• *Article* •

Cost Imposition, Misaligned Gaming Strategies and Risk Deferral: The Practical Logic and Security Dilemma of the U.S. Strategic Competition Policy towards China's Semiconductor Industry

Ximing Wang[1], Hongchang Liu[2,*]

[1] School of National Security, University of International Relations, Beijing, China

[2] School of National Security, University of International Relations, Beijing, China

* Corresponding Authors: Hongchang Liu. Email: liuerboger@uir.edu.cn

Received: 21 October 2024 Accepted: 3 November 2024 Published: 31 December 2024

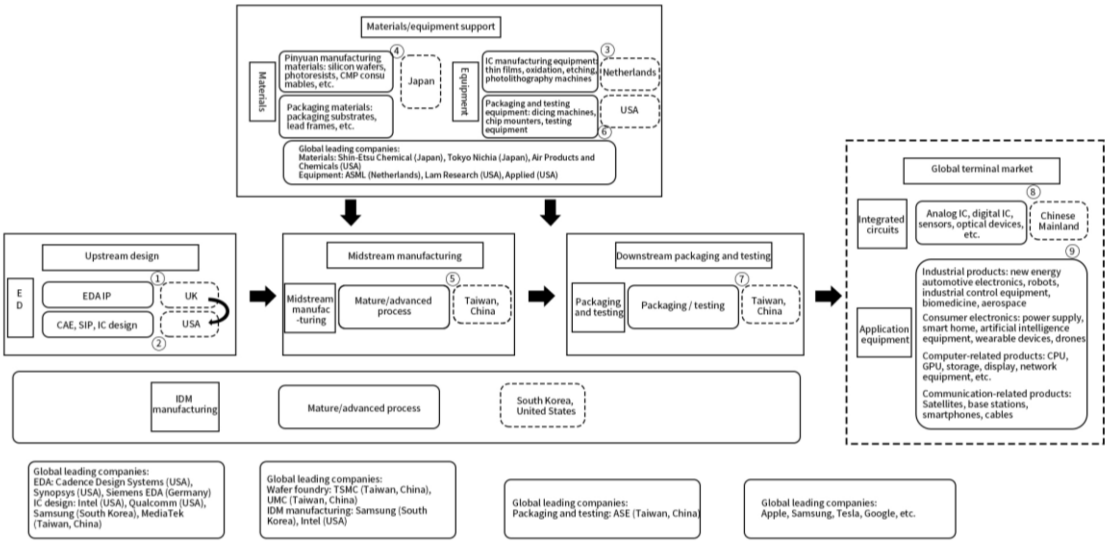
Abstract: Semiconductor industry, as a cornerstone of the digital economy, holds a vital position in cutting-edge technology fields such as electronic information engineering, communication systems, aerospace technology, and artificial intelligence. It has developed into a comprehensive system encompassing global supply chains, industrial chains, and value chains. It has formed a comprehensive system of global supply chains, industrial chains, and value chains. The United States and China serve as the primary drivers of the global semiconductor industry. To maintain its industrial dominance and technological hegemony, the U.S. has implemented a series of policies centered on "cost imposition" as part of its strategic competition policy against China, particularly in areas where the U.S. has a significant presence, namely innovation and development within this industry. By constructing a model of limited rationality risk game and conducting empirical analyses, it is demonstrated that the U.S. strategic competition policy towards China constitutes a non-optimal strategy under risk games characterized by a significant misalignment. This policy exerts a dual impact on the U.S. economy, manifesting as "small cycle advantages" and "large trend risks", resulting in a difficult-to-prevent "lag" effect. Additionally, it also underscores the temporal mismatch and cyclical imbalance inherent in the U.S.'s strategic competition approach, exacerbating the security dilemmas faced by the international community.

Keywords: Semiconductor Industry; China-US Strategic Competition; Cost Imposition; Game Strategy Misalignment; Risk Deferral; Security Dilemmas

1. Introduction

The "Fourth Industrial Revolution", which is generally characterized by the integration of cyber-physical systems, is progressing extensively and intensively. Frontier technologies such as 5G/6G modern communication systems, integrated circuits, consumer electronics, chip manufacturing, and so on, have become focal points of technological advancement and industrial growth. As the foundation of related high-tech applications, semiconductor technology is one of the most cutting-edge fields in international technological competition and strategic development. With a well-established global division of labor, a complete industrial chain, and a wide range of expanding applications, semiconductor and its upstream and downstream industries play a pivotal role in the global supply network, significantly shaping the world market.

Figure 1: Mechanism of the Global Division of Labor in the Semiconductor Industry and Application Terminals



Note: IP companies license intellectual property cores to fabless chip companies. ② Fabless chip companies design complex chips with the support of EDA software. ③ Equipment companies manufacture the equipment needed by chip factories in the chip process. ④ Raw material companies make silicon into silicon blocks and cut them into wafers. ⑤ Chip foundries etch sensors and circuits into wafers and make integrated circuits. ⑥ Test equipment manufacturers design and produce test equipment for packaging and testing companies. ⑦ Packaging and testing companies package and test semiconductor chips. ⑧ Electronics manufacturers integrate integrated circuits into terminal electronic devices. ⑨ Manufacture electronic products and sell them around the world.

Source: Internet search.

Since the 1990s, the world semiconductor industry has seen exponential growth in terms of total trade volume, participating entities and geographical reach. According to data from the Statistical Data Room of the Japanese Semiconductor History Museum, the world semiconductor market experienced an average annual growth rate of up to 17.1% from the 1970s to 1995; after 1995, even with an already substantial base, the market continued to grow at an average annual rate of 5.4% growth, with the output value exceeding the trillion-dollar mark by 2020. The United States, as the origin of the technology, enjoys a huge first-mover advantage in the world market, holding a comprehensive monopoly on core technologies such as EDA software and design IP. In contrast, China has been developing rapidly under the conditions of proactive industrial policy and increasing economic strength, and has replaced the United States to become the world's largest semiconductor manufacturer. In 2020, Huawei Haisi also successfully entered the world's top ten semiconductor companies, realizing an enormous breakthrough of Chinese enterprises, but also triggering anxiety and concern of the United States. In the context of the United States labeling China as a "revisionist state" and a "strategic competitor" coupled with the trend of de-globalization, disputes between China and the United States in the high-tech industry, especially in semiconductor innovation and development, have become inevitable.

In terms of the current development process regarding the international semiconductor market, academic research mainly focuses on four areas, namely, industrial chain layout, technological advantages of China and the United States, specific policy implementation and global impacts.

In terms of industry chain layout, the U.S. Semiconductor Industry Association (SIA) points out that U.S. companies dominate the global chip design market, while manufacturing is mostly concentrated in East Asia, affecting the security of the U.S. domestic semiconductor industry. Xu Zhang et al. (2022) argued that geopolitical risk significantly affects the global industry chain layout of the semiconductor industry, weakening its resilience to risks；In terms of the technological development of the two sides, scholars generally agree that U.S. companies lead in research and development, especially in sub-5nm chip technology; relatively speaking, China is limited by technical barriers in high-end chip design, but through policy incentives and other initiatives, it has enhanced the innovation of the local enterprises ; in the field of the implementation and analysis of the policies of the two countries, researchers have studied how U.S.. has restricted China's access to advanced semiconductor equipment, and collaborated with its allies through export control and other measures. meanwhile, they have also analyzed China's adoption of industrial policies such as "Made in China 2025" and its response to the US strategic competition.

In terms of global impact, the US-China semiconductor competition has led to adjustments in the value chain of the global high-tech industries, with some Southeast Asian countries, such as the Republic of Korea and Viet Nam, emerging as alternative manufacturing bases to cope with the instability of the supply chain. Scholars have pointed out that the competition between the United States and China in the field of semiconductors may reduce the efficiency of global science, technology and innovation and affect other countries, with the restructuring of the global supply chain facing challenges.

