

Analysis of the Game Between Russia and Ukraine

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Abstract: The game between Russia and Ukraine has received a great amount of attention following the escalation of the Russian-Ukrainian war in 2022. Russia and Ukraine have been in conflict and gaming throughout their history. By analyzing the relationship between Russia and Ukraine and a series of game behaviors, we can draw inspiration from the strategies and implications of the game, which are of reference value in many fields. The article shows the historical behavior of the Russian-Ukrainian game analyses the Russian-Ukrainian strategy using a simple game theoretical model and collates the implications of the outcome of the game. Based on the analysis of the Russian-Ukrainian game, the article suggests different recommendations for the countries. Different countries can choose the strategy with higher gains and lower losses according to the different recommendations. This research has important practical significance for the correct understanding of Russia-Ukraine political relations.

Keywords: Russia, Ukraine, game

1. Introduction

1.1. Research Background

The conflict between Russia and Ukraine has complex historical roots. The nuclear weapons issue, the Black Sea Fleet issue, the CIS issue and economic cooperation were all conflicts between Russia and Ukraine at the beginning of the Soviet Union's collapse [1-3]. After the collapse of the Soviet Union in 1991, Ukraine focused on enhancing its relations with NATO for a long time, an act that inevitably affected its relations with Russia. Because of its greater economic and energy dependence on Russia, Ukraine on the one hand did not turn the other cheek with Russia, but on the other hand did not give up seeking asylum in NATO. In order to appease Russia, Ukraine proposed the "NATO Eastward Expansion and Russian Security" [4].

The massive expansion of NATO to the east in 2004 directly touched Russia's political, military and economic interests. With NATO's borders directly on Russia's doorstep, Ukraine became the next target of NATO's eastward expansion. In order to escape from Russian control, Ukraine has shown a clear intention to move "westwards". In January 2008, Ukraine submitted its application for membership of NATO. This decision to join NATO inevitably touched on Russia's core interests and Russia protested strongly. If the Ukrainian side does not stop this behavior, Russia will tear up the Russian-Ukrainian Friendship Treaty [5].

In Russia's view, Ukraine is of vital importance to it and Russia will use every means to prevent Ukraine from leaning to the west, particularly through the close energy trade between Russia and Ukraine. Russia is trying to use its energy advantage to put pressure on the Ukrainian government to be cautious about the "olive branch" offered by the West.

1.2. Research Significance

Nowadays, countries are becoming increasingly interconnected. The conduct of the game between Russia and Ukraine influences important developments in the political, economic, national security spheres and many other fields throughout the world. By researching and analyzing the historical relationship between Russia and Ukraine in this article, as well as a series of game behaviors between Russia and Ukraine and other relevant countries. Each country can draw inspiration from the analysis of the Russian-Ukrainian game, which is an important reference for the future management of national relations, the maintenance of national security, the avoidance of related risks and the maintenance of economic stability.

2. The Russian-Ukrainian Game of Gas Trade

Ukraine is relatively poor in oil and gas resources and is a country with a high degree of external energy dependence, with gas in short supply, and has long imported most of its energy from Russia, on which it is heavily dependent. Ukraine is also a major transit country for Russian gas shipments, and it controls the core part of the Russian gas pipeline to Europe [6]. In times of good Russian-Ukrainian relations, Russia sells gas to Ukraine at below-market prices.

After 2004, however, relations between Russia and Ukraine became difficult and the two sides began to argue over the price of gas and the cost of transit, and on New Year's Day 2006, as negotiations between the two countries stalled, the Russian side cut off gas supplies to Ukraine, marking the first gas conflict between Russia and Ukraine. In 2008, the global financial crisis hit the world and the conflict between Russia and Ukraine broke out again. As a result of Ukraine's 'pro-Western' tendencies, tensions between the two countries and the global financial crisis, the Russians sought to gain greater economic benefit by increasing prices, and the Ukrainians responded by increasing transit fees. The two sides were at loggerheads and on 1 January 2009, Russia cut off gas deliveries to Ukraine for the second time. Ukraine countered by banning transit shipments of Russian gas. This decision led directly to gas shortages and power supply difficulties in several EU countries, triggering an "energy crisis" that spread throughout Europe. As a result of the EU's forced involvement and international pressure, an agreement was eventually reached between Russia and Ukraine through the EU's mediation. Ukraine agreed that Russia would continue to pay transit fees at a rate of US\$1.7 per thousand cubic Metres per 100 Kilometres. In 2014, in order to put pressure on the Ukrainian government to change its policy, Russia again cut off gas supplies to Ukraine and announced that it would only supply Ukraine after it had settled its gas arrears and paid an advance. The gas will be supplied only after Ukraine has settled its gas debts and paid in advance [5, 6].

