Policy Brief

# Preserving the Chokepoints

## Reducing the Risks of Offshoring Among U.S. Semiconductor Manufacturing Equipment Firms

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## Introduction

China can produce many types of computer chips, but it depends on companies headquartered in the United States and U.S. allies for the leading-edge computer chips that power smartphones, supercomputers, and artificial intelligence systems. China's chip dependence allows the United States and its allies to cut off the supply of chips to Chinese state or private actors that threaten human rights or international security.

Export controls on advanced semiconductor manufacturing equipment (SME) are among the most important tools available to sustain China's chip dependence. The production of advanced SME is dominated by a handful of firms in the United States, Japan, and the Netherlands, and the technology is highly complex, such that competitors face steep challenges to developing advanced SME.[1] For example, EUV photolithography equipment is essential for manufacturing leading-edge logic chips, but it is sold by just one company: the Dutch firm ASML.[2] The United States and its allies have used export controls on SME to prevent China from indigenizing advanced chipmaking capabilities, thereby sustaining China's dependence on democracies for access to leading-edge chips.[3] Since 2019, U.S. export controls on SME have also prevented chipmakers in other countries from selling chips to the Chinese telecommunications giant Huawei.[4] More recently, the United States and its allies have implemented similar rules to restrict sales of chips and a variety of electronic equipment to Russia and Russian military end users.[5]

But export controls can also have adverse long-term effects if they incentivize U.S. SME firms *themselves* to offshore production to other countries. Recent unilateral U.S. export controls targeting China—which is now the world's largest market for SME firms[6]—have raised concerns that U.S. SME firms might relocate production abroad to avoid future tariffs or export controls. Offshoring of SME production would both remove an important source of leverage over China and make the United States more dependent on other countries for access to some of the most important inputs to semiconductor manufacturing. This brief explores the degree to which U.S. SME firms are offshoring their production to other countries and the reasons driving firms to offshore.

Findings:

- **Top SME firms maintain and are building/investing in offshore manufacturing capacity.** Of the top three U.S. SME firms, Applied Materials states that half of its manufacturing occurs in Singapore, and both KLA and Lam Research have made significant investments in manufacturing facilities overseas. However, the United

States, Japan, and the Netherlands collectively continue to produce a majority of global SME exports onshore.

- **U.S. SME firms engage in offshore manufacturing for many reasons that predate recent export controls.** These include foreign acquisitions, greater proximity to customers in East Asia, and access to new STEM talent. However, SME firms are closely tracking developments in U.S. export control policy, particularly the use of the foreign-produced direct product rule (FDPR) and similar extraterritorial controls. Most U.S. SME firms have experienced limited business impacts from export controls thus far but discuss export controls as a risk in their annual reports.

Recommendations:

- **Establish a new multilateral regime for controlling SME exports.** Multilateral controls significantly reduce the risks of offshoring, but the Wassenaar Arrangement—currently the primary regime for coordinating multilateral export controls on SME—is too large and unwieldy for this purpose. Fortunately, the United States, Japan, and a handful of other allies are currently discussing the establishment of a new regime for controlling SME and other advanced technologies.[7] Such a regime is urgently needed.

- **Avoid unilateral export controls on SME.** Conventional unilateral controls typically will not prevent U.S. firms from shipping SME to China from their overseas manufacturing sites. Extraterritorial controls like the FDPR can prevent this in the short run, but such controls create incentives to design out U.S.-origin technologies over the long run.

- **Fund the CHIPS for America Act.** Historically, proximity to chipmakers in East Asia—SME firms' largest customers—has been a key motivator of offshore manufacturing among SME firms. Reshoring chipmaking capacity to the United States could therefore indirectly draw SME firms to produce more in the United States.

- **Promote onshore SME production through workforce investments, high-skilled immigration, and direct incentives.** Congress should pass the green card cap exemption for PhD holders in certain STEM fields, as stipulated in the America COMPETES Act of 2022. Congress should also consider tax credits for SME firms, such as those in the Facilitating American-Built Semiconductors (FABS) Act and the Advanced Manufacturing Investment Credit (AMIC) included in the House-passed Build Back Better Act.

