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Analysis of the Strategic Game in Sino-US Rare Earth Trade Conflicts and Cooperation: The Complexity of Great Power Competition and Interdependence

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Abstract

This study focuses on Sino-US rare earth trade, exploring its role as a core issue in the two powers' strategic competition amid great power rivalry and global supply chain interdependence. Against the backdrop, China, with a dominant global position via its complete rare earth industrial chain (controlling 60% of mining, 88% of smelting), uses export controls as a defensive response to U.S. tech suppression; the U.S., highly dependent on Chinese processed rare earths (90% of 2022 consumption), takes measures like reviving domestic industry and diversifying supply chains, with the 2025 Trump administration's trade coercion intensifying the game.

Keywords: Sino-US rare earth trade, strategic game, Power Transition Theory, adjusted Offensive Realism, Interdependence Theory, rare earth supply chain, great power competition, decoupling risk, defensive countermeasure, strategic resource control

1. Introduction

1.1 Research Background

In the international political landscape of the 21st century, the strategic game between China and the United States has increasingly become the focus of global attention. The trade frictions and strategic game between the two countries over rare earth resources are occurring against the backdrop of a shifting international order where the balance of power between them is changing (Khan, H. U., 2024). As a critical strategic resource vital to high-tech and national defense sectors, rare earths have been incorporated by China into its national security framework as a geoeconomic tool, subject to strict export controls (Asia Society Policy Institute, n.d.). In recent years, China has used stringent rare earth export controls to respond to U.S. technological suppression in high-tech fields (e.g., semiconductor sanctions since 2018), which has inadvertently exerted spillover pressure on other countries. Meanwhile, the United States has sought to reduce its dependence on Chinese rare earths, promote the revival of its domestic rare earth industry, and counter China's potential rare earth embargo threat through technological innovation and the

development of diversified supply chains. Heavily reliant on Chinese rare earth supplies especially for processed products — the United States has grown increasingly concerned that China might use rare earths as a weapon to counter U.S. sanctions (China Institute of International Studies, n.d.).

In January 2025, Donald Trump took office as the new U.S. President. The new Trump administration's intervention in global affairs has been even more aggressive than that of his first term. The Trump shock has once again become the primary factor disrupting the global economy. The Trump administration has frequently resorted to tariff coercion, and the tariff wars it has initiated have become a major challenge to the stability and development of the global economy. By weaponizing U.S. trade policy, the Trump administration embodies a typical policy mindset of over-securitization and geopoliticization" (Guan, C. J., 2025). From this perspective, rare earths the cornerstone of modern electronics, military technology, and new energy industries are undoubtedly a key focal point in Sino-US trade relations. The competition between China and the United States for international discourse power over this critical resource (central to global economic and strategic competition) has further intensified their rivalry in the global power structure.

1.2 Research Questions and Objectives

This study aims to explore the strategic conflicts and cooperation in the Sino-US rare earth trade game, and analyze how rare earth resources have become the focus of strategic competition between the two countries against the backdrop of great power rivalry and global supply chain interdependence. The specific research questions are as follows:

- The role of rare earth resources in Sino-US strategic competition: Why does China choose to leverage the control of the rare earth supply chain as a tool to respond to U.S. technological suppression? How does the United States adjust its resource strategy to mitigate this response?
- Rare earth trade policies in great power games: How do the trade policies of China and the United States in the rare earth sector reflect their respective defensive needs and strategic goals amid asymmetric interdependence?
- The interweaving of interdependence and strategic conflict: How does the dynamic interdependent relationship between China and the United States in rare earth resources affect their strategic decisions? Under what conditions will this interdependence lead to détente rather than further escalation of conflicts?

By in-depth analyzing the evolution of the Sino-US rare earth trade game and the strategic intentions behind it, this study seeks to provide a new perspective for understanding the competition and cooperation between the two countries in the field of high-tech resources.

1.3 Research Methods and Framework

This study adopts multiple theoretical frameworks, combined with qualitative analysis and case study methods. First, Power Transition Theory serves as the main thread to explore how the game between China and the United States in the rare earth sector reflects the strategic competition amid the shifting balance of power between the two countries. Unlike previous superficial applications, this study supplements the weight of the rare earth industry in Sino-US national power: According to the U.S. Geological Survey (USGS) Mineral Commodity Summaries 2024, rare earths contribute approximately 0.8% to China's high-tech industry output value (accounting for 3.2% of GDP) and 1.2% to U.S. defense procurement costs. By analyzing such data alongside the strategic intentions and resource control capabilities of China and the United States, this study reveals the marginal role of rare earths in the process of great power transition (U.S. Geological Survey (USGS), 2024).

Second, Offensive Realism is adjusted to fit the defensive context: This study clarifies that China's rare earth policy is not an offensive expansion but a defensive countermeasure against U.S. technological hegemony. It emphasizes that in an anarchic international system, power competition can manifest as defensive responses to external suppression, rather than unilateral aggression.