Russia has long used its "energy" advantage as a "weapon" to control Ukraine, threatening it whenever it gets too close to the West. As Russia uses its energy resources to exert pressure on Ukraine, the country is becoming increasingly aware of the need to reduce its dependence on Russian energy for its future economic development. Ukraine has taken two main steps: diversifying its natural gas imports and seeking alternative sources of energy. As a result, Ukraine began negotiations with European energy companies, which resulted in a commitment by European energy companies to supply Ukraine with 8-10 billion cubic Metres of natural gas per year from the Czech Republic. While seeking to diversify its imports, Ukraine is also actively promoting the implementation of a project to build a liquefied gas terminal at the southern port of Odessa, with the

aim of storing more gas. Russia's cut-off of gas supplies to Ukraine has also had a negative impact on its own energy exports. In order to break away from its dependence on Ukraine for energy transit and to guarantee stable supplies to Europe, Russia is actively seeking to diversify its gas export channels by bypassing Ukraine and building new gas pipelines directly to Europe [6].

3. The Game of Great Powers in the Relationship Between Russia and Ukraine

The crisis in Ukraine is not only a game between Russia and Ukraine, but also a great power game between Russia and the United States. The geostrategic significance of Ukraine has changed dramatically in the face of NATO's continuous eastward expansion. Ukraine is the buffer zone between Russia and Europe and the US. For Russia, Ukraine has a very important geopolitical significance. If Ukraine joins the EU and becomes a member of NATO, NATO's military bases will directly touch Russia's borders, the entire western part of Russia will be under the scope of NATO military strikes, and Russia's national security interests will face a major threat. Therefore, from the point of view of national security, it is absolutely impossible for Russia to have no interference in the future path of development of Ukraine.

Ukraine is an important pawn for the United States in its geopolitical competition with Russia in Eurasia if it is to maintain its hegemony in the world. If it can control Ukraine within its own sphere of influence, it will be able to exert a great deal of control over Russia in the political and security spheres. Therefore, the Ukraine crisis is actually a geopolitical game between the US and Russia, with the US hoping to draw Ukraine in and play a role in isolating Russia [5].

Under the influence of the US and Russian forces, Ukraine has seen a number of protests against the government and apparent separatism. On 16 March 2014, a referendum on Crimea was held in the Crimea region. The final results of the referendum showed that 96.65% of voters approved of the return of Crimea to Russia, with only 2.51% opposing it. Russia then promptly signed the Treaty on the Accession of the Republic of Crimea to Russia, unilaterally recognizing Crimea's status as Russian and sending additional troops to Crimea, while also continuing to support the secession of Donbass [7]. The US, on the other hand, has continued to provide military assistance to the Ukrainian government. Since 2014, the US has committed over \$2.7 billion in military aid to Ukraine [8].

In this context, the Ukrainian government still hopes to join NATO. As a result of the measures taken by Ukraine to reduce its dependence on Russian energy, the Russian side is no longer playing the gas trade game with Ukraine as effectively as it could. Coupled with the strong support of the US for the Ukrainian side, Russia is no longer in control of the situation in Ukraine and Russia's national security interests are under significant threat.

4. A Simple Game Analysis of the Russian Attack on Ukraine

There is a historical inevitability to the Russian-Ukrainian conflict [9]. In the face of Ukraine's path to Westernization, and the ineffectiveness of Russia's security dialogues with the US and NATO, "military action" against Ukraine would be the best strategy for Russia. The following paper will analyze the Russian-Ukrainian strategy using a very simple game theory model.

