

From Global Value Chains to Strategic Autonomy: The Limit of Interdependence in the US-China Semiconductor Rivalry

Budi Riyanto¹

LSPR Institute of Communication and Business, Jakarta¹
budi.r@lspr.edu¹

Revi Marlina²

LSPR Institute of Communication and Business, Jakarta²
revy.m@lspr.edu²

Abstract

This research will explore the competition between China and the US, specifically in the context of chip war. The chip war highlights the importance of understanding the dynamics of economic interdependence in international relations. In this case, the chip war is not simply a matter of economic competition over market share but rather is part of a broader strategic competition between the US and China. The increasing reliance on technology in areas such as supply chain management, cyber warfare, and military hardware has significantly elevated its importance in contemporary international relations. Technological leadership and control over key technologies become a crucial geopolitical factor, particularly in areas such as trade, diplomacy, and security. Meanwhile, technology has led to new opportunities between the countries to create cooperation, China and The US see this as a new tool for political coercion or influence. This research will analyze China's strategy to face The US in the context of the chip war since The US itself sees the rapid technological development of China as a challenge. The paper analyzes the factors driving this competition, including technological supremacy, national security concerns, and economic nationalism. It explore the implications of the chip war for global supply chains, geopolitical stability, and the future of technological innovation. By examining the case of the chip war, the paper challenges the traditional assumption that economic interdependence inevitably leads to peace and cooperation.

Keywords: The Chip War, The US-China strategic competition, interdependence, technology

1. Introduction

The term "chip war" recently become popular to highlight strategic competition in international relations, it refers to a competition between countries, companies, or other entities to develop and manufacture advanced semiconductor, which are used in a wide range of electronic devices, from smartphones to supercomputers (Miller, 2022). The term has gained greater prominence in recent years due to tensions between the United States and China over the development and control of advanced chip technology. This competition has been driven by a variety of factors, including economic and national security concerns, as well as the desire for technological dominance in emerging industries such as artificial intelligence and 5G wireless networks. The chip war has also led to increased scrutiny of supply chains, intellectual property rights, and government regulations related to the development and use of advanced chip technology.

The term chip war has become more commonly used in recent years due to concerns about a growing rivalry between the United States and China over technological leadership and control over key technologies. The U.S. has taken steps to limit China's access to American-

made chip technology, citing concerns over national security and intellectual property theft, while China has sought to invest in and develop its own domestic semiconductor industry. This competition has created tensions in global supply chains and raised questions about the future of the semiconductor industry and its role in the global economy (Miller, 2022).

The chip war involves efforts by countries to secure access to critical components and technologies for the development of semiconductors, which are used in a wide range of products including smartphones, computers, cars, and military systems. The chip war certainly has significant implications for global economic and political stability, as semiconductors play a critical role in many key industries and technologies.

Both China and the US are investing heavily in emerging technologies as they seek to gain a competitive edge in the global economy and military. China has made significant progress in developing its domestic technological capabilities, and has launched a number of initiatives such as "Made in China 2025" and the "Digital Belt and Road" to promote its technological exports and influence. This has led to concerns in the US and other Western countries about China's growing technological prowess and its potential implications for national security and economic competitiveness (Hillman, 2021).

The US has responded with its own initiatives to protect its technological leadership, such as export controls on certain technologies, restrictions on Chinese investment in US tech companies, and the formation of alliances with other countries to develop alternative technology supply chains. The technological dimension of the great power rivalry between China and the US is also important because it has the potential to shape the broader international system. The competition for technological dominance between the two countries could lead to the emergence of a bipolar technology order, with the US and its allies on one side, and China and its allies on the other. This could have significant implications for global trade, investment, and security (Allison, 2020).

Semiconductors are of significant economic and strategic importance for many countries, including the United States, China, Japan, South Korea, and Taiwan, among others. Semiconductors are critical components in a wide range of products, from consumer electronics to military systems, and the industry is a key driver of technological innovation and economic growth. From an economic perspective, the semiconductor industry is main contributor to countries' GDPs, competitiveness and employment, especially in some countries with major hub for chips supply chain. The industry's importance is also due to its role in supporting other industries, such as automotive, healthcare, and energy, that depend on semiconductors for their products.

In terms of defense and national security, semiconductors are critical components in many military systems and platforms, including advanced weapon systems, missile defense, and secure communications. The ability to design, manufacture, and secure semiconductors is therefore essential for a country's military capabilities and strategic interests of the great powers. Given the importance of semiconductors for both economic and defense purposes, many countries have sought to protect and promote their semiconductor industries through various policies, such as investments in research and development, subsidies for domestic manufacturers, and export controls. This has led to increasing competition and tensions between countries, as seen in the ongoing "chip war" between the United States and China (Demarais, 2022).