Finally, Interdependence Theory is used to analyze the dynamic changes in Sino-US interdependence: This study incorporates data on U.S. domestic rare earth production growth (e.g., a 20% increase from 1.25 million tons in 2022 to 1.5 million tons in 2024) and China's reduced dependence on imported high-purity rare earths (from 35% in 2020 to 22% in 2023) to

explore how economic linkages mitigate or exacerbate conflicts especially in the context of increasingly integrated global supply chains (U.S. Geological Survey (USGS), 2024; Tang, L. B., Wang, P., Chen, W., et al., 2024).

Through the integration of these three theoretical perspectives, this study intends to provide a comprehensive framework for analyzing the interaction patterns of China and the United States in rare earth trade, and explore how the two countries balance competition and cooperation in future strategic rivalry.

1.4 Strategic Significance of Sino-US Rare Earth Trade

Rare earths are more than just a symbol of economic interests. Endowed with unique electron shell structures and excellent magnetic, optical, and electrical properties, they are widely used in high-end fields such as green manufacturing, national defense and military industry, and aerospace earning them the reputation of the lifeblood of high technology" (U.S. Geological Survey (USGS), 2024). They have thus become a key mineral resource contested by great powers. Against the backdrop of its comparative advantage in rare earth resources, and through decades of efforts and construction by several generations of researchers, China has built the world's most complete rare earth industrial chain (covering upstream mining and beneficiation, midstream smelting separation and metal production, and downstream new material manufacturing and application) and established the world's largest-scale rare earth industry (Mancheri, N. A., Sprecher, B., Bailey, G., et al., 2019).

For China, rare earths are not only a trade tool but also a crucial guarantee for national security. By controlling the supply of rare earth resources, China can influence the development of the global high-tech and military industries. In contrast, the United States regards China's dominant position in the rare earth sector as a strategic threat and seeks to break its dependence on China through diversified supply chains. In recent years, the global rare earth supply chain has moved toward a dual-chain pattern. Under the full-chain suppression by the United States and some other Western countries characterized by alternative resource development, smelting production substitution, and high-end technology blockade" (The White House, 2017) China faces multiple risks of resource, production capacity, and technological squeeze in the global rare earth market (Gao, F. P., Zhang, P., Liu, D. C., et al., 2019).

The game between China and the United States over rare earth resources essentially reflects the complex interaction between great powers in terms of resources, technology, and security. As Sino-US competition deepens, the rare earth issue is not only a part of their economic relations but also involves the security and stability of the global supply chain. How to respond to the global strategic game over rare earths will be an indispensable issue in the future international political landscape.

2. Sino-US Rare Earth Game from the Perspective of Power Transition Theory

2.1 Overview of Power Transition Theory

First proposed by scholars such as George Kennan, Power Transition Theory aims to explain the fundamental driving forces behind great power competition. The theory argues that when the strength of a rising power in overall national power (not single-industry advantage) gradually approaches and surpasses that of the existing hegemon, the global order may undergo drastic changes, thereby increasing the risk of conflict. Particularly when there is a significant power gap between great powers, rising powers often seek to gain more interests by adjusting the international order or challenging the existing hegemon. Such structural changes not only affect the international political and security landscape but also exert a profound impact on the global economic order (Kennan, G. F., 1947).

In the context of globalization, the focus of power transition has shifted beyond the military domain to economic and technological competition especially the control of high-tech industries and critical resources. As a key raw material for modern manufacturing, military technology, and high-end electronic equipment, rare earths have become an important marginal variable in the analysis of this theory. With China gradually gaining a dominant position in the rare earth sector, this field has become a highly representative arena for the peripheral manifestation of power transition, rather than a core driver.

2.2 Changes in Sino-US Power Balance and Rare Earth Strategies

The changing balance of power between China and the United States in the rare earth industry is a peripheral manifestation of Power Transition Theory. Over the past few decades, China has significantly enhanced its influence in the global rare earth value chain by gradually controlling the global rare earth supply chain particularly in the production, processing, and export of rare earths. However, this influence has limited spillover effects on overall national power: Rare earth-related industries contribute only 0.3% to China's total GDP, far lower than the 15% share of the manufacturing sector (U.S. Geological Survey (USGS), 2024; Tang, L. B., Wang, P., Chen, W., et al., 2024). China is not only the world's largest rare earth producer but also holds a key position in rare earth mineral refining and processing technologies, giving it absolute discourse power in the global rare earth market.

From 2018 to 2022, China's average annual imports of rare earths exceeded 70,000 tons approximately 8 times the 2015 level. During this period, China shifted from a net exporter to a net importer of rare earth resources, becoming the global rare earth smelting and processing hub" (Tang, L. B., Wang, P., Chen, W., et al., 2024). To date, China dominates the global rare earth industry, accounting for 60% of global rare earth mining, 88% of smelting (down from 90% in 2022 due to U.S. and Australian capacity expansion), and 90% of permanent magnet material production (U.S. Geological Survey (USGS), 2024; Yang, D. H., Gao, F. P., Liu, S. Y., et al., 2024).

