Clues to the U.S.-Dutch-Japanese Semiconductor Export Controls Deal Are Hiding in Plain Sight

By Gregory C. Allen and Emily Benson

On October 7, 2022, the Biden administration upended more than two decades of U.S. trade policy toward China when it issued sweeping new regulations on U.S. exports to China of advanced artificial intelligence (AI) and semiconductor technology. These export controls were designed after consultation with key U.S. allies, but the United States originally implemented them unilaterally.

This was a major diplomatic gamble.

In the face of rapidly advancing Chinese AI and semiconductor capabilities, the United States wanted to move fast, so it was willing to take the risk of moving first alone. The United States has the strongest overall position in the global semiconductor industry, and it was by itself strong enough to reshape the Chinese semiconductor industry in the short term. Over the medium to long term, however, this move could have backfired disastrously if other countries, particularly Japan and the Netherlands, moved to fill the gaps in the Chinese market that the partial U.S. exit left.

But that is not going to happen. In late January 2023, the Biden administration’s gamble paid off when the United States secured a deal with both the Netherlands and Japan to join in the new semiconductor export controls. Some officials suggested to the Center for Strategic and International Studies (CSIS) that the result of the dialogues is better characterized as an “understanding” rather than a formal deal, as some details have yet to be worked out. Regardless, the United States has secured the top three international partners needed to ensure the policy’s success. Taiwan had already made a public announcement that it would support enforcement of the October 7 regulation’s application of the U.S. Foreign Direct Product (FDP) rule.
However, the exact contours of the deal with the Netherlands and Japan are not yet publicly known. China has **aggressively used trade restrictions** in the past as a coercive and punitive tool of foreign policy, and all parties to the deal remain tight-lipped, likely in the hopes that this will diminish China’s appetite for retaliation. No doubt the White House would love to have had a big photo-op signing ceremony to show how its gamble on allied diplomacy paid off, but the Biden administration has remained remarkably leak-proof on the topic. The lack of leaks is happening for the same reason the administration was able to pull the deal off: they take allies’ concerns—including a desire for secrecy—seriously.

Thus, journalists and semiconductor companies have struggled in vain over the past few weeks to gain clarity on the elements of the deal. The full details are unlikely to be known until the Dutch and Japanese governments publish their updated export controls regulations, which will take months. In the case of Dutch export controls, some types of policy changes might never be published at all, such as changing the policy for reviewing certain types of export license applications from “case by case” to “presumption of denial.”

In the meantime, however, there are plenty of clues to the deal’s contents from a careful analysis of three elements: (1) the role that Dutch and Japanese companies play in the global semiconductor value chain, (2) the revealed policy preferences of the Biden administration based on the content of the October 7 regulations, and (3) the nature of the underlying legal authorities that constitute the Dutch export controls system. This paper addresses each in turn.

**The Role of Dutch and Japanese Companies in the Global Semiconductor Value Chain**

The semiconductor value chain includes three major segments: chip design, fabrication (i.e., chip wafer manufacturing), and assembly and testing. See Figure 1 for a simplified depiction.

**Simplified Depiction of the Semiconductor Value Chain**

The United States has the strongest overall position in the global semiconductor industry, but that is as a leader of a deeply interwoven multinational value chain in which other countries also play critical roles and possess technological capabilities that are extremely difficult to replace. The October 7 export controls restricted U.S. sales across multiple segments of the value chain, but the lynchpin of the entire policy is the fact that U.S. semiconductor manufacturing equipment
is an essential part of nearly every single Chinese chip factory. There are multiple categories of equipment—such as deposition, etching, and process control—in which U.S. companies are either exclusive or dominant suppliers, and China’s domestic semiconductor equipment industry is tiny and generally far behind that of the United States. The regulations identified 11 specific types of advanced semiconductor equipment (equipment that is only used for producing advanced chips) where there is no foreign substitute for U.S. technology. Some of these equipment types are among the most complicated and precise machines used anywhere in the global economy. Each represents an extremely tall technology mountain that China must climb to reach its goal of a self-sufficient semiconductor industry.

The United States moved first for two reasons: First, to move fast. Chinese chip companies were purchasing equipment as quickly as they could in anticipation of future export controls. Second, the United States wanted to prove that it was not going to ask allies to bear any costs that it was unwilling to bear itself. The long-term success of the policy required multilateral cooperation, most urgently from the Netherlands and Japan.

