas prices and overall weak nuclear and hydropower production following the Russia-Ukraine conflict in 2022 further support the shift to coal-fired power generation [9]. At the same time, under the sanctions against Russia, global coal flows will undergo major changes in 2022. Due to rail transport restrictions, all Russian supplies cannot be rerouted, leading to a global supply crunch. High-CV Newcastle free on board (FOB) and Amsterdam Rotterdam Antwerp (ARA) thermal coal prices surpassed USD 400/t several times in 2022. Newcastle and ARA prices first peaked just below USD 400/t at the beginning of March 2022 [8]. But at the end of 2022, rising coal prices and strong demand contributed to the strong balance sheets of coal mining companies. With the end of the La Niña phenomenon in Australia, a coal powerhouse, coal prices fell sharply, and the coal market gradually returned to a more recognized model: Recession in the US and EU, continued growth in Asia [9]. Declines in the United States and the European Union are thought to be caused by a combination of weak electricity demand and the expansion of renewable energy [9].

Table 3. Ranking of Russia's major coal exporters in 2021

CmdDesc	Period	ReporterDesc	FlowDesc	PartnerDesc	Qty	QtyUnitAbbr
Coal; briquettes, ovoids and similar solid fuels manufactured from coal	2021	Russian Federation	Export	European Union	48592083353	kg
Coal; briquettes, ovoids and similar solid fuels manufactured from coal	2021	Russian Federation	Export	China	43247231293	kg
Coal; briquettes, ovoids and similar solid fuels manufactured from coal	2021	Russian Federation	Export	Japan	21832679988	kg
Coal; briquettes, ovoids and similar solid fuels manufactured from coal	2021	Russian Federation	Export	Rep. of Korea	20025995680	kg

Source: UN Comtrade Database

At the same time, the European Union has implemented a ban on Russian coal from August 2022, and some Japanese and South Korean companies have also announced their intention to stop buying Russian coal. As shown in table 3, the main export targets of Russian coal in 2021 are the EU, China, Japan, South Korea, etc. Therefore, affected by Europe, Japan, South Korea and other countries, Russian coal has been facing discounts since March 2022. In response to sanctions, Russia has shifted its focus to Asia and increased exports to China. But it is worth noting that China's future demand for Russian coal needs to be studied as it pursues climate goals and mines domestic coal.

5. Russia's Response for Sanctions

Regarding personal sanctions, Russia has also adopted a series of "reciprocal" personal sanctions, including the expulsion of diplomats from unfriendly countries. In response to the depreciation of the ruble, the Putin government implemented strategies such as substantial interest rate increases, capital outflow controls, and forced foreign exchange settlement and sales to stabilize the financial market. At the same time, the Russian authorities stated that if Russian companies or individuals lack confidence in holding rubles, they can go to the bank to exchange for an equivalent amount of gold, thereby increasing public confidence. In response to trade restrictions, Russia has used the export of energy and energy products as a counterweight. It has implemented a ban on transactions with companies that supply and sell Russian natural gas in unfriendly countries, and a prohibition on setting price caps on direct or indirect use in contracts. foreign legal entities and individuals supply Russian oil and other strategies. This also provides Russia with room for policy adjustments in other areas.

At the same time, in response to the challenges of Western sanctions, the Russian energy industry seeks to formulate and implement long-term development plans, prioritize infrastructure construction, and diversify Russian energy exports to potential markets such as the east and south. At present, Russia has increased energy cooperation with China, India and other countries in the Asia-Pacific region by implementing friendly prices, and has also enhanced its influence in the Asia-Pacific market. This has made up for the lack of market share in the United States and Europe, and also helped Russia Integrate into the economic integration process of the Asia-Pacific region.

6. The Impact of Mutual Sanctions on Europe and the United States

As the implementers of sanctions and the targets of targeted countermeasures by Russia, Western countries have been more directly affected by the Russia-Ukraine conflict, especially in terms of trade. Europe has always been the largest market for Russian energy exports. Although calculations predict that the trade embargo on Russian energy exports and the embargo on European exports to Russia will have a smaller impact on Europe as a whole, compared with Western European countries, Bulgaria, Russia's former satellite countries such as Estonia and Latvia have been greatly affected, resulting in a decline in GDP. This could be explained by the presence of pipeline infrastructure between Russia's Eastern European neighbors that has historically prevented these economies from developing supply chain diversity [10]. The asymmetry of European countries' dependence on Russian energy will also pose greater challenges to the European integration process.