## All top SME firms have manufacturing capacity overseas

All leading global SME firms have manufacturing facilities overseas (Table 1). Applied Materials, the largest American SME firm, states on its website that its Singapore location is the company's largest manufacturing facility outside the United States, with roughly 50 percent of its global SME production.[8] In 2020, Lam Research announced the establishment of a new manufacturing facility in Malaysia, which is its largest facility,[9] and KLA has significantly increased its overseas footprint since 2005 (Figure 1).

**Table 1.** Headquarters and Overseas Locations of Top 10 Global SME Producers by Revenue

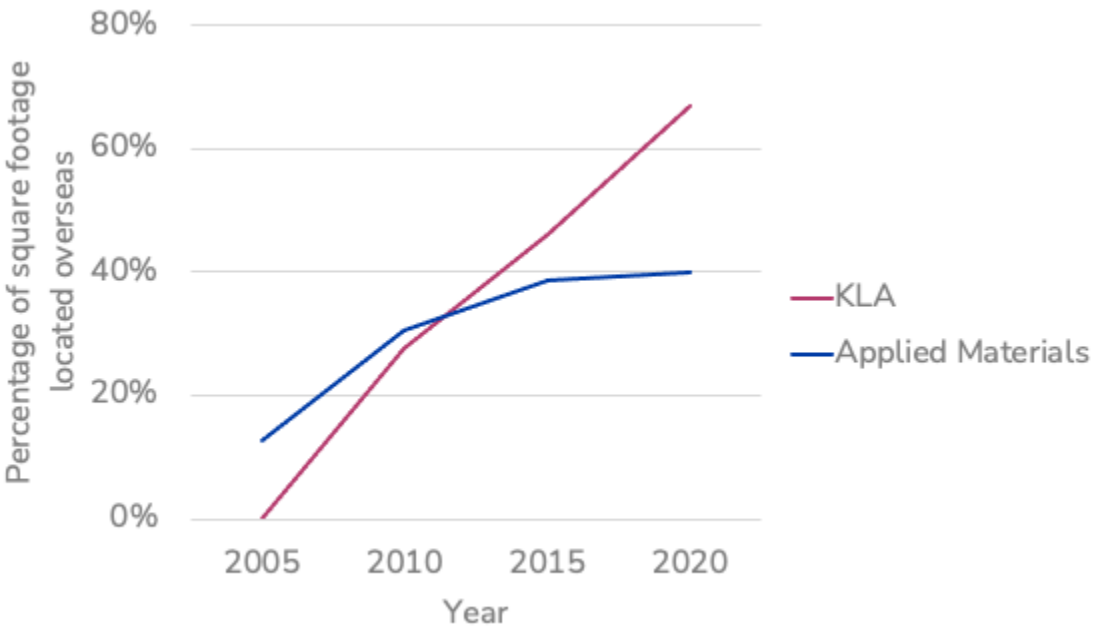
| Company | Country of Headquarters | Locations of Other SME manufacturing facilities |
|---|---|---|
| ASML[10] | Netherlands | ● Germany<br>● United States<br>● South Korea<br>● China*<br>● Taiwan** |
| Applied Materials[11] | United States | ● Israel**<br>● Singapore** |
| Lam Research[12] | United States | ● South Korea<br>● Austria<br>● Malaysia*<br>● Taiwan** |
| Tokyo Electron[13] | Japan | ● United States<br>● Taiwan**<br>● South Korea<br>● Ireland |
| KLA[14] | United States | ● Singapore**<br>● Israel**<br>● Germany<br>● United Kingdom<br>● Italy<br>● China* |

| | | |
|---|---|---|
| Advantest[15] | Japan | ● Malaysia*<br>● South Korea<br>● United States |
| Teradyne[16] | United States | ● Global but not specified in public materials |
| SCREEN SPE[17] | Japan | ● Global but not specified in public materials |
| Hitachi High-Tech[18] | Japan | ● China*<br>● Thailand*<br>● Spain<br>● United Kingdom |
| ASM International[19] | Netherlands | ● Singapore**<br>● South Korea |

* These countries are not members of the Wassenaar Arrangement and do not closely coordinate controls with Wassenaar.
** These countries are not members of the Wassenaar Arrangement but coordinate their controls closely with Wassenaar.[20]
Source: See footnotes to this table.