In summary, studies on the United States' strategic competition with China involves technology, policy and other aspects. However, there is limited systematic analysis of the logic and operational framework underpinning the U.S. strategic competition policy towards China's semiconductor industry. This study fills that gap by starting from examining the "cost imposition" strategy, introducing the game theory model and risk analysis method, and systematically presenting the internal logic of the U.S. strategic competition policy towards China's semiconductor industry and provide a theoretical foundation for China's policy response.

Based on this, this paper will analyze the U.S.'s strategic competition policy towards China from the perspective of "cost imposition" strategy, through the construction of "limited rationality risk game model". The analysis suggests that that this policy is a "non-optimal strategy choice", with obvious "misalignment" characteristics and "risk deferral" effect. Despite the short-term decline in China's semiconductor export trade and the technological innovation being blocked, in the long term, this policy imposes substantial risks on the U.S. semiconductor industry, including increased production costs and threats to sustainable development. It also exacerbates security dilemmas in the international community and harms the interests of global businesses and consumers.

2. Cost Imposition: The Check-and-Balance Logic and Profit-Driven Motives Behind the U.S. Strategic Competition Policy in the Semiconductor Industry Towards China

First of all, by comprehensively reviewing the history of competition between China and the United States in the field of semiconductor industry, this paper organizes and analyzes the U.S. semiconductor industrial policy towards China, especially after China was listed as a "strategic competitor" in 2017, to produce the following schedule:

Figure 2: Timeline of U.S. Semiconductor Policy towards China

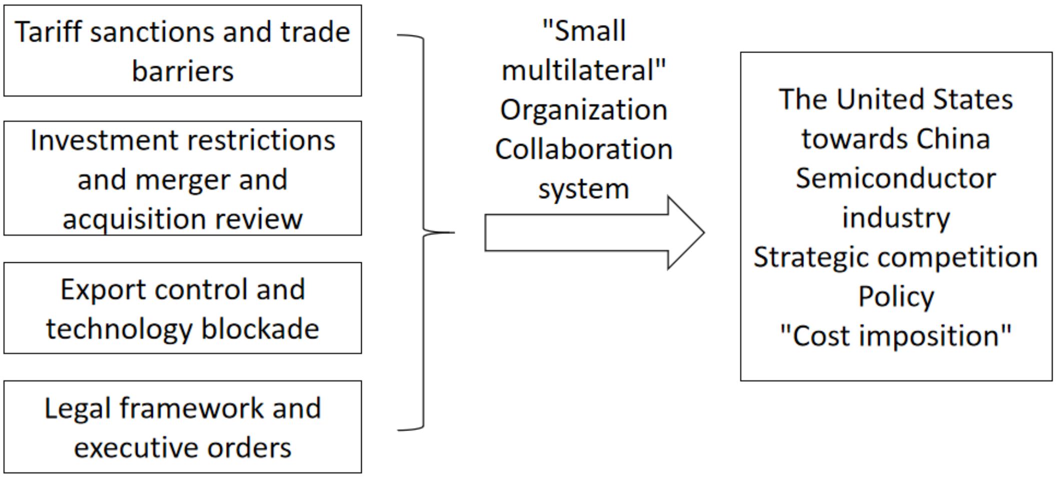
Time		Key Events
Year 1996	May	The Wassenaar Agreement establishes technology blockade and export control. China is not a Contracting State, but is still subject to the audit restrictions on the sale of restricted goods by a Contracting State to a Non-Contracting State
Year 2004	March	The United States proposed consultations with the World Trade Organization on the issue of value-added tax on Chinas integrated circuits, arguing that China imposed "discriminatory" tariffs on imported semiconductor products
Year 2017	August	The Office of the United States Trade Representative launched a "301 investigation" into China
Year 2018	April	Restart the sanctions ban on ZTE and prohibit U.S. companies from selling parts to it for 7 years
	August	Impose a 25% 301 tariff on US $46 billions of products imported from China, including about 29 tariff lines at the core of the semiconductor industry
	October	The New American think tank proposes a "small courtyard and high wall" confrontation strategy to restrict the development of Chinas chip industry Department of Commerce Bureau of Industry and Security (BIS) Amending the Export Administration Regulations (EAR) Amending the Export Control Reform Act (ECRA) U.S. Congress Passes Foreign Investment Risk Assessment Modernization Act (FIRRMA)
	December 1	Meng Wanzhou, chief financial officer of Chinas Huawei Technologies Co., Ltd., was arrested
Year 2019		Using semiconductors as weapons to launch a chip war against China to restrict domestic and foreign companies from exporting high-end chips to Huawei, Huawei's total revenue in 2021 will drop by nearly 30% year-on-year Trump administrations "Artificial Intelligence Initiative" mobilizes more resources to contain Chinese AI companies
	October	Sense Time, the largest AI unicorn company in China, is included in the list
	December	The Wassenaar Agreement was amended to add export controls on computer lithography software and large silicon wafer cutting and polishing technology
Year 2020	November	U.S. Treasury Department makes comprehensive revisions to FIRRMA to expand export jurisdiction The EU implements the Regulation on the Establishment of the EU Framework for the Review of Foreign Direct Investment

	December	The Dutch company ASML is prohibited from providing EUV lithography machines to SMIC on the grounds that its EUV (extreme ultraviolet) lithography machines use a large number of American technologies. "Executive Order No. 13959", imposing a securities investment ban on "Communist Chinese military companies" The New York Stock Exchange delists China Mobile, China Telecom, and China Unicom
	May	The Department of Commerce Foreign Direct Products Rule (FDPR) requires items not manufactured in the United States to comply with U.S. export control regulations as long as they use U.S.-supplied technology or software
Year 2021	January April	Update and expand the blacklist of "Chinese military-related enterprises" to include SMIC, Xiaomi, and China Micro Semiconductor. U.S.-Japan Partnership for Competitiveness and Resilience (Co Re) Updated export control list to add gallium oxide and diamond, two key semiconductor materials. Senates Strategic Competition Act of 2021
	May	Strengthen the examination and approval of international student visas and gradually restrict the connection between science and technology education between China and the United States
	June	US-Europe US-EU Trade and Technology Committee (TTC) Coordination of global trade, economic and technological issues
	September	Quadrilateral Security Dialogue (QUAD) Start semiconductor supply chain mechanism/ U.S. Congressional Research Service report "Chinas New Semiconductor Policy: Congressional Issues"
	The second half of the year	Forcing the world's major semiconductor companies to hand over confidential business data such as suppliers, prompting Intel, Samsung, TSMC, etc. to buck the trend and build factories in the United States
Year 2022	May	The "Quadrilateral Security Dialogue" Summit between the United States, Japan, India and Australia-Joint Declaration-Jointly Building a Semiconductor Supply Chain Chips and Science Act-$52.7 billion subsidies $39 billion for manufacturing incentives
	September	Sullivans U.S. competitive strategy towards China should switch from "maintaining relative advantage" to "maintaining maximum leading edge"
	October	2022 National Security Strategy Regulations on Export Administration
	December	Cambrian, which once provided AI processors to Huawei, is included in the list/
Year 2023	January	The Netherlands and Japan restrict exports of semiconductor production equipment to China
	August	Executive order: Prohibit/restrict U.S. investors investment in Chinese entities in three industries: semiconductors, microelectronics, quantum information technology, and artificial intelligence Outbound Investment Review
	October	Huawei's new semiconductor exports to China, advanced chips and manufacturing equipment, and sanctions dozens of Chinese technology companies.

Source: Author's own.

