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Article

U.S. Technological Decoupling from China: A Neoclassical Realist Explanation

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Abstract

The ongoing competition between the United States and China has upgraded to technological decoupling (TD). This paper analyzes the evolution of the U.S. TD policy toward China since the Bush administration and the reasons for the policy changes. With neoclassical realism, this paper defines the distribution of technological power as the independent variable and the U.S. threat perception of China as the intervening variable. It finds that although China's technological strength has gradually increased, imposing systemic pressure on the United States, the U.S. TD policy depends on the extent of the U.S. threat perception of China. As the United States defines China from a collaborator to a competitor and a challenger, its TD policy has gradually evolved to work with its allies and partners to contain China multilaterally, aiming to reshape the world's technology supply chain. Based on these findings, the United States is expected to adopt a more stringent TD policy against China, but the policy's effectiveness remains uncertain.

Keywords

Technological decoupling, U.S.-China competition, Technological power, Threat perception, Neoclassical realism

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Introduction

Since the Trump administration declared a trade war against China, the U.S. decoupling policy toward China has extended from the trade field to the industrial chain and technology fields (Yu & Wang, 2022). Gradually, the technological decoupling (TD) of the United States from China has become an emerging term in international relations in recent years. In a broad sense, "decoupling" refers to the policy adjustment between China and the United States to reduce economic connection and interdependence (Diao & Wang, 2020, p. 14). Accordingly, TD means cutting ties and dependencies between the two countries in the tech sector. Meanwhile, the decrease in both sides' economic and technological ties inevitably accompanies the dismantling of the original cross-border supply chain and the creation of a new one (Johnson & Grame, 2020). Hence, specifically speaking, the U.S. TD from China is defined as a series of policies implemented by the United States to reduce its technological ties with and dependence on China and rebuild a global tech industry chain.

Geopolitical tensions and the COVID-19 pandemic disturbed the global supply chain of semiconductors. The existing international relations literature on the U.S. TD from China can be divided into three categories. The first focuses on the description and summary of the U.S. decoupling policies toward China. This type of research aims to summarize U.S. policies and categorize them. For example, Bateman (2022) and Zhou (2022) think that the U.S. TD policy toward China can be divided into nine types, including export controls, investment restrictions, telecommunication licensing and equipment authorizations, visa bans, financial sanctions, technology transaction rules, federal use and spending restriction, and law enforcement actions. On this basis, Chi (2020) believes that all the U.S. decoupling policies can be divided into a "self-improvement" strategy that focuses on enhancing its strength and a "containment" strategy that hinders China's technological development. Shen and Mo (2022a) add a third type, arguing that the United States has also jointly drawn its allies and partners to shape a technologically competitive environment against China.

The second research category focuses on analyzing U.S. motivations for decoupling from China. Some scholars believe that the decoupling policy of the United States aims for the containment of China's scientific and technological strength, and therefore, TD is regarded as the use of existing technological advantages by an established hegemony to suppress a rising power to consolidate its hegemonic position (e.g., Ling & Luo, 2021; Yao, 2021; Zhai & Li, 2020). In contrast, some scholars argue that the U.S. TD is to (1) deal with unfair competition from Chinese tech companies, which gain cost advantages due to the Chinese government's massive subsidies and funding; (2) suppress China's ambitious Digital Belt and Road Initiative; and (3) promote the re-shoring of the technology industry (Capri, 2020). Meanwhile, other scholars believe that the U.S. decoupling from China is related to the features of U.S. leaders. For example, Yin (2018, pp. 70–71) holds that President Trump's view of economic nationalism makes him believe that China threatens the United States economically and strategically, so he adopted extremely hawkish policies toward China.

The third analyzes the possible impacts of America's decoupling policies. Kwan (2020) worries that the Sino-U.S. technology war will further decouple the Chinese and American economies, which may cause the world economy to split into two blocs centered on China and the United States. Zhou (2021) believes that the TD between China and the United States will be the primary mode of strategic competition between major powers in the future, hindering multilateralism's development and accelerating the bipolar international system. Besides, some research examines the impacts on other countries. For instance, Li and Gu (2022) find that U.S. allies will face intense alliance pressure from America's tech competition with China, which negatively influences their policy choice to China.

Nevertheless, the existing research has three shortcomings. First, these studies only analyze the motives of the U.S. decoupling policy but do not sort out and compare U.S. tech policy toward China since the 21st century. They also fail to explain the reasons for the evolution of U.S. tech policy. Second, scholars have yet to agree on which variables should be selected to explain the motivation of the U.S. decoupling policy toward China. As mentioned above, some studies believe that the U.S. decoupling policy is due to the systemic pressure caused by rising powers on the hegemonic power. Some believe that it is a countermeasure against China's unfair competition. Others attribute it to the personal factors of the American president. The lack of consensus on explanatory variables has led to a fragmented explanation of the U.S. TD from China. Third, the existing literature lacks the theoretical support of international relations theory and fails to form a unified analytic framework to provide a complete and theoretical explanation for the U.S. decoupling policy.

This paper uses the neoclassical realist international relations theory to explain the evolution of the U.S. TD policy toward China since the 21st century. To this end, the research questions of this paper are as follows. (1) How has the U.S. TD policy toward China evolved since the 21st century? (2) What factors contributed to the evolution of the U.S. TD policy? Why does the U.S. TD policy evolve? The structure of this paper is as follows. The second section will construct a neoclassical realist framework to explain the U.S. TD from China. Then, this paper divides the 21st century into four periods: from the Bush administration to the first Obama administration, the second Obama administration, the Trump administration, and the Biden administration. Therefore, it sorts out the evolution of the U.S. TD policy in Section 3 and analyzes the reasons for the U.S. policy evolution during these four periods in Section 4. Section 5 discusses the future trends and effectiveness of the U.S. TD policy. The last section provides concluding remarks.

Neoclassical Realism and Analytic Framework

Neoclassical realism (NCR) is a theoretical innovation based on classical realism and structural realism to make up for the deficiencies of the latter two theories. Therefore, this section first identifies classical and structural realism's logic before establishing a neoclassical realist framework and introducing research methods.

Structural Realism, Classical Realism, and Their Shortcomings

Structural realism, known as neorealism, was first established by Kenneth N. Waltz (2010). To establish a scientific and parsimonious theory of international relations, the neorealists set the explanatory variable of their theory as the international system defined by the distribution of states' capabilities without considering states' differences, which constitutes the dominant influence on state behaviors in an anarchic world (Waltz, 2010, pp. 88–101). Thus, structural realism aims to explain the common patterns and universality of state behaviors affected by the international system over time by treating states as homogeneous units (see Figure 1). For example, in *The Tragedy of Great Power Politics*, the structuralist Mearsheimer (2014) concludes that states always seek to expand their powers rather than cooperate to ensure national security. In expanding power and seeking security, great powers are bound to have conflicts with others, a so-called tragedy. From this point of view, structural realism is mainly concerned with enduring grand questions of international politics, such as war, peace, and balancing (Taliaferro et al., 2009, pp. 16–17).