At least two major U.S. SME firms, in particular, appear to have increased their overseas footprints over the last decade. Applied Materials and KLA—the largest and third-largest U.S.-headquartered SME firms, respectively—report the square footage of their major properties located around the world in their annual 10-K filings. (Unfortunately, Lam Research, the second-largest U.S. SME firm, does not report this data.) Figure 1 presents these firms' square footage located overseas as a percentage of the total square footage of their properties. For both companies, this metric of offshoring has increased markedly: from 13 percent in 2005 to 40 percent in 2020 for Applied Materials, and from 0 percent to 67 percent for KLA.

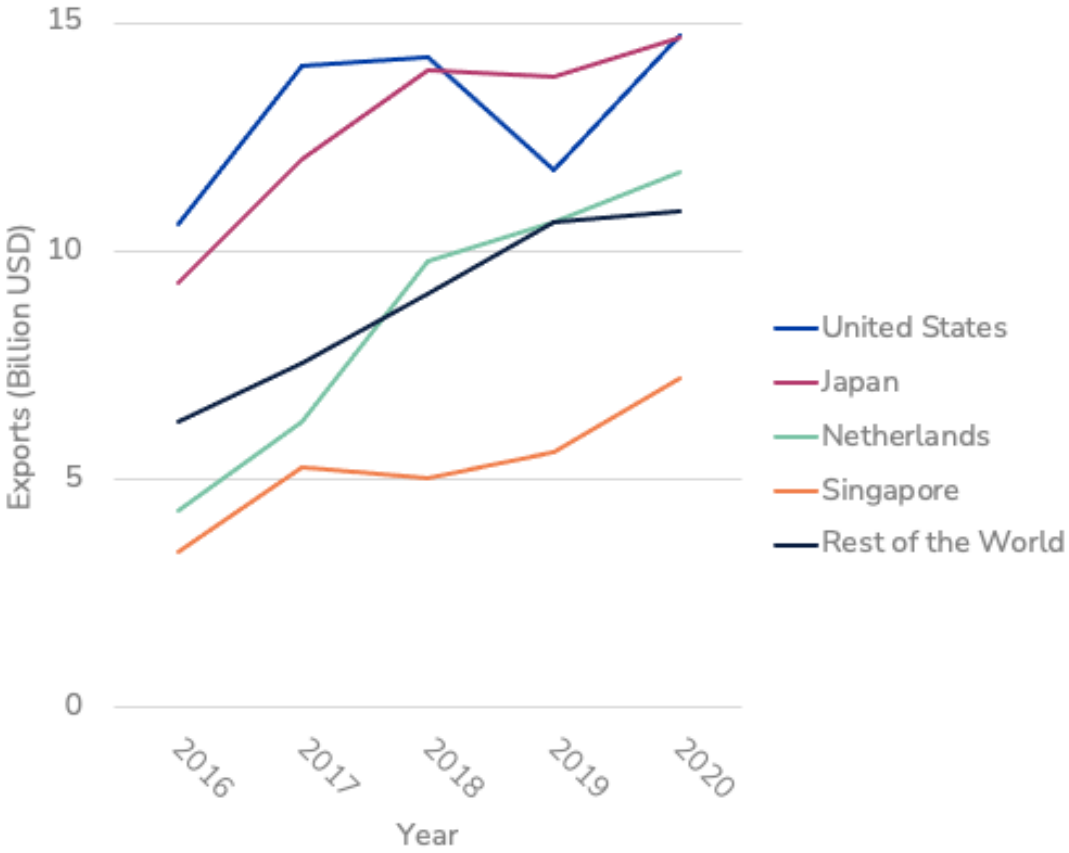
**Figure 1.** Top U.S. SME firms have increased their overseas manufacturing footprints




Note: In some years these firms also reported whether a given property was used for manufacturing or for other purposes, such as customer service; in such cases, we have excluded properties not involved in manufacturing.
Source: CSET analysis of 10-K filings by Applied Materials and KLA from 2005, 2010, 2015, and 2020.