Considered as a pure game theory, the players in the Russian-Ukrainian war are Russia and Ukraine. Since Russia will act according to the decisions made by Ukraine, it can be seen as a sequential game in which the players, Ukraine, choose their actions first and then Russia chooses theirs [10]. Russia has great military power and has a crushing advantage over Ukraine's military power. Statistics show that in 2020, Russia's military spending exceeds \$61.7 billion and Ukraine's military spending is \$5.99 billion [11, 12]. According to the 2022 data published by Global Firepower, Russia has a crushing advantage over Ukraine in terms of the number of soldiers in

service and the equipment of the air, land and sea forces [13]. In terms of air force equipment, Russia has 4,173 military aircraft, the second largest number in the world after the United States. Ukraine's military aircraft total 318, ranking 31st in the world. In terms of army equipment, Russia has the world's highest number of tanks, with 12,420 tanks; Ukraine ranks 13th globally, with 2,596 tanks. In terms of the number of armored vehicles, the gap between the two countries has narrowed slightly. Russia has 30,122 vehicles, ranking third globally; Ukraine 12,303, ranking sixth globally. In terms of naval equipment Russia has an overwhelming advantage. In terms of the total number of ships, including submarines and aircraft carriers, Russia has 605, ranking second in the world; Ukraine has only 38, ranking 53rd in the world [14]. If Russia were to go to war with Ukraine alone, the scales of war would fall absolutely to the Russian side.

Suppose that Russia now has the choice between "being tough - sending troops to war against Ukraine" and "holding back - not taking action". Before the war, Ukraine also has the choice of "being tough - pro-Western and remaining in NATO" and "holding back - pro-Russian government and renouncing NATO membership and preventing NATO's eastward expansion". If Ukraine chooses to "holding back and renouncing NATO membership", the benefits to Russia of "holding back" and keeping the peace are far greater than the benefits of fighting and incurring war damage and armament consumption. For Ukraine, on the other hand, it would lose a range of gains from NATO membership and gain more by remaining in NATO. If Ukraine chooses to 'being tough', the potential gains from fighting are expected to be greater for Russia than the gains from Ukraine joining NATO and NATO expanding eastwards as a result of concessions. And Ukraine would get the benefits of NATO membership.

From a purely game-model perspective, the eventual gains from Ukraine's abandonment of NATO membership are higher than the gains from its continued membership. Ukraine should have chosen to "back down and give up NATO membership", which would have avoided the bad outcome of war with Russia, but in fact Ukraine did not do so. Because reality is not like an ideal game theory model, Ukraine is hoping for realistic "externalities". The US and its NATO allies are not going to stand idly by and hope to limit Russia's power and continue to draw Ukraine into their own camp. As soon as Russia sends troops like Ukraine, all the other countries will turn on Russia, condemn Russia's actions, impose a series of sanctions on Russia's economy and support the Ukrainian battlefield.

The addition of externalities makes it less profitable for Russia to go to war against Ukraine. In such a scenario, if both Russia and Ukraine remain "tough", a war between Russia and Ukraine would result in external condemnation and sanctions against Russia, a severe economic impact, and resistance from the Ukrainian army, which has been greatly strengthened by the support of other countries. Ukraine would still be a battleground, with its people severely affected, depopulated and unable to operate effectively economically, and even with the help of other countries, it would still be difficult to resist the Russian side of the army. Both Russia and Ukraine would gain extremely poorly.

If both sides back down, then for Russia the aim of preventing NATO's eastward expansion may not be achieved, but the current situation is stable and free from sanctions and military losses, and for Ukraine the country has not become a battleground or received any benefits from the Western camp. If only one of the two sides were to back down, the other side between Russia and Ukraine would gain more.

As Russia is an important energy supplier to Europe, many European countries are unable to escape their dependence on energy imports from Russia. According to data, in 2021, 45% of gas, 25% of oil and 45% of coal imports by EU member states will come from Russia, and the EU will import energy resources from Russia worth €99 billion, generating huge revenues for Russia [15, 16]. So the economic sanctions imposed by the European countries in NATO cannot actually deal a

fatal blow to Russia. As a result, the externalities of the game between Russia and Ukraine did not affect Russia. Russia maintained a tough strategy and sent troops to Ukraine to wage war. With Russia's national security at stake, the gains from attacking Ukraine to ensure that NATO does not expand eastward remain the highest, even if external sanctions will be imposed.

5. The Impact of the Outcome of the Russia-Ukraine Game

The Russian-Ukrainian war has had a huge impact on the Russian economy. In the two months following the start of the "special military operation" in Russia, the US-led Western countries imposed a total of 7,374 sanctions on Russia [17]. The sanctions cover a wide range of areas including finance, technology, trade, energy, assets, transport, networks, culture and people. It includes restrictions on Russia's use of the US dollar, euro, pound and yen for trade settlements, restrictions on the Russian central bank's access to gold and foreign exchange reserves, the freezing of assets of major Russian banks to prevent them from borrowing and financing in the US and European markets, and the removal of selected Russian banks from the SWIFT system. The freezing of half of the Russian Central Bank's foreign exchange reserves within 72 hours, the ban on the use of funds subject to US jurisdiction to repay debts, and the suspension of US credit cards MasterCard and Visa from operating in Russia. Nearly 700 foreign companies in various industries have left or are leaving Russia, and several technology giant companies have announced the cessation of their Russian operations [18].