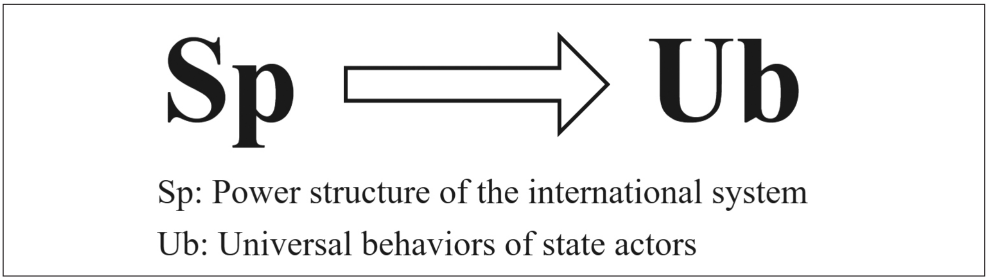

Figure 1. The framework of structural realism
Source: Wang and Qu (2013, p. 123)

However, structural realism has weaknesses in explaining a state's foreign policy because factors at the unit level may cause the state to be unable to accurately accept stimuli from the system level to make corresponding policy responses. Ripsman et al. (2016, pp. 19–25) question the causal relationship between the international system and state behaviors and point out that domestic limitations and distortions can lead to states not necessarily responding to system stimuli. Therefore, Rose (1998, p. 146) believes examining the unit-level intervening variable transforming systemic pressure is necessary. This shortcoming of structural realism makes it challenging to compare and explain the evolution of a state's foreign policy. Regarding the U.S. TD policy with China, the studies that explain the U.S. decoupling policy with the structural approach only analyze why America has changed from not utilizing decoupling to adopting decoupling policies. Their common explanation is that the U.S. TD is a response and containment to a rising China challenging its unipolar hegemony. In other words, they cannot compare the differences in the technology policies of successive U.S. administrations toward China and analyze the reasons for such changes in the U.S. TD policy.

In contrast, classical realism does not focus on the influence of the international system on state behaviors but selects variables at the unit level to explain the state's foreign policy. Therefore, compared with neorealism, classical realism has higher explanatory power in explaining foreign policy at the expense of theoretical parsimony (Wu, 2021, p. 9). Namely, different studies can pick up different variables to explain the same foreign policy or state behavior. However, they cannot determine which variable has the dominant influence compared with other variables. That is why Waltz (2010) criticizes classical realism as reductionism.

So, regarding the U.S. decoupling policy toward China, the existing studies have yet to reach a consensus on which variables to explain the U.S. decoupling policy, and their analysis is problematic. Specifically, some scholars believe that it is caused by President Trump's personal characteristics (Yin, 2018). However, the individual-level variable fails to explain why President Biden continues and intensifies President Trump's decoupling policy, even though the two presidents have very different personal characteristics. In parallel, this individual-level interpretation may exaggerate the discretionary power of the American president in foreign policy decisions. In addition, it is hard to say that a causal relationship exists between the state leader's personal characteristics and foreign policy (Wang & Shi, 2018). Meanwhile, other scholars attribute it to the emerging domestic thinking and bipartisan political consensus on decoupling from China in the United States (Yu & Wang, 2022). However, the United States still has not reached a broad domestic consensus on how to decouple technology from China, and it has split into three factions: restrictists, cooperationists, and centrists (Bateman, 2022, p. 42).

The Neoclassical Realist Framework

The birth of NCR aims to make up for structural realism's lack of explanatory power in explaining a state's foreign policy and the lack of theoretical parsimony of classical realism. NCR first questions the causal relationship between the system and state behavior shown in Figure 1. Although it agrees that the international system shapes each state's policy options, states do not necessarily respond to systemic stimuli because of domestic limitations and distortions. More precisely, states cannot always perceive systemic stimuli correctly or make rational decisions. Besides, systemic stimuli are not always easy for states to detect because the international system is sometimes filled with uncertainties due to anarchy, and states do not always obtain enough information to capture correct signals (Ripsman et al., 2016, pp. 16–25). In this light, analyzing and explaining states' foreign policies is far from enough to rely solely on systemic factors. After all, states must rely on themselves to identify the system's dynamics to make subjective judgments and decisions. Therefore, NCR introduces a unit-level intervening variable bridging the gap between the systemic stimuli and states' behaviors and policies condition whether and how states translate system stimuli and how states can react to them (Ripsman et al., 2016, p. 58). From this point of view, NCR has carved out a middle path between structural realism and classical realism.

Specifically, NCR regards system factors as the independent variable, unit-level factors as the intervening variable, and the state's foreign policy as the dependent variable. The systemic independent variable is the relative distribution of power that structures states' behaviors because NCR also holds that the international system plays the dominant role in shaping states' actions (Yoo, 2012, p. 323). The unit-level intervening variable, which plays as a secondary factor, not only builds a bridge between system factors and foreign policy but also conditions whether and how the country makes policy responses to system stimuli (Ripsman et al., 2016). In other words, the intervening variable explains the decisions and choices made by the state in response to system stimuli.

This paper constructs a neoclassical realist analytic framework for the U.S. technology policy toward China (see Figure 2). First, the independent variable is the technological power gap between the United States and China. Technology is the foundation of a state's material power. Based on the historical experience of the past three industrial revolutions, technological progress and breakthroughs can greatly enhance national strength and change the international system. At present, the world is in a new round of technological revolution, especially in critical fields such as artificial intelligence, semiconductors, and biological sciences. Among them, the semiconductor occupies the core position in this new wave of technological revolution. Therefore, the semiconductor field is regarded as a technical Achilles heel between the two sides from the U.S.'s perspective. The gap and relative changes in technological power between the United States and China reflect the power distribution of the two states. To operationalize the independent variable, this paper adopts the number of patent applications as the primary index to measure technological power (see Appendix). Compared to the investment in research and development, the number of patent applications is an output-oriented indicator measuring technological development, which can reflect an international actor's comprehensive technological strength at the macro level. Yan and Sun (2005, p. 42) argue that when a state's national power increases to 40% of the hegemonic state's power, this state can be regarded as a rising power. Based on this, this paper sets 40% of the technological strength of the hegemony as the critical point. If the technological power of the rising state is lower than 40%, its technological strength is relatively small; otherwise, it is relatively strong.