However, the implications of this trend should not be overstated. Export data suggests that while some offshoring may be occurring, the majority of SME production continues to occur in the United States, Japan, and the Netherlands (Figure 2). To measure country-by-country SME exports, we use United Nations COMTRADE data, which is widely used for measuring exports and contains detailed industry codes, allowing us to distinguish SME exports from other types of exports. COMTRADE data also attributes exports to the country where the SME is manufactured, regardless of where the firm is headquartered, allowing us to track SME manufacturing occurring outside of the United States, Japan, and the Netherlands. The data contains three industry codes (called HS codes) for the SME industry, which collectively include most—but not all—semiconductor manufacturing equipment. We exclude some SME-related HS codes from the analysis because they contain many items aside from SME and would therefore add noise to the analysis.

**Figure 2.** SME exports by country, 2016–2020




Note: This graph shows exports of SME in industry codes corresponding to: equipment for manufacturing semiconductor devices themselves (HS code 8486.20), for measuring and checking semiconductor devices and wafers (HS code 9030.82), and optical instruments for inspecting semiconductor devices, photomasks, or reticles (HS code 9031.41). These HS codes contain the most important SME, but there are also some SME in other HS codes that contain both SME and non-SME commodities.
Source: CSET analysis of UN COMTRADE data.

Figure 2 does show a rise in SME exports from countries such as Singapore in absolute terms, but the percentage of exports from these countries relative to global SME exports has remained constant between 2015 and 2020. Moreover, the United States is still one of the two largest SME exporters overall, tied with Japan in 2020. Exports from Singapore may be largely attributable to U.S. firms Applied Materials and KLA, as well as the smaller Dutch firm ASM International, all three of which have manufacturing facilities there. Note also that Figure 1 underestimates the onshore SME production occurring in Japan and the United States, because both countries have domestic chipmaking industries that consume SME, and within-country SME sales to these firms are not recorded in export data.

Overall, we conclude that while some U.S. firms have offshore manufacturing capacity, the United States continues to produce more SME onshore than any other country except Japan. These figures should be closely monitored, as exports are likely a lagging measure of offshoring and may take years to register more recent offshore investments. Additionally, the United States may be experiencing more offshoring than other countries; indeed, reviewers of this paper knowledgeable about the SME industry confirmed that Dutch firms are engaged in minimal offshoring, whereas U.S. firms are more actively engaged in offshoring. This aligns with the significant rise in the overseas footprints of KLA and Applied Materials.

## U.S. SME firms engage in offshore production for many reasons that predate recent export controls

To assess what might motivate U.S. SME firms to build capacity offshore, we examined the top four U.S.-headquartered SME firms' public statements about their reasons for offshoring. While such statements are snapshots in time, self-serving, and cannot be considered representative of the industry as a whole, they allow us to explore some of the publicly expressed motivations behind offshoring, which could be addressed by U.S. policy. Relevant factors driving offshoring decisions appear to include talent availability, proximity to customers and suppliers, foreign government support, business infrastructure, and foreign acquisitions (Table 2).[21]

All companies examined had made at least one foreign acquisition, which resulted in long-term investments in the same location. Talent is another commonly cited factor, and multiple reviewers of this paper affirmed that a lack of STEM talent in the United States motivated SME firms' decisions to invest overseas. Proximity to customers and suppliers is also cited frequently, in part because SME are frequently very large and expensive to ship over long distances.

**Table 2.** U.S. SME firms' stated reasons for establishing or expanding overseas footprint

| Company | Talent availability | Proximity to customers and suppliers | Foreign government support | Business infrastructure | Foreign acquisition |
|---|---|---|---|---|---|
| Applied Materials | | X | X | X | X |
| Lam Research | X | X | X | X | X |
| KLA | X | X | | | X |
| Teradyne | X | | | | X |

Source: Various—see Appendix A.