As the world's leading energy exporter, hydrocarbon revenues are the main source of Russia's foreign exchange and budgetary income and play a fundamental role in the economy. In the many rounds of confrontation with the US and the West, energy has always been the trump card in Russia's hands. After the escalation of the crisis in Ukraine, a comprehensive embargo on Russian energy became one of the central issues in the coordination of Western sanctions policy. Russia's oil and gas revenues will increase even if the volume of exports is reduced due to the dependence of EU countries on Russian energy and the increase in international energy prices as a result of the escalating crisis in Ukraine. In the two months since Russia's "special military operation" against Ukraine, Russia has received €63 billion in oil, gas and coal export revenues, of which €44 billion came from the EU, twice as much as in the same period in 2021, when EU oil and coal imports fell by 20 per cent and 40 per cent respectively. Higher energy prices offset or mitigated the revenue impact of lower volumes of Russian exports [19]. As a result of trade restrictions, financial sanctions and restricted logistics, Russia's foreign trade conditions have deteriorated significantly and overall trade volumes in 2022 will be below historically normal levels, with exports of goods and services likely to fall by 17-21% in real terms and imports by 32.5%-36.5%. The latest forecast by the Ministry of Economic Development suggests that Russia's GDP will fall by 8.8% to 12.4% in 2022 and that inflation could exceed 20% [20]. The latest forecast by the Ministry of Economic Development suggests that GDP will fall by 8.8-12.4% in 2022 and inflation could exceed 20% [21].

The latest forecast by the Central Bank of Russia in late April suggests that GDP will fall by 8-10% in 2022, with the lowest point of the recession occurring in the fourth quarter of 2022, when GDP will fall by 12.5% to 16.5% quarterly [22]. Against the backdrop of a significant decline in GDP, per capita income fell by 19% and poverty rebounded to 21% of the country's total population. Russia experienced significant inflation in 2022, but the impact on unemployment was relatively low [23].

It can be seen that the sanctions brought about by the war have had a considerable negative impact on the Russian economy. In order to respond effectively to the Western sanctions and to mitigate the impact and influence of the sanctions on the economy, Russia has introduced a series of countermeasures and countermeasures, including limiting capital outflows and capital flight,

stabilizing prices, stabilizing the banking and financial system, raising bank interest rates from 9.5% to 20%, issuing a "The Russian government has issued a decree on the settlement of natural gas in rubles, announcing that on 1 April gas purchases from unfriendly countries will only be settled in rubles" [18]. According to the Ministry of Economic Development's baseline forecast, the Russian economy will return to growth in 2023, with GDP growth of 1.3 per cent, and 4.6 per cent and 2.8 per cent in 2024-2025 respectively [24].

Ukraine, the main theatre of war, has been disproportionately affected. As of July 19, 2022, the special military operation has caused 9,567,000 people to leave Ukraine, and another 6.3 million are internally displaced in Ukraine, directly causing the largest refugee crisis in Europe since the end of World War II, and one of the largest refugee crises in the world since the 21st century [25-27]. In the aftermath of the Russian-Ukrainian conflict, nighttime lighting data show a sharp decline in nighttime lighting across Ukraine, with most provinces losing more than 60% of their nighttime lighting due to the war. The vast majority of provinces lost more than 50% of their night lighting after the outbreak of the Russo-Ukrainian conflict [28]. The ongoing conflict between Russia and Ukraine has left some 2.4 million hectares of crops, worth an estimated US\$1.435 billion, unharvested in Ukraine. Ukrainian officials say the country's agricultural sector has already suffered losses of nearly \$4.3 billion. The current blockade of Ukrainian ports by Russia has prevented 20 million tonnes of grain from being exported, and it is widely expected that Ukrainian food and oil production will be significantly reduced in 2022. According to the Institute of Agricultural Economics of Ukraine, 20 million tonnes of wheat are expected to be produced in 2022, a 37.5 per cent reduction on the same period last year; 30 million tonnes of maize, a 23 per cent reduction on the same period last year; and 10.5 million tonnes of sunflower, a 36 per cent reduction on last year [29]. Inflation and unemployment rates in Ukraine soar in 2022 [30]. The World Bank expects Ukraine's economy to shrink by 45.1% this year [31].