By focusing on the specific aspects of the semiconductor industry and the overall objectives of the U.S. policy towards China, and analyzing the underlying logic of the methods in the table, we find that the U.S. has implemented a series of strategic competition policies, including tariff sanctions and trade barriers, investment restrictions and merger and acquisition review, export control and technology blockade, legal and administrative statutes, as well as the construction of a "mini-multilateral" mechanism for coordinated blockade. The logic behind this strategic competition policy has a clear "cost-imposing" approach, which is a more tangible illustration of the strategic competition that the US is waging against China in the field of science and technology.

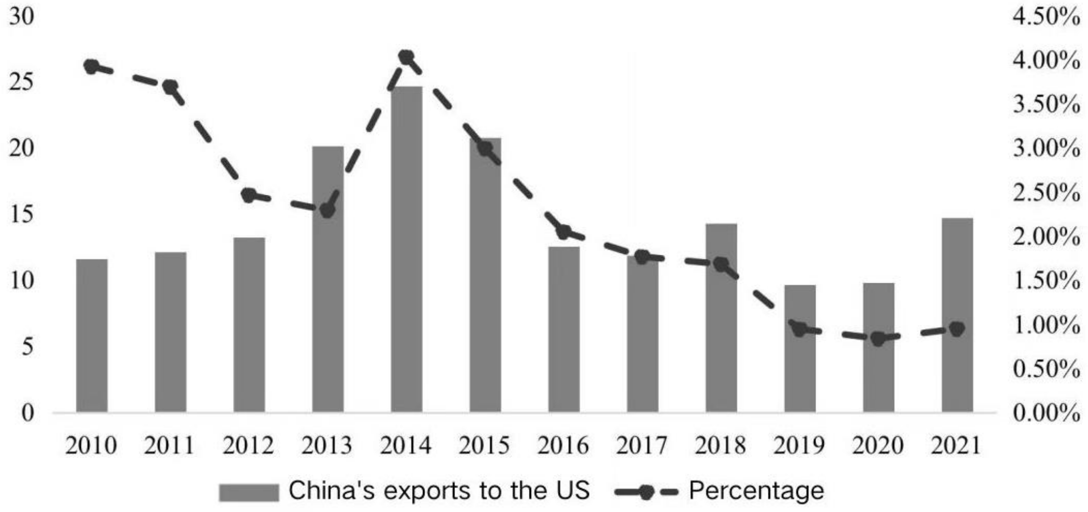
Figure 3: The "Cost Imposition" of U.S. Strategic Competition Policy on China's Semiconductor Industry



Source: Author's own production.

First, through tariff sanctions, the U.S. raises the cost of distributing semiconductor manufacturing equipment and parts, such as wafers, flat-panel displays and other products, produced in China, leading to an increase in their prices within the United States itself. This creates trade barriers and weakening the market competitiveness of Chinese companies. For example, Huawei's total revenue fell by nearly 30 percent year-on-year in 2021 after being sanctioned, while the value of China's exports of related products to the United States declined steeply.

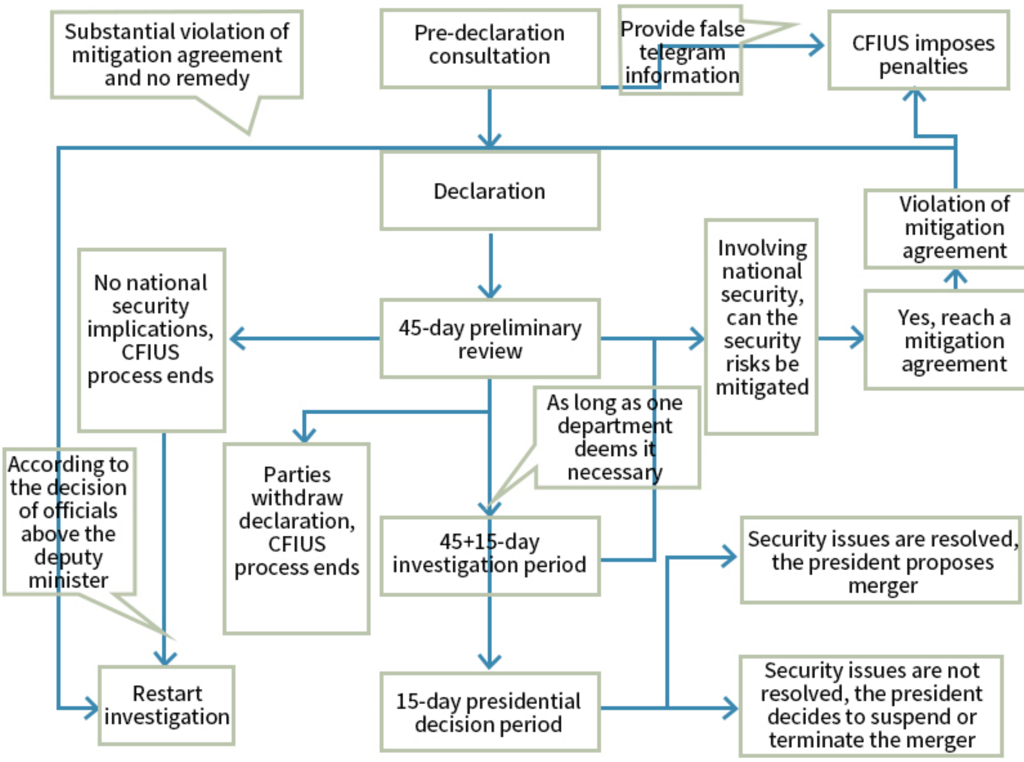
Figure 4: China's IC Export Size (US$ Billion) and Share



Source: UN Comtrade Database.

Secondly, through investment restrictions and M&A reviews, the U.S. has made it increasingly difficult for Chinese companies and production entities to invest in semiconductors, merge with other companies and acquire technology in the United States and even other parts of the world, greatly raising the transaction costs of the semiconductor industry. As early as 2010, the U.S. Committee on Foreign Investment in the United States (CFIUS) had begun imposing restrictions on Chinese investment in the U.S. and M&A activities, including communications (Huawei abandoned the acquisition of US-based 3Leaf Computer Technologies for$1.5 million), finance (in 2015, the Obama administration halted Ant Financial's $1.2 billion acquisition of payments company MoneyGram), and semiconductors (in 2017, Trump called a halt to the $1.3 billion acquisition of semiconductor firm Lattice by a Chinese firm). Immediately following the introduction of the Foreign Investment Risk Review Modernization Act (FIRRMA) in 2018, these restrictions were intensified. The non-transparent review process (as shown in the **Image 5**) is a manifestation of CFIUS's deepening restrictions on China's investment and M&A in the U.S., the blurring of the review criteria under "pan-securitization", and the U.S. government's "Cold War mentality" of restricting China's advanced technological development through investment. The well-known Tik-Tok case, is a typical example of the approach.

Image 5: US CFIUS Review Process under FIRRMA



Source: Web Find.

Thirdly, through export control and technological blockade, the U.S. has restricted the export of important raw materials for semiconductor production, such as gallium oxide and diamond, thereby increasing the production costs of Chinese enterprises; the ban on high-end chips and the prohibition of technology transfer from United States firms to China have led to the increased difficulty and rising costs of research and development for Chinese semiconductor firms and scientific research institutes.

Fourth, through the "2022 Chip and Science Act" and other legal frameworks and the introduction of a series of Presidential Executive Orders, the U.S. has heightened the legal costs and overseas risks of China's expansion into the world's semiconductor market. This is further supported by the construction of a "small multilateral" organizations collaborative system for the joint blockade, so that the semiconductor industry in mainland China in China, Taiwan, South Korea, Japan, the European Union and other key semiconductor technology and market countries are facing greater challenges. Consequently, the transaction and exchange costs have risen greatly.

