

How Techno-Nationalism Affects Technological Decoupling Between China and the U.S. - A Case Study of the Semiconductor Supply Chain

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Abstract: Since the outbreak of Sino-US trade disputes in 2018, the game between China and the US has gradually changed from the field of trade to the field of science and technology. At the same time, with the global spread of the COVID-19 pandemic in 2020, global technological nationalism has risen rapidly and is spreading. In the context of most countries advocating localization and strategic autonomy of global supply chains, Part of countries have taken opposite measures. They use technological containment as their main means. Linking supply chains to national security. As an excuse to impose sanctions on China or cut off its supply chain to the semiconductor industry. Resulting in technological decoupling between China and the United States. It also affects the global production and supply chain layout of multinational companies. Therefore, this paper will take the semiconductor industry, the most representative in the global value chain, as a starting point to analyze how the United States, driven by the trend of technological nationalism, affects the technological decoupling between China and the United States.

Keywords: Technological Nationalism, Technological Decoupling, Sino-American competition.

1. Introduction

Technology and nationalism are closely intertwined. The term techno-nationalism was first coined by Professor Robert Reich of the University of California in his 1987 article, "The Rise of Techno-Nationalism," which discussed the economic rivalry between the United States and Japan. Reich argued that the United States must be cautious of Japan's imitation of American technology. And it was suggested that the United States take measures to safeguard its advanced technology and maintain its leading position (Robert, 1987).

As a result, the US government and Congress proposed a range of policies aimed at promoting advanced technology in the country. During this period, some innovative concepts emerged in the United States. The American public desires to safeguard advanced technology within the United States, prevent it from falling behind other nations, and avoid exploitation by Japan. The fundamental concept is that technology is a distinctive product that can solely be advanced by Americans, within and for the United States.

In 1995, American scholar Paul Stoneman provided a more detailed definition of techno-nationalism. According to him, techno-nationalism pertains to the intersection of technological innovation, national security policies, and economic development. Stoneman posits that technology forms the cornerstone of national security. It is only by localizing technology that a country can become prosperous and strong (Stoneman, 1995). Since then, the term techno-nationalism has gained greater usage among scholars.

It has been a topic of frequent discussion in academic circles. Some scholars have acknowledged the role of techno-nationalism in upholding a dominant position in national security and economic development. While others have observed the protective behavior of states that has arisen as a result of techno-nationalism's prominence. Consequently, trade and sharing of technology in globalization have

emerged as new challenges to national development (Shigeru, 2012).

In recent years, American techno-nationalism has surged as a means to preserve the country's technological dominance and insulate against competitor impacts. Such sentiment has manifested in diverse forms, from national strategy to legislative and government initiatives. In the 2017 National Security Strategy, the Trump administration introduced the idea of establishing a national security innovation base. The essence of this idea is to encourage all American social forces to promote US leadership in scientific research and development (Report, 2017). As a result, since the end of the Cold War, techno-nationalism in the US has experienced a significant boost. The most crucial factor is that its benefits in emerging technologies are gradually diminishing, and it may even be at risk of being surpassed by competitors in certain areas.

2. Geopolitical Competition Between China and The Us in The Field of Emerging Technology

Emerging technologies are expected to have a significant impact on society, economy, and geopolitics in the next 20 years (MANNING, 2020). The competition for dominance in emerging technologies is the central theme of American techno-nationalism during this period, as well as the focus of Sino-US geopolitical rivalry. The US considers China as the primary challenger and strategic competitor in the National Security Strategy of 2017 (Report, 2017).

In the opinion of the US government, the challenges posed by China to the United States are not limited to the strategic sphere, but also extend to the economic and technical realms. The Center for A New American Security (CNAS) expressed concerns in 2017 about the rapid progress of China's artificial intelligence industry and implicitly highlighted US

technology control measures over China (Elsa, 2017).

And as China's 5G technology continues to rapidly develop, President Trump delivered a televised speech at the White House in April 2019 stating that the United States must win the national competition for advanced network technology. As a result, Chinese companies such as Huawei were blacklisted for sanctions. In response, the United States has implemented a series of measures including strengthened reviews of Chinese investments. According to a 2018 white paper from the U. Department of Defense, China is acquiring top U. S. technology through its investment in technology (Report, 2018). S. Consequently, stricter scrutiny is necessary for Chinese companies investing in the United States. In addition, the United States has initiated a trade investigation of technology transfer with China. And the US is regulating technology exports to China and blocking the supply of semiconductor products and technology to Huawei, considerably impairing the global semiconductor industry chain. This development indicates that the China-US trade conflict is progressively moving towards the regulation of core industries and technologies, hastening the process of technology decoupling.

