

# Restrictions on Trade with China Harm U.S. Leadership in Technology

**U.S. export controls that target China's semiconductor industry and AI sector threaten America's competitiveness and heighten tensions over Taiwan.**

The expansive packages of export controls released in December 2024 and January 2025 commit the semiconductor and artificial intelligence (AI) sectors of the United States and China to much higher levels of decoupling. Meanwhile, efforts to slow the diffusion of AI applications in China are adding to tensions over Taiwan and stymie a sector dominated by U.S. firms at every level. Much of the hardware for training AI models is manufactured on the island for major U.S. companies such as Nvidia, AMD, and Intel. This hardware is packaged for AI datacenters by leading U.S. firms such as Dell and HPE; and it is deployed by large cloud-services companies and in private datacenters—all mostly in the United States.

Beijing is responding—anticipating continuation of some Biden administration policies in the second Trump administration—in myriad ways. Already China has ratcheted up controls in areas that will hit U.S. companies hard, including by prohibiting the export of the critical minerals gallium, germanium, and antimony. This tit-for-tat escalation has unknown consequences and the potential to further disrupt supply chains still reeling from previous controls, tariffs, the pandemic, Russia's invasion of Ukraine, and other events.

The disconnect is becoming ever more stark between these decoupling policies and budding U.S. industrial initiatives in the technology space, embodied by the CHIPS and Science Act. Despite rhetoric from Washington about ringfencing only the most advanced semiconductors with potential military end uses, the risks to leading U.S. technology companies go much deeper. The sector is increasingly concerned about the significant second- and third-order effects on its global competitiveness (see also the Farrell memo elsewhere in this report).

Aspects of the U.S. rules have proved difficult to implement and have already damaged American firms. These include restrictions on end use, on memory, and on the servicing of U.S.-made machinery inside China.

As to the national security goals—however vaguely defined—are they being achieved, and how are they being measured? U.S. officials have given no clear answers to these questions, and there has been little independent cost-benefit analysis. We are now in a new world, key elements of which will be difficult to reverse, and where key parts of the system do not appear to appreciate the long-term impacts.

## **EXPANDING CONTROLS**

The previous administration rolled out unprecedented export controls in October 2022. These were designed to slow China's ability to develop advanced artificial intelligence and the semiconductors that could be used to train AI models and run AI algorithms. The justifications for the sweeping controls changed many times, leaving the tech industry up in arms.

Since 2018–2019, the United States has prohibited Chinese firms from obtaining the most crucial equipment for manufacturing advanced semiconductors: lithography gear from Dutch leader ASML. (These controls were agreed to by the Netherlands under a multilateral agreement on dual-use technology with military applications.)

But Chinese firms could still buy the most advanced semiconductors on the open market, including high-powered graphics processing units (GPUs) to train advanced models. So the 2022 package included restrictions on the performance of GPUs. The threshold changed in October 2023, and is due to change again. To comply, leading U.S. technology companies such as Nvidia, AMD, and Intel must degrade the performance of their GPUs—and risk losing market share in China.

The most problematic U.S. controls cover tools for making semiconductors. In addition to lithography, the Biden administration cranked up restrictions on etching, deposition, implantation, cleaning, and more. Here, U.S., Japanese, and Dutch companies dominated the market in China prior to 2022. Cut to 2025, and that landscape has transformed. More than two years of export controls have brought Chinese toolmakers to the fore, advantaging Japanese and Dutch toolmakers to a degree and massively disadvantaging those in the United States.

It is critical for the Trump administration to understand how this situation arose.

## OWN GOAL

The massive package of controls released in October 2022 was unusual. It was issued unilaterally, not coordinated with key allies. For the past two years, the United States has been in tense negotiations with the Japanese and Dutch governments over getting some alignment. U.S. officials have downplayed the idea that Chinese toolmakers could catch up and dismissed discussion about the impact of the controls at home.

Japan and the Netherlands have taken a different approach. They do not have controls on servicing or end use. Japanese companies in particular still operate tools at Chinese facilities, taking market share from U.S. toolmakers. Both governments, having listened closely to their key technology companies, are reluctant to hamstring them further, and accept that long-term access to the market in China is critical for R&D, innovation, and remaining competitive globally.

Officials in Japan have concerns about aligning with the United States on removing support personnel from specific Chinese facilities. They worry that relinquishing that oversight would actually help Chinese firms to become more competitive. Officials in Tokyo and the Hague strongly believe that this is a national security issue.

U.S. toolmakers share these concerns. Forced to pull all support personnel from Chinese facilities in October 2022, one major company told me that they were shocked at how quickly U.S. expertise and equipment were replaced. December's controls added 140 firms to the 'Entity List'—the catalogue of specific facilities that companies must determine whether they can continue supplying or supporting.

