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REPORT
China's Semiconductor Vulnerabilities

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China's Semiconductor Vulnerabilities

I have felt that the investor community's consensus that a Biden administration would be softer on China is a fallacy. The anti-China Washington consensus is deeply bi-partisan. While priorities and the implementation of strategy may drastically change post-inauguration, the underlying tone of policy towards a gradual detachment remains in place. China investors need not confuse greater dialogue and more rules / globalist approach to engagement with China as a sign of weakness by a Biden administration who will shift focus towards traditional Democrat ideals such as human rights and a strong military presence in Asia.

A key dynamic will be how the Biden administration handles the semiconductor bans, exposing China's strategic vulnerability of a heavy reliance on semiconductor imports. China doesn't have the domestic capacity to deal with the rapid expansion of companies like Huawei, who could run out of precision chips at some stage in 2021. Semiconductors are the lifeblood o any modern economy, and comparisons to the 1970's oil embargos are not far from the mark.

On October 22nd, the following panel of experts discussed China's dependency on high-end semiconductors manufactured abroad and the dilemmas facing companies such as TSMC in balancing business and political interests between the US and China. Attending were:

Maggie Lewis — Professor, Seton Hall Law School

Anil Tewari — Head of Research, RWC Partners

Mayank Mishra — Global Macro Strategist, Standard Chartered

Jimmy Goodrich — Vice-President for Global Policy, Semiconductor Industry Association

This conversation and a subsequent discussion about the future of Taiwan dives into what I believe is the largest threat to China's economic well-being - the lack of a domestic production capacity of precision chips. Domestic manufacturers such as SMIC cannot produce chips of the quality required by modern smartphones that do not have some US design, designs currently banned from sales to companies on the entities list such as Huawei semiconductor arm, HiSilicon. This threatens the ability of Huawei to launch new smartphone models, which will systemically harm the company's sales globally and potentially instigating an existential threat.

Huawei is but one company affected and telecommunications but one sector. How the Biden administration response to this semiconductor ban has the potential to define the US-China relationship in the years ahead.

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China's Semiconductors: An Overview

Mayank Mishra: China is heavily reliant on imports in the semiconductor area, even if it is a manufacturing powerhouse itself in this segment.

Chinese Policymakers have been focusing on increasing self-reliance in this strategic sector. Despite some success with domestic players, the country is still lagging. There's a considerable gap between China and industry leaders based in South Korea, Taiwan, and the United States.

This provides an interesting backdrop for rising tensions between the US and China in the technology sector. Huawei is the most discussed example of increasing limitations imposed by the US government in the high-end semiconductor sector. Huawei has tried turning to domestically-designed chips by its subsidiary, HiSilicon, but those chips are still manufactured by TSMC.

TSMC, although a Taiwanese company, relies on chipmaking equipment and software from the US. The US makes up around 40% of the total supply, and the country — along with Japan and the Netherlands, both US allies — have a virtual monopoly on this equipment. This puts China in a vulnerable position of depending on foreign sources for semiconductors and allows the US to increase its restrictions on China's technological access.

What companies and segments, both in China and those who sell to China, are the most affected?

Jimmy Goodrich: China is one of the top consumers of semiconductors. While it's the largest importer of integrated circuits, China actually re-exports about half of the semiconductors that it imports. Some key points:

- Washington is increasingly concerned about the national security risks of exporting this technology to China, but export controls have been in place for a while. The Obama administration placed Chinese companies such as ZTE on an Entity list, which restricted the export of exotic chip technologies that power microwave radars and spy satellite sensors.
- In May 2019, Huawei was placed on the Entity List. A year later, in May 2020, Huawei's subsidiary HiSilicon was hit with a unique restriction by the Department of Commerce that limited its access to chip production factories worldwide that used US production equipment and software.
- In August 2020, the restriction was expanded to every chip company in the world who produced for Huawei. These foreign companies with chip operations in the US were also required to have a license to sell to Huawei.
- Almost all chips made worldwide utilize some American technology or design software. Several Chinese companies have been placed on the Entity List for being complicit in human rights violations, but Huawei is the only one under broader "foreign direct product rule." That means Huawei's supply chain is especially under scrutiny.

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The US semiconductor industry is not opposed to export controls per se — there are understandable national security issues at play — but that has to be balanced with economic interests. In restricting sales to China, one of the largest markets, there will be a severe impact on the industry.

