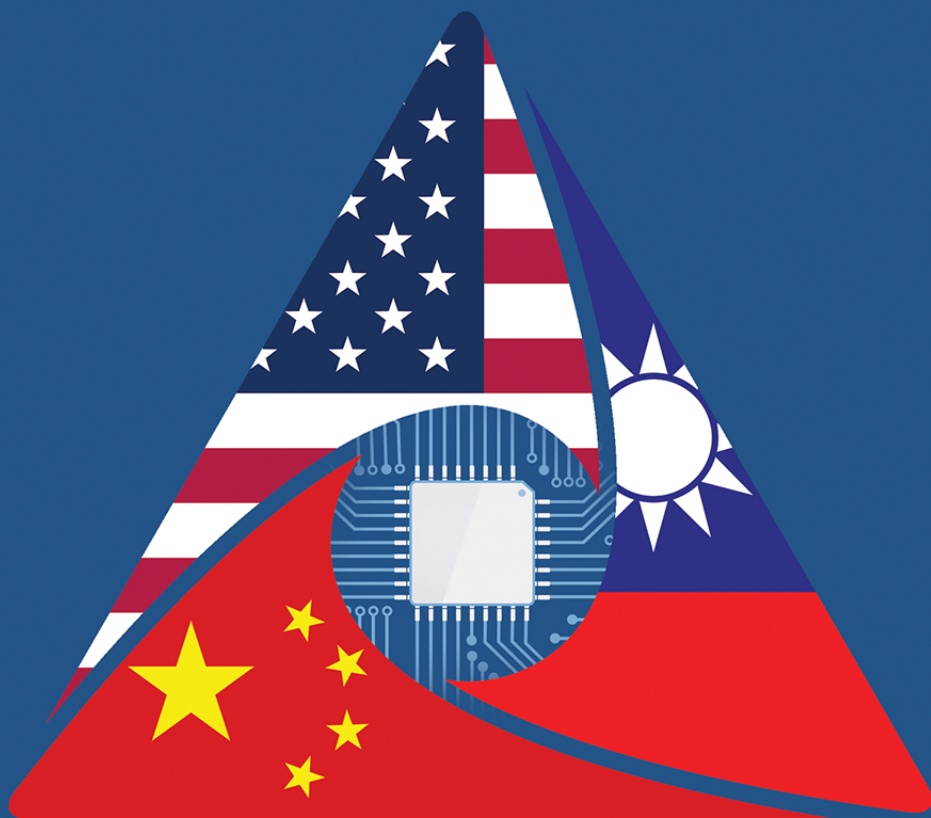




Silicon Triangle

The United States, Taiwan, China,
and Global Semiconductor Security

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CHAPTER SEVEN

Jointly Deterring Beijing through Semiconductors

MATTHEW POTTINGER

China's current dependence on US and partner semiconductor technologies offers options and trade-offs for economically deterring China's regional military or other coercive aims.

What could puncture the confidence of China's leadership that using force against Taiwan would be easier than alternatives? Largely independent of the semiconductor supply chain security-, competitiveness-, and innovation-related points above, the United States faces deep questions today regarding the tools it has available—or does not have available—to deter unwanted military or other coercive global actions by China's leaders. Aggression toward Taiwan is a key example but not the only one.

Military strength, coupled with a will to use it, is a core component of such deterrence. There are also clear steps that Taiwan, the United States, and partners could take to improve military deterrence—not through a policy of strategic clarity, but rather through planning and coordination that could preserve the credibility of options within strategic ambiguity.

Moreover, a strategy to deter China's leadership from conventional combat in the western Pacific through military strength has arguably become necessary but insufficient, given China's improving military capabilities. Going forward, this dynamic points to the need for a more deliberate economic deterrence strategy, given China's particular reliance on the United States and its allies as trading partners.

Here, semiconductors offer a unique but difficult economic deterrence choice: should the United States work with Japan, Korea, Taiwan, and the

Netherlands to further restrict the export of semiconductor technologies, manufacturing equipment, and design tools to China—and not just at the leading edge—in order to extend China’s current reliance on chip imports and partner technologies? Or do the downsides of those export controls outweigh the benefits? Indeed, this “jet-engine strategy,” affecting tools and subsystems rather than the final product, could entail significant costs for US and partner firms—even slowing the overall global semiconductor technological frontier. But if successful, it could serve as a major tool for economic deterrence against future military conflicts with China with potentially unbounded costs.