Historically, the strategy of "cost imposition" originated from the "competitive strategy" used by the United States during the Cold War in the 1970s. This strategy leveraged the U.S.'s economic and technological advantages to force the Soviet Union into an arms race, thus multiplying the cost of defense, and then supplementing it with peaceful evolution and public opinion attacks. And ultimately, the aim was to dismantle its competitors from within. Similarly, under the anxiety of the "New Cold War" trend, the U.S. "cost-imposing" strategy towards China mainly comes from think tanks and research institutions, including the Center for a New American Security, Center for Strategic and

Budgetary Assessment, Brookings Institution, and the National Security Council. and Budget Assessment Center, Brookings Institution, Center for Strategic and International Studies, the Strategist., Initially, this approach focused on the South China Sea issue, and in 2012, the U.S. launched the "Asia-Pacific Rebalance". During the U.S. "Asia-Pacific Rebalance" in 2012, the U.S. emphasized "viewing China as a threat from an emerging regional power, and stressed imposing unacceptable costs on regional security threats and repressive behaviors." In the second half of 2014, a series of studies by the Centre for a New American Security emphasized the use of "cost-imposing" tactics against China; in May 2015, Patrick Cronin and Glaser elaborated on the strategy at congressional hearings to discuss the "cost-imposing" strategy toward China. which has gradually evolved into the U.S. academia and the official strategic consensus on China. Regarding the definition of the "cost-imposing" strategy, Zhao Minghao summarized it as follows: "'Cost-imposing' means, on the one hand, avoiding the outbreak of a direct and large-scale armed conflict with China; on the other hand, it is necessary to adopt comprehensive policy tools through diplomacy, politics, military deterrence, law and public opinion warfare, to increase the costs associated with China's South China Sea policy. This is to make China bear the cost of the policy in terms of tensions in the neighborhood and damage to its reputation, so as to offset and negate China's policy gains in the South China Sea dispute." According to Ruan, "'cost imposition', although a peaceful competitive strategy with limited direct objectives, is not a purely passive defense, but on the contrary, it is potentially offensive, often using a combination of military, economic, political, technological and diplomatic means to increase opponents' security pressures, constrain economic development, dividing domestic consciousness, compressing international space, and weakening their ability to develop, mobilize and utilize resources." Thomas G. Mahnken of the Center for a New American Security argues that "'cost imposition' is a peacetime effort aimed at pursuing limited objectives, altering a competitor's decision-making algorithms and strategic behaviors rather than subverting its regime. It employs a combination of military, diplomatic, economic legal, public opinion, and other integrated means to deter competitors from stopping disruptive behavior, preventing the transformation of policy outcomes, forcing them to develop a strategic overdraft on persistently high competitive costs, adopting policy concessions, and inducing the adoption of non-offensive behaviors as a competitive strategy"; Patrick M. Cronin argues that "'Cost imposition' is based on the potential use of force to deter rather than defeat competitors, and limited objectives dictate that 'cost imposition' is implemented at lower intensities, aiming to negate their policy gains through a combination of tactics, dissuade them from engaging in disruptive behavior, and redirect the pursuit of less harmful claims." Specifically, the core of the so-called "cost-imposition" strategy is to increase the economic, political and social costs of competitors, i.e., the target country, in semiconductor technology research and development, market expansion, industrial competitiveness enhancement, etc., and intensify the consumption of resources, thus forcing the world to form a new "Patron-Client" system.

It can be seen that, through a series of "cost-imposition" policies, the U.S. has established a comprehensive competitive framework targeting various aspects of China's semiconductor industry including the R&D, production, circulation, trading, applications, legal and other parts of formation of a full range of competitive system, greatly increasing the cost of China's related technology research and development and market participation, consuming more government resources, forcing Chinese enterprises to withdraw from the international semiconductor market competition. In so doing, the U.S. aims to maintain its "industrial power" in the field of semiconductor "industrial power" and achieve the monopoly of the international cutting-edge technology and the high-end industrial chain.

3. Misaligned Game Strategies: Limited Rationality Risk Game Models and Competition Policy Utility Failures

In the analysis above, the author uses "cost imposition" as the core of the analysis to summarize the driving logic behind United States on China's semiconductor industry, the core of the driving logic of strategic competition policy. However, merely analyzing the operational logic of the policy itself is only superficial, we still need to understand the essence of the U.S. semiconductor industry policy towards China on a deeper level. Based on the game theory model, and incorporating the "pan-security" characteristics of the global economic system in the post epidemic era, the author proposes the "limited rationality risk game model", and argues that the background of the U.S. all-round strategic competition policy towards China in semiconductor trade is different from the U.S.-Soviet Cold War era and the U.S.-Japanese semiconductor trade competition era. According to the traditional "Thucydides Trap" theory and zero-sum game theory, the U.S. can achieve a "wedge-balancing" effect and "pressure transition" goal by imposing maximum cost pressures on China, thereby forcing China to relinquish its interests in the semiconductor trade. But globalization has become the most important covariate and influence factor of the great power competition between China and the United States, unlike the Cold War period, when trade volumes between the two camps were low, and Japan depended heavily on the U.S. for security and economic support, China and the United States have a huge amount of trade and interconnected interests that are deeply bound by the globalization. At the same time, China possesses an economic scale, market demand, and talent pool that Japan and the USSR did not have. Therefore, in the face of the stage crisis in the process of Sino-US great power competition, the opportunity cost paid by the United States to adopt a unilateral strategy towards China is extremely high, and rational American leaders usually choose to explore the way of coexistence between China and the United States, aiming to effectively manage the crisis, and resolve Sino-US economic contradictions and trade and technological disputes at a relatively low cost. However, in the context of the spread of populist discourse and the polarization of electoral politics in the United States, "strategic competition with China" has become the "political correct" in the United States, with the semiconductor trade sanctions and competition policy also taking on political symbolism Therefore, the U.S. policymakers, driven by the domestic interest groups and their own political interests under the discipline, did not choose to end the trade dispute between the two countries. Instead, they have escalated the policy incrementally, resulting in a prolonged standoff. With the help of empirical analyses of game theory models, the author concludes that the above-mentioned U.S. strategic competition policy on semiconductor trade with China belongs to the "non-optimal strategic choice" within a risk-laden game**.**

3.1 Model Construction: A Proposal for a Limited Rationality Risk Game Model

The traditional game theory model originates from microeconomics. A game is a formal description of the interactions between individuals in a strategically interdependent environment. In a classical game theory model, four elements are required.

'Players: who is involved in the game?'

'Rules: Who acts when? What information do they know when they act? What can they do?'

'Outcomes: What are the corresponding outcomes for each possible combination of actions by the participants?'

'Payoffs: What are the preferences (i.e., utility functions) of the participants for each possible outcome?'

From these four basic elements, we can clarify how individual decision-making in a market economy produces economic outcomes. Based on this, we analyze the traditional signal game model of state-to-state relations assuming that under the premise of international crisis, a country as the initiator of the crisis is the signal sender, and a country as the respondent of the crisis is the signal receiver. And the game proceeds as a dynamic game with incomplete information, and both sides of the game as the "rational actors" make optimal decisions to achieve their own utility according to their own beliefs, received information, expected returns and other conditions. However, in the analysis of semiconductor industry game between China and the United States, microeconomics game theory and traditional signal game model have evident limitations. First, microeconomics assumes that the premise of the game is a free market economy. Yet following the impact of the COVID-19 pandemic, safeguarding the national industrial chain supply chain security has become the top priority of the industrial policy of each country. The pure sense of the economic cost is no longer the only factor to be considered by the countries of the global economy to the "security" transition, The traditional concept of free market economy and economic globalization has been significantly reversed, and the first premise of the microeconomics game theory model has been deviated. Moreover, the traditional signaling game model assumes that the two parties to the game are completely rational state actors who make "optimal decisions" by calculating the economic costs and benefits. But in the "Barney era", due to information asymmetry between the two countries, increasing uncertainty from domestic societal diversity, and significant differences in national systems and development approaches, other factors have grown increasingly influential in the industrial policy of each country. In addition to the economic costs and benefits of the two countries in the game, the influence of the leaders' personal political psychology, the reputation of the country, the mood of the domestic public and the stability of the regime are also gradually enlarged. Therefore, neither the competition initiator nor the responding party can achieve reach the economic sense of "complete rationality" but can only be a "limited rationality actor". Based on this reality, the assumption premise of "pan-securitized world market system" and "limited rational actor", the author proposes the "limited rationality risk game model" for the strategic competition among countries, especially among big countries, in order to understand the game state between great powers from a more scientific point of view, and to empirically analyze the essential characteristics of the US strategic competition policy towards China's semiconductor industry.