The factors presented in Table 2 suggest that a variety of policies could make the United States more attractive. In particular, the U.S. government should take steps to:

- Strengthen the U.S. semiconductor workforce[22]
- Fund the CHIPS for America Act[23]
- Consider offering incentives directly to SME firms through CHIPS Act grants and tax credits such as the Facilitating American Built-Semiconductors (FABS) Act and the Advanced Manufacturing Investment Credit (AMIC) included in the Build Back Better Act

R&D investments could also be helpful, insofar as they lead to the creation of more SME-related startups in the United States.

Notably, we did not find public statements from SME firms stating that trade tensions motivated their decision to offshore supply, perhaps because existing controls are mostly limited in scope (Box 1). However, concerns about trade tensions may be rising. For example, the annual reports of all four of the top U.S. SME firms mentioned export controls imposed on China in 2020. The firms state that they are continually monitoring future developments related to export controls and that uncertainty about future export controls represents a risk to their operations.[24] Each of the three biggest U.S. SME firms have also publicly commented in earnings calls that, if needed, they can shift their production of equipment destined for Chinese entity-listed chipmakers to their overseas factories in order to maintain shipments to these firms.[25]

Thus, while recent U.S.-China trade tensions do not appear to be the primary factor motivating offshoring, unilateral controls could plausibly accelerate offshoring in the future. Multilateral controls should reduce the risk of offshoring and are therefore preferable to unilateral controls over the long term. But the Wassenaar Arrangement—the primary regime governing multilateral export controls—has 42 adherents, including Russia, making it slow and sometimes impossible to add new controls. Moreover, some major SME suppliers have manufacturing sites located in countries that do not adhere to the Wassenaar Arrangement (Table 1). Given the need for multilateral controls on SME and the difficulty of implementing them via Wassenaar, efforts are now underway to establish a smaller multilateral regime with allied countries, including Japan and the Netherlands, that would be capable of more nimbly applying export controls on technologies, including semiconductor manufacturing equipment.[26] Such a regime is welcome and urgently needed.

**Box 1. Background on U.S. export controls on SME**

The United States and its allies have historically placed only limited controls on exports of chipmaking equipment to China. One major U.S. semiconductor equipment maker—Lam Research—has commented that the last export restriction relevant to any of their technologies was removed in 2015.[27] CSET's report "U.S. Semiconductor Exports to China" documents that while U.S. exports of SME to China doubled from 2014 to 2019, in 2018 only seven SME license applications were filed, and all were approved.[28]

Since 2019, however, the United States has moved to impose more unilateral requirements on semiconductor manufacturing equipment exports or end users within China. In 2019, the U.S. Commerce Department placed a new Chinese memory chip start-up called Fujian Jinhua IC on the entity list for the theft of intellectual property from a U.S. memory maker, effectively halting its development and subjecting all items subject to Export Administration Regulations (EAR) to a license requirement with a policy of denial.[29] In 2020, the U.S. Commerce Department Bureau of Industry and Security (BIS) expanded the scope of the "military end-use rule" to include more SME. This rule requires exporters to conduct due diligence to identify whether U.S.-origin items exported to China, Russia, Venezuela, and Cuba may be diverted or used for military applications.[30] In addition, in 2020 BIS placed China's largest semiconductor manufacturer, SMIC, on the entity list.[31]

While they mark a change in U.S. export control policy, the direct impacts of these rules should not be overstated. On earnings calls, the three major U.S. SME firms stated that the military end-use rules would not significantly impact their business.[32] And while SMIC is on the entity list, BIS has imposed a policy of denial only on items that are "uniquely required" for the production of 10nm and below (i.e., leading-edge) chips, making this a limited control.[33] The most significant impacts of controls based on SME may be measured in terms of the uncertainty generated among U.S. SME firms about potential future controls.

## Conclusion

SME firms offshore for many reasons, including access to foreign talent, foreign acquisitions, and proximity to customers. It is too early to say whether recent export controls and trade tensions will increase offshoring among SME firms. However, SME firms are tracking developments in export control policy closely and have expressed willingness to shift production overseas in response to new unilateral controls. The United States should therefore avoid using unilateral controls on SME; ongoing efforts to develop a new multilateral regime for controlling the export of SME and other advanced technologies are welcome and urgently needed.