The United States lacks comprehensive interagency institutional mechanisms and expertise (or multilateral fora) to fully weigh and consult with industry on the dynamics of such options, whether in semiconductors or other emerging intersections of economics and technology with national security interests.

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This chapter recommends ways that Washington can mobilize its allies, and in the process inoculate itself and them against overdependence on China for semiconductors. Success in this effort would deprive China’s leaders in Beijing of a key means of the coercive leverage that they seek. It might also erode Beijing’s confidence in its ability to weather supply shocks in the event it attacks Taiwan.

These recommendations build upon the semiconductor export controls unveiled by the Biden administration on October 7, 2022—one of the most significant economic measures to date by the administration for improving the United States’ competitive footing vis-à-vis China. As described in chapter 6, US partners have key strengths in different parts of the global semiconductor supply chain and are each pursuing further advances through different strategies. The United States should do more to align itself to be a part of their successes. The following recommendations seek to further expand upon the role of partners in supporting Washington’s policy toward China—and they seek to tighten loopholes in *enforcement*, a perennial weakness of US export controls in recent decades.

First, it is important to appreciate how resolute China's leader, Party General Secretary Xi Jinping, is in his aim of making China into the world's chipmaking superpower. Dominance in semiconductor manufacturing has been his explicit goal for years. In 2014, China's State Council put forward "Guidelines to Promote the National Integrated Circuit Industry Development," which highlighted Xi's objective of achieving the world's dominant semiconductor industry by 2030 in terms of production, design, packaging, testing, materials, and equipment.¹ The guidelines included the objective of satisfying 70 percent of China's semiconductor demand using indigenous production by 2025. The State Council went further in 2019 when it stated that 80 percent of China's demand should be produced indigenously by 2030. And in a 2018 address to the Chinese Academy of Sciences and the Chinese Academy of Engineering, Xi declared that China must overcome "shortcomings" in its mission to seize the "high ground" of pivotal technologies, including "high-end microchips." "Our situation, in which key and core technologies are controlled by others, has not fundamentally changed," he warned.²

As detailed in this report's chapter 8 on China's semiconductor ambitions, Xi is putting big money where his mouth is. In 2017, the Washington, DC-based Information Technology and Innovation Foundation estimated that China had earmarked \$160 billion in subsidies for the sector.³ In December 2022, Reuters reported that Beijing was preparing a new round of subsidies and tax credits equivalent to about \$150 billion.⁴ Combined, the two figures are six times the \$52 billion the US Congress allotted to support semiconductor manufacturing through the landmark CHIPS and Science Act of 2022. Suffice it to say, Xi has shown little sign of wavering from his semiconductor goals since beginning his second decade as paramount leader following the 20th Party Congress in October 2022.

It is also important to appreciate *why* Xi is pursuing this goal. Through his dual-circulation strategy, he has stated explicitly his objective of decreasing China's dependence on high-tech imports while also making the world's technology supply chains increasingly dependent on China. Further, he has stated a goal of ensuring that China can

easily substitute imports from one country with those from at least one other country.

Xi characterizes these moves as defensive. “We must sustain and enhance our superiority across the entire production chain . . . and we must tighten international production chains’ dependence on China, forming a powerful countermeasure and deterrent capability against foreigners who would artificially cut supply [to China],” he said in a major 2020 address.⁵ In practice, however, leaders in Beijing also weaponize foreigners’ economic dependence on China as *offensive* leverage to advance Xi’s political objectives overseas.⁶ Indeed, in recent years Beijing has restricted trade with Australia, Canada, Japan, Mongolia, Norway, the Philippines, South Korea, Pacific Island nations, and other countries in sometimes successful attempts to coerce changes in a targeted country’s laws, policies, or judicial processes. Semiconductors are essential to Xi’s strategy because they are integral to so many of the other technologies Beijing is vying to control over the next decade—from biotechnology and space exploration to autonomous vehicles and military systems.

