CHIPS, CHINA AND CHOKE POINTS: THE ECONOMIC AND NATIONAL SECURITY CONSEQUENCES OF U.S. SEMICONDUCTOR EXPORT CONTROL POLICY

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I. INTRODUCTION

In a September 2022 speech at the Special Competitive Studies Project Global Emerging Technologies Summit, former National Security Advisor Jake Sullivan stated that "technology export controls can be more than just a preventative tool. If implemented in a way that is robust, durable, and comprehensive, they can be a new strategic asset in the U.S. and allied toolkit—one that can impose costs on adversaries and, over time, degrade their battlefield capabilities."[1] Export controls have become one of the most potent weapons that the U.S. government has wielded in its effort to confront and compete with China. The Biden administration saw restricting semiconductor technology in particular as key to hampering Chinese technical development, and by extension, its military capabilities. At the same time, the administration made domestic semiconductor fabrication a top priority. The CHIPS Act, signed in August 2022, contains $52.7 billion worth of funding for the domestic semiconductor industry, in an effort to onshore key elements of the semiconductor supply chain.[2] Even at a time of political uncertainty in the US, the importance of strategic competition with China and maintaining U.S. technological advantages remains a largely bipartisan priority.[3] The Trump administration has indicated that it will continue to enforce export controls. President Trump has been skeptical about the CHIPS Act, but Commerce Secretary Nominee Howard Lutnick generally expressed support for chip manufacturing in the United States in nomination hearings.[4]

To date, export controls on chip technology appear to have had a significant impact on the Chinese chip industry, fulfilling the goal of imposing costs on adversaries as Sullivan stated in his speech. CHIPS Act funding has already contributed to investments in semiconductor fabrication plants ("fabs") across the country. Yet, instituting both export controls and

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1. Jake Sullivan, Nat'l Sec. Advisor, Remarks at the Special Competitive Stud. Project Glob. Emerging Techn. Summit (Sept. 16, 2022), https://bidenwhitehouse.archives.gov/briefing-room/speeches-remarks/2022/09/16/remarks-by-national-security-advisor-jake-sullivan-at-the-special-competitive-studies-project-global-emerging-technologies-summit/.

2. Press Release, The White House, FACT SHEET: CHIPS and Sci. Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China (Aug. 9, 2022), https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/09/fact-sheet-chips-and-science-act-will-lower-costs-create-jobs-strengthen-supply-chains-and-counter-china.

3. Letter from Elizabeth Warren and Josh Hawley, Warren, U.S. Sens., to Howard Lutnick, Commerce Secretary Nominee (Feb. 3, 2025), https://www.banking.senate.gov/imo/media/doc/ai_warren_hawley.pdf.

4. Ana Swanson, *Commerce Nominee Defends Trump Tariffs and Promises Strong Stance on China*, N.Y. TIMES (Jan. 29, 2025), https://www.nytimes.com/2025/01/29/business/economy/lutnick-trump-tariffs-china.html.

domestic subsidies for semiconductors can potentially cause blowback in a variety of ways that could undermine the national security goals these measures are intended to achieve. At the same time, they risk devastating the domestic U.S. chip industry.

Every policy involves tradeoffs, and the Biden administration appeared willing to accept some costs for domestic industry for the purpose of shoring up national security. However, the actions that the United States has taken in this area so far are in many ways actively counterproductive to the goals that the Biden administration and now the Trump administration claim to be pursuing.

Current U.S. export controls on China are broadly aimed at slowing down Chinese development in AI, quantum computing, and other technology relevant to advanced weapons development. Though the link between these goals and increasing U.S. national security may be unclear, the aim of this paper is not to debate whether these policy goals are the right ones to have or not. Currently, U.S. export control policy is politically popular and its broad trajectory is unlikely to change, even if the Trump administration increasingly utilizes other tools, such as tariffs, to regulate trade. Rather, this paper takes these objectives as a given and examines whether export controls actually meet these objectives. In many ways, they either do not, or risk not doing so. Export controls create hurdles for domestic U.S. industry in its strongest areas (i.e., chip research, development, and design). They also risk inducing secondary effects in Chinese industry and policy which negate the objectives of U.S. controls, as the Chinese government and Chinese firms become increasingly motivated to invest in domestic technological development, including in directions the United States may not be able to control

II. EXPORT CONTROLS: BACKGROUND

Export controls are primarily administered and enforced by the Commerce Department's Bureau of Industry and Security (BIS). Controls under the Export Administration Regulations (EAR) relevant to semiconductor exports to China broadly fall under three categories—End User-based controls, Military End Use/User-based (MEU), and technology- or Commodity Control List (CCL)-based controls.[5] Technology-based controls are based on product characteristics or dual-use potential, while end user-based controls concern exports based on their destination. The main example of end

5. *Export Control Basics*, BUREAU OF INDUSTRY AND SECURITY, https://www.bis.doc.gov/index.php/all-articles/25-compliance-a-training/export-administration-regulations-training/1602-export-control-basics. (Noting that the webpage does not use these acronyms, but that they capture the broad categories of export control concerns.)

user-based controls is the Entity List, which consists of a list of individuals and companies that are subject to various licensing requirements for the export of specified items.[6] Historically, export controls have been applied to cover as narrow a range of technologies as possible, in order to prevent unnecessarily disadvantaging U.S. producers. The U.S. controls on semiconductor technology exports generally follow this principle. However, these controls, particularly as applied to China, were virtually nonexistent less than a decade ago; now they cover virtually all flow of the most advanced chip technology and equipment to China. Crucially, this includes exports from many non-U.S. suppliers, mostly due to expanded application of the Foreign Direct Product Rule ("FDPR").[7]

The FDPR is one of ten general prohibitions contained in the EAR. The FDPR subjects foreign-produced technology to US jurisdiction if the technology was produced using U.S. technology, equipment, or software.[8] There are actually several distinct FDPRs (currently eight), which have expanded the original FDPR to, among other things, specifically target certain types of equipment (e.g., semiconductor manufacturing equipment), or specific entities (Huawei most notably).[9] The majority of these new rules were promulgated after 2018.

The FDPR has become a powerful tool of foreign policy in part due to its jurisdictional reach but also because of its flexibility and ability to be applied to specific firms and sectors, all without any input from Congress. Compared to other agencies, BIS enjoys expansive investigation and enforcement powers, including the ability to issue subpoenas, conduct international and undercover investigations, and make arrests. These are largely derived from the Export Control Reform Act of 2018 (ECRA) and the International Emergency Economic Powers Act (IEEPA).[10] A 2024 Senate Permanent Subcommittee on Investigations report stated that "BIS is largely free to implement export control policy as it sees fit, so long as controls are administered transparently and predictably, coordinated with multilateral regimes as much as possible, and directed at preserving

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6. See BUREAU OF INDUSTRY AND SECURITY, ENTITY LIST, Supplement No. 4 to 15 C.F.R. § 744 (2024), https://www.bis.doc.gov/index.php/policy-guidance/lists-of-parties-of-concern/entity-list [hereinafter Entity List].

7. See Foreign-Direct Product (FDP) Rules, 15 C.F.R. § 734.9 (2025) [hereinafter *Explanation of FDP rule*]; Implementation of Additional Export Controls: Certain Advanced Computing and Semiconductor Manufacturing Items, 87 Fed. Reg. 62358 (Oct. 13, 2022); Implementation of Additional Export Controls: Supercomputer and Semiconductor End Use; Entity List Modification, 87 Fed. Reg. 62186 (Oct. 13, 2022) (hereinafter *Expansion of FDP Rule*).