Meanwhile, to ensure that U.S. SME firms continue to invest in the United States over the long term, policymakers should invest in growing the U.S. STEM-educated workforce through investments in workforce development and high-skilled immigration reform. Congress should also fund the CHIPS Act; this will encourage chipmakers to build more capacity in the United States, which will in turn draw U.S. SME firms to invest further in the United States to be closer to their customers. Finally, Congress should consider tax credits for SME firms such as those in the Facilitating American Built Semiconductors (FABS) Act and the Advanced Manufacturing Investment Credit (AMIC) included in the Build Back Better Act.

Taken together, investments in SME firms coupled with the establishment of a new multilateral regime for implementing SME-based export controls will help sustain U.S. and allied control over the most important chokepoints in the semiconductor supply chain.

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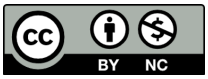




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## Appendix A—U.S. SME firms' statements on their reasons for offshore manufacturing

**Applied Materials** offered three motivations for establishing its Singapore manufacturing center—proximity to customers and suppliers in East Asia, solid business infrastructure, and strong government support.[34] Applied Materials also has a significant R&D center located in Israel, which was established upon the acquisition of two Israeli companies in the mid-1990s.[35]

**Lam Research** has overseas manufacturing capacity in Austria, Taiwan, and South Korea, and has built a new facility in Malaysia that is now its largest plant. Lam established its Austrian location in 2008 after the acquisition of SEZ Group and subsequently doubled the location's capacity in 2012.[36] Lam's South Korean location was established in 2019 and appears to have been driven in part by the South Korean government. Regarding motivations for government support, South Korean Provincial Governor Lee Jae-myung said, "One of the biggest issues in the Korean economy is speeding up the localization of equipment and materials."[37] Lam's facilities in Taiwan are the result of acquiring Talus, a Taiwanese firm.[38] Finally, the Malaysian facility appears to have been motivated by a combination of talent availability and infrastructure, not concerns about U.S.-China trade tensions, which preceded the decision to build in Malaysia.[39]

**KLA's** Israel location was established primarily due to the availability of human capital. Founder and then-CEO Ken Levy said of the decision to expand overseas: "Israel won hands down. We could have gotten much better deals on tax incentives, but the human capital was far above what was available elsewhere."[40] In contrast, KLA's Singapore establishment appears to have been motivated substantially by proximity to customers in East Asia. Then-president of KLA-Tencor Southeast Asia Dan Lee said, "Our Singapore operation is a key part of KLA-Tencor's globalization efforts, putting us closer to customers with the ability to improve our responsiveness to changing customer requirements and market conditions."[41] KLA has also made a number of acquisitions overseas, resulting in facilities located in Germany, Taiwan, the United Kingdom, and Israel. We were not able to find information about the origin of KLA's manufacturing facilities in China or Italy.

**Teradyne** established a manufacturing plant in Japan in 1995.[42] After a major earthquake caused significant damage to Japanese facilities, Teradyne decided to rebuild rather than shifting production to another location. Teradyne KK President Hiroshi Takashima said of the decision: "Our talented engineers have been engaged in the whole process from development, design and manufacturing to marketing in

Kumamoto for over 20 years. These 'human resources' with such accumulated experience are our most important assets. The corporate headquarters in the US has considered it best to rebuild the Kumamoto base because it is impossible to relocate the development base elsewhere."[43] Teradyne also announced its purchase of the Danish firm Universal Robots in 2015.[44]

## Endnotes

[1] Will Hunt, Saif M. Khan, and Dahlia Peterson, "China's Progress in Semiconductor Manufacturing Equipment" (Center for Security and Emerging Technology, March 2021), https://cset.georgetown.edu/publication/chinas-progress-in-semiconductor-manufacturing-equipment/.

[2] Saif M. Khan and Carrick Flynn, "Maintaining China's Dependence on Democracies for Advanced Computer Chips" (The Brookings Institution, April 2020), https://www.brookings.edu/wp-content/uploads/2020/04/FP_20200427_computer_chips_khan_flynn.pdf.