Constraining Beijing’s Ambitions

As I have argued elsewhere, the United States and its allies should pursue a policy of “constrainment” to foil Beijing’s ambition of technological self-sufficiency, including in semiconductors.⁷ The idea here isn’t so much to cut off the flow of chips to China (though we should do what we can to keep chips out of China’s hypersonic missiles, supercomputers, and other advanced military and surveillance systems), but to prevent China from accumulating the means to capture a large market share and then cut off the flow of chips to democracies. To put it in twentieth-century terms: our goal is not to cut off the flow of oil to China, but to prevent China from becoming OPEC. Permitting China to achieve a dominant OPEC-like status in chipmaking would hand Xi the means to cripple US and allied economies, blunt our technological edge, and compromise our military prowess.

The Biden administration's October 2022 export rules, if assiduously enforced, offer a good starting point for constraining Beijing's semiconductor ambitions.

One aspect of the rules builds upon the Trump administration's use of the once-obscure Foreign Direct Product Rule (FDPR). That rule forbids US or third-country companies from selling products made with US tooling, software, or design to blacklisted companies in China. Whereas the Trump administration used this approach against the telecommunications equipment maker Huawei, the Biden administration's new rules have expanded the blacklist to include companies in China involved in supercomputing or other military or surveillance uses. So far, the administration has put forty-nine companies on the blacklist in addition to Huawei.⁸

But the more significant part of the Biden administration rules targets China's *production* of chips by restricting the export of essential US software, equipment, and skilled labor. These rules include license requirements (with presumption of denial) for export of US products to fabs in China producing logic chips at 16nm or below, license requirements for semiconductor tooling components, and limits on US persons working at People's Republic of China (PRC) semiconductor firms that produce advanced chips.⁹ Those restrictions mark an evolution in US strategy. Previously, US policy emphasized the promotion of domestic industry—and its short-term pursuit of revenue—rather than the restriction of China's technological progress toward its industrial goals. The combination of the new export controls with the subsidies contained in the 2022 CHIPS and Science Act means Washington is finally attempting to pursue both objectives simultaneously.

US National Security Advisor Jake Sullivan signaled the shift in a September 2022 speech:

On export controls, we have to revisit the long-standing premise of maintaining “relative” advantages over competitors in certain key technologies. We previously maintained a “sliding scale” approach that said we need to stay only a couple of generations

ahead. This is not the strategic environment we are in today. Given the foundational nature of certain technologies, such as advanced logic and memory chips, we must maintain as large of a lead as possible.¹⁰

The new export controls indicate Washington is willing to take steps even when they are costly to US industry; the controls, at first announced unilaterally, serve as a sort of “down payment” before multilateralizing the effort in ways that would also require US allies to make commercial sacrifices. Washington knows that if the desired effects of the new policy are to be achieved and sustained, essential allies will need to be brought into the act, and soon.

An Example: Semiconductor Manufacturing Equipment Subsystems

Leading Dutch semiconductor equipment manufacturer ASML describes its role as one of an “integrator” that draws on a global supply chain of over one hundred thousand components, often from sole suppliers, to make the complex machines that produce the most complex chips.

Similarly, as China’s emerging indigenous semiconductor equipment manufacturers seek to match the capabilities of Western vendors on whom China’s chip manufacturers currently rely, they regularly buy subsystem components from a variety of suppliers in the United States, Japan, and Europe. Leading semiconductor manufacturing equipment firms in China include NAURA, Mattson, ACM Research, KingSemi, Piotech, ZKX, Hwatsing, and Raintree Scientific Instruments. In recent years, these firms have bought subsystems—including power supplies, fluid delivery systems, electrostatic chucks, vacuum systems, and magnets—from US and partner suppliers. Meanwhile, they have also recruited overseas engineers using significant compensation, bonuses, and equity stakes.