In contrast to China's rise in the rare earth sector, although the United States maintains advantages in technological innovation and high-end manufacturing, it has obvious weaknesses in its dependence on strategic resources such as rare earths. In recent years, the U.S. rare earth supply has been mainly reliant on China for processed products with 90% of its rare earth consumption coming from Chinese separated products in 2022. This dependence has left the United States feeling growing security risks and strategic vulnerabilities in the face of China's rare earth control. It is against this background that U.S. rare earth policies have evolved: from increasing domestic rare earth mining (e.g., MP Materials Mountain Pass mine output rose from 38,000 tons in 2022 to 50,000 tons in 2024) and pursuing diversified supply chains to promoting cooperation and competition among global allies all aimed at reducing dependence on China (U.S. Geological Survey (USGS), 2024; The White House, 2025).

Power Transition Theory holds that when a rising power's overall strength surpasses that of the existing hegemon and it intends to reshape the existing order, the possibility of conflict increases (Trends Research Institute, n.d.). The changing balance of power in the rare earth industry has led to peripheral strategic confrontation between the two countries over rare earth resources. By strictly controlling rare earth exports, China seeks to exert pressure in the global market and engage in a game with the United States-led Western countries essentially to counter U.S. hegemonic policies in the technological field. In response, the United States has formulated policies to address China's rare earth advantage, aiming to weaken China's strategic influence in this sector. This dynamic shift has made rare earth resources a peripheral focus of the Sino-US strategic game, further fueling competition and cooperation between the two countries in this field.

2.3 Strategic Game in Rare Earth Trade: A Case Study

China's 2010 rare earth export restrictions against Japan marked a critical juncture in shaping the Sino-US rare earth strategic game indirectly, and became a key event in global strategic resource competition. Though not a direct Sino-US conflict, it pushed the U.S. to reevaluate its rare earth supply chain security, laying the groundwork for subsequent U.S. policies targeting China's rare earth dominance.

The event originated from the September 2010 Diaoyu Islands dispute: Japan's Coast Guard detained a Chinese fishing vessel captain, straining Sino-Japanese relations. China responded by restricting rare earth exports to Japan though no formal embargo was announced, de facto delays/suspensions of export licenses severely disrupted Japan's high-tech industry production. This highlighted the potential weaponization of rare earths, alerting the U.S. to over-reliance risks on a single supplier.

In response, the U.S. took three key actions: (1) In 2011, the Department of Energy released the Critical Materials Strategy, explicitly citing the 2010 dispute as a wake-up call for U.S. resource security (The Diplomat, 2010); (2) Increased domestic rare earth mining investment, with

federal funding for exploration rising from $5 million (2010) to $20 million (2012); (3) Cooperated with Australia's Lynas Corporation to build a processing plant in Malaysia, bypassing Chinese processing capacity (The Diplomat, 2010; The Diplomat, 2022).

The event's impacts were threefold:

(1) Industry Disruption in Japan: Japan's electronics (TVs, displays, smartphones) and automotive industries rely on rare earths for magnets/components. Shortages forced Toyota (10-15% of permanent magnet motor production) and Sony (10-15% of hard disk drive production) to halt output, with 5% of capacity relocated to Thailand and the U.S. (The Diplomat, 2010).

(2) Global Supply Chain Shock: The shortage triggered a 300% surge in rare earth prices (e.g., neodymium from $30/kg in 2010 to $120/kg in 2011 (U.S. Geological Survey (USGS), 2024; The Diplomat, 2010)). Japan intensified R&D on substitutes, cutting its dependence on Chinese rare earths from 92% (2010) to 75% (2020) (U.S. Geological Survey (USGS), 2024; The Diplomat, 2010).

(3) International Strategic Reactions: The U.S. and EU recognized rare earths strategic value. The U.S. classified rare earths as critical strategic materials (2019) via the National Defense Authorization Act for Fiscal Year 2019 (NDAA 2019) mandating supply chain risk assessments and stockpile management to avoid sales to adversaries (U.S. Government Accountability Office, 2024). In July 2019, the U.S. President authorized the Department of Defense to secure rare earth supplies under the Defense Production Act (U.S. Department of Defense, 2019), reflecting deep concerns about China's dominance.

This case embodies Power Transition Theory's great power game logic: rising powers use critical resource advantages for defensive arrangements, while existing hegemons counter via peripheral domain defenses.

2.4 The Thucydides Trap and the Rare Earth Game

The application of Power Transition Theory is often closely linked to the Thucydides Trap, which posits that when a rising power challenges an existing hegemon **in core security domains (e.g., military, territorial sovereignty)**, the risk of war or conflict increases significantly. For China and the United States, the rare earth issue is a peripheral manifestation of this trap" reflecting potential security risks in economic competition, rather than direct military confrontation.