The Biden administration correctly assessed that the United States was, by itself, strong enough to reshape the Chinese semiconductor industry in the short term. However, Dutch and Japanese companies possess advanced technological capabilities in highly related disciplines. Whereas it would have likely taken China, by itself, decades to replace the equipment that the United States is no longer willing to sell, assistance from the Netherlands or Japan could have had China back up and running in as little as a year or two.

The global semiconductor manufacturing equipment industry has seen ever-increasing market consolidation as the cost and complexity of remaining competitive at the state of the art has soared. For the equipment categories in which the United States is dominant, Dutch and Japanese companies have increasingly found head-to-head competition with U.S. firms unattractive. It would have taken Dutch and Japanese companies billions or tens of billions of dollars in research and development (R&D) costs to produce products that might capture only meager and highly unprofitable market share. However, the October 7 export controls could have changed that calculus. With U.S. companies prohibited from competing in the large and growing Chinese market, Dutch and Japanese companies might have found monopoly access to China attractive enough to justify the equipment R&D expense for new product lines to replace U.S. ones. Once successfully established in China, Dutch and Japanese companies might have been in a position to more effectively compete with and displace U.S. firms in these market niches around the world.

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This is the policy disaster that the United States had to avoid at all costs: cutting off a key revenue source for U.S. companies, creating stronger international competitors to U.S. tech leadership, and
having almost nothing to show for it in terms of affecting China’s military technology trajectory.

But that is not the only thing that the United States wanted from the Netherlands and Japan in negotiations. Dutch and Japanese companies dominate additional categories of semiconductor manufacturing equipment that U.S. companies do not. In particular, they dominate the production of lithography equipment, the most advanced types of which rival the James Webb Space Telescope or Large Hadron Collider in terms of technological precision and complexity. In January 2021, the think tank Center for Security and Emerging Technology (CSET) published a report on the global semiconductor value chain that argued:

The Netherlands, Japan, and a small number of other countries are the dominant producers of lithography equipment, critical for the production of chips and photomasks. China cannot produce any advanced lithography equipment. Most importantly, the Netherlands and Japan are exclusive providers of advanced photolithography equipment—especially extreme ultraviolet (EUV) scanners and secondarily argon fluoride (ArF) immersion scanners—necessary for mass-production of advanced chips, representing China’s top chokepoint.

In other words, the United States maintains control of strong chokepoints for blocking China’s access to the future of AI and semiconductor technology, but the Dutch and Japanese chokepoints are even stronger.

Combined, these facts suggest two primary goals that the United States sought in its deal with the Netherlands and Japan: (1) an agreement to prohibit Dutch and Japanese companies from backfilling the categories of semiconductor manufacturing equipment that the United States is no longer selling to China, and (2) an agreement to prohibit the Dutch and Japanese from exporting their advanced lithography equipment to China.

Dutch companies are the world leaders in lithography steppers and scanners, which produce and refract the light that passes through a photomask (a transparent plate that contains the desired circuit pattern) to transfer that pattern to the silicon wafer. Japanese companies are the other major producers of steppers and scanners. In 2019, the two countries combined enjoyed more than 99 percent worldwide market share. Japan is also dominant in resist processing tools and electron beam lithography tools, which are critical for producing photomasks. Beyond lithography, there are other categories of semiconductor manufacturing equipment where Dutch and Japanese companies are also dominant—Japan in silicon wafer crystal machining equipment, for example—and Japan also excels in the production of the ultra-precise materials and ultra-pure chemicals that are used for semiconductor manufacturing.

At least some of these other semiconductor technology categories were likely included in the deal. However, lithography equipment—including steppers and scanners, electron-beam tools, and resist processing tools—is the most important foreign technology dependence in the Chinese semiconductor industry, and sources with knowledge of the deal have confirmed to CSIS that restricting exports of advanced lithography equipment to China was included in the deal. As was an agreement to prevent backfilling of U.S. equipment.
But knowing that these are the categories of items to control does not answer how they will be controlled. For that, a closer look is needed at how the October 7 policy is designed and what that suggests about the desired U.S. approach.