This paper draws on Yan and Sun (2005) to identify two reasons why 40% is set as the

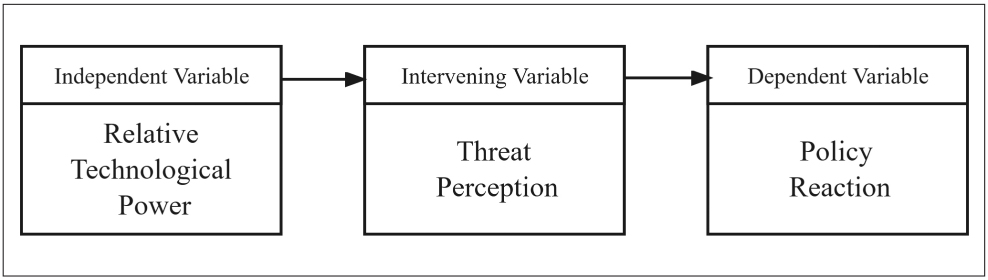

Figure 2. The neoclassical realist framework for the U.S. tech decoupling policy
Source: Authors' own

critical point for catching up with the technological strength of an established power by a rising power. To begin with, historical evidence shows that technological progress and innovation have significantly influenced the growth of national power, thereby affecting international relations and the evolution of the international system. These technologies include transportation, communication, nuclear, and information technology (Krishna-Hensel, 2017). Existing research indicates that technological progress in a country has a significant driving effect on its economic and military strength, both of which are core components of a country's comprehensive power (Beckley, 2018). Besides, the competition between China and the United States in terms of technology is becoming increasingly fierce. China has long believed that technological strength directly relates to comprehensive national power and international competitiveness. Achieving breakthroughs in cutting-edge science and technology is advantageous in gaining a leading edge and occupying a position of strength in international competition (Qiushi, 2023). Similarly, the U.S. government also views technology as the foundation of the American economy, as well as the leading force for social and international economic development. It considers promoting technological innovation a priority for accelerating economic growth and advancing U.S. foreign policy (U.S. Department of State, n.d.). Technological growth in China's military has also played its part in cementing the Pentagon's priority of preserving the U.S.'s current military advantage over China (Bateman, 2022, pp. 57–58). Given the United States' global alliance and partnership system and technological division of labor, this paper will take Mainland China, G7 states (including the United States, the United Kingdom, Japan, Germany, France, Italy, and Canada), South Korea, and Taiwan into consideration.

Second, the intervening variable is the United States' threat perception of China's technological advancement challenging U.S. tech supremacy. Threat perception is a crucial intervening variable put forward by NCR. Lobell (2009) believes that a state's threat assessment relates to how it translates systemic pressure and explains how it responds to perceived threats. This paper divides the threat perception of the United States toward China into three levels: collaborator, competitor, and challenger. (1) A collaborator means the United States believes China is not a technological threat. On the contrary, there is room for cooperation between the two countries. (2) A competitor means that the United States believes that China has threatened American technological supremacy, so it needs to compete with China to maintain its technological advantage. (3) A challenger means that the United States regards China as a significant technical threat to its technological supremacy and may surpass the United States in some technological fields. Therefore, the United States has to adopt a more stringent policy of technological containment and blockade against China. Finally, the dependent variable is the United States' technological policy toward China.

In terms of the research methods of this study, primary data on the U.S. official TD policy towards China is collected. The data includes speeches by U.S. leaders, official policy documents, and bills. The secondhand information collected in this paper mainly falls into three categories. The first is the relevant reports on the U.S. TD policy by international and Chinese mainstream media. The second is existing research and reports analyzing the U.S. TD policy. The third is patent application data from Mainland China, G7 states, South Korea, and Taiwan, as well as global semiconductor industry data. With the help of the data above, this paper thoroughly and comprehensively reviews the evolution of U.S. TD policy toward China, as well as the deepening of US perception of threats from China. This paper does not employ quantitative methods because quantifying the intervening variable defined in this study, namely the United States' threat perception of China's technological advancement, is difficult to achieve. To accurately understand how the U.S. views the threat from China, a qualitative analysis is necessary, relying on examining and analyzing both firsthand and secondhand data.

Evolution of the U.S. TD Policy

This section intends to sort out the TD policy of the United States since the 21st century. To this end, this paper builds a policy coordinate (see Figure 3). The horizontal axis of the coordinate indicates whether the U.S. decoupling policy toward China is unilateral or multilateral. A multilateral decoupling policy means the United States draws its allies and partners in the technology industry chain to form a technological alliance to coordinate and adopt a common decoupling policy against China. In contrast, a unilateral decoupling policy means that the United States relies solely on itself rather than forming a multilateral alliance to adopt a decoupling policy (Liu, 2023). The vertical axis of the coordinate indicates whether the target of the

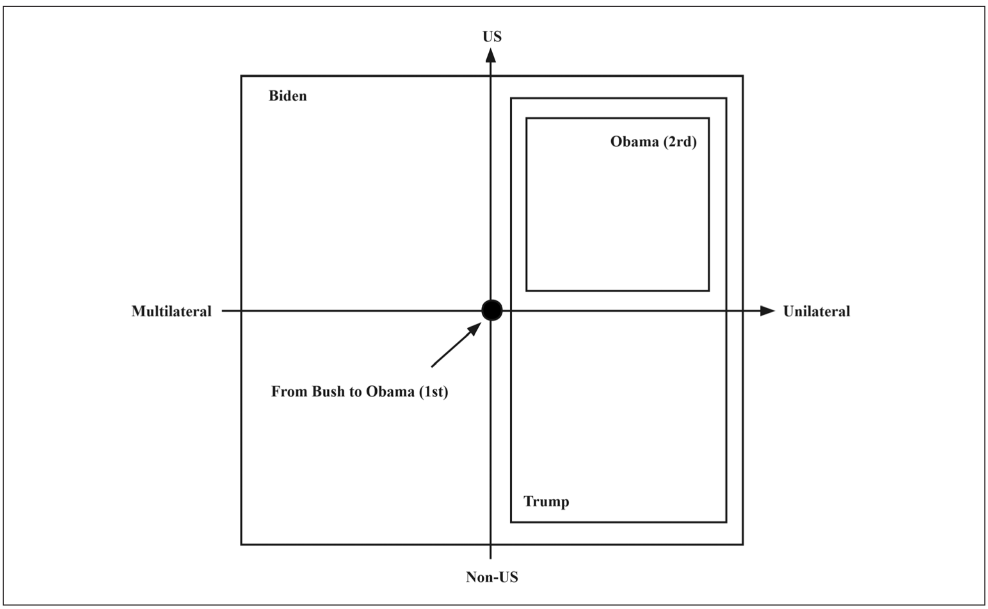

Figure 3. The policy coordination and the evolution of U.S. decoupling policy
Source: Authors' own

decoupling policy adopted by the United States is the U.S. government, institutions, enterprises, and individuals or non-U.S. foreign governments, institutions, enterprises, and individuals in the technology industry chain. It is important to note that, according to the definition in this paper, the key to determining whether the United States is pursuing a multilateral policy lies in whether the United States is attempting to build exclusive technological alliances to adopt TD policy toward China collectively. If the United States does not form such alliances with other countries and only requires them to adopt the technology policy imposed by the United States, then it can only be considered the United States' unilateral policy targeting other countries' actors rather than a multilateral policy.