Constraining the shipment of certain types of subsystems that China uses to build its wafer fab equipment could be one option to slow down China’s ability to build advanced semiconductor manufacturing

equipment. Indeed, the leading equipment manufacturers in China rely on a host of subsystem suppliers based in the United States, Europe, Japan, or Korea:¹¹

- *NAURA* is China's largest semiconductor equipment manufacturer, with \$1.2 billion in sales in 2021 and a 53 percent (two-year) compound annual growth rate. It supplies equipment for physical vapor deposition (PVD), chemical vapor deposition (CVD), epitaxy (the growth of one thin film in a chip over another), and atomic layer deposition (ALD) processes, and for plasma etchers, tooling thermal management systems, and cleaning tools. US-based subsystem suppliers to NAURA include MKS Instruments, CoorsTek, Edwards Vacuum, and Advanced Energy. NAURA has also been supplied by Comet (Europe), and from Japan-based firms (or their Korean subsidiaries) including Kyocera, DAIHEN, Sumitomo, and Kyosan.
- *Mattson Technology* was founded in the United States and retains a headquarters in Fremont, California—but in 2016 it was purchased by an organ of the Beijing municipal government, Beijing E-Town. It booked \$374 million in sales in 2021, representing a 47 percent annual growth rate, supplying manufacturing capabilities including thermal systems, plasma etching and dry stripping of photoresists, and epitaxy processes. Similar to NAURA, its US and partner-based subsystem suppliers include CoorsTek, Edwards Vacuum, Advanced Energy, Comet, DAIHEN, Sumitomo, and Kyosan.
- *AMEC* (Advanced Micro-Fabrication Equipment), similar in size to Mattson, had \$388 million in 2021 sales, representing a 31 percent annual growth rate. AMEC supplies plasma etchers and CVD equipment that are enabled by foreign subsystems from CoorsTek, Edwards Vacuum, Advanced Energy, Comet, DAIHEN, Sumitomo, and Kyosan.
- *Piotech*, based in Shenyang, with \$48 million in sales in 2021 and a 30 percent annual growth rate, supplies CVD and ALD equipment to chip manufacturers. US firms that supply subsystem components

to Piotech include XP Power/Comdel, MKS Instruments, and Advanced Energy; partner-country suppliers include Comet; Japan's Horiba, LINTEC, and DAIHEN; and Korea's KoMiCo and New Power Plasma (NPP).

- ZKX (Beijing Zhongkexin Electronics), with just \$15 million in 2021 sales, supplies ion implant equipment. In turn, it purchases from US-based Entegris, New Zealand's Buckley Systems, and Japan's Kyocera and Matsusada Precision.

The point is not to emphasize particular firms or suppliers as problematic. Rather, it is to illustrate how a large constellation of players within the United States and our partner countries—some of them small- or medium-sized businesses—continue to make seemingly rational commercial decisions to supply to willing buyers in China. At the same time, those buyers are operating within a policy framework that explicitly seeks first to internalize these overseas technologies and then to displace them, both domestically and eventually globally through trade. We have seen this pattern play out over a host of other technology-driven industries as well, from high-speed rail to power plant components to telecom.

Limiting the shipments of these critical semiconductor subsystems to China, therefore, could sustain China's dependence on Western equipment and limit its ability to build advanced semiconductors. The willingness of US partners to cooperate in such a strategy would hinge on various government views toward the security versus commercial implications of China gaining indigenous capabilities in this area, as well as on the process and framework for arriving at such multilateral engagements.

"COCOM" 2.0

Export controls are not a silver bullet—they tend to delay, rather than deny, an adversary's acquisition of sensitive technology. Export controls are also more effective when combined with other measures, which is why they are only one of the approaches advocated in this chapter.

But export controls are nonetheless an important tool that the United States and its partners have had ample experience wielding effectively since the 1940s. And delaying Beijing's technology ambitions is a worthy goal in its own right, according to the logic embedded in Jake Sullivan's quotation above. Moreover, export controls are remarkably well suited to constraining Beijing's chip manufacturing ambitions, given how heavily concentrated the choke point technologies are in the hands of corporate actors domiciled in the United States and in a handful of partner countries—the Netherlands and Japan in particular. In other words, conditions favor the effective employment of export controls against China if the United States marshals its partners to the cause and follows through with strict enforcement.

It will come down to a question of US leadership. It always has been so. In 1949 the US Congress passed the Export Control Act, giving President Harry Truman something highly unusual: peacetime authority to restrict US technology exports. Such authority was normally conferred only during wartime. But as Washington's World War II alliance with Josef Stalin transformed into Cold War rivalry, the Truman administration created lists of controlled items that were either prohibited from export or that required State Department or Commerce Department licenses. Soon after, Washington multilateralized the effort by setting up an export control regime with its allies called the Coordinating Committee for Multilateral Export Controls, or COCOM for short. Formed at the start of the Cold War, the group of seventeen member states agreed to restrict the sale of sensitive technology to the Soviet bloc.