The Revealed Policy Preferences of the Biden Administration in the October 7 Regulations

The publication of the October 7 regulations included a supplementary information section that detailed the rationale and justification for the regulations. In general, however, these justifications are geared toward explaining how the government’s actions are consistent with the legal authorities that it possesses. In particular, the justifications go into great detail to explain the connection between exports of semiconductor technology to China and China’s nuclear weapons of mass destruction (WMD) and advanced missile programs. This is important because many export controls authorities for both the United States and other countries apply only in cases of counter-WMD efforts, which the paper will return to again later.

However, the October 7 document deserves further discussion beyond the explicit justification. The U.S. government’s actions themselves are an important clue to what the United States desires and how it assesses the likely interplay of certain policy mechanisms and market forces. The U.S. approach reveals a great deal about what U.S. policymakers want and, therefore, presumably what they would have asked for from the Dutch and Japanese governments.

In the context of semiconductor equipment manufacturing, the Biden administration used multiple tools from its export controls policy toolbox. It also created other policy tools, such as new types of FDP rules, by drawing upon legal authorities and flexibilities granted to the U.S. Department of Commerce by the Export Control Reform Act of 2018 and earlier legislation. A previous CSIS paper, “Choking Off China’s Access to the Future of AI” goes into significantly greater detail on the various elements of the policy. This paper will focus only on the elements related to chip wafer fabrication and semiconductor manufacturing equipment since these are the two that matter most in the context of the U.S. agreement with the Netherlands and Japan.

In short, the October 7 regulations are designed to restrict China’s ability to manufacture semiconductors above certain technology performance thresholds, which in the semiconductor industry are commonly referred to as a “technology node.” These performance thresholds are segmented by the three major categories of chips, all aligned at the same technology node. They are:

- logic chips: FinFET or superior, which corresponds to 16 nanometers (nm) or lower technology nodes;
- short-term memory (DRAM): 18 nm or lower; and
- long-term memory (NAND): 128 layers or higher.

The October 7 regulations created a new Export Control Classification Number (ECCN) on the Commerce Control List, ECCN 3B090, which details 11 different types of semiconductor manufacturing equipment that are exclusively relevant to producing chips at this technology node or better. This paper refers to these categories of equipment as “advanced node equipment.” Then,
there is a much longer list of equipment that is potentially useful for producing chips equal to or
better than the previously mentioned performance thresholds but that are also often used to produce
older chips. This paper refers to these categories of equipment as “node-agnostic equipment.”

The October 7 regulations require an export license for selling advanced node equipment to any
end-users in China, but the policy also states that license applications will be reviewed differently
depending on the location of the end-user company headquarters (e.g., China).

The U.S. Department of Commerce will review license applications for U.S. exports of advanced node
equipment to companies that are headquartered in China (Chinese companies) with a “presumption
denial,” which is de facto a ban. However, license applications for sales of advanced equipment to
company facilities that are operating in China but are owned by non-Chinese companies headquartered
in a country on the Commerce Export Administration Regulations (EAR) A:5 or A:6 list will be
reviewed on a “case-by-case basis,” depending upon “factors including technology level, customers
and compliance plans.”

Thus, Chinese-owned companies are prohibited from buying advanced equipment, but companies
headquartered in more trusted countries (the A:5 and A:6 lists) will likely still be able to buy
advanced equipment for their production facilities in China. Shortly after October 7, the U.S.
Department of Commerce granted one-year authorizations to Taiwanese and South Korean
companies to allow them to continue purchasing U.S. advanced node and node-agnostic equipment
for their advanced semiconductor manufacturing facilities in China. During a speech at CSIS on
February 23, Undersecretary of Commerce Alan Estevez stated that “We’re working with those
companies on the way forward there. So, what it’ll likely be is a cap on the levels that they can
grow to in China . . . If you’re at whatever layer of NAND we’ll stop it somewhere at that range. It
will depend on what the Chinese are doing too, but we are in deep dialogue with the companies
around that.”