Have Chinese companies tried to circumvent the restrictions by buying from other apparently unrelated parties?

Jimmy Goodrich: From an enforcement perspective, there are only three companies in the world that can produce cutting-edge semiconductors on a foundry basis. However, a number of Chinese companies have been stockpiling their inventories, either because they're already on the Entity List or they're afraid they may be put on the list.

This is challenging for a company like Huawei, a large part of whose supply chain spanning thousands of inputs is suddenly subject to controls. Even if the company could circumvent some restrictions, there are still many other components they might have difficulty procuring. At this point, it's unknown what impact this will have on Huawei in the future.

Android Ban for Huawei

Apart from semiconductors, what is the systemic threat of the Android ban to Huawei?

Anil Tewari: Huawei's stockpile of equipment, especially of 5G base stations, will likely last them well into next year. That will be enough to supply Chinese telecom companies in the rollout of 5G, of which setting the standard is crucial for China and Huawei.

On the handset side, it's unlikely they can do much if Android continues to be restricted. Past initiatives from Samsung and Microsoft show that the dichotomy between Android and Apple's iOS makes it difficult for newcomers to garner any global or even Chinese share.

In terms of AI and robotics, Chinese domestic companies are trying to rise to the challenge. But for companies like Yangtze River Manufacturing involved in the memory sector, it isn't easy to ramp up their production on a global scale. Without the companies that are based in either the US or in allied nations, China would find it very hard to manufacture chips domestically, especially high-performance chips for sectors such as AI. Chinese companies could use lower-end suppliers and materials, but the resulting processors would be subpar products that cannot be globally competitive.

The problem is beyond what money can buy. Given the technological hurdles to overcome, along with sanctions and geopolitical issues, it will take years for Chinese companies to produce high-end chips in a field dominated by the US and its allies. China is rightfully concerned, especially in acquisitions such as NVIDIA's potential takeover of Arm. The purchase, if it happens, would bring more intellectual property into what is already the largest AI semiconductor company in the US.

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China's AI Ambitions Under Threat

Discuss if concerns over access to precision chips could inhibit China's AI ambitions.

Anil Tewari: To some extent, it should. AI requires high-end chips, and restrictions on companies such as HiSilicon will have a negative effect. There may be workarounds for Huawei, for instance, such as buying third-party vendor chips, but would the US then unilaterally ban the sale of all high-end chips? In general, China is leading the race in data collection, which still relies on relatively older technology that is not as affected by export controls. China's ability to collect data and utilize facial recognition is ahead of any other country.

Discuss the dominant positions that companies like TSMC and ASML have in their respective fields.

Mayank Mishra: The technological development needed for China to achieve the 7-nanometer process will require several years. China needs time to climb up the technological ladder, and that's especially hard given geopolitical considerations and the dominance of supply chains on the part of American and US-allied companies. For instance, the Trump administration has already pushed ASML, one of the largest chip manufacturers and producers of lithograph equipment production, into delaying its supply of equipment to SMIC. The US and its allies can make it very difficult for Chinese companies to increase their semiconductor industry positions.

The Complexities of Export Controls

Who are the producers of these precision chips, and where would China obtain them if these restrictions remain? Discuss in the context of NVIDIA's pending acquisition of Arm.

Jimmy Goodrich: Export control laws are very complicated legal issues entangled with business interests that stretch across multiple jurisdictions. Some key points:

- From an export control perspective, it's more important where the technology originates, rather than the ownership. The acquisition of Japanese or European technology by an American firm, for instance, does not change the fact that the technology originates outside the US.
- Multinational companies, operating in China or anywhere else, tend to comply with all the export control laws without complying with more than they have to for business and geopolitical reasons.
- US export control restrictions are mostly unilateral, which causes the market to shift to other countries that do not have restrictions. Japan, for instance, which doesn't have an Entity List, hasn't restricted Hikvision's access. In this case, the intended effect from US policymakers becomes minimal when much of the global supply chain can be sourced outside the US.
- At times, US political pressure carries weight: countries are shying away from Huawei's 5G infrastructure, for instance. But in many instances, the level of interest in US allies in

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restricting supplies to Chinese companies hasn't been high because of the economic interests involved. Taiwan, for instance, has not intervened in Taiwanese companies' interests in the Mainland Chinese market.