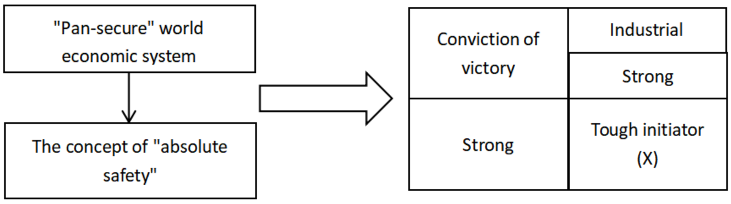
3.1.1 The Playing Field: the "Pan-Securitized" World Economic System

Since the 2008 global financial crisis, the process of economic globalization has been somewhat reversed. According to data from the United Nations Conference on Trade and Development (UNCTAD) and the World Investment Report of the China International Fair for Investment and Trade (CIFIT), during the 10 years before 2008, global foreign direct investment (FDI) inflows grew at an average annual rate of 20.2 per cent, whereas in the 10 years after the financial crisis, FDI inflows grew negatively at an average annual negative rate. In 2023, global foreign direct investment (FDI) fell by 2 per cent to $1.3 trillion. Excluding the impact of transit economies, global FDI flows fall by more than 10 percent. In addition, according to the World Trade Organization (WTO), total global exports of goods saw two consecutive years of negative growth in 2015 and 2016, at -13.5 per cent and -3.3 per cent respectively, highlighting sluggish growth in international trade and investment. More importantly, during the financial crisis, countries, especially developed economies, have introduced a series of economic control measures, and protectionism has begun to rise, and the free market economy envisioned by economists gradually faltered. The outbreak of the COVID-19 in 2019 shifted "security" rather than economic costs to the first goal of countries for stabilizing and developing their economies. During the outbreak, countries adopted a large number of containment measures, causing global trade and investment to plummet, and countries introduced a series of laws and policy documents to safeguard the security of their industrial chains and supply chains, while populist and protectionist ideas spread rapidly. Even in 2023, when the epidemic had basically come to an end, security was still the primary point for the formulation of economic policies by national governments, due to the extreme concern of countries—— especially developed countries represented by the United States—— over their own economic security and the exposure of systemic risks in the traditional international economic order. Therefore, a "pan-security" of the world economic system has emerged, constituting the current playing field for the strategic competition of the semiconductor industry between China and the United States.

3.1.2 Both Sides of the Game: "Limited Rationality" State Actors

Based on the "pan-securitized" world economic system, the levers of national actors on both sides of the game differ markedly. For the initiator of the competition, the initiator's industrial strength is usually greater, and the belief in "absolute victory" is reinforced by the notion of "absolute security". Therefore, in the "limited rationality risk game" between big powers, the initiator of competition is always the "strong initiator", and the "weak initiator" measured by the traditional signaling game model does not exist in the risk game. Let's assume that the "strong initiator" is x, and illustrate this with the following graph:

Figure 6: Game Model of State Actors under "Limited Rationality"



Source: Author's own.

For the competitive respondent, there are three levels of beliefs in the struggle against a tough competitive initiator: 1. High resistance. The respondent, motivated by factors such as domestic public sentiment, leadership characteristics, and national economic interests, does not make any compromise with the competition initiator. It adopts an equally competitive strategy until the competition initiator concedes and the two sides are in a constant stalemate; 2. Moderate resistance. The respondent tends to make partial compromise to end the competition deadlock as soon as possible due to the strong industrial strength and deterrent ability of the initiator, in order to seek a favorable and stable domestic and international development environment for itself; 3. Low Resistance. The respondent is unable to fight or be deterred by the competition policy and deterrent action of the initiator, and tends to accept the conditions of the initiator and make a complete compromise. Given the initiator's inherent developmental advantages, this model assumed that the industrial strength of the competing respondent lags behind that of the initiator of competition in general, and ultimately the competing respondent can be classified into three tiers: tough respondent (y1), moderate respondent (y2), and weak respondent (y3), as plotted in **Figure 7**:

Figure 7: Categorization of Competing Respondents in the "Limited rationality" Model

Conviction in Struggle	Industrial Strength
	Less
High	Tough Responders (Y1)
Medium	Moderate Response (Y2)
Low	Weak Respondents (Y3)

Source: Author's own work.

However, in the process of analyzing both sides of the industrial competition game, a large number of potential variables, in addition to the industrial strength and determination to win, also play an important role. For example, the differences in national systems can lead to entirely completely different results when launching or responding to industrial competition; the democratic systems in Europe and the United States lack effective social mobilization and resource concentration capacity when facing major crises, and it is easier for them to make compromises in the face of crises compared to China's centralized system. The domestic public sentiment and socio-cultural factors also have an important impact on the inter-country game of industrial policy. For the U.S. election, the China issue is an important political bargaining chip for the two parties, and in order to win more votes, the leaders of the two parties are generally inclined to show a tough stance towards China, even if it may cause damage to the U.S. economic interests. Therefore, the assumption of rational choice theory and rational actor models in traditional economics appear to be limited and inadequate for analyzing great power competition. The assumption of "limited rationality" for state actors is closer to the reality of the game subjects.

3.1.3 Mechanisms of the Gaming Process: Deviation of the "Ideal Type" from the Real Total Return

In terms of the specific mechanism of the game process, the author analyses it from the perspective of the initiator of the competition, arguing that there is a deviation between the "ideal game" and the real benefits. In other words, in the industrial game among great powers, the tough moves of the initiator of the competition cannot lead to the optimal results originally envisaged by the initiator, and the final direction of the game may even completely deviate from the initial vision, leading to the results of the "non-optimal strategic choice".

In the context of a "pan-securitized" world economy, the dominance of the concept of "absolute security" and the relative strength of industrial power fosters a determination to win, and often chooses the zero-sum game mode of competition. Under this mode of competition, the "ideal outcome" of the game can take three forms:

a: The respondent to the competition fails completely in the competition and eventually accepts the demands of the initiator of the competition in full, resulting in a "complete victory" for the initiator.

b: The competition respondent makes countermeasures but, due to its own economic power constraints and increased domestic social pressures, among other reasons, accepts the core demands of the initiator, makes major compromises and withdraws from the competition.