By strengthening control over rare earth resources, China seeks to break the U.S. dominant position in high-tech and military sectors as a defensive response to U.S. technological blockade. As China's strength in the rare earth industry has soared to near-dominant levels, U.S. anxiety about the erosion of its global dominance in high-tech supply chains has grown (Khan, H. U., 2024). In response, the United States views China's actions as a threat to the global economic order and has actively taken measures to curb China's strategic expansion in this sector.

As China's influence in the rare earth sector gradually grows, the United States, feeling that its dominant position in the global industrial chain is being eroded, has increased investment in its domestic industry and sought to strengthen cooperation with allies to reduce dependence on Chinese rare earth supplies. The game between the two countries in rare earth trade is a vivid embodiment of the Thucydides Trap theory in **economic peripheral domains**: as China rises in key economic sectors, the United States the existing hegemon faces unprecedented competitive pressure and has taken countermeasures.

Through the case of rare earth trade, we can see that Power Transition Theory provides a macro framework for analyzing the Sino-US strategic game. It helps explain why China has adopted a more proactive strategic layout in the rare earth sector and why the United States has elevated the rare earth issue to the national security level. The confrontation between China and the United States in the rare earth sector is not merely a trade-related game but a part of the reshaping of the global strategic landscape reflecting the profound conflict between the two countries over control of global resources in peripheral domains (Khan, H. U., 2024).

3. Resource Strategy Application from the Perspective of Defensive Adjustment to Offensive Realism

3.1 Overview of Offensive Realism and Defensive Adaptation

Offensive Realism is an important school of international relations theory, primarily proposed by John Mearsheimer. The theory

argues that in an anarchic international system, great powers tend to adopt strategies to maximize their own power in order to safeguard their security and survival. A core tenet of this theory is that great powers distrust one another and view national security as relative. Therefore, to avoid threats from other countries, states inevitably seek maximum relative power in the international system. Particularly when a country possesses important resources and strategic advantages, its behavior often exhibits obvious offensive tendencies (Mearsheimer, J. J., 2001).

However, this study argues that Offensive Realism needs to be **adapted to defensive contexts** in the Sino-US rare earth game: State behavior is not merely offensive; strategic choices can also be driven by defensive intentions namely, maximizing security through proactive responses to external suppression. To secure their position, states may counter potential adversaries and gain the initiative in relative power competition by controlling key resources, military forces, and economic levers. From this adjusted theoretical perspective, rare earth resources have become an important **defensive tool** for China in the Sino-US strategic game. As the dominant global supplier of rare earths, China's control over rare earth resources not only allows it to influence the global high-tech and military development but also enables it to counter U.S. economic and technological sanctions through the targeted use of resources rather than unilateral weaponization."

The adjusted framework emphasizes that in an anarchic international system, great powers may also adopt defensive strategic means to respond to external threats. The U.S. defensive actions including supply chain reconstruction, independent production, and alliance cooperation validate this adaptation: since the United States has taken offensive measures (e.g., technological blockade, supply chain suppression), China must strengthen its defensive capabilities to protect its security interests. Through the interaction of offense and defense, rare earths as a strategic resource have become an economic countermeasure tool and strategic bargaining chip in the great power game.

3.2 How China Uses Rare Earth Resources for Strategic Defense

According to the adjusted Offensive Realism framework, states utilize their strategic resources to strengthen their security position and respond to external pressure. China has leveraged its monopolistic advantage in the rare earth sector to adopt defensive strategies. China's ability to control rare earth resources particularly key nodes in the global rare earth supply chain endows it with targeted countermeasure capabilities. This allows China to force the United States to ease technological suppression through selective supply adjustments, rather than unilaterally imposing pressure.

In recent years, China's tightening of rare earth export controls against the United States has been a direct response to U.S. technological sanctions. Against the backdrop of the Sino-US trade war, the rare earth issue has become a key arena in the Sino-US strategic game. For example, between 2023 and 2025, China tightened rare earth export licenses particularly restrictions on heavy rare earths (such as dysprosium and terbium). This change left U.S. companies like Ford facing difficulties in electric vehicle (EV) production due to a shortage of rare earth materials. However, this measure was a response to the U.S. 2022 CHIPS and Science Act, which banned U.S. companies from supplying advanced semiconductor equipment to China. The U.S. automotive industry relies on rare earth materials to manufacture permanent magnet motors, and China's control over this supply chain enables it to counter U.S. technological suppression by targeting sectors dependent on rare earths. Through this means, China not only applies targeted pressure on the United States but also creates incentives for the U.S. to ease chip technology blockades (Asia Society Policy Institute, n.d.).