8. General Prohibitions and Determination of Applicability, 15 C.F.R. 736.2(b)(2) (2025).

9. Foreign-Direct Product (FDP) Rules, 15 C.F.R. § 734.9 (2025).

10. 50 U.S.C. § 4820; 50 U.S.C. Ch. 35.

military, scientific, and technological advantages."[11] Though BIS designations of controlled technologies are subject to notice and comment requirements,[12] Entity List additions are not.[13] BIS is otherwise largely exempt from Administrative Procedure Act requirements.[14] It also handles appeals of its own license denials.[15] ECRA explicitly contains an APA carveout, exempting BIS from notice and comment and APA adjudication procedures for actions taken pursuant to ECRA.[16] Furthermore, judicial deference to agencies on national security and foreign affairs issues means that judicial review of designations and other BIS actions is limited.[17]As a result of its broad jurisdictional reach and administrative power, BIS plays an outsized role in U.S. technology policy with regard to China.

III. U.S. EXPORT CONTROLS ON CHINA AND CHINESE ENTITIES SINCE 2016

U.S. export controls on China have only been imposed at scale relatively recently. In 2016, the Obama administration added the Chinese telecom company ZTE to the Entity List for re-exporting items to Iran in contravention of U.S. sanctions. ZTE later reached a settlement with the DOJ and was removed from the Entity List in 2017.[18] Although the Obama administration had expressed some concern over Chinese access to advanced U.S. semiconductor technology, the first Trump administration was the first

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11. U.S. CONG. SENATE COMM. ON HOMELAND SEC. & GOVERNMENTAL AFF. PERMANENT SUBCOMM. ON INVESTIGATIONS, THE U.S. TECH. FUELING RUSS.'S WAR IN UKR.: EXAMINING THE BUREAU OF INDUS. AND SEC.'S ENF'T OF SEMICONDUCTOR EXP. CONTROLS 9 (2024), www.hsgac.senate.gov/wp-content/uploads/The-U.S.-Technology-Fueling-Russias-War-in-Ukraine-Examing-BISs-Enforcement-of-Semiconductor-Export-Controls.pdf.

12. *Id.*

13. See, e.g., Additions to the Entity List, 90 Fed. Reg. 4621 (Jan 16, 2025). https://www.federalregister.gov/documents/2025/01/16/2025-00480/additions-to-the-entity-list

14. U.S. CONG. SENATE COMM. ON HOMELAND SEC. & GOVERNMENTAL AFF, *supra* note 11, at 9.

15. *Id.* at 10.

16. 50 U.S.C. § 4821(a)

17. *See, e.g.* Huawei Techs. USA, Inc. v. United States, 440 F. Supp. 3d 607 (E.D. Tex. 2020) (dismissing Huawei claim that NDAA ban on U.S. government use of Huawei equipment was unconstitutional); Paradissiotis v. Rubin, 171 F.3d 983 (5th Cir. 1999) (upholding OFAC application of financial sanctions). These cases do not deal with export controls directly but illustrate judicial deference in regards to sanctions and technology controls.

18. Press Release, Dep't of Just., ZTE Corp. Agrees to Plead Guilty and Pay Over $430.4 Million for Violating U.S. Sanctions by Sending U.S.-Origin Items to Iran (Mar. 7, 2017), https://www.justice.gov/opa/pr/zte-corporation-agrees-plead-guilty-and-pay-over-4304-million-violating-us-sanctions-sending.

to use export controls with the explicit aim of preventing transfers of chip technology to Chinese companies.[19] In May 2019, BIS added Huawei to the Entity List, purportedly for a similar rationale as ZTE.[20] In August 2020, the Commerce Department severely tightened the restrictions on Huawei, expanding the FDPR to cover any items (regardless of origin) containing U.S. technology that are destined to be used in Huawei products, as well as transactions involving controlled items where Huawei is a party in the transaction.[21] In a press release, then-Commerce Secretary Wilbur Ross stated that the new restrictions demonstrated a "continuing commitment" to impede Huawei's ability to work through third parties to "harness U.S. technology in a manner that undermines U.S. national security and foreign policy interests."[22] The Huawei rulemaking established a licensing scheme where essentially any item relevant to 5G technology development was subject to a presumption of denial (of license applications) by BIS.[23]

U.S. policy increasingly targeted Chinese firms with the explicit aim of hampering Chinese tech development, rather than on the basis of those firms contravening other U.S. sanctions. In December 2020, the Trump administration added SMIC, China's largest contract chip manufacturer, to the Entity List.[24] Thus, "items uniquely required to produce semiconductors at advanced technology nodes 10 nanometers or below" were subjected to

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19. *Cf.* PRESIDENT'S COUNCIL OF ADVISORS ON SCI. AND TECH., ENSURING LONG-TERM U.S. LEADERSHIP IN SEMICONDUCTORS ix (2017), https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_ensuring_long-term_us_leadership_in_semiconductors.pdf. (Concerning the Obama administration's view on this matter.)

20. Addition of Entities to the Entity List, 84 Fed. Reg. 22961 (May 21, 2019).

21. Addition of Huawei Non-U.S. Affiliates to the Entity List, the Removal of Temporary General License, and Amendments to General Prohibition Three (Foreign-Produced Direct Product Rule), 85 Fed. Reg. 51596 (Aug. 20, 2020).

22. Press Release, Dep't of Com., Commerce Department Further Restricts Huawei Access to U.S. Technology and Adds Another 38 Affiliates to the Entity List (Aug. 17, 2020), https://2017-2021.commerce.gov/news/press-releases/2020/08/commerce-department-further-restricts-huawei-access-us-technology-and.html.

23. JILL GALLAGHER, CONG. RSCH. SERV. R47012, U.S. RESTRICTIONS ON HUAWEI TECHNOLOGIES: NATIONAL SECURITY, FOREIGN POLICY, AND ECONOMIC INTERESTS 3 2022), https://crsreports.congress.gov/product/pdf/R/R47012/2#:~:text=While%20DOC%20permitted%20some%20transactions,unlikely%20to%20approve%20license%20requests. *Also see* Tamer Soliman et al., *Tightening the Screws: U.S. Further Restricts Huawei's Access to U.S. Technologies*, MONDAQ (Aug. 25, 2020), https://www.mondaq.com/unitedstates/security/978856/tightening-the-screws-us-further-restricts-huawei39s-access-to-us-technologies#authors.

24. Sheila Chiang, *China's Largest Chipmaker SMIC Posts a 80% Drop in Third-Quarter Profit*, CNBC (Nov. 9, 2023), https://www.cnbc.com/2023/11/10/chinas-smic-posts-a-80percent-drop-in-third-quarter-profit.html.

a "presumption of denial to prevent such key enabling technology from supporting China's military modernization efforts."[25] The restrictions on SMIC were in response to concerns over China's Civil-Military Fusion doctrine, defined by the Trump administration State Department as involving "the elimination of barriers between China's civilian research and commercial sectors, and its military and defense industrial sectors."[26] The SMIC designation was the most explicit action to date that specifically identified Chinese access to advanced node semiconductors as a national security threat and differentiated between advanced node chips and older designs, known as "mature nodes" or "legacy chips."