"The United States and its allies were relatively successful at the outset in controlling the export of items on the COCOM lists to the Soviet Union and Eastern Europe," wrote John H. Henshaw in his Stimson Center history of the network.¹² "In short, the effectiveness of COCOM has been tied to the quality of US leadership." The Achilles' heel of any export control regime is alternative sources of supply, which is what makes an allied—not just unilateral—approach so essential. By bringing along the Netherlands and Japan in particular, but also South Korea, Taiwan, Germany, Israel, and others, the United States can preempt loopholes before China has a chance to exploit them.

Restricting China's, as well as Russia's, Iran's, and North Korea's, production of microchips could serve as the kernel around which a revived COCOM structure could sprout. Such a renewal is needed in part because after the Cold War, Russia was brought into the Wassenaar Arrangement, the successor to the original COCOM. With Russia now waging war in Europe, a new body that excludes that authoritarian aggressor state is overdue.

Here are eight steps the US government could take to marshal its partners and amplify the impact of the recent export control rules.

1. *Elevate and expand.* Elevate trilateral talks on *semiconductor controls* to the national security advisors and select cabinet officials of the United States, the Netherlands, and Japan. In parallel, build a larger grouping that includes South Korea, Germany, Israel, Taiwan, the United Kingdom, and India to discuss *supply chain resiliency* for semiconductors specifically. The group should commission studies of existing and planned fab capacity at advanced and legacy nodes, as well as related segments of the semiconductor industry, such as chip packaging and testing.
2. *Remember that "legacy" matters.* I recommend Washington and its allies expand the scope of regulations to prohibit the export of equipment that China could use to make logic chips from 16nm to 28nm. Given the strength that China has already attained in 28nm fab capacity, trade tools such as tariffs should be considered to incentivize American and allied chipmakers to continue making these legacy chips. To be sure, the Biden administration rules restrict US exports that would help China make advanced-logic chips—that is, circuits etched below 16nm. But older generations of chips—referred to as mature or “legacy” nodes—are generally excluded from the regulations, even though, as described in chapter 2 of this report, they have many specialized commercial and military uses and still constitute a massive part of the global market. Chips of 28nm and older still power consumer electronics, vehicles and transportation equipment, high-capacity energy storage systems, and our

most advanced weapons systems. In particular, allowing China to dominate the market for logic chips in the range of 28nm or other specialized analog, sensor, and radio frequency (RF) chips, could be highly disruptive to this existing and more globally distributed production base. Locked out of advanced nodes, continued semiconductor subsidies in China could flood the global market with cheaply priced legacy chips, driving today's free-market chip manufacturers out of the space and eventually generating new US or partner dependency on China's supply. US and allied chipmakers could further be deprived of the revenue these legacy chips generate for research and development.

3. *Restrict deep ultraviolet (DUV)*. The most effective way of hobbling China's ambitions to build the world's largest base for 28nm logic chips would be for the Netherlands to restrict ASML from selling DUV lithography tools used to etch such chips. The Dutch will argue that Beijing already has many of these machines. True enough—but scale matters. Many fabs in Taiwan and elsewhere outside China are on a waiting list to receive ASML DUV machines. The Netherlands could effectuate a “soft ban” on China by simply reprioritizing sales of DUV machines to non-China companies. Japanese and US companies, too, should be restricted from exporting tools and skilled labor for making 28nm chips in China.
4. *Expand the blacklist*. The Foreign Direct Product Rule blacklist should be expanded to include the subsidiaries and affiliates of listed Chinese companies, given the ease with which targeted China-based companies can evade export controls via affiliates. The blacklist should also incorporate China's machine tool firms to constrain Beijing's bid for self-reliance in this segment.
5. *Go beyond chips*. For the United States and its allies to build resilient microchip supply chains and reduce the potential for coercive leverage, it is important to incentivize the allied manufacture of not only memory and logic chips, but also the printed circuit boards, ingots, and assembly packaging and testing that accompany them. While not there today, according to Rick

Switzer of the Special Competitive Studies Project, China is currently on course to control over 80 percent of some of these market segments. Policy makers should dig deep into their tool kits to mobilize private capital (such as through investment partnerships with the US International Development Finance Corp.) to actively push more of these production lines to Southeast Asia, India, and Mexico.