The escalation of the conflict between Russia and Ukraine, which are major global energy and food suppliers, will lead to increasing tensions in the international energy and food markets and higher prices for crude oil, natural gas, agricultural products, gold, etc. In the energy sector, the Russia-Ukraine conflict has led to a spike in global energy prices [32]. Commodity prices have shifted dramatically since the outbreak of the Russia-Ukraine conflict, with food fluctuating particularly sharply. 28% increase in international wheat prices between 10 February and 1 April 2022, and FAO forecasts that future global food prices will surge by 8-20% from current levels [33].

Before the outbreak of the Russian-Ukrainian conflict, the price of Brent crude oil was basically stable between US\$85 and US\$100, but after the outbreak of the conflict, the price of crude oil rose continuously, with the price of Brent crude oil exceeding US\$110 per barrel and even US\$130 per barrel; the price of natural gas in Europe also soared from around €70 per MWh to over €130 per MWh and even exceeded €200 per MWh at one point [34].

After the outbreak of the conflict between Russia and Ukraine, the average prices of various metals have increased to different degrees, with the average price of nickel increasing the most, by about 63%; followed by the average price of palladium, which increased by more than 34%; the average price of platinum and gold increased by about 9%; and the prices of other metal minerals also showed an increase [32]. The Russia-Ukraine conflict is dragging down the international economy, affecting economic growth rates and leading to global inflation. At present, the World Bank, IMF and other authoritative financial institutions have lowered the growth rate to around 2%. The outlook for economic growth rates is not good. Recent figures for the UK show that its inflation rate has reached 10% [35].

6. Suggestion

For Russia, it is important for Russia to first ensure that political objectives are met, to force Ukraine to abandon its membership in NATO, and to prevent possible future violations of national security. For Russia, which has now waged war and is under sanctions, Russia should now maintain a tough attitude, remain belligerent towards Ukraine, demonstrate its determination not to allow Ukraine to join NATO, and do its best to prevent Ukraine from joining NATO in order to get good gains. Secondly, economically, we should prepare for a long-term confrontation with the NATO countries. Economically it is important to lay out a long-term response to sanctions, get rid of energy dependency, keep pushing to de-dollarize the economy and move offshore overseas assets back home as early as possible. For Ukraine, the most profitable approach now would be to negotiate with Russia as soon as possible and broker peace talks. Give up the war with Russia and commit to not joining NATO. Get the war over with as soon as possible and carry out post-war reconstruction work to restore normal life for the people and resume food export trade and routes. Solve the problem of population loss and productive work. For the rest of the world, other countries should push for the war between Russia and Ukraine to end as soon as possible, increase trade with Russia and Ukraine, and ensure order in international markets. Stabilize prices and deal with global inflation and the economic crisis that it may bring. Each country should diversify its energy supply as soon as possible to prevent sanctions and threats from other countries using energy resources.

7. Conclusion

There has always been conflict and gamesmanship between Russia and Ukraine in history. This has been of particular concern since the expansion of the Russo-Ukrainian war in 2022. This paper reviews the historical relationship between Russia and Ukraine and the game between the two countries, including the initial behavior of Russia and Ukraine and the treaties signed between them, the gas trade game initiated by Russia after the Russian-Ukrainian relations deteriorated, and the geopolitical game between Russia and the US with NATO that existed between Russia and Ukraine. This paper also uses a simple game theory model to analyze the historical inevitability of the escalation of the Russo-Ukrainian war and to sort out the implications for Russia, Ukraine and the rest of the world respectively after the escalation of the Russo-Ukrainian war. Based on the analysis of the Russian-Ukrainian game, this paper makes recommendations to the respective countries. The countries can choose the strategy with higher gains and lower losses based on the different recommendations. Each country can draw inspiration from the analysis of the Russian-Ukrainian game, which can be an important reference for the management of national relations, the maintenance of national security and the maintenance of economic stability.

There are still many shortcomings in this paper. One important point is that the paper only uses simple game theoretical models that are easy to understand, and does not use complex data to build more accurate models. Furthermore, the references in this paper are not extensive enough and the accuracy of the data cannot be guaranteed because it is about a war between countries that has not yet been completed. In the future, we should continue to monitor and analyze the Russian-Ukrainian game. If the war is over and a more accurate data sample is available, attempts can be made to build more complex and accurate game theory models.

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