Confusion around definitions abounds. The end-use restrictions attempt to designate certain manufacturing processes as higher risk with thresholds that trigger controls. They fail to account for the fact that tools are not designed to operate only at a preset level. For example, to produce the sophisticated chip at the heart of what Huawei called "the most powerful Mate phone ever," released in November 2024, the Chinese firm SMIC used well-known techniques and lithography kits probably intended for less advanced chips.

Most importantly, running the gauntlet of U.S. rules has transformed the Chinese semiconductor industry. **Chinese toolmakers have become innovators**, incentivized by the sanctions to collaborate and integrate, and under directives from Beijing to favor domestic technologies. Companies that were second-tier suppliers just a couple of years ago can now compete with U.S. firms. This includes some companies just added to the Entity List, such as Naura and Piotech.

Indeed, all Chinese companies in the technology sector are rushing to replace and design-out U.S. companies and technologies across their supply chains.

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## WHERE'S THE WIN?

It is not clear how U.S. technology leaders will replace the billions of dollars in revenue lost from China, as more and more U.S. equipment is replaced by Chinese gear or equipment from Japan and other countries. Some firms have already cut budgets and laid off personnel. Having the biggest market made increasingly difficult to access as competitors gain major advantages calls into question the long-term viability of U.S. semiconductor toolmaking in particular. This could have ripple effects across the supply chain.

The technology industry understands national security concerns. Still, there is frustration around what the intended gains are. So far, the controls have had little impact on the ability of Chinese firms to train large language models (LLMs). Officials point to Chinese companies' lagging development of advanced AI datacenters, arguing that this gap will grow as the controls continue to restrict access to cutting-edge GPUs. But in China, as in the United States, such datacenters are primarily used by private sector organizations for civilian applications of AI, either training or inference.

Hence it is hard to assess the impact of the entire effort on China's military modernization. It is not clear whether or when advanced LLMs will be used for critical military missions, nor how much of a game changer that would be. Those arguing that U.S. export controls will prevent China from getting to artificial general intelligence (AGI) base this on a host of unverifiable assumptions.

Meanwhile, the real and measurable impacts of the entire approach must be tallied—on U.S. companies, on civilian applications, such as for medicine and the energy transition, and on other critical issues. How, for instance, under these conditions, can the United States and China reach an agreement on regulating advanced AI models to reduce the risks of their deployment by malicious actors?

The one analysis done so far by a credible independent institution, the Federal Reserve Bank of New York, was issued in April 2024. It concludes: "Forbidding U.S. firms from exporting to a selected list of Chinese firms for national security reasons, export controls aim to generate a selective strategic decoupling of U.S. firms from China." The Commerce Department is reportedly doing an internal assessment of the impact of the controls implemented since October 2022. It is working with RAND, a think tank heavily focused on national security and less on U.S. technology leadership and competitiveness.

No analysis has accounted for the impact of China's retaliation for U.S. technology controls, of which we are likely only in the early innings. Over the past two years, Beijing has put in place a range of legal measures to allow for targeted retaliation. Already, U.S. firms, including Micron and Nvidia, have experienced security reviews, anti-monopoly investigations, or penalties, further eroding their business in China. In October 2024, a Chinese cybersecurity industry body called for a security investigation into U.S. semiconductor leader Intel. More such skirmishes are likely.

The full cost of retaliation will likely come from increased restrictions on the export from China—direct to the United States, and via allied countries—of minerals critical to semiconductors, green technology, and the automotive

industry. For example, Japanese firms rely on China for about 60% of the battery-grade graphite that they need; China’s Ministry of Commerce has indicated it will tighten reviews of licenses for graphite export to Japan.

Beijing has lots of room to escalate. Beyond the export ban on germanium, gallium, and antimony, it could soon curb tungsten. Chinese companies dominate production, processing, and IP for this element. Chinese firms also control supply chains for rare earths and finished products based on them, such as magnets.

Xi has repeatedly **stressed** that “China will not stand idly by” while the United States tries to hold back Chinese firms. In a November meeting with President Biden, Xi again put technology control issues on par with Taiwan as a redline for Beijing. He called the ‘small yard, high fence’ policy “**not what a major country should pursue**”—or perhaps translated more faithfully, “unbecoming of the behavior of a great power.”

The sweeping set of rules was driven by a few White House officials who are now gone. Many U.S. companies are **enraged by the controls on AI diffusion**. One senior official told me the situation was like members of the previous administration “walking out the door and throwing a grenade over their shoulder.” Their replacements in the new administration must now audit what has been accomplished by the process started in October 2022, assess the extent of the damage to U.S. industry and market share, and rethink. The United States’ technology leadership hangs in the balance.

The new administration needs to answer all the tough questions on costs and benefits for a sector central to American prosperity.

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#### **FURTHER READING**

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