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China's Chip Industry: Down, But Not Out?

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SYNOPSIS

Huawei has recently launched the Mate 60 Pro smartphone featuring an advanced chip manufactured by the Semiconductor Manufacturing International Corporation. ***MANOJ HARJANI*** *evaluates how the launch not only highlights the realities of export controls imposed by the United States but also the bottlenecks that continue to plague China's chip industry. An important question is how the United States will respond to this latest signal of perseverance from China, particularly with presidential elections around the corner.*

COMMENTARY

The recent Huawei Mate 60 Pro smartphone launch has prompted considerable speculation over how the company produced a 5G-capable handset despite US efforts to block China's access to advanced chips and the technology to make them.

The Kirin 9000s chip used in the Mate 60 Pro was manufactured by Semiconductor Manufacturing International Corporation (SMIC), China's largest contract chipmaker. However, both Huawei and SMIC have been the subject of American export controls since 2019 and 2020 respectively.

These restrictions ostensibly deny Huawei access to advanced chips, while its stockpile accumulated prior to export controls has reportedly dwindled by the end of last year. SMIC's access to the latest generation of extreme ultraviolet (EUV) lithography equipment – solely produced by Dutch company ASML and typically required to manufacture such advanced chips – has been similarly restricted.

The launch thus prompted calls for the United States to investigate whether Huawei and SMIC had violated or skirted export controls. There is a possibility that SMIC used older deep ultraviolet (DUV) lithography equipment to achieve similar results to EUV lithography equipment, albeit at a significantly higher cost. Nevertheless, either scenario would be bad news for the United States in containing China's push for self-sufficiency in chip manufacturing.

Despite US export controls, Huawei recently launched the 5G-capable Mate 60 Pro smartphone. The phone features the Kirin 9000s chip manufactured by China's largest contract chipmaker, Semiconductor Manufacturing International Cooperation (SMIC), and signals China's persistence to become self-sufficient in chip manufacturing. *Image from Trusted Reviews.*

Realities of Implementing Export Controls

Export controls have been a centrepiece of the Biden-Harris administration's strategy to contain China's growing technological capabilities. From February 2021 to December 2022, 134 Chinese companies were added to the US Department of Commerce's Entity List. Another 70 have been added so far this year, bringing the total tally under the Biden-Harris administration to 204. This far exceeds that of previous administrations.

However, being added to the Entity List does not necessarily amount to an outright ban. In practice, any US-based company seeking to do business with a company on the Entity List must apply for an export licence from the Department of Commerce. The reality is that a substantial proportion of licences have been approved, although approvals for 2022 – at 70% – were lower compared to 88% in 2021 and 94% in 2020.

In fact, it was only in January this year that the United States stopped approving licences for Huawei outright. Between November 2020 and April 2021, 113 licences for Huawei and 188 licences for SMIC, worth US$61 billion and US$42 billion respectively, were approved. The process behind how the Department of Commerce

grants licence approvals has been criticised by Congress, with the House Foreign Affairs Committee even struggling to obtain relevant data despite repeated requests.

All these developments raise doubts regarding the overall efficacy of American export controls. Much more attention has arguably been paid to additions to the Entity List rather than to the actual extent of enforcement. In February 2023, the US Departments of Justice and Commerce announced the creation of a "strike force" to improve enforcement of export controls, but its impact will likely not be apparent for some time.

State-Sponsored Safety Net

Meanwhile, China has been actively supporting its domestic champions affected by export controls. From 2020 to 2022, Huawei received approximately 12 billion RMB (~US$1.6 billion) in grants from the state, a large proportion of which was disbursed in 2022, amounting to 18.4% of the company's net profit for that year. While SMIC received only 4.4 billion RMB (~US$604 million) over 2021 and 2022, it was the largest recipient of state support among other chip companies.

Earlier this month, China also announced the third and largest iteration of its Integrated Circuit Industry Investment Fund, or "Big Fund". With a targeted 300 billion RMB (~US$41 billion) on the cards, it dwarfs previous iterations that raised 200 billion RMB (~US$27.4 billion) in 2019 and 138.7 billion RMB (~US$19 billion) in 2014. However, doubling down on an aggressive state-led investment strategy alone will not guarantee success, as seen in several high-profile failures of Big Fund-supported chipmakers and even investigations into the fund's leadership in 2022.

China's chip industry continues to face significant bottlenecks, particularly in chip design software and manufacturing equipment. The former might be easier to circumvent, for example, through backchannels. However, equipment poses a much greater challenge given ASML's monopoly in EUV lithography machines. China's sole producer of lithography machines – Shanghai Micro Electronics Equipment – is several generations behind, while the extent of localisation for this type of equipment is only at an estimated 5%.

Prospects for China's Chip Industry

The possibility that SMIC produced Kirin 9000s chips for Huawei despite American export controls and without EUV lithography equipment highlights the determination of China's chip industry to address existing bottlenecks. However, some analysts have been circumspect about this achievement, as SMIC's manufacturing process using older DUV lithography equipment would likely have resulted in lower yields. The prohibitive cost to manufacture these chips cannot be sustained indefinitely, even with state support.

An important question is how the United States will respond to this latest signal of perseverance from China's chip industry. US National Security Advisor Jake Sullivan has said that, for now, the Biden-Harris administration's "small yard, high fence" approach to export controls will remain in place. However, with presidential elections due next year, turbulent US domestic politics could result in another shift in its approach.

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