First, after establishing diplomatic relations between China and the United States in 1979, the two sides signed the *Agreement on Cooperation in Science and Technology*, which laid the foundation for the subsequent Sino-U.S. technological cooperation. In the 1980s, the United States lifted the ban on the export of some military equipment to China and expanded the technology transfer to China as well. In the 1990s, the United States further relaxed restrictions on exporting high-performance computers and chips to China, and the two sides further cooperated in military technology, such as missile technology, biological weapons, and nuclear non-proliferation (Shen & Mo, 2022b, pp. 104–106). From the Bush administration to the Obama administration's first term, the United States did not adopt a TD policy toward China. Therefore, as shown in Figure 3, this stage can only be attributed to the origin instead of the four quadrants. Although the Bush administration emphasized improving U.S. technological capabilities to deal with outside competition, it generally inherited the previous technology policy toward China. It issued the *American Competitiveness Initiative: Leading the World in Innovation* in 2006 (White House, 2006) and passed the *America Competes Act* in 2007 (GovInfo, 2007). Both underscored that the United States should strengthen innovation and education to expand scientific and technological achievements and maintain its advantages in an increasingly competitive world instead of TD.

During the first Obama administration, China and the United States held the *Innovation Dialogue* for the first time in 2010 (White House, 2010a). In 2012, China and the United States held the third innovation dialogue in Beijing, during which the two sides expressed their willingness to carry out multiple technological cooperation (Chinese Ministry of Science and Technology, 2012). Furthermore, the two sides strengthened bilateral cooperation in various fields, such as energy, environment, climate change, health, agriculture, and disaster prevention. They jointly signed a series of bilateral cooperation plans, agreements, frameworks, and memorandums, co-established several research centers, and enhanced the exchange of scientific and technical personnel (Cheng & Wang, 2019, p. 3). For example, China and the United States launched the "China-U.S. Science and Technology Personnel Exchange Program," "Chinese Young Scientists Visiting the United States Program" and the "China-U.S. Youth Scientist Forum" (Institute for Global Cooperation and Understanding, 2022, p. 11). More importantly, with the rapid development of globalization since the 21st century, China and the United States have formed an industry chain in which the United States dominates research and development, design, marketing, and supply of critical components, while China focuses on assembly and low-end component production (Li, 2020, p. 33). A 2019 report demonstrates that the U.S. suppliers played a crucial role in China's technology supply chains, accounting for over 50% in China's technology sectors (see Figure 4).

Second, beginning with the second term of the Obama administration, the U.S. TD policy began to take shape. Nevertheless, in general, the Obama administration's decoupling policy is only limited to unilateral actions, and the targets of policy constraints are mainly American actors. Therefore, this stage is classified into the first quadrant in Figure 3. Specifically, the

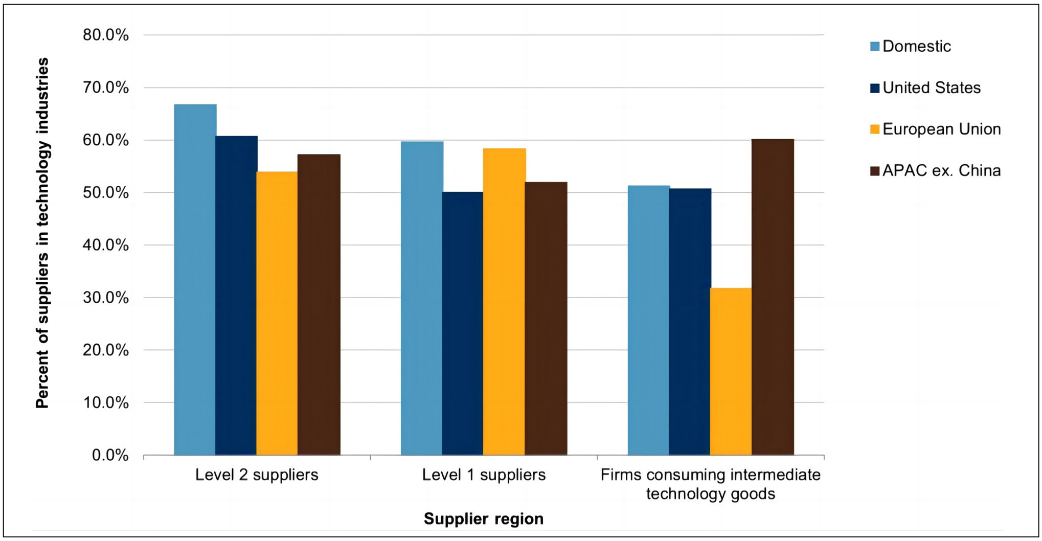

Figure 4. The proportion of suppliers in China's technology sectors
Source: S&P Global (2019, p. 13)

Obama administration unilaterally imposed high tariffs on technology products from China to restrict imports. A typical case is that the United States imposed a 31% anti-dumping duty on Chinese photovoltaic cells in 2012 (U.S. Department of Commerce, 2012). In 2014, the Obama administration further raised the tariff level on Chinese solar products, with the highest anti-dumping duty reaching 165.04% (U.S. Department of Commerce, 2014). The United States believed that many cheap solar products from China poured into the American market, causing local American manufacturers to go bankrupt (Cardwell, 2014). Therefore, the Obama administration's import restrictions on Chinese solar products aimed to protect domestic manufacturers. However, the Obama administration's TD policy was preliminary. Despite the steep anti-dumping duties, the United States did not stop exchanges and cooperation with China in technology. For example, the U.S. and China continued to hold innovation dialogues. As of 2016, the two countries held seven dialogues, providing a platform for the two sides to bridge differences and innovate technological cooperation models (ScienceNet, 2016).

Third, the Trump administration upgraded the decoupling policy of the Obama administration. In addition to unilaterally expanding the content of TD, the Trump administration's policy targets included both U.S. and non-U.S. actors, which expanded its scope to the fourth quadrant. To begin with, the United States carried out export controls. For example, the United States imposed sanctions on Chinese technology companies and institutes by putting them on the Entity List. Exporters in the United States were not allowed to export controlled items to entities on the entity list without obtaining a license. As of October 13, 2022, 889 Chinese entities have been included in the Entity List (U.S. Department of Commerce, 2022). Besides, the Trump administration tightened scrutiny of Chinese companies' investment activities in the United States to prevent China from acquiring U.S. technologies. President Trump signed the *Foreign Investment Risk Review Modernization Act* in 2018. It enlarged the power of the Committee on Foreign Investment in the United States to address investment activities with national security concerns (U.S. Department of the Treasury, 2018). The act is considered to be mainly used to increase scrutiny and restrictions on China's investment in critical technologies, infrastructure, personal data, and real estate in the United States (Wei, 2022, p. 86). Furthermore, the Trump administration restricted Sino-U.S. cooperation and personnel exchanges in science and technology. For example, the Trump administration issued the *Proclamation on the Suspension of Entry as Nonimmigrants of Certain Students and Researchers from the People's Republic of China* in 2020 to suspend the visas of Chinese students and scholars whom the United States believed would help the Chinese government acquire critical and emerging technologies (White House, 2020).