6. *Restrict US government exposure to China's chips.* A provision of the 2023 National Defense Authorization Act passed by the US Congress strengthens the security of defense systems by prohibiting US government procurement of products that contain semiconductor chips from China's chipmakers with ties to the Chinese Communist Party, including Semiconductor Manufacturing International Corp. (SMIC), Yangtze Memory Technologies Co. (YMTC), and ChangXin Memory Technologies (CXMT). The legislation also requires the US government and its suppliers to understand their supply chains. Congress should close several loopholes in this important bill by expanding its scope beyond "national security systems"—an outdated construct limited to weapons and certain equipment required for defense and intelligence activities—to include "critical infrastructure." As evidenced by China's 2015 hack of the US government's most sensitive personnel records at the Office of Personnel Management, our national security relies heavily on "commercial" infrastructure. The updated provision should also be expanded from covering procurement of goods to also covering services. The public and private sectors typically spend more annually on services than on goods. Disruption to or compromise through a service, such as cloud computing, can have more profound effects than a single piece of equipment. For that reason, the bill should prohibit the government from buying not only goods but also *services* that depend on China's chips.
7. *Make Taiwan and South Korea into force multipliers.* The world's top chipmaker, Taiwan Semiconductor Manufacturing Company (TSMC), should be encouraged to further diversify its

production base beyond China or Taiwan to hedge its exposure to the risk of economic or military coercion by China, among other potential commercial benefits. Likewise, South Korean firms are currently producing in China about 12 percent of the world's total dynamic random-access memory (DRAM) chips and 19 percent of global NAND Flash chips;¹³ they, too, should be incentivized to shift more of their production to places other than China. The executive branch should also align Taiwan and South Korea, both of which rely heavily on the United States for their defense, to the objectives of the Foreign Direct Product Rule. This alignment would preempt a longer-term risk that non-US-designed chips made in Taiwan and South Korea could flow to China's military-industrial complex.

8. *Enact a litmus test for the European Union.* The Biden administration has invested significant time and resources into coordinating with the European Union through the US-EU Trade and Technology Council (TTC). The TTC should be a venue for Europe to demonstrate its seriousness about strategic technologies by working with the Biden administration on joint export controls or trade actions to constrain China's semiconductor ambitions. Failure on the part of Europe to do so will cast doubt on the TTC's strategic relevance.

Enforcement

Washington's export control regime is only as good as its enforcement—and enforcement has been a perennial struggle.

China is a dictatorship in which a Leninist party overrules the rule of law. The Party can and does direct corporate behavior through a variety of methods, irrespective of the ownership structure of a particular company. These features make the system well suited to exploiting loopholes in US export controls: where there are gaps, entities will circumvent them by acquiring prohibited goods, technologies, and software through in-country intermediaries exempt from the scope of US rules.

It was reported in 2021, for example, that China's acquisition of nominally controlled US integrated circuit design and technology enabled it to leapfrog the United States in hypersonic weapons development.¹⁴ Some China-based fabs, having successfully acquired and adapted Western technology, have manufactured more-advanced chips than are currently produced in the United States.¹⁵ China also diverts "controlled" US integrated circuits to assist Washington's adversaries, including two sanctioned states, the Russian Federation and the Islamic Republic of Iran, whose weapons have been found to contain American chips and other components.¹⁶

The official body charged with conducting and enforcing US export controls is the Commerce Department's Bureau of Industry and Security (BIS). BIS is understaffed, short on China expertise, and traditionally oriented toward favoring export revenues over national security concerns. In turn, US and partner companies that stand to make money selling software, equipment, and services to China's heavily subsidized chip industry unsurprisingly lobby their governments for "nuanced" regulations that won't foreclose business opportunities in China. To address these split incentives, Congress should allocate BIS more funding (beyond adjustment for inflation) to handle its growing plate of responsibilities. Its fiscal year (FY) 2022 budget was \$133 million, and it requested nearly \$200 million for FY 2023. A study from the Center for Strategic and International Studies (CSIS) found that BIS's export controls budget has failed to keep pace with inflation since FY 2020 and that almost 90 percent of its \$66 million requested budget increase would be absorbed by rampant inflation and other expenses unrelated to export controls.¹⁷

Among other things, BIS simply needs more staff. The bureau reportedly has at times had only two officers to conduct end-use export checks in China.