In October 2022, the Biden administration instituted the most expansive controls on exports of semiconductor technology yet. The BIS interim final rule effectively amounted to an embargo on the provision of any technology relevant for manufacturing or developing advanced chips or supercomputers to Chinese firms.[27] Applications for licenses to export to facilities in China operated by foreign firms are reviewed on a case-by-case basis.[28] The rule additionally prohibits U.S. persons from supporting the "development, production, or use" of semiconductors at certain facilities in China.[29] The administration further built upon the October 2022 controls by widening tech parameters, adding items to control lists, expanding licensing requirements, and closing other loopholes, notably through an

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25. Addition of Entities to the Entity List, Revision of Entry on the Entity List, and Removal of Entities From the Entity List, 85 Fed. Reg. 83416 (Dec. 12, 2020).

26. U.S. DEP'T OF STATE, MILITARY-CIVIL FUSION AND THE PEOPLE'S REPUBLIC OF CHINA 1 (2020), https://www.state.gov/wp-content/uploads/2020/05/What-is-MCF-One-Pager.pdf. *See also* U.S. DEP'T OF DEF., MILITARY AND SECURITY DEVELOPMENTS INVOLVING THE PEOPLE'S REPUBLIC OF CHINA IV (2023) (defining the program on behalf of the current administration), https://media.defense.gov/2023/Oct/19/2003323409/-1/-1/1/2023-MILITARY-AND-SECURITY-DEVELOPMENTS-INVOLVING-THE-PEOPLES-REPUBLIC-OF-CHINA.PDF.

27. *United States Creates New Export Controls on China for Semi-Conductor Manufacturing Technology, Advanced Semiconductors, and Supercomputers in New Phase of Strategic Tech Competition*, GIBSON DUNN (Oct. 13, 2022), https://www.gibsondunn.com/us-new-export-controls-on-china-for-semi-conductor-manufacturing-technology-advanced-semiconductors-in-new-phase-strategic-tech-competition/#_ftn1

28. Implementation of Additional Export Controls: Certain Advanced Computing and Semiconductor Manufacturing Items; Supercomputer and Semiconductor End Use; Entity List Modification, 87 Fed. Reg. 62186 (Oct. 13, 2022).

29. Coco Liu et al., *Ban on U.S. Talent at China Chip Firms Thwarts Xi's Key Ambition*, BLOOMBERG (Oct. 17, 2022), https://www.bloomberglaw.com/product/blaw/bloomberglawnews/bloomberg-law-news/XF67UD5K000000. *See also* Brian Egan, *New U.S. Semiconductor Export Controls Signify Dramatic Shift in Tech Relations With China*, JUST SECURITY (Oct. 24, 2022), https://www.justsecurity.org/83744/new-us-semiconductor-export-controls-signify-dramatic-shift-in-tech-relations-with-china/.

October 2023 rulemaking.[30] BIS's primary focus so far has been to hamper AI development, supercomputing, and advanced weapon development more broadly.[31]

In December 2024, the Biden administration issued new major controls via two rulemakings. These included adding over 140 entities to the Entity List, as well as creating two new FDPR, a "footnote 5" FDPR and a SME-focused FDPR.[32] These new FDPR, combined with De Minimis Rule changes, expand U.S. jurisdiction to a wide swath of SME equipment with any non-zero portion of U.S. content.[33] The rules notably also include controls on High Bandwidth Memory (HBM), design software, and software keys.[34] Finally, in January 2025, the Biden administration issued new controls on advanced computing items and AI model weights.[35] This marks the first time controls have been placed on exports of model weights. However, regarding chip technology, instead of controlling additional specific hardware, the IFR establishes a framework to "regulate the global diffusion of the most advanced artificial intelligence (AI) models and large clusters of advanced computing integrated circuits (ICs)."[36] This involves broadening

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30. Hanna Dohmen & Jacob Feldgoise, *A Bigger Yard, A Higher Fence: Understanding BIS's Expanded Controls on Advanced Computing Exports*, CENTER FOR SECURITY AND EMERGING TECHNOLOGY (Dec. 4, 2023), https://cset.georgetown.edu/article/bis-2023-update-explainer/. *See also New Export Controls on Advanced Computing and Semiconductor Manufacturing: Five Key Takeaways*, SIDLEY (Nov. 1, 2023), https://datamatters.sidley.com/2023/11/01/new-export-controls-on-advanced-computing-and-semiconductor-manufacturing-five-key-takeaways/.

31. Press Release, Bureau of Industry and Security, Commerce Strengthens Restrictions on Advanced Computing Semiconductors, Semiconductor Manufacturing Equipment, and Supercomputing Items to Countries of Concern (Oct. 17, 2023), https://www.bis.doc.gov/index.php/documents/about-bis/newsroom/press-releases/3355-2023-10-17-bis-press-release-acs-and-sme-rules-final-js/file.

32. Neena Shenai et al., *BIS Issues Sweeping Additional Restrictions on Semiconductors and Advanced Computing, Entity List Designations*, WILMERHALE (Dec. 6, 2024), https://www.wilmerhale.com/en/insights/client-alerts/20241206-bis-issues-sweeping-additional-restrictions-on-semiconductors-and-advanced-computing-entity-list-designations#:~:text=Expanded%20Export%20Control%20Jurisdiction&text='There%20are%20two%20new%20FDP,most%20other%20Entity%20List%20designees.

33. *Id.*

34. *Id.*

35. *New U.S. Export Controls on Advanced Computing Items and Artificial Intelligence Model Weights: Seven Key Takeaways*, SIDLEY (Jan. 21, 2025), https://datamatters.sidley.com/2025/01/21/new-u-s-export-controls-on-advanced-computing-items-and-artificial-intelligence-model-weights-seven-key-takeaways/.

36. Framework for Artificial Intelligence Diffusion, 90 Fed. Reg. 4544, 4544 (Jan. 15, 2025).

the geographic reach of existing controls through new licensing requirements and tightened license exceptions.[37]

At the time of writing this paper (May 2025) the second Trump administration has not modified or created any new controls since the start of the term. However, consistent with prior trends and administrations, such changes may be expected in the near future.

While it may still be too early to tell what the overall ramifications of recent semiconductor export controls may be industry responses to new regulations have often been significant. Within days of the October 2022 interim final rule, U.S. equipment suppliers stopped installing equipment and withdrew their workers from Chinese factories,[38] Apple put on hold plans to source memory chips from Yangtze Memory Technology Company (YMTC), and South Korean chipmaker giant SK Hynix indicated that they were considering selling their memory chip production operations in China (although to date this has not happened).[39] Also apparent is that U.S. export controls have galvanized Chinese government efforts to fund investments in the domestic semiconductor industry as it embarks on a "whole nation" approach to attain self-sufficiency. As early as 2018, President Xi stated that "internationally, advanced technology and key technology is more and more difficult to obtain. Unilateralism and trade protectionism have risen, forcing us to travel the road of self-reliance."[40] Thus, the impacts have been significant both politically and commercially.

IV. THE CHIPS ACT IN THE CONTEXT OF EXPORT CONTROLS

Export controls are a key element of the "defensive" prong of U.S. semiconductor strategy, which seeks to slow down competing Chinese tech development and entrench U.S. dominance of key technological choke points, such as advanced chipmaking software and manufacturing

37. *See id.*

38. Yoko Kubota et al., *U.S. Suppliers Halt Operations at Top Chinese Memory Chip Maker*, WALL ST. J (Oct. 12, 2022), https://www.wsj.com/articles/u-s-suppliers-halt-operations-at-top-chinese-memory-chip-maker-11665573761?mod=hp_lead_pos7.