Not only that, but the Trump administration's policy of TD from China also targets non-U. S. actors. For example, the U.S. lobbied its allies and partners to ban Huawei's 5G equipment. Since 2020, the United States began to reach a series of bilateral agreements or statements with its partners on 5G equipment to exclude Chinese companies represented by Huawei from the 5G networks and markets of these countries (Lang, 2021, p. 96). Under U.S. pressure, some countries gave up on using Huawei equipment, while others stepped up security scrutiny of Huawei and Chinese investment (Chi, 2020, p. 37).

Fourth, on the basis of continuing the Trump administration's decoupling, the Biden administration has further adopted a multilateral approach, which covers the whole coordinate. President Biden's multilateral decoupling policy is reflected in two aspects. One example is that the Biden administration has asked U.S. allies and partners to form an exclusive technology alliance to implement a common TD policy. On the one hand, the Biden administration takes advantage of existing multilateral mechanisms to expand its agenda into technology. The U.S.-Japan-India-Australia Quad established a new critical and emerging technologies working group in March 2021 and stated that it would establish a liaison group working in advanced communications and artificial intelligence to formulate technical standards, jointly strengthen the security of the semiconductor supply chain, and support 5G deployment diversification (White House, 2021a). On the other hand, the Biden administration also forms new technology alliances. The most representative one is Chip 4, including the United States, Japan, South Korea, and Taiwan, which play leading roles in the upstream and downstream of the semiconductor industry (Semiconductor Industry Association, 2021, p. 15). Through Chip 4, the United States wishes to construct a semiconductor industry alliance with its partners in Asia to contain China's fledgling semiconductor industry (U.S. Congress, 2022).

Besides, President Biden's multilateral approach is not limited to using multilateral mechanisms to decouple technology from China jointly but to reshape the global technology industry chain, especially to encourage the industry chain to flow back to the United States. The semiconductor industry is typical. Due to the global division of labor, 75% of semiconductor production capacity is concentrated in Asia (Semiconductor Industry Association, 2021, p. 15). To reverse the semiconductor industry's over-reliance on Asia, the Biden administration is pursuing a secure global supply chain by building an on-shoring industrial chain (Wang et al., 2022, p. 25). To this end, President Biden signed the CHIPS and Science Act in August 2022. According to the act, the United States will provide about 52.7 billion U.S. dollars in financial support to the semiconductor industry and provide companies with 24 billion U.S. dollars in investment tax credits to encourage them to develop and manufacture chips in the United States. However, it prohibits subsidized companies of the U.S. and its allies and partners from building or expanding advanced chip factories in China and other countries of concern for ten years (U.S. Congress, 2022). The United States hopes to increase the difficulty for China in obtaining cutting-edge semiconductor technology, reduce this industry's dependence on China through cooperation with its allies and partners, and finally establish a supply chain pivoting to itself. For instance, President Biden announced South Korean conglomerates' investment at the summit talks with South Korea in 2021 and 2022 (White House, 2021b, 2022a). In 2022, the U.S. also intercepted

Taiwan Semiconductor Manufacturing Company's (TSMC) decision to invest in Korea and took it home (Nocut News, 2022).

Sino-U.S. Tech Power Dynamics and U.S. Threat Perception

This section uses the analytical framework of NCR to examine the relative distribution of Sino-U. S. technological power and the changes in the U.S. threat perception toward China from the Bush administration to the Biden administration to demonstrate the causal relationship between these two variables and the U.S. policy of decoupling technology. Figure 5 shows the ratio of China's patent applications to the number of patents of the United States and its allies to measure the dynamics of the technological strength of both sides.

Bush to 1st Obama: Unbalanced Tech Power and No Threat Perception

The number of China's patent applications did not show significant growth until 2005. From 2005 to 2012, its number of patent applications rose from 2,503 to 18,620, an increase of 7.4 times. Nevertheless, its number of patent applications in 2012 was still far behind that of the United States, with 51,861. In terms of proportion, its patent applications in 2001 accounted for only 4% of that of the United States, 2.1% of G7, and 2.0% of G7, plus South Korea and Taiwan. Despite its increasing number of patent applications, by 2012, the number of patent applications in Mainland China only accounted for 35.9% of the United States, 14.1% of the G7, and 11.2% of the G7 plus South Korea and Taiwan. All the proportions are below the critical point of 40%, indicating that China's tech power during the Bush and 1st Obama administrations was relatively small, far behind the United States and its allies and partners, even though it had been improving rapidly. More importantly, in the first decade of the 21st century, China's manufacturing industry was mainly concentrated in labor-intensive industries. It was not until the early 2010s that Chinese companies in labor-intensive industries gradually shifted production overseas, such as in Southeast Asia and Africa (Chen & Li, 2019). In other words, during this period, even though

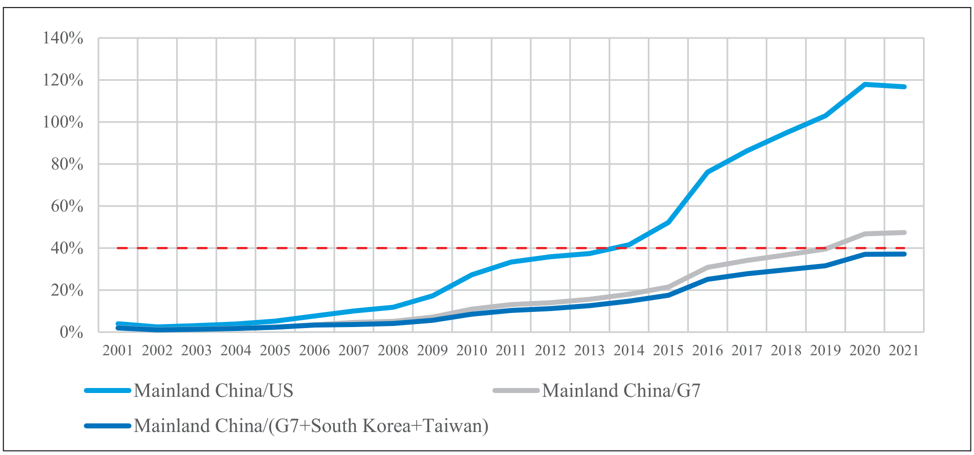

Figure 5. The ratio of the number of China's patent applications to the number of patents of the United States and its allies

Source: Authors' own based on the data in Appendix

China's technological power had risen, China had not yet achieved industrial transformation and upgrading.