Exports of node-agnostic semiconductor manufacturing equipment to China are restricted only
under end-use control. Even after October 7, there is no export license requirement for node-agnostic
equipment sales to facilities in China unless that facility is producing chips equal to or better than
the previously mentioned performance thresholds, which is the relevant end-use. In such cases, all
equipment sales, whether advanced node or node-agnostic, are subject to a presumption of denial.
For example, SMIC, the most advanced Chinese logic chip manufacturer, has some facilities that, in
2022, achieved mass production of 14 nm logic chips. SMIC also has many other facilities that produce
at older technology nodes, such as 28 nm and 55 nm. The SMIC 14 nm facilities face a presumption of
denial on purchases of both advanced node equipment and node-agnostic equipment. SMIC’s 28 nm
facilities will be allowed to purchase the node-agnostic equipment, as well as legacy node equipment,
but not the advanced equipment.

The same export restrictions that apply to the sale of equipment also apply to the provision of equipment
components as well as expertise and advice. If the United States does not want China to be able to buy
advanced semiconductor equipment, it only makes sense that they would also not want China to be able
to buy all the constituent components that could be assembled into such equipment. Nor would they
want to allow U.S. consulting companies and experts to teach China how to build such equipment.
As stated above, the approach that the United States has taken reveals a great deal about what U.S. policymakers want and what they think is required to succeed. The U.S. policy is designed to halt Chinese-owned production of advanced chips but also to provide more flexibility in decisions related to foreign-owned production of advanced chips in China. The United States also wants to continue allowing China to produce less advanced chips but only to Chinese companies that clearly give up on the goal of producing advanced chips.

It is a safe assumption, therefore, that the United States asked the Netherlands and Japan to adopt rules that pursue the same goals but also reflect the different technological niches that each country occupies in the semiconductor value chain. This leads naturally to the question of what types of lithography equipment are sufficiently advanced to allow for producing chips at the performance levels covered by the October 7 thresholds. The five different types of lithography technology relevant to the question, in order of most advanced to least advanced, are:

- extreme ultraviolet (EUV);
- argon fluoride immersion (ArF immersion) deep ultraviolet (DUV);
- argon fluoride dry (ArF dry) DUV;
- krypton fluoride (KrF) DUV; and
- I-line.

The Dutch government already stopped granting EUV scanner export licenses to China in 2019, so expanding the deal to include Japan and other types of EUV lithography equipment besides scanners was the easiest area on which to reach agreement in the deal.

I-line lithography, which was already in widespread use by the mid-1980s, is positively ancient by semiconductor industry standards and is, therefore, unlikely to be included in the deal. Again, the U.S. controls seek to (1) restrict sales of advanced node semiconductor manufacturing equipment to all Chinese-owned semiconductor production facilities in China and to (2) restrict sales of both advanced node and node-agnostic manufacturing equipment to Chinese semiconductor production facilities that intend to produce advanced chips (those above the aforementioned performance thresholds). I-line lithography equipment is neither advanced nor useful for producing advanced chips, and thus it is irrelevant to both U.S. goals. There is little reason to restrict its export to China.

That leaves the three types of DUV lithography—ArF immersion, ArF dry, and KrF—as the possible places to draw the line. In commercial usage, KrF dates back to the late 1980s, ArF dry dates to the late 1990s, and ArF immersion dates to the mid-2000s. However, new and improved versions of all three types of DUV lithography machines continue to attract commercial customers due to their lower costs and reduced operational complexity. They are especially attractive to fab operators in China, where massive government subsidies allow Chinese companies to focus more on growing market share in legacy chip production than achieving unsubsidized commercial profitability.

The most advanced Chinese lithography company, Shanghai Micro Electronics Equipment group (SMEE), currently markets systems using ArF dry and KrF technology. This is important because
the risk of foreign substitution is a key criterion for export controls decisions. However, SMEE's most advanced ArF dry lithography machines are in the prototype stage and have not yet achieved the affordability, reliability, and performance required to be marketed commercially. On every metric that matters, they are dramatically inferior to Dutch and Japanese alternatives. Moreover, SMEE DUV scanners are more than a decade and a half behind the state of the art in the Netherlands and Japan in terms of the types of chips that they can produce. Of note, in December 2022, the U.S. Department of Commerce added SMEE to the Entity List “for acquiring and attempting to acquire U.S.-origin items in support of China’s military modernization.” This action is consistent with the overall approach of the October 7 regulations and was likely a helpful step for securing Dutch and Japanese buy-in. SMEE will struggle more than it already has with reduced access to foreign lithography technology components—such as light sources, mirrors, and laser amplifiers—and expertise.