39. *See, e.g.,* Sujai Shivakumar et al.*, A Seismic Shift: The New U.S. Semiconductor Export Controls and the Implications for U.S. Firms, Allies, and the Innovation Ecosystem,* CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES (Nov. 14, 2022), https://www.csis.org/analysis/seismic-shift-new-us-semiconductor-export-controls-and-implications-us-firms-allies-and; Cheng Ting Fang et al., *Apple Freezes Plan to Use China's YMTC Chips Amid Political Pressure*, NIKKEI ASIA (Oct. 17, 2022), https://asia.nikkei.com/Business/Tech/Semiconductors/Apple-freezes-plan-to-use-China-s-YMTC-chips-amid-political-pressure.

40. Gabriel Wildau, *China's Xi Jinping Revives Maoist Call For 'Self-Reliance'*, FINANCIAL TIMES (Nov. 18, 2018), https://www.ft.com/content/63430718-e3cb-11e8-a6e5-792428919cee.

equipment that Chinese companies are reliant on. The other prong is the "offensive" prong, policies that are aimed at stimulating U.S. domestic industry.[41] The primary example of this is the CHIPS and Science Act ("CHIPS Act"), which was signed into law in August 2022. The act directs $280 billion in spending over 10 years, with $52.7 billion devoted to semiconductor investments through FY 2027 and $24 billion worth of tax credits for chip production.[42] The CHIPS Act remains in effect, despite Trump administration hostility towards it and efforts to reorganize CHIPS Act administration.[43]

The CHIPS Act was essentially an effort by the Biden administration to kill two birds with one stone: to divert foreign reliance and bolster domestic economy. It is a prime example of what the administration termed "foreign policy for the middle class."[44] One function of the act is as an insurance policy – the idea is that by investing in domestic semiconductor manufacturing capacity, U.S. chip supply chains can be moved away from dependence on Taiwan in particular. Taiwan manufactures more than 92% of the world supply of leading-edge logic chips, which among other things are crucial for AI development.[45] Taiwanese manufacturer TSMC, which holds 62% of global market share, is one of the companies that the U.S. government hopes CHIPS Act funding will lure to invest in domestic production.[46] TSMC has invested $40 billion so far in US-based production

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41. JON BATEMAN, U.S.-CHINA TECHNOLOGICAL "DECOUPLING" 14 (2022), https://carnegieendowment.org/research/2022/04/us-china-technological-decoupling-a-strategy-and-policy-framework?lang=en&center=global.

42. *The CHIPS and Science Act: Here's what's in it*, MCKINSEY AND COMPANY (Oct. 4, 2022), https://www.mckinsey.com/industries/public-sector/our-insights/the-chips-and-science-act-heres-whats-in-it;

EMILY BLEVINS ET AL., CONG. RSCH. SERV., R4752, FREQUENTLY ASKED QUESTIONS: CHIPS ACT OF 2022 PROVISIONS AND IMPLEMENTATION 1 (2023), https://crsreports.congress.gov/product/pdf/R/R47523.

43. *See* Exec. Order No. 14,255, Establishing the United States Investment Accelerator, 90 Fed. Reg. 14,701 (Apr. 3, 2025).

44. Jake Sullivan, Nat'l Sec. Advisor, Remarks on Renewing American Economic Leadership at the Brookings Institution (Apr. 27, 2023), https://www.whitehouse.gov/briefing-room/speeches-remarks/2023/04/27/remarks-by-national-security-advisor-jake-sullivan-on-renewing-american-economic-leadership-at-the-brookings-institution/.

45. Larry Diamond et al., *The Treacherous Silicon Triangle: How to Strengthen the Semiconductor Supply Chain Without Endangering Taiwan*, FOREIGN AFF., July 17, 2023, https://www.foreignaffairs.com/united-states/semiconductor-supply-taiwan-treacherous-silicon-triangle.

46. Madeleine Ngo & Don Clark, *TSMC Will Receive $6.6 Billion to Bolster U.S. Chip Manufacturing,* N.Y. TIMES, Apr. 8, 2024, https://www.nytimes.com/2024/04/08/us/politics/tsmc-taiwan-chips-grants.html.

capacity.[47] The other function of the act is to revitalize the U.S. domestic chip industry—despite U.S. dominance in advanced chip design, manufacturing equipment, and design software, the U.S. share of global semiconductor manufacturing is only about 12%.[48] The Biden administration marketed the CHIPS Act as a way to add potentially tens of thousands of jobs in advanced manufacturing.[49]

The public marketing of the CHIPS Act masks some inconvenient realities. Funding for U.S. firms could be seen as helping revitalize a stagnating sector, or it could be seen as a remedial measure to counteract some of the financial costs imposed on U.S. firms as a result of recent export controls. Pursuing domestic subsidies also creates diplomatic challenges with allies and risks a "race to the bottom" on subsidies.[50] This could potentially lead to retaliatory trade controls, or market distortions that create oversupply or leave developing countries' industry behind. At the most basic level, despite being a landmark piece of legislation with unprecedented investments in the U.S. context, it simply may not be enough funding for the U.S. semiconductor industry to remain competitive while being increasingly cut off from China. Beijing has already pledged tens of billions of dollars in investments for its domestic chip industry—these include a $40 billion fund announced last September, which was preceded by similar funds announced in 2019 (about $27 billion) and 2014 (about $20 billion).[51] Provincial and municipal governments in China are contributing billions as well. This funding does not include massive subsidies and tax breaks that Beijing is granting to chipmakers, which some have valued at over $50 billion.[52] Combined Chinese funding and subsidies dwarf the CHIPS Act and

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47. *Id.*

48. *Id.*

49. *U.S. Semiconductor Jobs are Making a Comeback*, THE WHITE HOUSE (Mar. 20, 2024), https://bidenwhitehouse.archives.gov/cea/written-materials/2024/03/20/u-s-semiconductor-jobs-are-making-a-comeback/#:~:text=After%20two%20decades%20of%20declining,semiconductor%20manufacturing%20is%20growing%20again.

50. *See* Foo Yun Chee and Supantha Mukherjee, *EU may struggle to catch up with U.S., Asia in chips subsidies race,* REUTERS (Apr. 18, 2023), https://www.reuters.com/technology/eu-may-struggle-catch-up-with-us-asia-chips-subsidies-race-2023-04-18/

51. *See* Chee and Mukherjee, *supra* note 50.

52. Guówùyuàn guānyú yìnfā xīn shíqí cùjìn jíchéng diànlù chǎnyè hé ruǎnjiàn chǎnyè gāo zhìliàng fāzhǎn ruògān zhèngcè de tōngzhī (国务院关于印发新时期促进集成电路产业和软件产业高质量发展若干政策的通知)[State Council Notice on the Publication of Certain Policies to Promote the High-Quality Development of the Integrated Circuit Industry and the Software Industry in the New Period] (promulgated by the PRC State Council, Jul. 27, 2020, effective Jul. 27, 2020), Center for Security and Emerging Technology, Sept. 2, 2020 (China),

its EU equivalents. The potential inadequacy of the CHIPS Act for its stated goals should make the current administration reassess the export control prong of its semiconductor strategy.