[3] Saif M. Khan, "Securing Semiconductor Supply Chains" (Center for Security and Emerging Technology, January 2021), https://cset.georgetown.edu/publication/securing-semiconductor-supply-chains/.

[4] "BIS Publishes Final 'Direct Product' Rule for Huawei and Entity List Compliance Obligation Clarifications," Crowell, August 21, 2020, https://www.crowell.com/NewsEvents/AlertsNewsletters/all/BIS-Publishes-Final-Direct-Product-Rule-for-Huawei-and-Entity-List-Compliance-Obligation-Clarifications.

[5] Bureau of Industry and Security, "Implementation of Sanctions Against Russia Under the Export Administration Regulations (EAR)," U.S. Department of Commerce, 87 FR 12226, https://www.federalregister.gov/documents/2022/03/03/2022-04300/implementation-of-sanctions-against-russia-under-the-export-administration-regulations-ear.

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[7] Amanda Lee, "US-Japan alliance restricting vital tech exports to China risks 'major impact' on trade, supply chains," *South China Morning Post,* January 25, 2022, https://www.scmp.com/economy/china-economy/article/3164537/us-japan-alliance-restricting-vital-tech-exports-china-risks.

[8] It is not clear whether "production" is measured by value of sales or some other metric. "Applied Materials South East Asia," Applied Materials, https://www.appliedmaterials.com/en-sg/company/about/singapore-overview. The Singapore manufacturing facility was established in 2010 with a $60 million investment. In 2012, Applied Materials opened a Center of Excellence in Advanced Packaging with a $100 million investment. "Applied Materials Singapore," Applied Materials, 2012, https://www.appliedmaterials.com/files/media/singapore_factsheet_2013.pdf.

[9] Opalyn Mok, "Lam Research opens largest manufacturing plant in Penang with RM 1b investment," *Malay Mail*, August 3, 2021, https://www.malaymail.com/news/money/2021/08/03/lam-research-opens-largest-manufacturing-plant-in-penang-with-rm1b-investme/1994835.

[10] "ASML 2020 Annual Report" (ASML, February 2021), https://www.asml.com/en/investors/annual-report/2020

[11] Note that we include here only locations manufacturing products included in Applied Materials' Semiconductor Systems business line; we exclude locations that produce products for "Display and Adjacent Markets" as well as "Remanufactured Equipment Products." U.S. Securities and Exchange Commission, "Applied Materials, Inc.," Form 10-K, 2020, https://ir.appliedmaterials.com/static-files/23db1829-8afd-408e-a820-669346acbad3.

[12] U.S. Securities and Exchange Commission, "Lam Research Corporation," Form 10-K, 2017, https://investor.lamresearch.com/static-files/060c48ec-d0e9-433d-a280-69cc16bd0a6f

[13] "Head Office," TEL Magnetic Solutions Ltd., https://www.tel.com/about/locations/telmsl.html

[14] U.S. Securities and Exchange Commission, "KLA Corporation," Form 10-K, https://ir.kla-tencor.com/sec-filings/annual-reports/content/0000319201-21-000029/0000319201-21-000029.pdf

[15] "Integrated Annual Report 2020" (Advantest, 2020), 76, https://www.advantest.com/about/pdf/E_all_IAR2020.pdf.

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[17] "Annual Report 2020" (SCREEN Group, March 2020), 54, https://www.screen.co.jp/download_file/get_file/SCREEN_ARE_2020.pdf.

[18] "Hitachi High-Tech Global Network," Hitachi, https://map.hitachi-hightech.com/en?lang=en&_ga=2.143158641.558272455.1632154760-177854477.1632154760. Note that not all facilities are necessarily related to SME.

[19] "Annual Report 2020" (ASM International, 2020), 14, https://www.asm.com/Downloads/2020_ASMI_Annual_Report.pdf.