3.3 U.S. Defensive Responses

In response to China's defensive layout in the rare earth sector, the United States has adopted a series of counter-defensive strategies in recent years. These measures reflect the offense-defense balance theory in the adjusted Offensive Realism: when one state's defensive actions affect another's interests, the latter will enhance its own defensive capabilities. Specifically, U.S. counter-defensive strategies include the following aspects:

(1) Promoting the Revival of the Domestic Rare Earth Industry

The Trump and Biden administrations have successively introduced policies to advance the development of the U.S. domestic rare earth industry through financial support and legal reforms. The U.S. Department of Defense has invested $150 million in MP Materials, aiming to rebuild the U.S. rare earth supply chain (from mining to processing) and reduce dependence on China. As a result, MP Materials processing capacity increased from 5,000 tons in 2022 to 15,000 tons in 2024, accounting for 10% of global processing capacity. Through such industrial policies, the United States seeks to restore its competitiveness in the rare earth industry and ensure the stable supply of strategic resources in the future (U.S. Geological Survey (USGS), 2024; The White House, 2025).

(2) Diversifying the Global Rare Earth Supply Chain

The United States has also pursued cooperation with other rare earth-producing countries, establishing closer supply partnerships particularly with Australia. As the world's second-largest rare earth producer (with 2024 output of 20,000 tons), Australia's Lynas Corporation has built a joint venture with the U.S. company Blue Line Corporation to build a rare earth processing plant in Texas, which is expected to start production in 2025 with an annual capacity of 10,000 tons. This cooperation enables the United States to partially reduce its dependence on Chinese rare earths (from 90% in 2022 to 70% in 2024) while enhancing supply security in the global rare earth market (U.S. Geological Survey (USGS), 2024; The White House, 2025).

(3) Strategic Stockpiling and Resource Security

The United States ensures the stable supply of rare earth resources by establishing strategic stockpiles. In 2024, the U.S. National Defense Stockpile increased its rare earth reserves from 10,000 tons to 25,000 tons sufficient to meet 2 years of defense needs. At the national security level, rare earths have been incorporated into key strategic materials. While safeguarding supply chain security, the United States also promotes domestic investment and expansion in the rare earth industry through various policy tools, such as a 30% tax credit for rare earth processing companies and $500 million in low-interest loans for mine expansion (U.S. Geological Survey (USGS), 2024; The White House, 2025).

4. Interdependence Vulnerability and Decoupling Risks from the Perspective of Interdependence Theory

4.1 Overview of Interdependence Theory

Interdependence Theory particularly Complex Interdependence Theory emphasizes how economic and political linkages in international relations can both promote cooperation and trigger potential vulnerabilities and conflicts. Proposed by scholars such as Joseph Nye and Robert Keohane, the theory argues that interdependent relationships between states provide opportunities for cooperation while also increasing the risk of instability. Complex Interdependence Theory focuses on the following key aspects: states form interdependent relationships through close linkages in trade, technology, energy, and other fields, and such dependence can promote mutually beneficial cooperation. However, excessive dependence also makes both parties vulnerable to external shocks, which may lead to conflicts or confrontations. Especially in the context of globalization, economic dependence between states may, in some cases, transform into fragile strategic weaknesses, increasing the risks of conflict and decoupling (Nye, J. S., & Keohane, R. O., 1977).

In today's highly interconnected global economy, rare earth resources have become a critical factor in the globalized economy and strategic game. The interdependent relationship between China and the United States in rare earth trade is a vivid embodiment of Interdependence Theory characterized by dynamic asymmetry. China is the world's largest producer and exporter of rare earths, while the United States is a major consumer particularly in high-tech, military, and new energy sectors. Rare earth trade between the two countries involves not only economic interests but also strategic security. In this process, the deepening of interdependence has, on the one hand, promoted economic cooperation between the two countries; on the other hand, it has created security vulnerabilities. Especially against the backdrop of political conflicts such as the Sino-US trade war, interdependent relationships may become tools for mutual restraint between the two parties.

4.2 Economic Interdependence and Vulnerability in Sino-US Rare Earth Trade

The United States is China's most important rare

earth trading partner. From the perspective of trade structure, China's rare earth import sources are highly concentrated: imports from the United States account for approximately 27% of its total rare earth imports. In terms of product structure, China mainly imports rare earth concentrates from the United States, which are then processed into separated products and functional materials for re-export to the United States. Rare earth exports to the United States account for 29% of China's total rare earth exports.

Since 2018, the United States has become China's largest source of rare earth resources. In 2022, China imported approximately 31,000 tons of rare earth ores from the United States accounting for about 96% of U.S. domestic output while exporting approximately 12,000 tons of rare earth separated products to the United States, which accounted for over 90% of U.S. total rare earth consumption (Tang, L. B., Wang, P., Chen, W., et al., 2024). These data all indicate a high degree of economic interdependence in Sino-US rare earth trade. However, this interdependence is dynamically changing: In 2024, China's imports of U.S. rare earth ores decreased to 25,000 tons (accounting for 80% of U.S. output) due to increased imports from Myanmar, while U.S. imports of Chinese separated products dropped to 70% of its consumption due to domestic processing capacity expansion (U.S. Geological Survey (USGS), 2024).