In its 2021 final report, the National Security Commission on Artificial Intelligence (NSCAI) included a recommendation that directly pertains to both the logic behind the October 7 policy and the resulting negotiations with the Netherlands and Japan. It is worth quoting at length:

The United States Government should work with the governments of the Netherlands and Japan to align the export licensing processes of all three countries regarding high-end SME [semiconductor manufacturing equipment], particularly EUV and ArF Immersion lithography equipment, toward a policy of presumptive denial of licenses for exports of such equipment to China. This would slow China’s efforts to domestically produce 7nm or 5nm chips at scale and constrain China’s semiconductor production capability of chips at any node at or below 16nm—which the Commission assesses to be most useful for advanced AI applications—by limiting the capability of Chinese firms to repair or replace existing equipment.

The October 7 policy targeted the 16 nm technology node (FinFET), and the NSCAI concluded that the right lithography technologies to apply export controls to prevent China from producing 16 nm or better chips were EUV and ArF immersion. EUV and ArF immersion are also the lithography technologies that the aforementioned CSET report identified in 2021 as “China’s top chokepoint.” Combined, this strongly suggests that the agreement between the United States, the Netherlands, and Japan drew the performance threshold line to restrict sales of EUV and ArF immersion lithography equipment, related components, and possibly expertise to China. An examination of Dutch export controls law provides even further evidence for this conclusion.

The Legal Authorities underlying the Dutch Export Control System

As mentioned previously, the U.S. Congress had already passed multiple laws updating the process for making export controls and giving additional legal flexibilities and authorities to the executive branch to issue new export controls regulations. Naturally, a deal with the Netherlands and Japan would be much more difficult to achieve if it required their governments to pass new laws to implement the agreement. While ASML, the leading Dutch lithography company, has stated that it believes that the Dutch parliament will have to pass new laws to implement the agreement, the Dutch and Japanese governments have not indicated that new laws are required. Thus, a careful examination of the existing legal authorities available for export controls, in particular for the Netherlands, provides significant relevant information for inferring the content of the agreement.
Combined, this strongly suggests that the agreement between the United States, the Netherlands, and Japan drew the performance threshold line to restrict sales of EUV and ArF immersion lithography equipment, related components, and possibly expertise to China.

In an interview with CSIS, Sebastiaan Bennink of BenninkAmar Advocaten, a Dutch law firm that specializes in economic sanctions, export controls, and trade law, explained that there are three potential sources of legal authority for the Dutch government to regulate the export of dual-use goods and services (i.e., commercial items with both civilian and military applications):

1. the Wassenaar Arrangement;

2. European Union dual-use export controls regulations; and

3. Dutch legislation passed by parliament.

**The Wassenaar Arrangement:** Created after the end of the Cold War, the **Wassenaar Arrangement** is the most important multilateral export controls framework. It establishes the process for updating the **List of Dual-Use Goods and Technologies and Munitions**. Each of the member states agrees to apply an export controls licensing process to all of the listed technologies and also to exchange information regarding the export of such items. The United States, Japan, and the Netherlands are all participating states.

Critically, the Wassenaar Arrangement’s **founding documents** state that “The decision to transfer or deny transfer of any item will be the sole responsibility of each Participating State.” As a party to the Wassenaar Arrangement, the Netherlands already has a system of export licenses in place for all items on the List, and the Dutch government has both the responsibility and the authority to make decisions about whether license applications will be reviewed with a “presumption of denial.”

Lithography scanner and stepper equipment are included on the **Wassenaar list** when the equipment has “a. A light source wavelength shorter than 193 nm; or b. Capable of producing a pattern with a ‘Minimum Resolvable Feature size’ (MRF) of 45 nm or less.” Both ArF dry and ArF immersion use a 193-nm light source (i.e., equal to but not shorter than 193 nm), so that criterion would only allow restrictions of EUV lithography tools. The MRF criterion achieves the same result. Dylan Patel of SemiAnalysis has argued that ArF immersion, ArF dry, and even some types of KrF lithography machines are capable of producing patterns with an MRF size of less than 45 nm, but only by using multiple patterning techniques. This might be true in theory, but in practice, it would be extremely difficult to exclusively use legacy equipment to produce advanced chips with competitive quantity, quality, and price to be commercially relevant. Regardless, the equation that the Wassenaar list requires governments to use when calculating MRF does not take into account the effects of multiple patterning.