[20] "The Wassenaar Arrangement at a Glance," Arms Control Association, February 2022, https://www.armscontrol.org/factsheets/wassenaar

[21] Our analysis did not identify any public statements from SME firms stating that they had offshored capacity specifically in order to avoid trade restrictions. But concerns about trade restrictions have only become salient for SME firms since U.S.-China trade tensions ramped up in 2018. And it is not clear whether firms would be candid about their desire to avoid trade restrictions, even if this is an important factor in offshoring decisions.

[22] Will Hunt and Remco Zwetsloot, "The Chipmakers: U.S. Strengths and Priorities for the High-End Semiconductor Workforce" (Center for Security and Emerging Technology, September 2020),

https://cset.georgetown.edu/publication/the-chipmakers-u-s-strengths-and-priorities-for-the-high-end-semiconductor-workforce/.

[23] Will Hunt, "Reshoring Chipmaking Capacity Requires High-Skilled Foreign Talent" (Center for Security and Emerging Technology, February 2022), https://cset.georgetown.edu/publication/reshoring-chipmaking-capacity-requires-high-skilled-foreign-talent/.

[24] U.S. Securities and Exchange Commission, "Lam Research Corporation," Form 10-K; "Annual Report 2021" (KLA, 2021), https://d1io3yog0oux5.cloudfront.net/_b6d2b341189f548b377aee85647f2c01/klatencor/db/1157/10354/annual_report/Annual+Report+%28Final%29.pdf; U.S. Securities and Exchange Commission, "Teradyne, Inc.". Notably, the annual reports from 2019 and earlier mention "trade disputes" in the abstract, but the ones from 2020 are much more specific—all of them discuss at length (devoting at least one paragraph) to recent export controls targeting Huawei and other entity-listed companies in China.

[25] "We have definitely the ability, the similarity in what we do in these different sites allows us some flexibility, which over time has caused us actually to transition more to the site out of the U.S. in both, the case of Israel and also in Singapore. So that's something that we're always evaluating in terms of our ability and flexibility to manufacture in different products and different locations based on customer needs, supply chain and our staffing. So of course, that's a lever and an option that we have as we look out and think about where the best place to be positioned is," Rick Wallace, CEO, KLA, "KLA Corporation (KLAC) CEO Rick Wallace on Q1 2020 Results – Earnings Call Transcript," Seeking Alpha, May 5, 2020, https://seekingalpha.com/article/4343405-kla-corporation-klac-ceo-rick-wallace-on-q1-2020-results-earnings-call-transcript?part=single; "And we all have factories outside of the United States in addition to in the United States. And if we needed to or chose to, we could move things over a period of time, if that made sense to do," Doug Bettinger, CFO, Lam Research, "Lam Research Corporation (LRCX) Management Presents at Bank of America Securities Global Tech Conference (Transcript," Seeking Alpha, June 3, 2020, https://seekingalpha.com/article/4351852-lam-research-corporation-lrcx-management-presents-bank-of-america-securities-global-tech; "We do have, and we talked about that on the call, significant flexibility from a geographic footprint perspective. I think many investors know we have large operations in Singapore. We have large operations and Austin. In many cases we're dual building products between those two operations. That really helps us also from a business continuity perspective, whether it's COVID-19 or any other type of situation," Gary Dickerson, CEO, Applied Materials, "Applied Materials Inc (AMAT) CEO Gary Dickerson Presents 2020 Bernstein Strategic Decisions Conference (Transcript)," Seeking Alpha, May 30, 2020, https://seekingalpha.com/article/4351028-applied-materials-inc-amat-ceo-gary-dickerson-presents-2020-bernstein-strategic-decisions.

[26] Lee, "US-Japan alliance restricting vital tech exports to China," https://www.scmp.com/economy/china-economy/article/3164537/us-japan-alliance-restricting-vital-tech-exports-china-risks.

[27] "I think it—we used to need to get licenses to ship etch [equipment]. I think that the industry lobbied and that went away. I think it was in 2015. It's been gone for quite a while. So, no, we don't need any licenses as we sit here today to sell anything in China," Doug Bettinger, CFO, Lam Research, "KLA

Corporation (KLAC) CEO Rick Wallace on Q1 2020 Results – Earnings Call Transcript," Seeking Alpha.

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