The semiconductor industry is highly globalized, and semiconductors are integral to the communication industry. As a result, semiconductor technology represents the initial stage of Sino-US technology decoupling. In light of geopolitical and technological competition between China and the US, the information technology sector has become a vital area of focus. In particular, the United States has attempted to deprive China of critical semiconductors necessary for installation in information and communication technology (ICT) equipment and systems. Meanwhile, a surplus of orders resulting from booming ICT demand (including for a varied array of products from appliances to automobiles) and supply-chain disruption caused by the pandemic have worsened the global chip shortage. All of this has encouraged the US and China to strive for greater independence in their respective core supply chains (Chen, 2021). The rivalry between the two sides is likely to result in

further instances of intellectual property theft and mandatory technology transfers (Allen, 2020).

3. How Techno-nationalism Affect the Global Semiconductor Supply Chain

Semiconductors are a product of advanced manufacturing and collaboration worldwide. The design and manufacturing processes are nearly error-free. The global semiconductor supply chain has achieved a high level of industrialization and is spread throughout the world. The production process exhibits a high degree of labor division and strict technical management, with superior enterprises selected as operators. The global semiconductor industry can be categorized into four modes. The first mode, exemplified by Intel and Samsung, comprises highly vertically integrated companies. The second mode, typified by Qualcomm and other companies, represents a research and design focus with no manufacturing plants. Third, the foundry model, represented by the Taiwan Semiconductor Manufacturing Company, is responsible for one of the manufacturing links. Fourth, the original design manufacturer model entails transferring the completed chip to the original manufacturer within the supply chain. For instance, companies in mainland China like Xiaomi and Huawei (Yu & Ji, 2021) follow this model.

Secondly, over the last 30 years, the semiconductor supply chain has become a key global commodity. The global semiconductor supply chain is characterized by a worldwide division of labor and close collaboration based on each country's technological capabilities. Semiconductor chips pass through multiple import and export processes, spanning multiple countries and regions before finally being installed in the end-use product. At present, the global semiconductor industry is primarily dominated by a few American companies, which account for 45% of the industry. South Korea follows with a 24% share, while Japan and the European Union hold 9%, Taiwan, China 6%, Chinese Mainland 5%, and the remaining global regions and countries hold 2% collectively (refer to Figure 1).

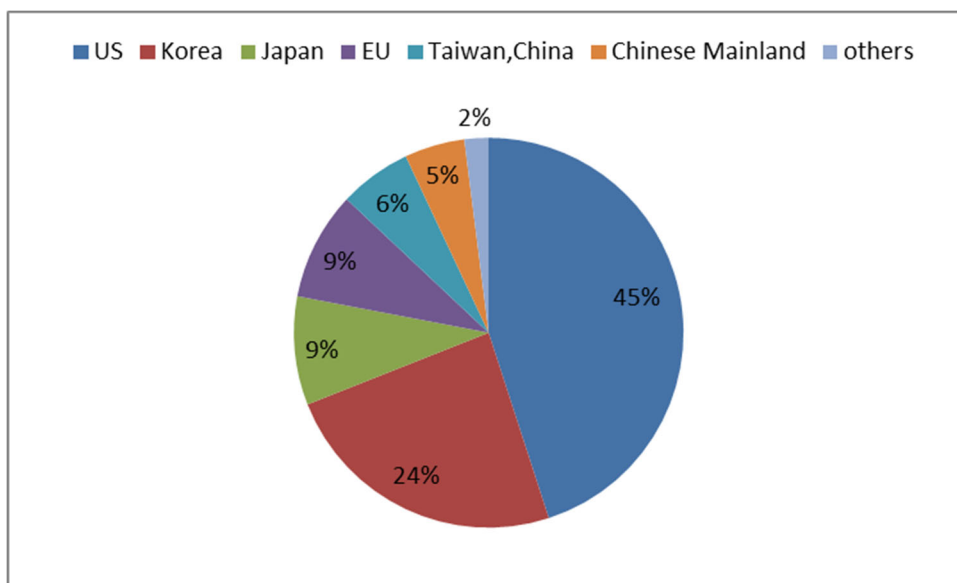


Figure 1. Distribution of the global semiconductor industry

Source: Semiconductor Industry Association (SIA), <https://www.semiconductors.org/data-resources/market-data/>

By analyzing the proportion of semiconductor companies based in the US in different global markets (see Figure 2), we

observe that American firms hold a strong position in the worldwide semiconductor industry. In 2019, the United States

supplied 45% of the world's semiconductor products, whereas Chinese mainland provided only 5% of semiconductor products. However, China currently serves as the largest demand market in the semiconductor industry. American

Intel's sales represented 37% of their total sales, while 75% of Qualcomm's products were sold to China. Only a small fraction of their products, less than 5%, were sold to the United States (Seamus & Debin, 2020).