Therefore, from the Bush to the 1st Obama administrations, China's weak technological power did not give the United States a systemic stimulus that China would challenge its technological supremacy. In contrast, the then U.S. government viewed China as a cooperator in technology. After the 911 incident broke out, the Bush administration regarded China as a partner on counter-terrorism issues and defined China as a responsible stakeholder in the international system, so the two sides cooperated in anti-terrorism and nuclear non-proliferation (Wang, 2017, pp. 107–138). In Obama's first term, the U.S. adopted a "comprehensive engagement" strategy toward China, which made the U.S.'s cooperative attitude toward China more obvious. For example, when the Obama administration described U.S.-China relations in its 2010 National Security Strategy, it wrote, "We will continue to pursue a positive, constructive, and comprehensive relationship with China. We welcome a China that takes on a responsible leadership role in working with the United States and the international community to advance priorities like economic recovery, confronting climate change, and non-proliferation" (White House, 2010b, p. 43).

Ikenberry (2008) illustrates the 1st Obama administration's engagement policy toward China nicely. He believes that to continue the Western system led by the United States, America should absorb China into the international system so that China would face "a Western-centered system that is open, integrated, and rule-based, with wide and deep political foundations" and then, China would become a member instead of a revisionist of the system. In a nutshell, the U.S. government adopted a cooperative and tolerant attitude toward China. It did not believe that China threatened the United States but hoped to integrate China into the U.S.-led international system and shape China into a responsible stakeholder. Therefore, guided by the engagement rationale, the U.S. government also held a cooperative technology policy toward China. In the 2010 U.S. National Security Strategy, the U.S. emphasized in terms of science and technology policy that it should strengthen investment to enhance its scientific and technological strength and innovation without narratives related to technological challenges from China.

2nd Obama: Decreasing Gap of Tech Power but Small Threat Perception

Since the second term of the Obama administration, China's technological strength has grown faster than in the previous period (see Figure 5). During these four years, the number of patent applications in China rose from 21,515 in 2013 to 43,091 in 2016. In contrast, the number of patent applications in the United States during this period began to decline to 56,591 in 2016 after peaking at 61,483 in 2014. Therefore, in terms of ratio, Mainland China surpassed 40% of the United States in 2014 and reached 76.1% in 2016. At the same time, the ratio of Mainland China's patent applications to the G7 and G7 plus South Korea and Taiwan was also on the rise, even though the figures were still below 40%, which were 30.9% and 25.2%, respectively.

More importantly, China began to emphasize industrial upgrading and technological innovation at this stage. In 2015, the Chinese State Council proposed the "Made in China 2025" industrial plan to develop advanced manufacturing through technological innovation and make China's manufacturing informationized and intelligent. Ten areas were listed as critical technological areas, including integrated circuits, aerospace technology, bio-medicine, new-energy vehicles, and robotics (Chinese State Council, 2015). Take the semiconductor industry as an example. After a quick recovery from the 2008 global financial crisis, China's semiconductor industry revenue reached 86.4 billion U.S. dollars in 2015, with an annual growth rate of about 20% from 2013 to 2015. Furthermore, China contiguously became the world's largest semiconductor consumption market, with a market size of 353.6 billion U.S. dollars in 2015 (PWC, 2017). This indicates that

China's technological strength grew rapidly at this stage, and the Chinese government had the political will to achieve upgrades and breakthroughs in the technological field.

Yet, the 2nd Obama administration still did not see China as a serious threat, despite China's fast development in technological power and ambitions in critical technology areas, unleashing explicit systemic stimuli that China's technological power was rapidly catching up with the United States. On the contrary, the then-U.S. government generally held a cooperative attitude toward China with a certain degree of alert. According to the 2015 National Security Strategy, "the United States welcomes the rise of a stable, peaceful, and prosperous China" and seeks to "develop a constructive relationship with China that delivers benefits for our two peoples and promotes security and prosperity in Asia and around the world" (White House, 2015). The Obama administration believed there was massive room for cooperation between China and the United States in regional and global affairs, such as climate change, economic growth, and public health, and rejected avoidable conflicts. For example, in terms of the semiconductor industry, U.S. companies and their allies' companies benefited from China's semiconductor industry and market, taking over the top ten suppliers of China's semiconductor industry from 2013 to 2015 (PWC, 2017).

Therefore, Obama's second term continued the engagement policy of the first term. The difference, however, is that the Obama administration became wary of Chinese military modernization. According to the National Security Strategy, "the scope of our cooperation with China is unprecedented, even as we remain alert to China's military modernization" (White House, 2015). Against this backdrop, Sino-U.S. technology cooperation continued during Obama's second term. The Obama administration did not pursue a harsh policy of TD with China that could lead to confrontation. Moreover, despite the rapid growth of China's technological power, it was still less than one-third of the capacity of the United States and its allies and partners. Therefore, the TD by the United States during this period was reflected in the unilateral anti-dumping of Chinese solar products without building a technology alliance. As shown in Figure 6, Obama's first term saw a significant increase in citations of Chinese companies on the Entity List. Under Bush's two terms, only 21 citations were issued compared to Obama's first term of 73 citations and Obama's second term of 104 citations, reinforcing the shift in policy of TD.

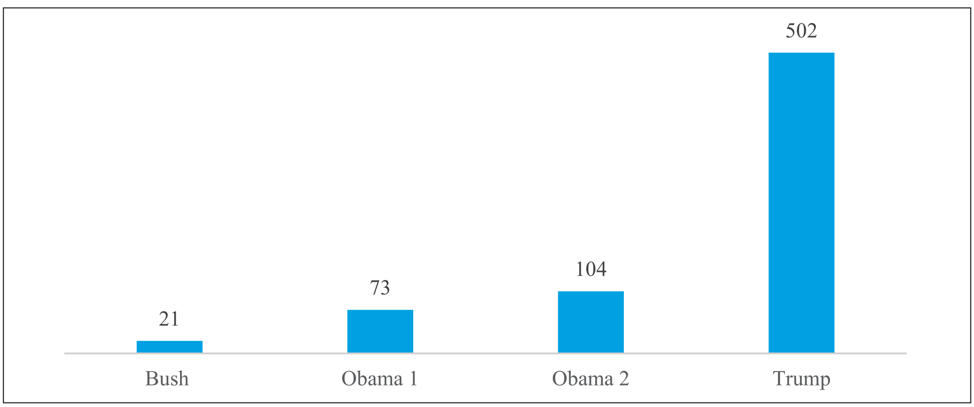

Figure 6. The number of Chinese entities on the Entity List with Federal Register citations
Source: U.S. Department of Commerce (2024)

Trump: Surpassing U.S. Tech Power and Medium Threat Perception

Under President Trump, the technological power of China and the United States reversed. The number of patents in China reached 59,187 in 2019, surpassing the 57,466 in the United States, and continued to rise to 117.9% of the United States in 2020. At the same time, its number of patent applications exceeded 40% of the G7 in 2020, reaching 46.8%. Although Mainland China did not reach 40% of the G7 plus South Korea and Taiwan, it also reached 37% in 2020. These figures show that during the Trump administration, China's technological strength increased significantly relative to the United States and demonstrated a relative upward trend compared to U.S. allies and partners.

