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China's Approach in Mitigating Chip Supply Chain Disruptions

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SYNOPSIS

The semiconductor industry has emerged as a pivotal arena in the ongoing US-China technological competition. As the major players in the industry tilted towards the US, China has faced intensifying pressures to stabilise its semiconductor supply chain. In response to the challenges, China has taken strategic and diplomatic actions to buy time while it develops the country's indigenous capabilities in the production of semiconductors.

COMMENTARY

Chip supply chains encompass a complex network of interlocking production stages that transcend political boundaries, thereby creating opportunities for political manoeuvering and negotiation. Presently, the global semiconductor supply chain is dominated by the United States, with 39 per cent of the overall value attributed to it, while allied nations and regions such as Japan, Europe (especially the Netherlands and Germany), South Korea, and Taiwan collectively account for 53 per cent.

Global Chip Supply Chain Tilts Towards the United States

The US has proposed establishing a "Chip4 Alliance" comprising itself, Japan, South Korea and the Taiwan Semiconductor Manufacturing Company (TSMC) to prevent technology outflows to China and subsequent diversion into military use. From early 2023, with the CHIPS and Science Act (CSA) bringing on "the most rigorous export ban on the semiconductor industry" stakeholders are further compelled to choose between aligning with China or the US.

Indeed, after the CSA was signed into law by President Joe Biden in 2022, the Netherlands has been prohibited from selling extreme ultraviolet (EUV) lithography –

its most advanced technology – to China. The latest proposal from the Netherlands' government in March 2023 aims at extending the prohibition to include immersion deep ultraviolet (DUV) lithography products, further restricting China's access to necessary equipment. Being the home to Advanced Semiconductor Materials Lithography (ASML), which is the world's only supplier of EUV lithography technology, the Dutch government's actions further disrupted China's chip supply chain.

Notably, Japan, which has a formidable history in semiconductor manufacturing, has been striving to establish itself as a prominent player in the ongoing competition over chips. In March 2023, following in the footsteps of the US, Japan introduced export controls on 23 specific categories of high-performance semiconductor manufacturing equipment. From July 2023, new regulations restricting the export of semiconductor manufacturing equipment will come into effect. These escalating export controls have triggered strong protests from China. The Chinese Ministry of Commerce strongly urged Japan to cease its export controls on semiconductors, deeming it a "wrongful action" that "seriously violates" international economic and trade rules.

The concentration of chip supply sources among Japan, Europe, South Korea and Taiwan, and the increasing supply tilt towards the US, have transformed the chip supply chain into a "choker" for China.

China's Responses

The global semiconductor value chain comprises three main stages: design, fabrication, and assembly; testing; and packaging (ATP). China, as the largest outsourced ATP market, demonstrates notable strengths in ATP except for overall design and fabrication capabilities, which cannot be quickly developed overnight. This highlights the importance of having access to raw materials and machinery, particularly from the members of the proposed Chip4 Alliance and the Netherlands.

Currently, China's strategy is based on strengthening its value chain connections with critical partners to mitigate potential disruptions in its supply chain that may arise from the tilt towards the US. This strategy encompasses both China's own development of the industry and collaboration with other countries.

The development of China's semiconductor industry can be traced to the Mao era. The industry faced significant setbacks due to technological embargoes imposed by Europe and the US, as well as reduced domestic investment and political instability during the 1980s. These factors gradually eroded China's position, allowing countries like South Korea to surpass it in the field.

After Xi Jinping's assumption of power, there has been renewed emphasis on developing indigenous research and manufacturing capabilities. For instance, the State Council issued "Made in China 2025" and established the China Integrated Circuit Industry Investment Fund to achieve a 70 per cent self-sufficiency rate in chip production by 2025. It has also announced a whole-of-nation approach to mobilise the resources nationwide, namely from the central to local governments and from public to private sectors, to achieve breakthroughs in core technologies, especially in semiconductors.

However, challenges associated with chip design and manufacturing are overwhelming and cannot be overcome immediately. China has therefore actively employed strategic and diplomatic tools to secure additional time for its self-sufficiency campaign.

Firstly, China has applied a “carrots” and “stick” strategy on semiconductor multinational corporations (MNCs). On the one hand, it has provided “carrots” to major MNCs whose products are irreplaceable. For instance, only 20 days after the Dutch government announced export control measures on semiconductor equipment, Chinese Minister of Commerce Wang Wentao met with Peter Wennink, the President and CEO of ASML, which enjoys monopoly status in the semiconductor industry. During the meeting, the minister expressed that his government shared the same objective as the company in terms of safeguarding the stability of the global semiconductor industry’s supply chain and reassured Wennink that China remains a reliable partner despite the Dutch government’s ban.

On the other hand, China has used “sticks” on MNCs whose products can be backfilled. In May 2023, China took its first unilateral retaliatory measure against a US-based MNC; it banned critical information infrastructure operators from buying products from US-headquartered Micron because of the company’s “network security risk”. The gap left by Micron will be filled at least partially, if not entirely, by Samsung Electronics and SK Hynix, the two largest manufacturers of memory chips globally.

Secondly, China has used its economic power on countries that are economically reliant on the chip trade. Since chips exported by South Korea are “intermediate goods” that need to be manufactured in China or elsewhere, China has exploited South Korea’s vulnerability of over-dependence. Fifty-five per cent of South Korea’s semiconductors were sent to China in 2022. In April 2023, however, South Korea's chip exports to China plummeted by 37.7 per cent year on year, which was a grave setback to its export-dependent economy. Possibly in part as a result, South Korea has agreed to strengthen bilateral dialogue and cooperation with China on the semiconductor industry supply chain.

Thirdly, China has relied on both multilateral platforms and, increasingly, unilateral actions to cope with semiconductor supply chain disruptions. China launched a trade dispute at the World Trade Organization against the US over its sweeping semiconductor export curbs in December 2022. This is the first complaint filed by China at the global trade body against the US’ semiconductor sanctions. In the meantime, it has proposed to amend its Catalogue of Technologies Prohibited or Restricted from Export.

With this new catalogue, it is widely believed that China will enhance export restrictions on products and technologies of rare earth, a non-renewable and valuable material for semiconductor production. Moreover, China has enacted a series of legal frameworks which allows the Chinese authority to take countermeasures against foreign sanctions. Based on these, China took its first unilateral retaliatory measure against the US-based Micron in May 2023. China recently unveiled a new Foreign Relations Law, which will enable it to take more unilateral measures against others in the future.

Conclusion

China is facing challenges in creating a resilient semiconductor supply chain in the face of the worsening US-China technological competition. Although no country can host an end-to-end semiconductor supply chain by itself, China has fewer advantages than the US in this regard. This is due to the fact that in a producer-driven value chain, such as the semiconductor one, profit and power are often held by players who control the core and advanced technologies as well as those who can produce efficiently and in large volumes.

Japan and the Netherlands have joined the US in banning their semiconductor companies from exporting some of their products to China. This makes it even more crucial for China to stabilise its chip supply chain. Enhancing its own designing and manufacturing capability is key, but technological breakthroughs cannot be made overnight. Hence, China has been relying more and more on diplomatic and strategic tools that combine incentives and punitive measures, aimed at both countries and private companies.

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