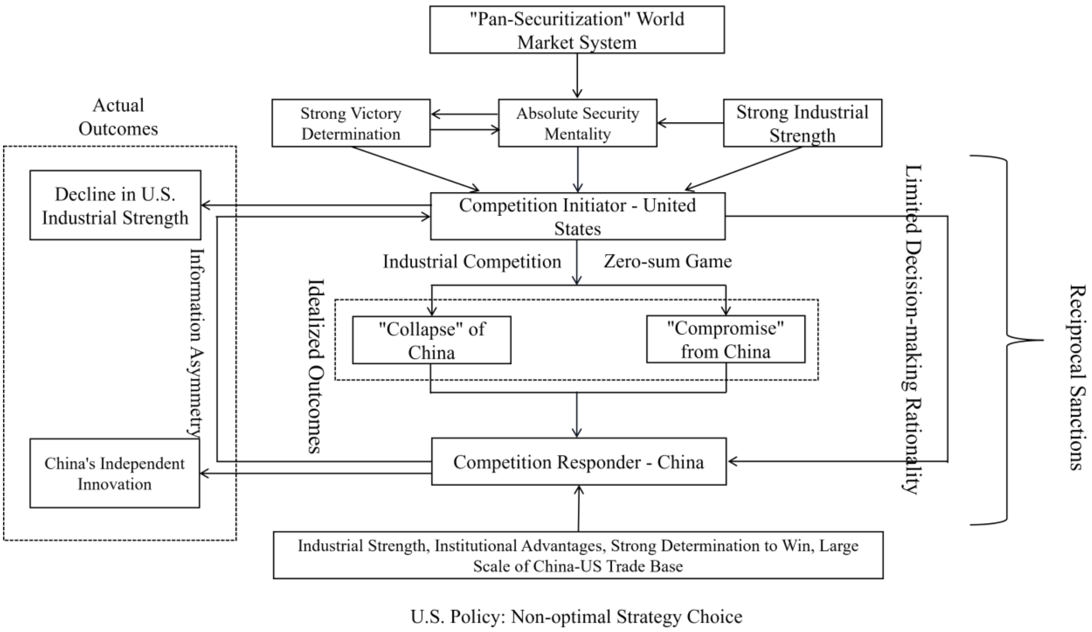
c: The competing respondent, driven by a strong resolve, forces the initiator to make some concessions, and each side backs down, but the result is still favorable for the initiator because of the initiator's first-mover advantage.

For the competition initiator, the policy outcomes are clearly ranked as a>b>c.

However, in the face of the competitive counterparty, due to the asymmetry and uncertainty of the information between the two parties, it is impossible for the competitive initiator to fully and completely understand the full strength of the counterparty, and there may even be information bias. Therefore, for the competitive initiator, the above game results can only be called the ideal model. Although the competing party may be weaker than the initiator in terms of industrial strength, with a high fighting spirit, distinct institutional advantages, strong national cohesion, and high economic interdependence between the initiator and the competing party, the competing party will be enabled to implement the national system to promote the independent innovation of the key core technology of its own country, thus improving the domestic industrial chain and supply chain, and making use of diplomacy, trade, law, science and technology to fight back against the initiator in a variety of ways. As a result, the initiator's initial goal of curbing the respondent's industrial development is not achieved. On the contrary, the fierce game forced the respondent to improve the innovation capacity of key technology, economic development sustainability and growth resilience. Meanwhile, the competition initiator, due to the over-optimistic expectations of the prospects, and high economic dependence on the competition counterpart, their own economic development is damaged, resulting in a final "lose-lose" outcome.

To sum up, by designing the "limited rationality risk game model", the author provides valuable insights into the internal logic and essential characteristics of industrial competition between the major powers, China and the United States.

Figure 8: Model Diagram of the Limited Rationality Signaling Game Model of Industrial Competition between China and the US



Source: Author's own.

3.2 Case Study: Limited Rational Risk Game Model and US Strategic Competition in the Semiconductor Industry with China

Using the above theoretical model, the author argues that the model is well-suited to analyzing the strategic competition policy of the United States towards China's semiconductor industry. According to the model, the U.S. semiconductor industry competition policy towards China is essentially a "non-optimal strategic choice", resulting in a "lose-lose" result for the United States.

First of all, the United States, relying on its strategic advantage in the world semiconductor market and the concept of "absolute security", approaches China—a rising competitor—with a belief in "certain victory". This belief is fueled by a notion that it can replicate the experience of victory in the Cold War against the USSR, and in the 1980s against Japan. At the same time, due to China's increasing role in the international industry transfer and rapid economic development, as well as the decline of the traditional manufacturing industry in the United States, and the collapse of the middle class, anti-China sentiment has been fueled among U.S. citizens. The U.S. domestic people, especially semiconductor interest groups, is invested in the false belief that their own unemployment is attributed to China's economic development. Thus, through political contributions, election intervention and other forms of influence on U.S. political decision-making, this sentiment pressures U.S. leaders to choose to prioritize voters' demands over the rational choices typically advised by elite scholars. As a result, the United States semiconductor trade policy with China fall into a "limited in rationality", expanding from an economic issue to a politically charged domestic issue. Through the biased propaganda of the election and the developed social media system of the United States, the sentiment is further aggravated into the resolute and uncompromising attitude of the interest groups towards China. As a result, the U.S. approach to China has gradually evolved from "engagement and change" to "competition to win", evidenced by Trump administration's *2017 National Security Strategy Report* that labeled China as a "revisionist state" and a "strategic competitor", marking a drastic change in U.S. strategic intentions and tactical choices toward China. For the U.S., this competition can only result in one of two outcomes: China's complete concession or alignment with core U.S. interests. However, this is also bound to cause China's strong rebound. China has previously put forward the "Made in China 2025" strategy and the "China Smart Manufacturing" strategies viewing technological innovation as a core strategic interest. In light of the U.S.'s competitive stance, China calculates that close economic and trade relations between China and the United States may help alleviate the effects of United States of America's policies, or even prompt temporary compromises from the U.S. Moreover, if China wins the semiconductor trade crisis, it can reap huge international reputation and provide great opportunities for China's cutting-edge technological innovation. Consequently, it will surely choose an uncompromising attitude and strategy in the semiconductor field. As a result, China's ability to innovate independently in key core technologies has been significantly strengthened in recent years, with Huawei Haisi ranking among the world's top 10 semiconductor companies for the first time in 2020; and 55 per cent of the world's semiconductor patent applications from China in 2021-2022, twice that of the United States. In addition, due to the U.S. policy of high tariffs on China and the relative decline of U.S. domestic manufacturing capacity, the lack of low-priced chip raw materials in China directly led to the rise in production costs of U.S. domestic market. Semiconductor manufacturing companies that have relocated to the U.S. are also faced with high labor prices, stringent environmental protection policies and political gridlock. In summary, the United States to China's semiconductor trade strategy competition policy, is "limited rationality under the conditions of non-optimal strategic choice". Not only has it failed to contain China's semiconductor industry innovation or consolidate U.S. industrial hegemony, but has also promoted China's innovation in key core technology, raised the production costs for the U.S. industry, resulting in the "lose-lose" outcome.

4. Risk Deferral: The Structural Limits and Potential Crisis in the U.S. Semiconductor Trade Competition Strategy with China

According to the above model analysis, the author argues that the U.S.'s "limited rationality" semiconductor trade game strategy toward China, exhibits a "risk deferral" transmission mechanism and distinct characteristics The “Risk deferral” specifically includes “short-term cyclical gains” and “long-term structural crisis”. In the short term, this strategy may hinder or even stall the development of China’s semiconductor industry, promoting semiconductor technology and manufacturing back to the United States. However, in the long term, it will cause the United States national credit to be overdrawn, innovation blocked and damage the world semiconductor market development prospects, exacerbating the security dilemma of the international community.