In this context, the U.S. government obviously could not continue to regard China as a collaborator. The Trump administration clearly defined China as a competitor of the United States (Lee et al., 2022). According to the 2017 National Security Strategy, the U.S. accused China of stealing U.S. intellectual property to give China an unfair competitive advantage. It claimed that China used these technologies to narrow the technological gap with the U.S. and erode U.S. competitive advantages (White House, 2017). Therefore, the U.S. government adopted a containment policy against China and competed with China in technology. However, it is worth noting that what the United States believed at the time was that China was using unfair competition to narrow the gap with itself. So, the United States needed to punish China's unfair behavior to curb China's competitive advantage, thereby protecting its dominant position and buying time for its technological development.

To this end, the Trump administration attacked China's 5G technology and relevant Chinese companies. Huawei becomes the target. Huawei's telecom equipment revenue has been the world's No. 1 since 2015, far ahead of other companies such as Nokia and Ericsson (Bicheno, 2020), meaning China has already obtained an advanced position in 5G technology more than the U.S. and its partners. Huawei was accused of maintaining close ties with the Chinese government. On the one hand, Huawei was believed to receive massive subsidies from the Chinese government to gain a cost advantage, and on the other hand, Huawei closely cooperated with China's Belt and Road Initiative projects (Capri, 2020, pp. 6–9). Given Huawei's significant global market share, the U.S. had to expand the target of its decoupling policy to non-U.S. actors. In addition, the United States did not employ a multilateral approach because its purpose was to punish China for its unfair behaviors and compete with it instead of reshaping the global supply chain. Figure 6 illustrates the dramatic near five-fold increase under the Trump administration in the number of cited Chinese companies added to the Entity List, reaffirming the competitor status of U.S.-China relations at this point in time.

Biden: Surpassing U.S. Tech Power and High Threat Perception

Since the Biden administration came to power in 2021, it has continued to adopt a containment policy toward China and a tougher TD policy. Although in 2021, China's relative technological strength relative to the United States and its allies and partners has not changed much, at 116.7%, 47.4%, and 37.2%, respectively, China has officially rolled out an even more ambitious technology blueprint in 2021, *China Standard 2035*. It is an update of the "Made in China 2025," which requires China to improve technology standardization and promote the compatibility of Chinese standards with international standard systems (Chinese State Council, 2021). China Standard 2035 manifests that China will focus on the formulation, unification, and international dissemination of China's technical standards. China's technical standards will undoubtedly challenge the existing standard system of the United States and its allies regarding technical

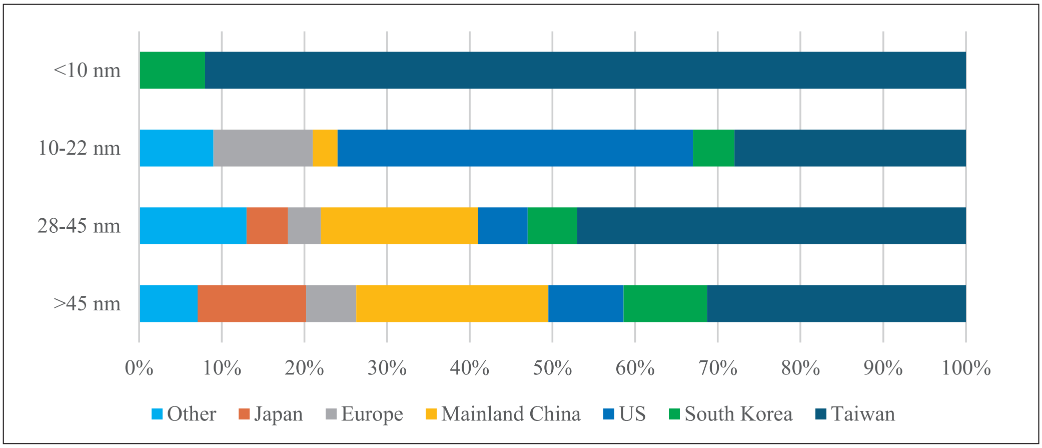

Figure 7. Global logic process technology by region, 2019 (%)
Source: Semiconductor Industry Association (2021, p. 19)

strength and technical standards.

Therefore, the Biden administration's threat perception of China has further improved. The Biden administration issued an executive order on the implementation of the Chips Act of 2022 (White House, 2022c). According to the latest 2022 National Security Strategy, America claims that "The PRC is the only competitor with both the intent to reshape the international order and, increasingly, the economic, diplomatic, military, and technological power to do it" and "it [China] is using its technological capacity and increasing influence over international institutions to create more permissive conditions for its authoritarian model and to mold global technology use and norms to privilege its interests and values" (White House, 2022b). After all, China possesses the potential to become a leading power with a sphere of influence in the Asia-Pacific region (He & Feng, 2023). From this point of view, the Biden administration goes beyond accusing China of unfair competition and believes that China has the ability and intention to reshape the existing international order, norms, and values. Undoubtedly, this is considered a challenge to American hegemony and order. For this reason, the United States must rely on its allies and partners to jointly formulate TD from China through a technology alliance. The Biden administration aims to introduce a common decoupling policy, formulate exclusive technical standards, and rebuild a safe global supply chain away from China and centered on the United States through technological alliances.

Notably, the semiconductor industry is crucial. As shown in Figure 7, the United States and its partners have almost monopolized the technology for high-end chips, while Mainland China's technical level can only manufacture middle- and low-end chips. However, the three players in the global semiconductor industry, South Korea, Japan, and Taiwan, which occupy approximately 75% of the world's semiconductor manufacturing (Feng, 2022), are all located in East Asia. Their close geographic distance from Mainland China poses a considerable risk to the United States because of China's massive influence in the region. The United States needs to restructure an on-shoring semiconductor supply chain to reduce China's influence on the supply chain and improve its competencies in the semiconductor industry. Therefore, Chip 4 was born under the initiative and pressure of the United States.