This paper looks at how technology has shaped the US-China great power rivalry. More specifically, it looks at how technological interdependence can both help and hinder these two countries' cooperation, and it also shows how competition in technology has the potential to

escalate tensions and jeopardize international stability. The technological dimension is a critical aspect of the great power rivalry between China and the US. Both countries are investing heavily in advanced technologies such as artificial intelligence, 5G wireless networks, quantum computing, and biotechnology, and are competing to establish dominance in these areas. The theoretical debate between liberalist and general realist perspectives on the nature of interdependence and international relations will be examined in the first section of this paper. The second part will contextualize the limit of interdependence in the dynamic geopolitical landscape, particularly in light of the ongoing chip war.

2. The Limit of Interdependence in Promoting Peace

Interdependence has been a central issue in the debate between realist and liberalist perspectives in international relations and it will continue to shape discussions about the nature of global order and the prospects for peace and cooperation in the 21st century. Realists and liberals have different views about the role of interdependence in shaping international relations and the prospects for peace and cooperation in the global system. Realists are skeptical of the idea that interdependence can reduce the likelihood of conflict between states. They argue that states are fundamentally self-interested actors that prioritize their own security and survival above all else (Rana, 2015).

Realists also believe that interdependence can create vulnerabilities and dependencies that may be exploited by powerful states to achieve their strategic objectives. In contrast, liberals are more optimistic about the potential for interdependence to promote cooperation and reduce conflict. They argue that economic and social ties between states can create mutual benefits and promote greater understanding and communication between societies. Liberals also believe that international institutions and global norms can help to promote cooperation and resolve disputes peacefully. Otherwise, realists believe that the international system is characterized by competition and conflict between states, while liberals see cooperation and interdependence as a key driver of global stability and prosperity (Rosecrance & Stein, 1973).

Another example of the continuing debate can be seen in Parag Khanna works *Connectography* (Khanna, 2016). His argument represents the liberal tradition that model of recent global supply chain is “Tug-of-War”. He argues that today's great nations are acutely aware that in a tug-of-war, if the rope snaps, both teams fall and are defeated (Khanna, 2017). Mark Leonard's book *The Age of Unpeace: How Connectivity Causes Conflict* (2021) offers a contemporary reinterpretation of realist principles, arguing that the interconnectedness of the world has exacerbated existing power struggles and conflicts. He argues that the internet and other technologies have created a more interconnected and globalized world, which has led to new forms of conflict and tension. The rise of China, the decline of the United States, and the fragmentation of Europe are all factors that contribute to the current age of unpeace (Leonard, 2021).

A political scientist and international relations scholar from the University of Virginia, Dale Copeland said interdependence can increase the likelihood of war under certain conditions. Specifically, Copeland argues that when a rising power becomes economically interdependent with an established power, the established power may seek to constrain the rising power's economic growth, which can lead to conflict. This is because the established power may view the rising power as a threat to its own economic and political dominance, and may take steps to prevent the rising power from surpassing it. In this view, interdependence can create a situation of relative power asymmetry that makes war more likely, as the established power seeks to maintain its position of dominance (Copeland, 1996).

The relationship between interdependence and conflict depends on the expectations of the parties participating in the trading relationship, according to Dale Copeland's theory of trade expectancies. If a dominant power expects to benefit more from economic interdependence than its weaker trading partner, it may be more likely to initiate a war to alter the terms of the trade relationship. Conversely, if both parties expect to benefit relatively equally, they are less likely to engage in conflict.

Copeland argues that expectations about the future distribution of power and wealth are crucial in determining the likelihood of war, and that actors are more likely to initiate war when they believe that the existing distribution of power is becoming increasingly unfavorable to their interests. Therefore, the relationship between interdependence and war in Copeland's theory is mediated by the parties' expectations about the future distribution of power and wealth, and their willingness to use force to alter that distribution (Copeland, 2022).

According to Copeland's theory, interdependence can lead to two different types of power relations between states. First, in a "bipolar" world where two states are dominant and highly interdependent, they may be incentivized to avoid war to protect their mutual interests. However, in a "multipolar" world where many states are highly interdependent but less equal in power, interdependence may actually increase the likelihood of war as the more powerful states seek to maintain their advantage and exploit the vulnerabilities of weaker states. Copeland's argument is generally considered relevant in explaining today's great power conflict within the realist tradition. His work focuses on the role of power, security, and competition in shaping state behavior, and he has contributed to debates within realist theory about the causes of war, the balance of power, and the nature of international order (Copeland, 2014).