V. EXPORT CONTROLS AND THE COST TO U.S. FIRMS

Former Secretary of Commerce Gina Raimondo stated at the Reagan National Defense Forum in December 2023 that "I know there are CEOs of chip companies in this audience who were a little cranky with me when I did that [referring to export controls] because you're losing revenue… protecting our national security matters more than short-term revenue."[53] Jeopardizing U.S. firms' ability to derive revenue from sales to China could have major security implications in itself. Simply put, China is a massive market for U.S. semiconductor companies—it is the world's largest customer for chips.[54] It is the largest market for most major U.S. semiconductor firms. China accounts for a quarter of all revenue for Intel, the 6th largest U.S. semiconductor firm by market cap.[55] U.S. semiconductor firms have $700 billion worth of assets located in China.[56] In recent years, gross U.S. semiconductor sales figures to China have continued to rise despite export controls, potentially mitigating worries about revenue loss.[57]

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https://cset.georgetown.edu/wp-content/uloads/t0195_IC_software_policy_EN.pdf,; GREGORY C. ALLEN, CTR. FOR STRATEGIC & INT'L STUD., CHINA'S NEW STRATEGY FOR WAGING THE MICROCHIP TECH WAR 6 (2023), https://csis-website-prod.s3.amazonaws.com/s3fs-public/2023-05/230503_Allen_Microchip_War.pdf?VersionId=hGO78uxC3Z3yCzdS8R_bqlNgg7RQpHJO.

53. Peter Martin, *Raimondo Says Commerce Needs More Money to Halt China Chip Drive*, BLOOMBERG (Dec. 2, 2023), https://www.bloomberglaw.com/product/blaw/bloombergterminalnews/bloomberg-terminal-news/S51ULGDWLU68?criteria_id=fa27c628000b143b3a9b6ae05e3e29ab

54. *Who's Winning the US-China Chip War?,* CITIGROUP (Oct. 11, 2023), https://www.citigroup.com/global/insights/global-insights/who-s-winning-the-us-china-chip-war-

55. AGATHE DEMARAIS, BACKFIRE: HOW SANCTIONS RESHAPE THE WORLD AGAINST U.S. INTERESTS, 180 (Columbia University Press, 2022); Market cap figure from Aliza Zia, *20 Biggest Semiconductor Companies in the US,* Yahoo Finance (Mar 27,2024), https://finance.yahoo.com/news/20-biggest-semiconductor-companies-us-215737584.html.

56. Demarais, *supra* note 555 at 180.

57. Iain Morris, U.*S. Chip Exposure to China Grew Even More Last Year*, LIGHT READING (May 1, 2023), https://www.lightreading.com/semiconductors/us-chip-exposure-to-china-grew-even-more-last-year.

Nevertheless, CEOs of major U.S. firms have lobbied Congress with urgency, noting the threat that more stringent controls could pose to business.[58]

The focus on revenue is uniquely important for semiconductor firms, who spend much more on R&D than firms in other industries. This is particularly true for fabless design houses, which derive revenue from selling chip designs rather than physical chips. Most major U.S. semiconductor companies are fabless firms. U.S. companies spend on average 18.75% of their sales revenue on R&D, which is even higher than firms in other countries.[59] This compares to roughly 3% in general industries, and 4% in aerospace and defense sectors. The only industry with a comparable R&D spending ratio is pharmaceuticals.[60] Historically, U.S. firms have relied on a cycle of deriving revenue (in large part from the Chinese market) and channeling this revenue into major R&D spending to maintain an edge in technological "choke points" that the United States dominates, particularly such as advanced chip manufacturing technology.[61] Even if revenue losses remain relatively limited in the aggregate, they do not affect all firms equally. For example, Nvidia, currently the largest U.S. chip company, is the world's leading supplier of advanced chips and GPUs used for AI applications. The October 2022 rulemaking, which regulated certain chip exports based on data transfer rates, forced Nvidia to stop selling its A100 and H100 GPUs to Chinese customers. In response, Nvidia sold a rebranded, slightly downgraded version, the H800, to China. Commentators at the time noted that it was possible that Chinese customers could just use a greater quantity of the rebranded chips to derive similar performance.[62] Nvidia CFO Colette Kress said that these specific controls would not have a major short-term impact on its financials, but that "over the long-term, restrictions prohibiting the sale of our data center GPUs to China, if implemented, will result in a permanent loss of an opportunity for the U.S. industry to compete

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58. *Chip Leaders Head to Washington to Lobby for China Rules Relief*, BLOOMBERG (July 15, 2023), https://www.bloomberg.com/news/articles/2023-07-15/chip-leaders-head-to-washington-to-lobby-for-china-rules-relief.

59. SEMICONDUCTOR INDUSTRY ASSOCIATION, SIA 2023 FACTBOOK (May 2023), https://www.semiconductors.org/wp-content/uploads/2023/05/SIA-2023-Factbook_1.pdf.

60. *Strategies to Lead in the Semiconductor World*, MCKINSEY & COMPANY (Apr. 15, 2022), https://www.mckinsey.com/industries/semiconductors/our-insights/strategies-to-lead-in-the-semiconductor-world.

61. Ansgar Baums, *The Chokepoint Fallacy of Tech Export Controls*, STIMSON (2024), https://www.stimson.org/2024/the-chokepoint-fallacy-of-tech-export-controls/.

62. Zhiye Liu, *Nvidia Gimps H100 Hopper GPU to Sell as H800 to China*, TOM'S HARDWARE (Mar. 21, 2023), https://www.tomshardware.com/news/nvidia-gimps-h100-hopper-gpu-to-sell-as-h800-to-china.

and lead in one of the world's largest markets."[63] In the October 2023 rule-making, BIS restricted exports of the downgraded H800 chips as well.[64] Short-term costs can still be significant in certain instances. On April 15 of this year, Nvidia stated in an SEC filing that they expected $5.5 billion in charges in the quarter due to yet-unreleased controls on their H20 chip.[65] Even if short-term financial impacts on U.S. firms can generally remain limited, that could be a sign that export controls are working as intended. However, the long-term consequences should not be ignored. In addition to lost revenue, U.S. firms also suffer costs in the form of tighter lending conditions and increased difficulty finding alternative customers.[66] Evidence of limited re-shoring and other supply chain rigidities could indicate longer-term challenges for domestic industry.[67]

Some projections have estimated that U.S. chip industry losses could amount to $1 trillion if the companies are completely cut off from the Chinese market.[68] This scenario may seem far-fetched at present, notwithstanding the rapid escalation of U.S. export controls just within the past couple of years. However, Jake Sullivan explicitly stated that U.S. export controls will no longer follow a "sliding scale" approach, where controlled technologies gradually become de-controlled as they mature and become readily available.[69] Instead, the stated focus was to maintain or expand as large a

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63. Dylan Butts, *Nvidia Sees Permanent Loss of Business Opportunity if U.S. Tightens Chip Export Controls to China,* SOUTH CHINA MORNING Post (Aug. 24, 2023), https://www.scmp.com/tech/article/3232186/nvidia-sees-permanent-loss-business-opportunity-if-us-tightens-chip-export-controls-china. *See also* Raffaele Huang et al., *Everyone's Rattled by the Rise of DeepSeek—Except Nvidia, Which Enabled It*, WALL STREET JOURNAL (Feb. 2, 2025), https://www.wsj.com/tech/ai/nvidia-jensen-huang-ai-china-deepseek-51217c40.

64. Implementation of Additional Export Controls: Certain Advanced Computing Items; Supercomputer and Semiconductor End Use; Updates and Corrections, 88 Fed. Reg. 73458 (Nov. 17, 2023).

65. Lauren Almeida, *Nvidia Expects to Take $5.5bn hit as US tightens AI Chip Export Rules to China*, The Guardian, (Apr. 16, 2025), https://www.theguardian.com/technology/2025/apr/16/nvidia-expects-to-take-55bn-hit-as-us-tightens-ai-chip-export-rules-to-china#:~:text=Nvidia%20has%20said%20it%20expects,plunging%20in%20after%2Dhours%20trading.