In the short term, the series of strategic competition policies adopted by the U.S. have temporarily achieved certain established goals:1., it has successfully “regulated and locked” some key enterprises in China’s semiconductor industry. The U.S. has delayed these companies’ efforts to expand into overseas markets. Under the Trump administration, Presidential Executive Orders placed certain Chinese companies on the “Chinese Military-Related Enterprises” list, prohibiting U.S. investors from engaging with them. Following these orders, the New York Stock Exchange delisted China Mobile, China Telecom, and China Unicom. Key Chinese semiconductor companies, including Semiconductor Manufacturing International Corporation (SMIC), Xiaomi, and Advanced Micro-Fabrication Equipment Inc. (AMEC), were also added to this list. In April 2018, the U.S. restarted the sanctions against ZTE, prohibiting it from importing products from the U.S. in any form. In October 2019, China’s largest domestic AI unicorn, Shangtang Technology was listed on the U.S. “Entity List”. Furthermore, in 2020, the U.S. banned Dutch company ASML from supplying EUV lithography to SMIC. This series of policies has had a huge impact on the semiconductor production and trade of Chinese companies. ZTE’s semiconductor R&D and operations are temporarily in trouble due to the lack of key technologies; Huawei’s turnover has declined significantly, and South Korea’s Samsung refused to provide foundry services for Huawei in June 2020. And China’s Zhilu Capital’s acquisition of South Korea’s Megane Semiconductor in March 2021 was forced to be suspended. China’s key semiconductor companies have been greatly restricted in terms of raw material imports, access to production equipment, investment in key technologies, cross-border mergers and acquisitions, and market expansion, and China’s semiconductor trade has slowed down.

Secondly, the promotion of semiconductor manufacturing back to the United States has strengthened the United States supply chain security system and manufacturing capacity, increasing jobs. Reducing the supply chain dependence on the Asian supply chains is a key component of the U.S. competitive strategy against China in semiconductor trade. In 2020, the United States “Creating Helpful Incentives to Produce Semiconductors (CHIPS)” invested $22 billion to support the domestic semiconductor production and research and development. The National Defense Authorization Act for Fiscal Year 2021 appropriated $37 billion to strengthen the production of chips, while the U.S. Innovation and Competition Act of 2021 allocated $52 billion. Further, the CHIPS and Science Act of 2022 provided an additional $52.7 billion to strengthen the domestic supply chain and discourage investment in Chinese factories, with $39 billion dedicated to the semiconductor sector, including chip manufacturing. As shown in the **Figure 9**, under the support of huge subsidies, Intel, Samsung, TSMC and other leading semiconductor companies to build factories in the United States in large numbers:

Figure 9: Investment by US-based Semiconductor Companies since 2020

Time of announcement	Name of enterprise (country of origin)	Amount invested ($ billion)	Investment location	Specific projects
May 2020	TSMC (Taiwan, China)	120	State of Arizona	Construction of advanced wafer fabs
Mar. 2021	Intel (United States)	200	State of Arizona	Construction of two wafer fabs
May 2021	Samsung (Korea)	170	State of Texas	Construction of the second wafer foundry
May 2021	SK Hynix (Korea)	10	California	Building R&D Centres
Jul. 2021	Gergen (United States)	10	New York state	Construction of a second plant and increase in production capacity
Nov. 2021	Texas Instruments (USA)	300	State of Texas	Construction of four wafer fabs
Jan. 2022	Intel (United States)	200	Ohio	Construction of two wafer fabs

Source: Web Find.

The decision of leading semiconductor companies to establish factories in the United States against the prevailing trend has reduced U.S. dependency on semiconductor raw materials and manufactured goods from China, thereby alleviating the worries about the supply chain security. This shift supports the return of local manufacturing and advances the process of "re-industrialization", increasing domestic employment. In the short term, the U.S. policy to maintain the U.S. domestic semiconductor industry innovation and worldwide semiconductor "industry power" has played a role.

However, from the general trend, the United States of America to China's semiconductor competitive trade policy still present substantial risks. These policies may hinder the healthy development of U.S. domestic semiconductor innovation, but also usurp the law of the market, affect the world's semiconductor industry's resource allocation and sustainable development, revealing clear structural limitations.1. the United States has seen limited Improvement in the U.S. Manufacturing Environment. and the semiconductor manufacturing industry faces challenges in addressing problems related to the real economy of the United States. Although TSMC, Intel, Samsung and other semiconductor companies in the United States are returning to the United States one after another, encouraged by relevant bills, loans, and subsidies, substantial obstacles persist. Local labor costs in the United States are still high, and the long-term decline of the real economy also makes it difficult for the infrastructure to adapt to high-tech enterprises to move further. Moreover, environmental regulations across different regions of the U.S. have also increased the "Green Cost" for enterprises to build production facilities. At the same time, due to the great uncertainty of U.S. election politics, bipartisan conflicts, the bill is difficult to implement efficiently. Therefore, the relevant semiconductor enterprises to return to the United States, whether it is a long-term investment, or a flash in the pan, remains uncertain. Without a comprehensive approach addressing environmental policy, labor costs, supporting infrastructure and other perspectives, reliance solely on the industrial subsidies and grants is unlikely to form a lasting attraction to the relevant enterprises.

Secondly, in the era of globalization, China and the United States are intertwined in terms of economic development, technological advancement, education, etc., making “decoupling” fraught with potential risks of backlash for the United States. While the United States intends to aim to reduce dependency on China by turning to importing semiconductor raw materials and manufactured goods from Southeast Asia and Japan, South Korea and other regions, China remains Asia’s largest economy and Southeast Asia’s largest trading partner. Much of the semiconductor production equipment, raw materials and infrastructure still originate from China, indicating that the United States is still essentially unable to get rid of dependence on China. The United States’ efforts to limit the number of Chinese students to study integrated circuits, chip manufacturing, and other natural science and technology in the U.S., will not only excludes China from its talent pool and innovation ecosystem. but also stagnate the process of innovation in U.S. science and technology. The politicization of the development of education and science and technology will deteriorate the scientific research and academic environment, and in the long run will damage its own resilience to innovation.

Thirdly, the abuse of competitive trade policies by the United States, which oversteps the law of the market, is not conducive to the sustained development of the world market and damages the national credibility of the United States. By abusing strategic competition policy and upholding trade protectionism, the government has employed tools to strengthen the intervention in the world market, disrupting the semiconductor industry’s optimal allocation of global resources. This interference increases the production cost of key semiconductor enterprises and innovation costs, but also inhibits the enthusiasm for semiconductor and other key industries to invest in the world’s semiconductor trade growth and market transactions. At the same time, due to the continuous introduction of sanctions, the U.S. national credit system has been shaken, the world’s countries have doubts about U.S. trade protectionism, and continue to promote their own “de-dollarization” and their own self-sufficient supply chains. The global shift to security-focused rather than market-oriented industrial chain ultimately damages the overseas market potential of U.S. domestic enterprises to expand overseas markets, harm the interests of U.S. consumers ed, and raise the costs of science and technology research and development, market transaction, cross-border marketing, and capital turnover, which will bring great uncertainty to the global economic recovery in the post-pandemic era.

Overall, the U.S. semiconductor trade policy with China in time has a temporal mismatch between “short-term profit cycles” and “long-term risk trends”, as well as an imbalance between them. Due to the U.S. bipartisan infighting and the short-sightedness of electoral politics, U.S. leaders aim to appease voters, stabilize interest groups, and secure electoral victory. This has continuously lengthened the relevant strategic competition, forming a vicious cycle of “election-sanctions-election-sanctions”, which might ultimately result in “grey rhino” events, bringing unpredictable risks to the U.S. economy.

5. Conclusions and Outlook

From the internal point of view, with the emphasis on the “new quality productive forces”, semiconductor technology serves as the computational foundation of the science and technology industry, undoubtedly playing a vanguard role in the process of industrial transformation. From the external point of view, countries like the United States, Europe, Japan and South Korea are attempting to expand their share in the world’s Semiconductor industry chain. One of the greatest challenges, in the face of external sanctions and competition, how to ensure the security and stability of the national semiconductor industry. For China, facing a once-in-a-century shift in the international landscape marked by “great turbulence, great awakening, great development, great change, and great adjustment,” this challenge necessitates higher standards and strategic foresight. For China, facing a once-in-a-century shift in the international landscape marked by “great turbulence, great awakening, great development, great change, and great adjustment,” this challenge necessitates higher standards and strategic foresight.