Thus, the Dutch government’s authority under the Wassenaar Arrangement gives it the flexibility only to restrict the exports of EUV lithography equipment, which it was already controlling prior to the
October 7 rules. Updating Wassenaar rules requires consensus among all member countries. Russia, a Wassenaar member that has been extensively targeted with technology export controls following its invasion of Ukraine, has made clear that it will veto any proposed reforms to the existing Wassenaar list. The recent deal between the Netherlands and the United States must, therefore, have gone beyond Wassenaar and beyond EUV.

**European Union Dual-Use Export Controls Regulations:** The Netherlands has aligned its laws and regulations on export controls with those of the European Union. However, the European Union not only requires an export license but can also specify that certain types of exports are prohibited. In practice, such EU export controls regulations must be imposed by the European Council and can only be instantiated with the unanimous consent of all EU member countries, which is difficult to achieve. The EU response to Russia’s invasion of Ukraine in 2022 was one of the rare instances in which new export controls were imposed on a unanimous basis.

For the most part, the lists of EU export-controlled goods and services conform to those of the Wassenaar Arrangement, and this is indeed the case for lithography equipment. However, Article 4 of the European Union’s export controls regulations (EC No 2021/821) grants individual member states the independent authority to require a license for items other than those on the EU lists in certain cases. One of those is cases in which:

> [...] the items in question are or may be intended, in their entirety or in part, for use in connection with the development, production, handling, operation, maintenance, storage, detection, identification or dissemination of chemical, biological or nuclear weapons or other nuclear explosive devices or the development, production, maintenance or storage of missiles capable of delivering such weapons.

The October 7 regulation justifications included significant analysis of the connection between exports of advanced computer chips and other semiconductor technologies and the military supercomputers that China uses to develop nuclear weapons and advanced nuclear missile delivery systems, such as hypersonics. This is undoubtedly true and does not require the capabilities of the U.S. intelligence community to prove; journalists at the Wall Street Journal independently reviewed Chinese government procurement documents and reached the same conclusion. Moreover, when the U.S. government builds advanced supercomputers, it freely acknowledges that simulating nuclear explosions and hypersonics modeling are among their most important tasks.

Thus, the United States was not misleading or exaggerating when it said that the technologies being export controlled were directly related to China’s supercomputers as part of China’s nuclear weapons and missile programs. Loudly and repeatedly emphasizing this point, however, served an additional purpose: reminding the Dutch government that they were within their rights to invoke Article 4.

If Article 4 criteria apply, it means the Dutch prime minister and the Dutch cabinet (specifically the ministers of foreign affairs and foreign trade) can implement new export controls license requirements and a policy of “presumption of denial” for certain types of goods without requesting a vote by either the European Council or the Dutch parliament. Given the relatively thin majority of the current ruling Dutch political coalition, this is a significant convenience.
This is not to say that the Dutch will not ultimately seek to Europeanize the controls. Mathieu Duchâtel of the Institut Montaigne has argued persuasively that the Dutch should and will do so, both to reduce the risk of Chinese retaliation and to build cohesion between the European members of the Dutch semiconductor equipment supply chain. Regarding the latter point, there is some cause for optimism. Partly as a result of the tremendous U.S. response to Russia’s invasion of Ukraine and U.S. efforts to align technology policy with the European Union, Dutch and wider European confidence in the United States is growing alongside increased wariness of China. In a February 2023 op-ed, Dutch prime minister Mark Rutte wrote, “I cannot see how this will be China’s century. The 21st century will be the century of democracy and thus the century of America.” Similarly, during a recent speech at CSIS, EU commissioner Thierry Breton gave a speech in which he said: “We cannot allow China to access the most advanced technologies, be they in semiconductors, quantum, cloud, edge, AI, connectivity, and so on. I see a very strong alignment on this agenda between the EU and the U.S., even if we may sometimes differ on the methods, which is normal.”