66. Matteo Crosignani et al., *Securing Technological Leadership? The Cost of Export Controls on Firms*, FEDERAL RESERVE BANK OF NEW YORK STAFF REPORTS, no. 1096 (Apr. 2024; revised Feb. 2025), https://doi.org/10.59576/sr.1096.

67. *See id.* at 31-32.

68. Demarais, *supra* note 55, at 180; Lower projections from ANTONIO VARAS AND RAJ VARADARAJAN, HOW RESTRICTIONS TO TRADE WITH CHINA COULD END US LEADERSHIP IN SEMICONDUCTORS 18 (BCG, Mar. 2020) (More like $83 billion in 2018 dollars.)

69. *Remarks by National Security Advisor Jake Sullivan at the Special Competitive Studies Project Global Emerging Technologies Summit*, THE WHITE HOUSE (Sept. 16, 2022),

lead as possible, rather than maintaining a continuous, slight lead.[70] By definition, export controls will become broader over time. At a certain point for example, Nvidia might not be able to sell even downgraded GPUs in the Chinese market, while at the same time Chinese domestic technology catches up, boxing out Nvidia's product. Lower revenues and lower R&D spending could then lead to technological edges disappearing. The consequences of a "death spiral" started by reduced R&D spending could echo the collapse of U.S. telecom firms Lucent, Nortel, and Motorola, who were forced to cut R&D spending after the tech bubble burst of the early 2000's and ended up being eclipsed by European and Asian peers.[71]

It is clear that U.S. companies are wary of export controls. This is evident not just from public statements but also from the number of export license applications filed in recent years. In 2022 (post-October 2023 data is not readily available), "BIS reviewed 4,555 export/re-export license applications valued at $204.8 billion for China. Of these, BIS approved 3,251 applications valued at $113.6 billion with an approval rate of 71.4%."[72] Of course, policymaking should not always defer to industry opinions. However, the high approval rates may suggest that BIS is unsure of how controls should be applied as well. The U.S. system is leaky, even if by design.

VI. CHALLENGES IN SECURING ALLIED SUPPORT FOR U.S. EXPORT CONTROLS

There are also risks of Chinese customers shifting to alternative non-US suppliers that are not subject to the same export control constraints as U.S. companies. Even in 2020 some reports suggested that foreign

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https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/09/16/remarks-by-national-security-advisor-jake-sullivan-at-the-special-competitive-studies-project-global-emerging-technologies-summit/

70. *Id.*; Jeremy Mark & Dexter Tiff Roberts, *United States-China Semiconductor Standoff: A Supply Chain Under Stress*, ATLANTIC COUNCIL (Feb. 23, 2023), https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/united-states-china-semiconductor-standoff-a-supply-chain-under-stress/.

71. *See, e.g.* William Lazonick & Edward March, *The Rise and Demise of Lucent Technologies*, Inst. for New Econ. Thinking, Working Paper No. 06 at 16-17 (2011), https://www.economicpolicyresearch.org/images/docs/SCEPA_blog/the_financial_crisis/lazonick_paper2_panel6.pdf.

72. ANALYSIS OF U.S. TRADE WITH CHINA, 2022, Bureau of Indus. & Sec. U.S. Dept' of Com., https://www.bis.doc.gov/index.php/documents/technology-evaluation/ote-data-portal/country-analysis/3420-2022-statistical-analysis-of-us-trade-with-china/file; *see also* Christian Schoeberl, *BIS Best Data Practices: Part 1*, CSET (Nov. 3, 2023), https://cset.georgetown.edu/publication/bis-best-data-practices-part-1/.

companies were marketing "EAR-free" manufacturing equipment.[73] As of 2020, Boston Consulting Group estimated that 70% of Chinese demand for U.S. chip technology could be sourced from foreign alternatives.[74] The Biden administration was fully aware of this risk, which is partially why current export control regulations rely in large part on the extraterritorial jurisdiction of the FDPR.

The administration also sought to reach agreements with allied countries who are also key players in global chip supply chains. In 2023, the Netherlands and Japan instituted export controls that mirror those of the US.[75] The Netherlands is home to key equipment supplier ASML, who is also the sole global supplier of extreme ultraviolet lithography (EUV) equipment, an essential component for manufacturing cutting-edge chips.[76] However, these controls were instituted months after BIS unilaterally released its October 2022 round of export controls. At the time, U.S. officials said that they had not secured commitments from allies to institute similar controls and that discussions were "ongoing."[77] Moving forward, it is unrealistic to expect allies to continuously impose export controls that match the stringency of ones imposed by the US. Even if they implement controls that on paper mirror those of the US, enforcement may be lacking, in part due to not having the same domestic political pressures behind export controls. A Japanese official remarked that "Japan does not have the authority to ban shipment to any specific country" and that its new export controls are "a checklist, not a ban list."[78] In regard to the EU, the simple process of getting all member states on board can prove to be a separate challenge. Allies may simply have different assessments of the security threat Chinese

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73. *America's Latest Salvo Against Huawei Is Aimed at Chipmaking in China*, THE ECONOMIST (May 23, 2020), https://www.economist.com/business/2020/05/23/americas-latest-salvo-against-huawei-is-aimed-at-chipmaking-in-china.

74. Varas & Varadarajan, *supra* note 68, at 1.

75. *See* Gregory Allen et al., *Japan and the Netherlands Announce Plans for New Export Controls on Semiconductor Equipment*, CSIS (Apr. 10, 2023), https://www.csis.org/analysis/japan-and-netherlands-announce-plans-new-export-controls-semiconductor-equipment.

76. *See* Katie Tarasov, *Inside ASML, the Company Advanced Chipmakers Use for EUV Lithography*, CNBC (March 23, 2022), https://www.cnbc.com/2022/03/23/inside-asml-the-company-advanced-chipmakers-use-for-euv-lithography.html.

77. Sujai Shivakumar et al., *A Seismic Shift: The New U.S. Semiconductor Export Controls and the Implications for U.S. Firms, Allies, and the Innovation Ecosystem*, CSIS (Nov. 14, 2022) (quotations omitted), https://www.csis.org/analysis/seismic-shift-new-us-semiconductor-export-controls-and-implications-us-firms-allies-and.

78. Cheng Ting-Fang, *How China's Tech Ambitions Slip Through the U.S. Export Control Net,* NIKKEI ASIA (Oct. 20, 2023), https://asia.nikkei.com/Business/Business-Spotlight/How-China-s-tech-ambitions-slip-through-the-U.S.-export-control-net.

development poses.[79] Some allies may try to reap the benefits of a U.S. security umbrella, while simultaneously capturing rents by maintaining as open chip-related trade with China as possible. Even certain U.S. politicians who support export controls have noted the importance of multilateral cooperation. Members of California's congressional delegation have expressed concern that misalignment with the export control regimes of Japan, the Netherlands, and South Korea could lead to revenue death spirals for U.S. firms and loss of market share to foreign firms.[80] Ultimately, the Trump administration appears likely to continue the export control strategy of his first term (roughly continuing the trajectory of current controls), while spurning any sort of multilateralism. Failure on this diplomatic front could spell disaster for U.S. firms.