Although the overall impact of trade sanctions on Europe's GDP is expected to be small, the sharp increase in international oil prices triggered by economic sanctions has directly raised the price of natural gas and electricity in the EU, affecting the living and production costs of various countries. On March 9, 2023, international oil prices rose sharply, with European Brent crude oil prices exceeding US\$130/barrel and New York oil prices exceeding US\$125/barrel [2]. Natural gas prices in Europe also hit a record high, reaching 2,200 euros/thousand cubic meters [2]. As various energy companies within the EU withdraw from the Russian market, these companies urgently need to find alternative suppliers as soon as possible. This requires the EU to diversify its energy supply as soon

as possible and expand energy cooperation with the United States, the Middle East and other countries and regions. At the same time, it requires The EU to provide loans or grants subsidies, which means that the financial pressure on EU governments will further increase. In the long run, this will be more positive for the development of new energy fields in Europe.

As a major oil and gas exporter, the United States is mainly facing the problem of insufficient production. The daily production of U.S. crude oil in December 2021 was 11.57 million barrels, a decrease of 9% from February 2020. The American Petroleum Institute reported that its crude oil inventories fell by more than 6 million barrels in the latest week [2]. The U.S. oil and gas industry took the opportunity to ask the government to open more land and oceans for domestic drilling and relax controls on large companies' increased exploitation of fossil fuels. As the energy landscape changes, the EU and other countries will become more dependent on oil and gas supplies from the United States in the future, and the United States will use oil and gas supply as a strategic weight in its development of geopolitical relations [2].

7. Impact on Global New Energy Transformation

In October 2022, IEA Administrator Fatih Birol pointed out that the world has entered the first real energy crisis. This crisis may be a turning point in energy history and will accelerate the development of clean energy.

However, in the short term, the energy crisis caused by sanctions on Russia has directly led European countries such as the UK, Germany and France to "restart" coal power as a temporary measure, which is not conducive to promoting global climate measures such as The EU's carbon border adjustment initiative and the green energy phase. In addition, the high price of natural gas has caused power crises in many developing countries. For example, Pakistan has stated that it will no longer add coal power and will vigorously develop renewable energy power generation. However, because it cannot afford the cost of natural gas power generation, Pakistan has to continue to increase power generation. Use coal power.

IEA data shows that global coal consumption will hit a record high in 2022, with a year-on-year increase of 1.2%, exceeding 8 billion tons in a single year for the first time [9]. Coal production and power generation also reached record highs last year. Therefore, in the context of the Russia-Ukraine conflict, countries around the world should increase the diversification of energy supply, invest in renewable energy, reduce energy dependence on a single country, improve energy efficiency in construction, industry and other fields, and vigorously support the research of new energy technologies. develop.

8. Conclusion

This study shows that the Russia-Ukraine conflict has caused two-way policy sanctions and economic energy price fluctuations on the international energy landscape, which can be explained by the following facts. First of all, Russia is one of the world's largest energy suppliers and plays an important role in the export of oil, natural gas, coal, and electricity. The mutual sanctions between Western countries and Russia have not only caused a reduction in the export volume of Russia's main energy products and price discounts, causing fluctuations in the global energy market and motivating the formulation of policies for sustainable development in different regions. Achieving a secure energy supply and the development of new energy technologies in the context of the Russia-Ukraine conflict is a topic for every country. To a certain extent, this will help increase countries' experience in increasing the risk of geopolitical conflicts and promote the global new energy transition and the realization of climate goals.

However, due to the limitations and short-term nature of the available data, current research still questions whether the changes in the energy supply and demand pattern in Europe and even many regions around the world are permanent, and to what extent the Russia-Ukraine conflict will

accelerate the global energy shift from fossil fuels to renewable energy. The changes cannot be accurately analyzed. In addition, the implementation of policy measures introduced in the study may face resistance from certain stakeholders, which may also hinder or delay the implementation of these policies. The use of nonlinear models in the context of the Russia-Ukraine conflict may further expand research on energy fluctuations and policymaking. In addition, the analysis of the impact of sanctions can be expanded to specific sectors and be accurate to high-frequency data, such as intraday data.

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