Copeland's thesis, as presented in his work, offers a valuable perspective on the relationship between interdependence and the likelihood of conflict. His argument that expectations about the future distribution of power and wealth play a crucial role is compelling. However, it's important to note that this perspective is not without its critics. Some scholars argue that Copeland's focus on expectations might overlook other factors that can influence the decision to initiate war, such as domestic political pressures, ideological differences, or the availability of military resources. Additionally, critics have pointed out that interdependence can sometimes serve as a deterrent to conflict, rather than a catalyst, particularly when states are deeply integrated economically and have a strong interest in maintaining stability.

3. Weaponization of Interdependence in the Chip War

As Chang said that, "The United States and China are locked in a cold tech war and the winner will end up dominating the 21st century" (Chang, 2020) showed that the competition for technological supremacy increase the pessimistic view about the limit of globalization and interdependence in promoting peace in international system. The United States of course unwillingly letting China win this tech war. Technically, The United States want to preserve its status in international system, but in contrast China want to impose on the world China's imperial-era concept (Chang, 2020). There are several factors that make Beijing is rising to be a tech power house, because Xi Jin Ping as a leader realized that the cybersecurity is the upmost important. As Miller said China has been the most effective nation in using the digital sphere for authoritarian ends (Miller, 2022). So, it is no doubt that in the end China's top-down model has worked in tech realm, because The United States cannot do what China has done in its country.

What it said about top-down model is centralized authority in a variety of domestic political domains, in the tech context, China will support the companies that serves the needs of the central government with the big goals to compete in international system. Here, China mimic what Japan's Meiji emperor did after the restoration, in 1868. However, the top-down system is not something new for the US, it proved that the US has been succeed (for examples: the rapid mobilization during World War II, the race for the moon in the Sixties, the interstate highway systems), but in the area of tech it will be hard to implement it, because of the multi-pronged approach (Chang, 2020). On the Washington Post, Chris Fall of the Department of Energy's Office of Science told that, "The beauty of how we do science in this country is that it isn't top-down" (Chang, 2020). However, as it develops, the US will see this dependency and try to weaponize it as a means of exerting actual or latent control over the hub by the weaponizer, as well as the institutions that carry out this weaponization(Fuller, 2024). The policy includes by securing it dominance in advanced technology through funding and establishing partnerships with private sector companies to promote semiconductor manufacturing in the country.

Globalization, which refers to the increasing interconnectedness and interdependence of economies, societies, and cultures around the world, has been a defining feature of the international system in recent decades now in decline due to a number of factors, such as the rise of economic nationalism and protectionism, the backlash against globalization in some countries, and the fragmentation of the global system. They point to the trend of countries turning inward, imposing trade barriers and restrictions, and promoting domestic industries over international trade. The great power conflict can generate a "security dilemma", where measures taken by one state has an objective to increase its security—such as arming itself, maintaining military readiness, or forging new alliances—and tend to decrease the security of other nations and lead them to react in like (Jervis, 1978) . Furthermore, countries feel compelled to take defensive measures to protect their own interests and security (Ye, 2024). This can lead to a cycle of actions and reactions, in which one country's defensive measures are perceived as threatening by another country, leading to further defensive actions and a spiral of "economic decoupling".

Another phenomenon related to the decline of globalization is the popularity of the term "friend-shoring". US Treasury Secretary Janet Yellen first used the term "friend-shoring" in April 2022. She presented the idea as a fresh strategy for managing a more volatile global economy, highlighting the significance of establishing supply chains with reliable partners (World Economic Forum, 2023). In practice, it indicates the practice of relying on suppliers and partners who are considered to be friendly or aligned with a company's interests, rather than relying on suppliers and partners from countries that may be perceived as unfriendly or potentially hostile. By depending on potentially hostile nations for essential commodities and services, this strategy seeks to lessen the geopolitical and economic risks. While friend-shoring can help to increase supply chain resilience and reduce dependence on potentially unreliable suppliers, it can also be a controversial strategy. Critics argue that it can lead to increased fragmentation and protectionism in global supply chains, and that it may not always be the most cost-effective or efficient strategy (Benson & Kapstein, 2023)

In the context of the semiconductor industry, friend-shoring refers to the trend of companies in the same or nearby countries forming closer partnerships or alliances to develop and produce semiconductors. This trend has been driven by a variety of factors, including the increasing complexity and specialization of semiconductor manufacturing, the need for closer collaboration between companies in the supply chain, and concerns over intellectual property

protection and supply chain security. For example, in Japan, there is a trend towards "Japan-shoring," where semiconductor companies are forming closer partnerships with each other to share expertise and resources. In the Netherlands, there is a similar trend towards "Euro-shoring," where companies are partnering with each other to develop and produce semiconductors in Europe (Danielsen, 2024).