U.S. Partners' Responses and Policy Effectiveness

At the time this paper was written, the leading contenders for the 2024 U.S. Presidential Election were the incumbent Democratic President, Joe Biden and his Republican rival, former President Donald Trump. Despite their differing foreign policy strategies, if China continues to advance in its technological capabilities and the U.S. continues to perceive China as a significant threat, then, according to the analytical NCR framework of this paper, the U.S. is likely to implement a more robust and stringent TD policy toward China. For instance, the United States is likely to expand the fields of containment of Chinese technology, from the semiconductor industry to new energy vehicles, in which China's technology and market share have grown rapidly (U.S. Congress, 2020).

However, the effectiveness of the U.S. decoupling policy toward China is another issue worthy of attention because decoupling and reshaping the supply chain cannot be achieved without the cooperation of crucial U.S. partners. The first key player is Taiwan, which has long benefited from its closeness with the U.S. and Mainland China. Now that Taiwan's TSMC dominates the semiconductor industry, it is caught in the middle of the battleground and must reluctantly choose sides. Taiwan seems to be leaning toward the U.S. as it begins helping Biden invest in building up America's domestic production. However, TSMC's investment and operation in the United States did not go smoothly. The chip giant worries that operating and producing in the United States would weaken its cost advantage and its management style would not be acceptable to American employees (New York Times, 2023).

South Korea and Japan are both at an impasse with decoupling since they rely so heavily on trade with China, so both countries enjoyed a neutral stance. Business leaders now fear huge losses from any shock to the regional supply chain, especially in South Korea (since Korean semiconductor manufacturers export 60% of their products to China and import 60% of their materials from China) (Lee, 2023). The U.S. has begun courting South Korea and Japan through technological cooperation with the Chip 4 initiative, but its allies are not entirely satisfied with this initiative. South Korea's trade ministry has complained that the U.S. Chips Act imposes additional conditions on subsidies to foreign chip manufacturers, such as sharing some profits with the U.S. government, making it difficult to invest in the U.S. (Korean Ministry of Trade, Industry and Energy, 2022). From this perspective, the allies and partners of the United States cannot faithfully cooperate with it in decoupling technology from China. Therefore, the effectiveness of the U.S. TD policy is to be speculated because of individual members' self-interest.

Conclusion

With the help of NCR, this paper analyzes the evolution and motivation of the U.S. TD policy toward China, taking the comparison of China-U.S. technological strength as the independent variable and the U.S. threat perception of China as the intervening variable. As summarized in Table 1, Despite imposing systemic pressure on the United States, China's relative technological strength does not directly determine the U.S. technological policy toward China but through interpreting the U.S. perception of threats to China. Based on the interpretative framework of this paper, the United States is expected to adopt a harsher decoupling policy toward China in a multilateral manner with both U.S. and non-U.S. actors.

Also, much of the U.S.-led globalization is interconnected to the release of finished products through various processes, including supply chain management, resource production, and the

Table 1. The neoclassical realist explanations for U.S. TD policy

	China's Tech Power	U.S. Threat Perception	Policy
Bush to 1st Obama	Small	Collaborator	No Tech Decoupling
2nd Obama	Middle	Collaborator (with alert)	Unilateral Decoupling with U.S. actors
Trump	Big	Competitor	Unilateral Decoupling with U. S. and non-U.S. actors
Biden	Big	Challenger	Multilateral Decoupling with U. S. and non-U.S. actors

Source: Authors' own

movement of materials. If the United States leads decoupling in earnest, China is also expected to start producing semiconductors in the high-end sector through its development. Likewise, it may take some time, but the United States may give China a development opportunity. More importantly, the U.S. TD policy is inseparable from the cooperation of its partners, but the extent to which they comply with U.S. policy is questionable. The Biden administration tries to establish an industrial complex in its own country by attracting investment from Samsung Electronics, SK Hynix, and TSMC. Nevertheless, the United States' effort to reshape the industrial chain will also take time. Therefore, the expected summary is as follows. First, if the U.S. strategy fits perfectly, China may have already accelerated or approached technology development, and second, if advanced semiconductor countries, including Korea, are hit, it will also be twisted by maintaining the international order that the U.S. claims. So, regardless of its route, the United States has no choice but to bear strategic losses.

Finally, in terms of future research direction, while this paper takes the threat perception of the United States toward China as an intervening variable in neoclassical realist analysis, the threat perception in this paper is mainly based on the changes in the comparative technological strengths between the United States and China. The paper does not adopt an interactive perspective to analyze the mutual threat perceptions of the United States and China in the technology field, primarily due to the limitations of the analytical perspective within the realist paradigm. Thus, future research can analyze the cooperation, competition, and decoupling between the United States and China in the field of technology from the perspective of the mutual perception construction of the two countries.

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Appendix

Appendix 1. Comparison of the number of patent applications

	Mainland China	United States	Japan	Germany	France	United Kingdom	Italy	Canada	South Korea	Taiwan
2001	1730	43060	11905	14035	4706	5499	1623	2114	2324	/
2002	1015	41316	14061	14323	5091	5389	1982	2260	2520	/
2003	1297	41046	17415	14658	5169	5213	2163	2270	2946	/
2004	1707	43398	20268	15218	5183	5036	2189	2104	3555	/
2005	2503	46884	24870	15991	5747	5099	2346	2315	4689	/
2006	3930	51303	27024	16737	6263	5097	2698	2575	5946	/
2007	5455	54062	27743	17821	6566	5542	2946	2879	7064	23275
2008	6119	51668	28763	18855	7076	5467	2883	2976	7902	23832
2009	7896	45658	29810	16795	7217	5044	2652	2527	8040	22470
2010	12300	45090	32216	17568	7231	4891	2658	2698	9604	22073
2011	16398	49210	38864	18852	7406	4848	2695	2945	10357	22448
2012	18620	51861	43523	18750	7802	4917	2845	2738	11787	21850
2013	21515	57459	43771	17920	7905	4848	2868	2846	12381	21022
2014	25548	61483	42381	17983	8261	5268	3059	3072	13119	18591
2015	29839	57123	44053	18004	8421	5290	3072	2821	14564	16091
2016	43091	56591	45209	18307	8210	5504	3362	2336	15555	15813
2017	48906	56687	48204	18951	8014	5569	3225	2400	15751	17110
2018	53349	56252	49706	19742	7918	5634	3330	2417	16917	17533
2019	59187	57446	52702	19347	7923	5777	3385	2726	19074	18984
2020	68923	58477	50578	18499	7782	5889	3398	2605	20045	19012
2021	69540	59570	50260	17322	7380	5841	3581	2627	20678	19547

Source: Data of Mainland China, the United States, Japan, Germany, France, the United Kingdom, Italy, Canada, and South Korea are based on the PCT applications from the World Intellectual Property Organization. Available at https://www.wipo.int/pct/en/activity/index.html. Data of Taiwan are based on the patent applications from Taiwan's Intellectual Property Office. Available at https://www.tipo.gov.tw/tw/cp-174-219414-a1c98-1.html. Data of Taiwan from 2001 to 2006 is not available.