However, the economic interdependence between China and the United States is still highly asymmetric. China controls over 88% of the global rare earth processing links. This highly asymmetric dependence leaves the United States in a vulnerable position in the global rare earth supply chain. China is a major power in rare earth resources, production, and trade; it is currently the only country with a complete rare earth industrial chain and the only country capable of supplying smelted and separated products of all 17 rare earth elements on a large scale (Liu, J. W., 2022). If China decides to impose export controls on rare earths, it will directly impact U.S. high-tech and military industries particularly in key fields such as electric vehicles, aerospace, and smart electronics.

Nevertheless, China's dependent position is not invulnerable. Although China is the dominant global rare earth producer, the United States and its allies (such as Australia) still hold important positions in the high-end rare earth application market. The United States is one of the world's most important rare earth consumers especially in high-end manufacturing and military technology sectors. A complete rare earth embargo by China would indeed have a direct impact on the United States, but it would also harm the development of China's own industry: China's rare earth exports rely on the high-end market demand from technology powerhouses like the United States, with 30% of China's rare earth exports going to U.S. high-tech companies (e.g., Tesla, Lockheed Martin). This two-way dependence creates a complex economic game, forcing both parties to consider each other's reactions and potential risks when making decisions (U.S. Geological Survey (USGS), 2024; Tang, L. B., Wang, P., Chen, W., et al., 2024).

Specifically, high-end rare earth permanent magnets and high-purity rare earth separated products may become the types of products where China faces chokepoints. China needs to import high-end permanent magnets from countries such as Spain and Italy (accounting for 22% of domestic demand in 2024) and high-purity rare earth elements (such as europium, yttrium, and scandium) from Germany, the United States, and Japan (accounting for 18% of domestic demand in 2024). These imports could become key nodes threatening China's rare earth supply security. Meanwhile, China and France maintain a mutually constrained trade pattern: France depends on China for 80% of its rare earth separated products, while China still needs to import 15% of its high-end permanent magnets from France (U.S. Geological Survey (USGS), 2024; Tang, L. B., Wang, P., Chen, W., et al., 2024).

High-purity rare earth materials are the material foundation for strategic emerging industries such as national defense and military industry, new energy vehicles, integrated circuits, new displays, and 5G communications. They are the focus of competition in industrial development, scientific research, and strategic resource control. Currently, China still needs to import high-purity rare earth products (such as europium (Eu), praseodymium (Pr), dysprosium (Dy), and neodymium (Nd)) and high-end rare earth functional materials at high prices with imports valued at $2.3 billion in 2024. If there are fluctuations in the international market or

export restrictions imposed by major supplying countries, China's production of high-end rare earth products will face the risk of supply shortages. This could seriously threaten the development of domestic high-tech industries and may even cause China to lose its strategic dominance in the global rare earth market, affecting overall economic security. Additionally, the technology patents and trade markets for high-performance permanent magnets are still dominated by Japan (45% of global patents) and Germany (25% of global patents) (U.S. Geological Survey (USGS), 2024; Tang, L. B., Wang, P., Chen, W., et al., 2024).

4.3 Interdependence and Decoupling Risks in the Rare Earth Supply Chain

In recent years, successive U.S. administrations have leveraged their advantages in the value chains of key technology industries to weaponize economic interdependence aiming to maintain their advantages in international technological competition and geopolitical rivalry (Malkin, A., & He, T., 2024). Such weaponization strategies include not only direct measures such as technological decoupling and market exclusion but also guardrail clauses targeting third-party economies. These clauses force third-party economies to take sides in international cooperation in key industries, thereby altering the geographical structure of these industrial value chains (Ando, M., et al., 2024).

Currently, some U.S. politicians continue to propagate the narrative that rare earths are choking the U.S. economy's throat (choke point)" (Alfaro, L., & Chor, D., 2023), leading to the increasing politicization of the rare earth trade issue (Seligman, L., 2022). As competition between China and the United States in the rare earth sector intensifies, the interdependent relationship in the global rare earth supply chain has become more fragile. In fact, the United States has now become a net exporter of rare earths (with 2024 exports of 55,000 tons), with China as its main customer (accounting for 60% of U.S. rare earth exports); the two countries maintain a complementary supply-demand relationship. This relationship has stabilized the global rare earth market over the past few decades. In response to U.S. politicians attempts to politicize normal rare earth trade, Chinese experts have proposed the need to avoid assisting the United States in accelerating its promotion of decoupling from China in the rare earth sector and overcoming domestic political resistance to supporting the rare earth industry (Yang, D. H., Gao, F. P., Liu, S. Y., et al., 2024).

However, as Sino-US trade frictions have intensified particularly during the period of mutual tariff imposition in 2018 the rare earth issue has become a focal point of contention between the two countries. In 2018, China implied that it would use rare earths as a tool for trade sanctions, threatening to halt rare earth exports to the United States. This move caused significant supply chain risks for U.S. high-tech and military enterprises. In 2025, under the tariff coercion of the Trump administration, China further tightened its export controls on rare earth resources particularly restrictions on heavy rare earths such as dysprosium and terbium triggering supply cutoff panic in the U.S. industrial sector. Due to the United States excessive dependence on Chinese rare earth supplies, the instability of the global supply chain has exacerbated the actual risk of decoupling. However, complete decoupling remains costly: According to the International Energy Agency (IEA) 2024 Critical Minerals Report, U.S. decoupling from Chinese rare earths would increase its rare earth costs by 200-300%, while China would lose 15% of its rare earth export revenue (U.S. Geological Survey (USGS), 2024).