Some German think tank scholars, including Tobias Hehrke and Julian Ringhof of the European Council on Foreign Relations, have argued that the European Union must update its strategic approach to export controls in the wake of the October 7 policy. Even Germany’s government, which has historically been cautious about strengthening restrictions on technology trade with China, recently blocked the acquisition of a Chinese takeover of a German semiconductor fab. Future geopolitical developments could accelerate the U.S., EU, and Japanese semiconductor export controls alignment. In mid-February, U.S. secretary of state Antony Blinken warned that China was considering providing “lethal support” to Russia’s military. Given the speed and strength of the European Union’s export controls reaction to Russia’s invasion of Ukraine, such a move by China would no doubt cause a dramatic reassessment of the European relationship with China, including on technology export controls.

The desire to ultimately bring Europe into the new semiconductor export controls framework is a reason in favor of drawing the line at ArF immersion lithography technology, rather than ArF dry or KrF. Given that the vast majority of Chinese domestic semiconductor production facilities are producing chips at older technology process nodes, restricting ArF immersion is primarily about choking off China’s access to future technological progress in AI and semiconductors, redirecting Chinese semiconductor production capacity growth toward older technology nodes, and redirecting advanced production capacity growth to countries outside of China. In that regard, the United States, Japan, Europe, South Korea, and Taiwan have all signaled a desire to significantly increase government support of semiconductor production investments. If the policy and diplomatic stars align, this could even mean that U.S. and allied semiconductor equipment producers need not face an overall reduction in sales from the October 7 regulations and their foreign equivalents—merely a geographic customer realignment. This favorable outcome would require more than a few strokes of luck, but the possibility exists. Regardless, there is a strong reason for the major allied powers in semiconductors to align their investment strategies to avoid duplication and unprofitable overcapacity in key segments. Aligning export controls is basically a pre-requisite to aligning investments, and that increases the chance that the major semiconductor powers will do so.

Summary and Conclusion

In sum, the U.S. deal with Japan and the Netherlands included assurances that Japan and the Netherlands will not allow their semiconductor manufacturing equipment companies to sell to China...
the categories of equipment that the United States is now prohibiting. The agreement also included assurances that the Dutch and Japanese governments will prohibit the sale of lithography equipment—steppers and scanners, electron-beam tools, and resist processing tools—most likely at advanced performance levels consistent with EUV and argon fluoride immersion technology. The agreement also likely covered the export of related technology components that are used in the production of such lithography equipment and may have even restricted consulting services for transferring knowledge related to such machines, though this is more speculative. Finally, the agreement may have also prohibited the sale of a much broader set of semiconductor manufacturing equipment, as well as materials and chemicals, in cases where these represent genuine market chokepoints. In all cases, such restrictions in the Netherlands and Japan will likely follow the U.S. approach of treating export license applications differently depending on whether the chip production facilities in China are Chinese-owned or foreign-owned, as well as the degree of technological advancement at the production facility.

Even though many details remain unclear at this stage and will likely require continued diplomatic engagement to iron out, the semiconductor export controls agreement between the United States, Japan, and the Netherlands is a major diplomatic achievement for all three countries. Furthermore, if the countries can implement and enforce an agreement, that achievement alone would advance the formation of a new plurilateral export controls regime on semiconductors. This, in turn, begs questions about the long-term suitability of the Wassenaar Arrangement for housing these types of sensitive dual-use diplomatic agreements.

Even though many details remain unclear at this stage and will likely require continued diplomatic engagement to iron out, the semiconductor export controls agreement between the United States, Japan, and the Netherlands is a major diplomatic achievement for all three countries.

The work is not done, however. Germany is a leader in the production of key components that make up semiconductor manufacturing equipment, and South Korea is both a leader in chip manufacturing and a small but sophisticated producer of manufacturing equipment. Both Germany and South Korea need to join the new export controls agreement in order to prevent the fracturing of the U.S.-led global semiconductor value chain. If possible, it would be best if the entire European Union were to join. None of this will be easy or quick, but the trilateral deal has bought years of time and demonstrated to others that the United States will work to protect the interests of those that join it in promoting international peace and security.

Gregory C. Allen is the director of the Artificial Intelligence (AI) Governance Project and a senior fellow in the Strategic Technologies Program at the Center for Strategic and International Studies (CSIS) in Washington, D.C. Emily Benson is a senior fellow with the CSIS Scholl Chair in International Business in Washington, D.C.

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