VII. GALVANIZING CHINESE SUPPORT FOR DOMESTIC INDUSTRY

As discussed previously, the Chinese government has embarked on a massive effort to try and secure their own chip supply chains, with the stated ultimate goal of attaining self-sufficiency. Chinese leaders have framed this effort as one of necessity, given U.S. export controls—and Chinese commentators have described this effort in historic terms, dubbing it the "great semiconductor leap forward" or "long tech march."[81]

Historically, Chinese industrial policy has come with mixed results – much of Chinese technological advancement was not necessarily through direct government intervention.[82] In recent years, the "Made in China 2025" plan has floundered in its aerospace and car manufacturing goals.[83] Current Chinese funding efforts for semiconductors have not been flawless either, in part due to inefficient distribution of funding, including instances of fraud. However, it is indisputable that U.S. actions have sharpened Chinese government objectives. They have also aligned incentives for the

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79. CHRIS MILLER, CHIP WAR: THE FIGHT FOR THE WORLD'S MOST CRITICAL TECHNOLOGY 302 (Scribner 2022).

80. Letter from Zoe Lofgren and Alex Padilla, U.S. Cong., to Alan Estevez, Under Sec. for Ind. & Sec. (Aug. 13, 2024), https://democrats-science.house.gov/imo/media/doc/2024-08-13_Lofgren-Padilla_Nonalignment-Letter.pdf

81. Yimou Lee, Norihiko Shirouzu, David Lague, *SPECIAL REPORT-Taiwan chip industry emerges as battlefront in U.S.-China showdown,* REUTERS (Dec. 27, 2021) https://www.reuters.com/article/technology/special-report-taiwan-chip-industry-emerges-as-battlefront-in-us-china-showdow-idUSL4N2TC0JE/; *China needs new long tech march after US attack on SMIC: Global Times editorial,* GLOBAL TIMES (Sep. 27, 2020) https://www.globaltimes.cn/content/1202232.shtml .

82. *See* Dan Wang, *China's Sputnik Moment?*, FOREIGN AFFAIRS (Jul. 29, 2021), https://www.foreignaffairs.com/united-states/chinas-sputnik-moment.

83. *Id.*

Chinese government and private (or semi-private) semiconductor firms. Chinese commercial constituencies who formerly were committed to globalized supply chains and may have had different goals than the Chinese government now are motivated to work towards government objectives. Chinese firms who previously preferred to source advanced equipment from foreign suppliers now have been forced, not by Beijing, but by the US, to turn to domestic alternatives.

An early indication that U.S. export controls would spur Chinese domestic efforts was the reaction to the U.S. government's imposition of export controls on ZTE. The ZTE controls hamstrung all ZTE production of telecom products, and the company was on the verge of bankruptcy within months. ZTE only recovered when Chinese President Xi Jinping personally urged President Trump to lift the controls.[84] This experience alerted Chinese officials to the inevitability of future controls and the potential dire consequences for Chinese firms.[85] By 2020, President Xi was highlighting the need for breakthrough progress in "stranglehold" technologies, while also stating the need to retain leverage over international supply chains through artificially cutting off supply if necessary.[86] U.S. academics have described the Chinese State Council's July 2020 Document No. 8, "Issuance of the New Era to Promote the Integrated Circuit Industry" as advocating essentially unlimited support to the semiconductor industry—though this stance was tamped down somewhat in response to backlash over fraud and wasteful spending. In 2020, 22,000 Chinese firms registered as chip companies to qualify for government subsidies—many of these firms specialized in online gambling, seafood or other unrelated industries.[87] However, the Chinese government largely accepts this misrepresentation as part of the process; Chinese planners have adopted a mindset borrowed from American venture capitalists—funding ten projects knowing nine might fail, but hoping that the tenth becomes a huge success.[88]

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84. Gregory Allen, *China's New Strategy For Waging the Microchip Tech War*, CENTER FOR STRATEGIC & INTERNATIONAL STUDIES, 3 (May 2023). Note—ZTE settled with DOJ for $1.3 billion over its sanctions violations.

85. Wang, *supra* note 82.

86. Xi Jinping, Remarks at the Seventh Meeting of the Central Financial and Economic Affairs (Apr. 10, 2020) (transcript available at CSIS) https://interpret.csis.org/translations/major-issues-concerning-chinas-strategies-for-mid-to-long-term-economic-and-social-development/.

87. Demarais, *supra* note 55, at 190. *See also* Miller, *supra* note 79, at 310.

88. TAI MING CHEUNG ET AL., CHINA'S ROADMAP TO BECOMING A SCIENCE, TECHNOLOGY, AND INNOVATION GREAT POWER IN THE 2020S AND BEYOND: ASSESSING ITS MEDIUM- AND LONG-TERM STRATEGIES AND PLANS 112 (IGCC July 2022), https://ucigcc.org/wp-content/uploads/2022/07/Ocea-revised-19-July-2022-1.pdf.

The October 2022 restrictions came as a surprise to Beijing and Chinese strategy since then has evolved accordingly. Broadly speaking, China has four strategic objectives: limit China's exposure to foreign pressure; deter future US/allied pressure; increase foreign dependence on China; and gain economic/security benefits from AI.[89] There are a variety of policy choices that China may pursue (or has already pursued) to reach these objectives. However, at the most basic level, Chinese state support for domestic entrepreneurial firms has been galvanized at a major scale—Huawei for example must now turn to Chinese suppliers that never would have been able to compete with U.S. firms but who now are experiencing massive cash infusions to innovate. Analyst Dan Wang notes that the Chinese government has now empowered these entrepreneurial firms who are at the forefront of Chinese industrial policy.[90] This is in marked contrast to past Chinese industrial policy efforts, where it was "inefficient state-owned enterprises and government ministries taking the lead rather than innovative tech firms."[91]

Another element of Chinese strategy moving forward is economic retaliation. In reality, retaliatory measures have been somewhat limited, in part because China ultimately wants to preserve foreign firms' presence and the continued access to technology that comes with it. So far, retaliation has come in a couple forms. One is blocked mergers—Chinese antitrust authorities have blocked essentially all M&A activity involving U.S. semiconductor firms.[92] The other is through obstruction in the name of cybersecurity; for example, U.S. chipmaker Micron failed a security review by Chinese cybersecurity regulators, preventing Chinese operators of "critical information infrastructure" from purchasing Micron products.[93]

Moreover, retaliation could, and already has, come in areas tangential to semiconductors. In August 2023, China instituted its own export controls on certain critical minerals, namely gallium, germanium and graphite, followed by restrictions on exports of processing equipment.[94] China has a 60% global share of rare earth mineral production but processes about

89. Allen, *supra* note 84, at 12.

90. Wang, *supra* note 82.

91. *Id.*

92. *See* Lingling Wei and Asa Fitch, *China's New Tech Weapon: Dragging Its Feet on Global Merger Approvals*, WALL ST. J. (Apr. 4, 2023), https://www.wsj.com/articles/chinas-new-tech-weapon-dragging-its-feet-on-global-merger-approvals-d653ca4a.

93. *China fails Micron's products in security review, bars some purchases*, REUTERS (May 21, 2023), https://www.reuters.com/technology/chinas-regulator-says-finds-serious-security-issues-us-micron-technologys-2023-05-21/.

94. Christopher R. LeWand et al., *China's Export Controls on Critical Minerals: Gallium, Germanium, Graphite*, FTI CONSULTING (Dec. 19, 2023), https://www.fticonsulting.com/insights/articles/chinas-export-controls-critical-minerals-gallium-germanium-graphite.

90%.[95] Chinese rare earth exports have now been effectively halted, in response to U.S. tariffs.[96] Restricted rare earth minerals supply could have major impacts on U.S. production and access to a variety of crucial defense and other products, including electric vehicles, solar panels, and wind turbines, potentially jeopardizing U.S. efforts to deploy clean energy.[97]

It is evident that regardless of what direction U.S. policy takes, Beijing is committed to strengthening their domestic chip industry, as they have been doing in other tech-intensive sectors. However, increasingly stringent U.S. export controls could be influencing the direction and magnitude of Chinese investments in ways that could run counter to U.S. interests.