Adherence to the Fundamental Policy of Opening Up It is recommended to further strengthen international cooperation, learn from the excellent experience of other countries and regions, actively seek cooperation in the field of semiconductors, and jointly research, develop and produce advanced semiconductor technology applications. Efforts should be made to continuously expand the import of raw materials and components, reasonably plan the construction of industrial parks, production bases and R&D centers, adjust the policies related to supply channels, reduce the dependence on specific countries or regions, and improve the ability of independent security and the industry chain synergy efficiency, establish a diversified and multi-mode security supply chain system, and establish a sound risk response mechanism.

Commitment to Knowledge Innovation. It is recommended that R&D investment in the semiconductor field be increased to support basic and applied multi-port research, strengthen multilateral cooperation among the government, academia, industry and research institutions, promote the implementation of the policy of integrating “industry, academia and research”, and anchor development opportunities for the training of relevant talents, so as to enhance China’s core competitiveness in the field of semiconductor technology.

Adopting an Industrial Transformation Strategy. It is recommended to pay attention to the high-end development trend of the semiconductor industry in the international community. And focusing on breaking through key core technologies, adjusting and optimizing the structure of industrial organization, and promoting resource integration and industrial upgrading, will help form a number of leading semiconductor enterprises with international influence. Achieving the strategic goal of increasing the added value of products and creating an internationally competitive semiconductor industry cluster is critical.

In conclusion, this paper has sorted out the timeline and specific initiatives of the U.S. strategic competition policy in the semiconductor trade with China by starting from the strategic principle of "cost imposition", analyzing the logic of checks and balances of the relevant policies and the national interests behind the policies. By applying the "limited rationality signaling game model", this paper discusses the theoretical underpinnings of these policy, arguing that the U.S. semiconductor trade strategic competition policy with China is a "non-optimal strategic choice" within the risk-laden dynamics of major power rivalry, and approves to be a "double-edged sword" for the U.S. itself. In the "competition" between China and the United States, identifying the mutual interests of the two countries and effectively managing disputes between the two countries will be crucial to seeking the maximum marginal interests for the economic and social development of the two countries and even the world market. Within the framework of globalization, the two countries can carry out cooperation on global governance of AI and development of cutting-edge technology closely related to semiconductor technology, in order to most effectively safeguard the security of the global supply chain, give full play to the international role that a big country should play, and maximize the well-being and benefits for the entire world.

Acknowledgement

Thank to Dr Sun for his inspiration in the thinking of this paper, and Associate Professor Zhong for his guidance and help.

Funding Statement

None.

Author Contributions

The author confirms the sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Availability of Data and Materials

The data for this study are derived from publicly available literature、news reports and web pages, which have been listed in the references.

Conflicts of Interest

The authors declare that they have no conflicts of interest to report regarding the present study.

References

[1]. *Maintaining U.S. global leadership: Priority defence in the 21st century.* (2012), 2-4.

[2]. Arita, T., & McCann, P. (2002). The spatial and hierarchical organisation of Japanese and US multinational semiconductor firms. *International Management*, *8*(1), 121-139.

[3]. Cédric, D., & Milberg, W. (2020). Intellectual monopoly in global value chains. *Review of International Political Economy*, *27*(5), 1-26.

[4]. Dou, L. (2023). Value chain reconstruction of China's electronic and optical equipment industry under the perspective of China-US trade friction. Nankai University.

[5]. Jiang, Z., Zhong, W., & Han, M. (2023). Analysis of the evolutionary game of oil trade among major countries - Taking China, Russia, India, and Saudi Arabia as an example. *Earth Journal*, *44*(2), 387-394.

[6]. Li, Y. (2023). A study of the Biden administration's semiconductor policy. Liaoning University.

[7]. Li, Z., & Jiang, S. (2021). China's semiconductor industry development strategy under U.S.-China trade friction. *Foreign Investment in China,* (22).

[8]. Liu, Y., Yan, Z., Cheng, Y., & Ye, X. (2018). Exploring the technological collaboration characteristics of the global integrated circuit manufacturing industry. *Sustainability.*

[9]. Ma, O. (2023). The research on the international competitiveness of China's IC trade and influencing factors: Based on the comparison of China, the United States, Japan, and South Korea. Liaoning University.

[10]. MacCarthaigh, M. (2017). Reforming the Irish public service: A multiple streams perspective. *Administration*, *65*(2).

[11]. Mahnken, T. G. (2014). *Cost-imposing strategies: A brief primer.* Center for a New American Security.

[12]. Martin, X., Salomon, R. M., & Wu, Z. (2020). The institutional determinants of agglomeration: A study in the global semiconductor industry. *International Journal of Industrial Organization*, *19*(6), 1769-1800.

[13]. Qu, R., & Li, J. (2020). The analysis of the world trade pattern of high technology products and China's trade position. *Economic Geography*, *40*(3).

[14]. Ren, B., Li, J., & Liu, J. (2023). The local market effect of inner circle pulling outer circle: An example from China's semiconductor industry. *World Economic and Political Forum,* (5).

[15]. Smith, D., Feldman, M., & Anderson, G. (n.d.). The longer term effects of federal subsidies on firm survival: Evidence from the advanced. *The Journal of Technology Transfer*, *43*, 593-614.

[16]. Snyder, D., & Kick, E. L. (1979). Structural position in the world system and economic growth, 1955-1970: A multiple-network analysis of transactional interactions. *American Journal of Sociology*, *84*(5).

[17]. Song, Y., Yu, C., Hao, L., & Chen, X. (2021). Path for China's high-tech industry to participate in the reconstruction of global value chains. *Technology in Society.*

[18]. Tao, T., & Shi, K. (2023). From Japan-US semiconductor conflict to China-US semiconductor conflict: Motivation, nature, and impact. *International Trade.*

[19]. Xu, F., Ye, X., & Wang, R. (2022). An analysis of the U.S. high-tech industry subsidy policy system: Taking the semiconductor industry as an example. *American Studies*, *36*(5).

[20]. Yang, C., Li, W., & He, J. (2024). Trends in U.S. semiconductor controls on China, implementation points, and China's response. *Industrial Economics Review*, (02), 187-200.

[21]. Yang, D., Miao, X., & Qiu, Y. (2021). Research on the competitive situation and countermeasures for the development of China's integrated circuit industry. *Research Management*, *42*(5).

[22]. Yang, K., Yan, C., Shi, K., & Cui, L. (2023). A comparative study of chip industry policies of China and the United States under the threshold of cross-country comparison: Based on text quantitative analysis. *Information Technology and Management Applications*, *2*(5).

[23]. Yang, Z., Wu, Q., & Song, M. (2023). Research on the impact of the U.S. Chip and Science Act on the development of China's semiconductor industry and countermeasures: Based on the perspective of the innovation chain theory. *Nankai Management Review*, *26*(1), 146-160.

[24]. Yin, X., & Cui, Y. (2010). State intervention in Japan-U.S. semiconductor industry competition: An analysis from the perspective of strategic trade policy. *Modern Japanese Economy*, (1).

[25]. Zhang, W. (2023). U.S.-Japan semiconductor trade friction and U.S.-China science and technology game: Comparison and reflections. *Southern Finance*, (3), 80.

[26]. Zhou, G., & Yi, Y. (2021). Research on enhancing the safety and controllability level of China's integrated circuit industry chain under the new development pattern. *Macroeconomic Research* (11).

[27]. Zhou, J. (2018). Oligopoly competition and M&A restructuring: The catch-up logic of the global semiconductor industry. *International Economic Review*, (5).