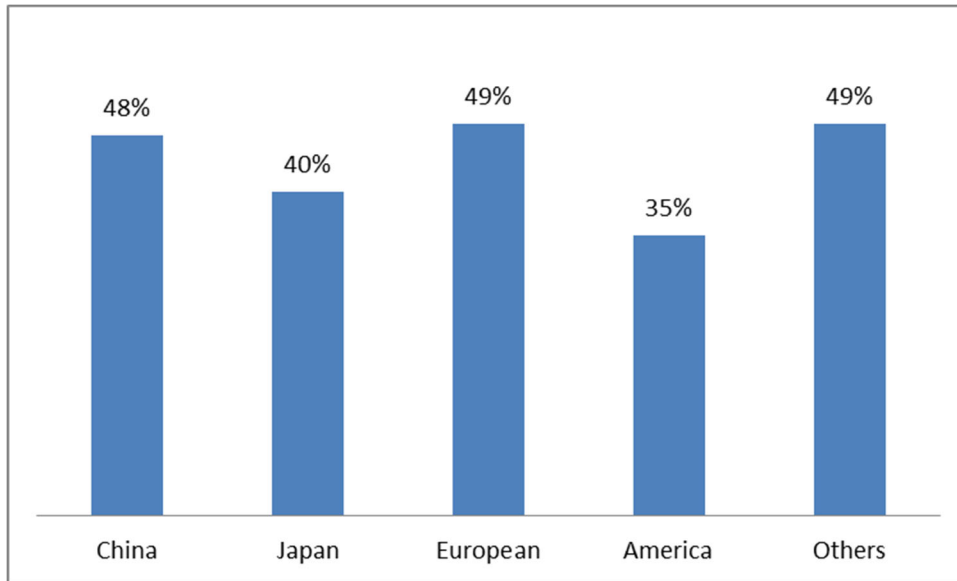


Figure 2. 2019 U.S. companies accounted for the global semiconductor market
 Source: <https://www.semiconductors.org/data-resources/market-data/>

Therefore, based on the analysis of the industrial chain and global value chain, the US technology control has had a widespread impact beyond the technology decoupling between China and the US, causing unintended consequences for product suppliers across the globe.

In addition, the United States restricts the high-value-added section of the semiconductor industry to certain local regions to gain control over the global semiconductor industry chain. For instance, some nations have been requested to prohibit the deployment of Chinese 5G technology. When face-to-face with pressure, the British government categorized some Chinese companies as high-risk in 2020, while other countries opted to support China, and many others remain in a state of ambiguity.

Moreover, techno-nationalism hampers the semiconductor supply chain. And that is the source of the divide (Segev & Orion, 2020). The present-day global semiconductor supply chain is the culmination of the industry's extensive optimization and integration. However, due to the existence of technological control and techno-nationalism, various nations are obliged to diminish their reliance on semiconductor goods from foreign countries. It is essential to consistently escalate R&D funding in semiconductor firms. Based on recent information, the expenses for chip designing remain on the rise.

Consequently, the efficiency of the global division of labor cooperation for semiconductors may decline significantly or even cease to exist, leading to nationalization rather than globalization of the industry. And based on logical deductions, the ever-increasing costs of the global semiconductor supply chain can only be afforded by the top companies under technological nationalism. If a particular country monopolizes the technology, downstream companies may seek alternative options. This could also lead to overcapacity in technology-driven countries (Report, 2019) and protectionism that slows the movement of technology, capital, and labor. The most significant outcome of this could result

in deglobalization (García-Herrero, A., & Tan, 2020).

From an objective standpoint, following the announcement by the United States of an increase in the chip embargo and technology control on China, China's semiconductor industry has been compelled to increase R&D investment (Yu & Ji, 2021). This has resulted in China being forced to construct a complete and secure semiconductor industry chain, which is a challenging task. But China has recently shown progress in enhancing access to AI chips, illustrated by Huawei and Alibaba's display of advanced chip capabilities (Ernst, 2020). This has led to a development in the semiconductor supply chain towards fragmentation. On the flip side, the US semiconductor industry will also suffer significantly. Due to these events, the global supply chain is disrupted, causing the United States to be at risk as well. And the Chinese and American technology ecosystems have always been interconnected (Schmidt, 2022). The technology disentanglement between China and the United States will only intensify in the future.

4. Conclusion

At present, the Sino-US technological competition is increasingly influenced by techno-nationalism, inevitably leading to technology decoupling between China and the United States. This way of thinking disrupts not only the semiconductor industry, but also the global production and supply system. However, there is currently no adequate solution in place to reduce the global political and economic risks associated with techno-nationalism. This situation poses challenges for all countries. Therefore, it is imperative for the country to eschew narrow perspectives such as technological advancement or transcendence theories. To develop effective industrial policies, nations worldwide should strive to integrate into globalization and construct a stable global supply chain. Collaborating on technical expertise can be a viable solution and lead to consensus.

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