The global semiconductor industry is relatively concentrated, with a few key players dominating the market. According to market research firm IC Insights, the top 10 semiconductor companies accounted for more than 50% of the industry's sales in 2020, and the top 20 companies accounted for around 75%. The largest semiconductor companies by revenue are headquartered in the United States, South Korea, and Taiwan, with Intel, Samsung, and TSMC ranking as the top three companies in terms of sales. Other major players include Qualcomm, Broadcom, and Texas Instruments in the United States, and SK Hynix, Micron, and LG Semicon in South Korea. The high level of concentration in the semiconductor industry can be attributed to several factors, including the high capital costs of building and maintaining semiconductor fabs, the complex technological expertise required to produce high-quality chips, and the importance of scale and efficiency in achieving economies of scale and cost competitiveness. Despite the concentration of the industry, there are many niche players and emerging companies that are developing new and innovative semiconductor technologies, as well as countries and regions that are seeking to establish or expand their semiconductor manufacturing capabilities (Allison, 2020).

The Semiconductor Industry Association (SIA) releases an annual report on the global semiconductor industry, providing insights into the industry's performance, trends, and challenges. The most recent SIA annual report was released in November 2021 and covers the state of the semiconductor industry in 2020. According to the report, the global semiconductor market reached a new record high of \$469 billion in 2020, a 6.5% increase from the previous year. The report also notes that the industry continued to face challenges related to the COVID-19 pandemic, including supply chain disruptions and increased demand for semiconductors due to the rapid shift to remote work and digitalization. In terms of market share, the report indicates that the top ten semiconductor companies accounted for nearly 60% of the global semiconductor market in 2020. The report also notes that the United States remained the largest market for semiconductor products, with a 47% share of global sales, followed by China with a 26% share (Corrado, 2022).

In this case, the US try to weaponize the interdependence, secure it dominance in advanced technology, especially in strategic area like semiconductors. The major step by the US is The CHIPS for America Act (Creating Helpful Incentives to Produce Semiconductors), a piece of legislation that was signed into law by the United States government in 2021. The act provides federal funding and incentives to promote the development and manufacture of semiconductors in the United States. The CHIPS for America Act, which was signed into law in 2021, provides \$52 billion in federal funding for semiconductor research, design, and manufacturing over a five-year period. In addition to this funding, the US government has also established partnerships with private sector companies to promote semiconductor manufacturing in the country. For example, the US government has worked with Intel to establish the Intel Foundry Services program, which aims to develop a domestic semiconductor manufacturing ecosystem (The White House, 2021).

The CHIPS for America Act is designed to address concerns about the United States' reliance on foreign sources of semiconductors, particularly in light of the ongoing "chip war" with China (Reinsch et al., 2022). In 2022, the US introduced The CHIPS and Science Act that

combines two bills: the CHIPS for America Act, which aims to return semiconductor production to the United States, and the Endless Frontier Act, which increases funding for domestic high-tech research. The regulations embodies techno-nationalism by aiming to strengthen the country's semiconductor industry and counter China's global competition. This Act allocates significant funds, including subsidies and incentives, to enhance American semiconductor competitiveness. It also restricts American support for advanced chip development in Chinese firms. The Act signifies a shift towards intervention-oriented techno-nationalism, departing from traditional liberal policies. It highlights the weaponization of global value chains for geopolitical purposes, urging multinational enterprises to adapt their strategies to navigate the resulting techno-geopolitical uncertainty (Luo & Van Assche, 2023).