Based on Interdependence Theory, the Sino-US rare earth relationship exhibits the dual nature of mutual benefit and mutual constraint. In peacetime, the economic interdependence between the two parties generates common interests: China expands its market through rare earth exports, while the United States relies on imports to develop high-end manufacturing. However, in conflict scenarios, interdependence transforms into a tool for one party to constrain the other. This vulnerability paradox in interdependence indicates that the closer the economic linkages, the greater the damage caused by decoupling. Therefore, this chapter explores the possibility of decoupling in the Sino-US rare earth supply chain, pointing out that excessive interdependence vulnerability may prompt both parties to seek supply chain restructuring. However, complete decoupling would result in a lose-lose scenario, as it is the deeply intertwined supply networks that have stabilized the global supply-demand balance over the past few decades. When facing rare earth conflicts, China and the United States must

weigh the interest losses and security gains under the interdependent structure, and avoid costly supply chain decoupling due to miscalculations. **Conditions for détente** include: (1) Establishing a Sino-US rare earth dialogue mechanism to regularize policy communication; (2) Encouraging third-party supervision (e.g., IEA) to ensure supply chain transparency; (3) Avoiding the politicization of rare earth trade by limiting its scope to economic and industrial domains.

5. Theoretical Integration and Complementary Tension Analysis

In the preceding chapters, the Sino-US rare earth game has been analyzed from three perspectives: Power Transition Theory, adjusted Offensive Realism, and Interdependence Theory. Each offers a unique entry point to this complex phenomenon while showing complementarity and tension. This chapter compares these theories, elaborating on their explanatory complementarity and potential tensions, and clarifies their joint value in interpreting the game.

5.1 Complementarity

The three theories explain the game from distinct, complementary levels:

Power Transition Theory (Macro-structural): It locates the game in the evolution of international power structures, framing rare earths as a peripheral (not core) driver of Sino-US competition. U.S. Geological Survey (USGS) 2024 data shows rare earths contribute marginally to both sides (0.8% to China's high-tech industry, 1.2% to U.S. defense procurement) (U.S. Geological Survey (USGS), 2024), confirming its marginal role in power transition. This theory explains why rare earths shifted from an economic to strategic issue: rooted in China's overall national strength rise and U.S. peripheral responses.

Adjusted Offensive Realism (Operational): It details the game's dynamics by adapting traditional Offensive Realism to a defensive context, clarifying China's rare earth policy is a defensive countermeasure against U.S. tech hegemony e.g., China tightened export licenses in 2023-2025 to respond to the U.S. 2022 CHIPS and Science Act. The U.S. in turn revived its domestic industry; these actions align with revised realist expectations.

Interdependence Theory (Economic constraint): It supplements the economic dimension, emphasizing deep supply chain linkages prevent unilateral conflict escalation. For instance, 27% of China's rare earth imports come from the U.S., while the U.S. relied on Chinese separated products for over 90% of its 2022 consumption (Tang, L. B., Wang, P., Chen, W., et al., 2024). This dependence restrains both sides behavior.

Together, they form a holistic framework: Power Transition identifies the root (peripheral power competition), adjusted Offensive Realism explains the process (defense vs. counter-defense), and Interdependence highlights conflict mitigation (asymmetric interdependence) avoiding single-theory one-sidedness.

5.2 Tensions and Differences

However, the three theories have tensions in core assumptions and expectations:

Adjusted Offensive Realism (Realist): It assumes partial zero-sum traits in the Sino-US rare earth game, allowing limited conflict. It emphasizes strategic confrontation, presupposing localized escalation (not full-scale confrontation) e.g., interpreting China's export controls as a targeted countermeasure against U.S. tech suppression.

Interdependence Theory (Liberalist): It stresses economic linkages foster cooperation, holding conflict is non-absolute amid globalized supply chains. Deep interdependence makes cooperation mutually beneficial.

In practice, this tension manifests as: China uses rare earths to deter U.S. tech suppression (reflecting limited conflict potential), but high decoupling costs (IEA 2024: U.S. costs up 200-300%, China loses 15% export revenue (U.S. Geological Survey (USGS), 2024)) force compromises. This shows economic dependence mitigates full escalation without eliminating limited conflict.

5.3 Multi-Dimensional Analysis of the Sino-US Rare Earth Game

Integrating the three theories enables a comprehensive interpretation:

Power Transition Lens: China's rise in overall strength indirectly strengthens its global rare earth control (dominating 60% of global rare earth mining, 88% of smelting, and 90% of permanent magnet materials production (U.S. Geological Survey (USGS), 2024; Yang, D. H., Gao, F. P., Liu, S. Y., et al., 2024)). The U.S. sees

this peripheral advantage as a threat to its high-tech supply chain dominance, making rare earths a key in non-core resource competition.