And BIS needs to upgrade its technical systems to private sector standards. BIS's internal database "is so unreliable that an identical data search query executed twice in a row will not necessarily retrieve identical records, as various parts of the system are often crashing or otherwise non-responsive," according to CSIS. Officers often "only

have access to outdated versions of Microsoft Excel.” BIS officers can’t be reasonably expected to properly enforce these controls when they still work in the twentieth century.

BIS should also make better use of private providers of market intelligence and abandon the flawed “end-use” paradigm when it comes to China. China’s military-civil fusion policy means that Beijing can require companies—irrespective of pedigree—to serve China’s military modernization and to do so in secrecy. A small number of US officials, much less only two of them, can’t be expected to reasonably determine the ultimate “end user” of US chips under such a large and complex system. US officers should assume that if Beijing can violate end-use agreements, it will.

Finally, permitting US persons to work in China’s chip plants and directly transfer expertise and know-how for even legacy chips may also indirectly, but substantially, impact China’s chipmaking capabilities at leading-edge nodes, the level where the technology-transfer restrictions apply. BIS should strongly encourage US talent to leave China’s semiconductor industry and work elsewhere, including the United States, where numerous fabs are under construction.

One of the main opportunities provided by the CHIPS and Science Act is to smooth such US or partner transitions away from China—whether for personnel, production capacity, or equipment sales—alongside otherwise commercially costly restrictions.¹⁸

Eroding Beijing’s Confidence in War

There is a popular idea in Taiwan that the island’s dominance in chip-making confers a “silicon shield”—that is, a deterrent against war since any wartime damage to Taiwan’s fabs could create supply shocks that would hurt China’s economy as much as anyone else’s.¹⁹

As discussed in other chapters in this report, the degree to which Beijing perceives and respects a “silicon shield” over Taiwan is debatable, and perhaps even dubious. Some nationalistic commentators in China have asserted that Taiwan’s fabs are a point *in favor* of Beijing’s invading Taiwan, based on the (faulty) assumption that the fabs could

be nationalized and easily put to work producing chips as part of China's industrial juggernaut.²⁰ In fact, Taiwan's fabs would struggle to produce much of anything in the aftermath of even a quickly successful invasion by China. Fabs unscathed by bombs would still find it difficult to maintain operations without the support of Taiwanese workers—let alone the equipment, engineering, consumables, software, and equipment upgrades provided daily by companies domiciled in the United States, Japan, and other democracies. Washington and its allies would be as loath to support Beijing's industry as they are loath to support the Russian economy following its February 2022 reinvasion of Ukraine. And Taiwan's contract foundry business model—which relies on close collaboration and deep trust between chip designer clients and the manufacturer—would be shattered. If there is a “silicon shield” over Taiwan, Beijing does not yet fear it.

Even so, there can be little doubt Beijing is weighing the effects of a potential war on its supply chains. While semiconductors are unlikely to be a primary factor for or against Beijing's decision to invade Taiwan, Washington should still do what it can to help Beijing ponder wartime scenarios and their likely impact on China's semiconductor supplies. Any realistic appraisal by Beijing would have to view the supply shocks—both to semiconductors and a broad range of other Western goods, services, and infrastructure on which China relies—resulting from any hostile acts, including invasion, as less of a “pro” and much more of a “con.”

A decision by Beijing to commit aggression against Taiwan would ultimately be an act of *optimism* by Xi Jinping—optimism that he can achieve more through war than through peaceful means, and optimism that the costs of a war would be manageable. Depriving Xi of his path toward making China the OPEC of microchips, a journey described in the chapters that follow, might gnaw at his optimism about how well China could manage the economic shocks stemming from an invasion of Taiwan. Therefore, enlisting US partners into a coordinated strategy on semiconductors—both in shouldering shared costs and in mutually opening our markets to new shared opportunities—is an approach worth undertaking.

NOTES

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