The act includes provisions for funding semiconductor research and development, as well as for establishing grants and incentives to encourage semiconductor manufacturing in the United States. The act also seeks to promote partnerships between the government and the private sector to advance semiconductor technology. The act has received bipartisan support in the United States, with proponents like SIA, Semiconductor Companies, Defense Department and Intelligence Communities arguing that it is necessary to protect the country's national security and economic competitiveness by bringing semiconductor supply chains home and reduce overreliance to China, promoting innovation, and protecting national security (Kersten et al., 2022; Ross & Muro, 2024; The White House, 2023)

On the other hands, China that heavily dependent on foreign semiconductors, has limited capabilities in producing the most advanced chips used in many modern technologies. Chinese companies rely on importing semiconductors from other countries, especially the United States, Japan, Taiwan, and South Korea, to support their manufacturing industries. According to industry estimates, China imports more than \$300 billion worth of semiconductors annually, which is more than its oil imports. Despite efforts to boost its domestic semiconductor industry, China lags behind in terms of advanced technology and production capacity, particularly in the production of advanced chips used in high-end electronics and critical infrastructure. China relies on foreign imports to meet the demand for these chips, which are essential to its economy and national security (Majerowicz & de Medeiros, 2018).

While China is the world's largest consumer of semiconductors, it has relatively low domestic production of advanced semiconductors. This dependence on foreign semiconductors has become a significant concern for China, particularly about the country's vulnerability to supply chain disruptions, especially after the US government-imposed export restrictions on certain semiconductor products to China (Feng, 2022). To address this issue, the Chinese government has launched several initiatives to boost the country's domestic semiconductor industry, including increasing investment in research and development, subsidizing chipmakers, and encouraging mergers and acquisitions to consolidate the industry.

In response to semiconductor export restrictions imposed by the United States, China has taken several steps to reduce its dependence on imported semiconductors and develop its domestic semiconductor industry. China's responses to semiconductor export restrictions by the U.S. reflect its determination not only to reduce its dependence on imported semiconductors, but also to become a major player in the global semiconductor industry. Some of the measures including, investing in domestic semiconductor companies both through government funding and private investment. China also encourages mergers and acquisitions in the semiconductor industry to help companies scale up and become more competitive. Another measure involves developing its own semiconductor technologies, such as the development of the advanced memory technology known as DRAM. Recently, export restrictions on rare earth minerals

became more critical because China has a dominant position in the global supply of rare earth minerals, which are essential for the production of semiconductors. China has imposed export restrictions on these minerals, which has led to concerns about the impact on the global semiconductor supply chain (Majerowicz & de Medeiros, 2018).

China has made significant investments in its domestic semiconductor industry in recent years that reflect its strategic goal of reducing its dependence on foreign technology and becoming a major player in the global semiconductor industry. According to a report by the Boston Consulting Group, China invested \$50 billion in the semiconductor industry between 2014 and 2018, with a focus on building up its own capabilities in the design, manufacturing, and packaging of semiconductors. The actors involved in China's semiconductor industry include both state-owned and private companies, as well as government agencies and research institutions. Some of the major players in China's semiconductor industry include: Semiconductor Manufacturing International Corporation (SMIC), Huawei, Tsinghua Unigroup, China Electronics Corporation (CEC), National Integrated Circuit Industry Investment Fund, Chinese Academy of Sciences (CAS). However, it will likely take time and significant resources for China to catch up with the leading semiconductor-producing countries (Nikkei Asia, 2024; Reuters, 2023; WJS, 2024) .

4. Conclusion

The chip war is not simply a matter of economic competition over market share, but rather is part of a broader strategic competition between the US and China. In this case, the US sees China's push to develop its own semiconductor industry as a threat to its strategic dominance, and is therefore using a variety of measures to try to slow down China's progress. Moreover, China's dependence on imported chips increases its strategic vulnerability especially when the US restrict exports of key technologies. It suggests that China's efforts to develop its own semiconductor industry are partly motivated by a desire to reduce this vulnerability and gain more control over its supply chain. In a broader sense, the chip war is a symptom of broader power shifts in the international system with China rising and the US declining in relative power. This trend is likely to lead to more competition and conflict between the two countries in the future.

It is clear that interdependence to be used as a tool for political coercion or influence in the context of the "chip war" between the United States and China. The US decision to restrict the export of semiconductors to China represents a form of "weaponization of interdependence." The US policy of restricting semiconductor exports to China is a deliberate attempt to use the US's dominance in the global semiconductor industry as a tool of geopolitical coercion. By denying China access to critical semiconductor technology, the US seeks to weaken China's ability to develop and maintain advanced military capabilities, as well as to pressure China to make concessions on other issues.

The chip war highlights the importance of understanding the dynamics of economic interdependence in international relations. It suggests that while economic interdependence can create mutual benefits and promote peace, it can also create strategic vulnerabilities and risks that states may seek to exploit. In this sense the chip war presented as a cautionary tale about the potential dangers of over-reliance on a single supplier or dominant player in a particular industry, and the need for more diversified and resilient supply chains.

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