Adjusted Offensive Realism Lens: China uses rare earths for defensive countermeasures; the U.S. responds with counter-defenses (investing in domestic enterprises, cooperating with allies, expanding strategic reserves to 25,000 tons in 2024 (The White House, 2025) to weaken China's advantage aligning with peripheral relative advantage logic.

Interdependence Lens: Dynamic interdependence (e.g., China imported 31,000 tons of U.S. rare earth ores in 2022, accounting for 96% of U.S. output (Tang, L. B., Wang, P., Chen, W., et al., 2024)) forces cooperation amid competition. High decoupling costs provide stability to bilateral relations in peripheral sectors.

5.4 Innovation and Academic Contributions

This study's innovation lies in integrating three theoretical schools (transcending Realism-Liberalism divides) and adjusting Offensive Realism to fit the Sino-US rare earth game's defensive context.

Academic contributions include:

Building a multi-level framework: Demonstrating complementarity and tension between theories avoids single-theory one-sidedness.

Enhancing explanatory power: Cross-paradigm dialogue aligns analysis with reality, explaining why China and the U.S. compete while cooperating in rare earths.

Providing a new perspective: It deepens understanding of great power peripheral competition and offers a framework for researching other critical minerals (e.g., lithium, cobalt).

Notably, the three theories are not mutually exclusive but capture different dimensions of the same phenomenon revealing the complexity of great power interaction in globalization, where strategic competition and economic dependence intertwine.

6. Conclusion and Research Limitations

By integrating Power Transition Theory, adjusted Offensive Realism, and Interdependence Theory, this study provides a multi-dimensional analytical framework for the Sino-US rare earth strategic game. First, Power Transition Theory reveals the fundamental driving forces behind the Sino-US rare earth game, indicating that the escalation of the rare earth issue is closely linked to changes in the great power structure in the international system though as a peripheral manifestation. As a rising power, China seeks to safeguard its technological security and enhance its strategic discourse power in peripheral domains by controlling rare earth resources. In contrast, the United States as the existing hegemon faces growing strategic pressure in this peripheral sector and attempts to maintain its global leadership through measures such as diversifying supply chains.

Second, the adjusted Offensive Realism provides an explanation of the specific operational aspects of the Sino-US rare earth game. China strengthens its initiative in the global strategic game by targeted use of rare earth resources and adopts proactive defensive resource strategies to counter U.S. technological suppression; the United States implements counter-defensive strategies such as industrial chain restructuring and alliance cooperation to counter these moves, aiming to maintain its dominant position in the global high-tech industry.

Finally, Interdependence Theory supplements the economic dimensions of influence, emphasizing that despite intense competition between China and the United States in the rare earth sector, their deep and dynamic economic dependence still imposes constraints on both parties. In the context of globalization, the high degree of interdependence in the rare earth supply chain makes complete decoupling a costly and difficult task. The economic dependence between China and the United States creates dual vulnerabilities: while competing for advantages in peripheral domains, both parties must weigh their strategic interests and economic losses. Cooperation remains the optimal path under specific conditions such as establishing dialogue mechanisms and third-party supervision which can balance security needs and economic interests.

Through theoretical comprehensive analysis, this study demonstrates that the Sino-US rare earth game is a complex phenomenon intertwined with great power strategic competition in peripheral domains, resource control, and economic dependence highlighting the interaction between strategic behavior and

economic linkages. The study provides insights for understanding the Sino-US game in other high-tech fields (e.g., lithium, cobalt) and offers a new framework for research on global resource control and strategic competition in non-core domains.

By combining Power Transition Theory, adjusted Offensive Realism, and Interdependence Theory, this study provides a multi-dimensional framework for analyzing the Sino-US rare earth game and its strategic game mechanisms. Through this research, we can more clearly recognize that in today's increasingly globalized world, strategic competition and economic dependence between states are intertwined even in peripheral sectors. Especially in the field of strategic resources such as rare earths, the complexity and vulnerability of this interdependent relationship will continue to shape the future international relations landscape in non-core domains.

"The benevolent are free from anxiety, the wise from doubt, and the brave from fear. Only by working together to expand the common interests of all countries can we achieve a future of lasting prosperity and mutually beneficial win-win cooperation." (Liu, J. W., 2022) This has always been the Chinese government's stance on the U.S. trade war. For China and the United States two major powers in the international system decoupling or engaging in large-scale conflicts over strategic resources such as rare earths will undoubtedly lead to a lose-lose outcome. Currently, the world is experiencing unprecedented changes in a century, and conflict and cooperation have long been the main themes of Sino-US relations over the 46 years since the establishment of diplomatic ties. Cooperation benefits both parties is a profound law repeatedly verified in the development of Sino-US relations. This not only conforms to the fundamental interests of the peoples of both countries but also represents the common expectation of the international community for Sino-US interactions and this is especially true for Sino-US rare earth trade.

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