Taiwan's Semiconductor Dilemma

Discuss Taiwan's semiconductor industry in the context of US-China relations and the potential forms of retaliation from China if restrictions on semiconductors continue to be in place.

Maggie Lewis: Taiwan's status as a semiconductor leader wedged between China and the US puts it in a very interesting and delicate position. Some key points:

- Taiwan's top two trading partners are China and the US.
- Its relationship with China has changed over the years with the accession of Xi Jinping, and later of Tsai Ing-wen. The latter's difficult job is to steer the country between two giants: China and the US.
- Retaliation could certainly come in the form of trade restrictions — as it was the case during the trade war — but it's problematic to frame these questions in a cold war perspective of retaliation between China and the US. After all, the original Cold War between the US and the USSR involved two economically independent entities.
- Another form of retaliation could be similar to what happened to Michael Kovrig and Michael Spavor, two Canadians who have been detained in China in retaliation for the arrest of Huawei's CFO, Meng Wanzhou. Recently, reports have even surfaced saying the same could happen to Americans in China too.

Retaliation goes both ways when the US-China relationship becomes over-scrutinized. One of the costs of the US government cracking down on Chinese economic espionage is alienating Chinese in America and Asian Americans at large. That has ramifications for the US' technological competitiveness and an ability to attract talent; after all, a company like TSMC was founded by Morris Chang, who studied in the US.

Discuss TSMC's path forward as a company that needs to cater to both China and the US.

Jimmy Goodrich: Taiwan's outsized role in the global semiconductor industry is quite astonishing. Roughly half of the world's capacity in producing advanced 10-nanometer and below is in Taiwan. Collectively, Taiwanese foundries account for well over 60% of the market share.

TSMC, founded by US-educated Morris Chang, re-invented the business model by disaggregating production. When companies previously would design and build everything in-house, the fabless foundry model means that design and production can be done in different locations, thereby reducing the risks of taking on large amounts of capital. Multiple companies can share access to

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foundries across Taiwan, South Korea, and the US. By far, TSMC is the leader in chip technology, ahead of Samsung and Intel.

Companies like TSMC, in navigating tensions between China and the US, will have to comply with US law if they want to do business in the US. Overall, we're seeing most companies doing just that, as the US is the biggest market. Since there are limited numbers of foundries, the restriction on Huawei means other companies can easily replace that demand for semiconductors. In China, that is happening with companies like Xiaomi, OPPO, and Vivo, among others, as demand for 5G handsets continues.

There's no doubt that US-China tensions impact companies and their business decisions. Simultaneously, some Taiwanese companies such as TSMC, Powerchip, and others continue to operate in China, and South Korean companies are doubling down on investment in Mainland China. These business interests continue despite geopolitical tensions that plague international relations.

Anil Tewari: To add, TSMC's recent results demonstrate robust growth of around 30% and continued demand for high-end chips. To stay in the business, a lot of their equipment and software comes from the US, which means they'd have to comply with US regulations.

There is a trend for companies, including TSMC, to re-focus on the US, motivated by political considerations or otherwise. TSMC, for instance, is no longer building fabs in China; instead, it's building out in Arizona. Samsung has been out of the China market for some time, while Intel is well-aware of the political risks as well. In my opinion, the US' influence outside its unilateral export control laws is more substantial than many would think.

Conclusion

In mid-September, SMIC asked the US Commerce Department for permission to use US designs to produce chips for Huawei. While we haven't yet seen a formal response, the answer to that question is apparent. As we stand today, Washington is not budging in its stance to prevent companies it views as a national security risk from accessing American chips. While the traditional trade wars garnered most of the attention in recent years, it is prevailing semiconductor embargos that have the potential to cause the greatest economic harm.

While China will spend tens of billions of dollars in the years ahead to ensure domestic technology independence, this path is made incredibly problematic as the essential equipment from the likes of ASML is unavailable. Throwing money at the problem doesn't solve these issues, and a timing mismatch between domestic independence and supply shortages could cause a significant economic schism.

Like it or not, TSMC and Taiwan as a whole have been thrust in the middle of a brewing geopolitical issue that must be monitored. A conflict remains a low probability event and a focus left for academics and not investors. That said, the strategic importance of TSMC should not be discounted for a moment.

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