VIII. ARE EXPORT CONTROLS WORKING?

Export controls have had significant direct impacts on Chinese industry. This was apparent even in 2018, as ZTE and Fujian Jinhua were crippled within months of being subjected to controls. In the short term, Chinese companies will not be able to replicate ASML's EUV machines, and likewise will not be able to manufacture cutting-edge chips at scale for at least some time.[98] YMTC announced layoffs in June 2023 and SMIC announced 1 to 2-quarter delays in mass production due to "difficulties in securing key equipment."[99] However, in terms of the Biden administration's stated goals of slowing down overall Chinese advanced technological development, it may take time to get a fuller picture. Some have claimed that Chinese AI development will not be slowed significantly by using Nvidia's slower chips, and that there are algorithmic methods to get around any handicaps posed by slower chips.[100] The DeepSeek-R1 LLM release in January 2025 may be an example of this, though there remains disagreement on whether this is the case.

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95. Gracelin Baskaran, *What China's Ban on Rare Earths Processing Technology Exports Means*, CSIS (Jan. 8, 2024), https://www.csis.org/analysis/what-chinas-ban-rare-earths-processing-technology-exports-means.

96. Keith Bradsher, China Tightens Grip on Rare Earths Exports, Raising Global Concerns, NEW YORK TIMES (Apr. 13, 2025), https://www.nytimes.com/2025/04/13/business/china-rare-earths-exports.html.

97. *Id.*; *see also China Ban Would Slow, Not Halt Western Solar Push*, REUTERS (Feb. 3, 2023), https://www.reuters.com/breakingviews/china-ban-would-slow-not-halt-western-solar-push-2023-02-03/.

98. Sujai Shivakumar et al., *Balancing the Ledger: Export Controls and U.S. Chip Technology in China*, CSIS (Feb. 21, 2024), https://www.csis.org/analysis/balancing-ledger-export-controls-us-chip-technology-china.

99. *Id.*

100. Stephen Nellis et al., *China's AI Industry Barely Slowed by U.S. Chip Export Rules*, REUTERS (May 4, 2023), https://www.reuters.com/technology/chinas-ai-industry-barely-slowed-by-us-chip-export-rules-2023-05-03/.

So far, U.S. controls have not completely handicapped Chinese advanced chip development. For example, in October 2023, Huawei unveiled its new 5g phone, the Mate 60 Pro, which coincided with Secretary Raimondo visiting China. The Mate 60 Pro incorporated a 7-nm chip manufactured by leading Chinese chipmaker SMIC.[101] At a Senate Commerce Committee hearing, Raimondo called this development "incredibly disturbing."[102] 7-nm is considered "high-end" technology but is not at the cutting edge level of 3- and 4-nm chips manufactured by TSMC.[103] Despite this surprise, U.S. officials, including BIS head Thea Kendler, stated that neither the chip's performance nor SMIC's manufacturing capacity were adequate for the market Huawei was targeting.[104] Moreover, the Mate 60 Pro rollout was only a year after the October 7 controls were imposed. Indeed, Huawei's 7-nm chip was likely developed using at least some U.S. technology. Recent reports indicate that SMIC is readying production lines for 5-nm chips and may start production at scale as early as this year.[105] SMIC's progress has been in part due to stockpiles of U.S. manufacturing equipment and ASML lithography machines. ASML EUV machines, which are essential for cutting-edge chip production, are now unavailable to Chinese firms due to Dutch export controls.[106] Nevertheless, it is apparent that SMIC has been able to make some progress despite U.S. and allied export controls. SMIC revenues have also remained stable and have even grown in the past year.[107]

101.*TechInsights Finds SMIC 7nm N2 in Huawei Mate 60 Pro*, TECHINSIGHTS, https://www.techinsights.com/blog/techinsights-finds-smic-7nm-n2-huawei-mate-60-pro.

102.Lionel Lim, *Why U.S. Commerce Secretary Gina Raimondo Says Chip Controls Are Here to Stay*, YAHOO FINANCE, Oct. 6, 2023, https://uk.finance.yahoo.com/news/why-u-commerce-secretary-gina-045552897.html.; *see also Raimondo Says Huawei Chips Case Shows U.S. Needs Different Tools*, BLOOMBERG, Oct. 4, 2023, https://www.bloomberg.com/news/articles/2023-10-04/raimondo-says-huawei-chips-case-shows-us-needs-different-tools.

103.Anton Shilov*, U.S. Officials Doubt China's SMIC Foundry Can Produce Enough 7nm Chips to Satisfy Huawei's Demand,* TOM'S HARDWARE, Dec. 13, 2023, https://www.tomshardware.com/tech-industry/manufacturing/us-officials-doubt-chinas-smic-foundry-can-produce-enough-7nm-chips-to-satisfy-huaweis-demand.

104.Matthew Connatser, *Chinese Foundry SMIC is Bruised but Not Broken by U.S. Sanctions; Revenue Still Much Higher Than in 2021 and 5nm Node on Track*, TOM'S HARDWARE, Mar. 1, 2024, https://www.tomshardware.com/tech-industry/semiconductors/chinese-foundry-smic-is-bruised-but-not-broken-by-us-sanctions-revenue-still-much-higher-than-in-2021-and-5nm-node-on-track.

105. Qianer Liu, *China on cusp of next-generation chip production despite US curbs*, FINANCIAL TIMES, Feb. 6, 2024, https://www.ft.com/content/b5e0dba3-689f-4d0e-88f6-673ff4452977

106. Shivakumar et al., *supra* note 98.

107. Connatser, *supra* note 104.

U.S. export control policy has certainly had an impact on Chinese industry. However, due to the complexity of semiconductor supply chains and the industry as a whole, how U.S. policy will affect Chinese industry in the future remains very uncertain. Regardless of whether export controls are "working" or not, the United States has introduced major disruption into the global industry. Accordingly, the United States should be prepared for outcomes that may be surprising or hard to predict.

IX. STRATEGIC CONSIDERATIONS FOR EXPORT CONTROLS

The American policymaking process historically has not excelled at long-term strategy, and there might not even be a long-term strategy currently for tech export controls on China (if there is one, government officials have not articulated it). However, there are multiple factors and questions that U.S. policymakers should consider when instituting future rounds of export controls. Policymakers should reconsider assumptions of the direction, pace, and current state of Chinese technical development, as well as the nature of the chip supply chain. They should question whether U.S. strategy aimed at changing Chinese behavior in some way, and if so, how. Finally, the lack of controls on legacy nodes should be addressed.

Given current U.S. rhetoric, it does not seem that export controls are aimed at changing Chinese behavior in any tangible fashion. But if it is, is the United States offering any "carrots" in exchange, thereby using export controls as negotiating leverage, and is there an off-ramp for the Chinese to avoid export controls? Similarly, is the United States actively giving up leverage by instituting export controls? China was always going to invest in developing its domestic chip industry to some extent. However, the assumption was that this development would be within a context of continued access to U.S. technology and connection with U.S. firms, as demonstrated by Chinese leaders' surprise and subsequent reactions to the restrictions imposed on ZTE, and later, the October 2022 controls. If export controls cover all technology in which the United States has an advantage over China on, there is no further room for more stringent controls in the event of an acute security crisis (i.e., the United States could restrict mature technology, but this would not hurt Chinese industry much, given their existing capabilities in mature technology). At present, BIS has taken steps to ensure that companies listed on the Unverified List (UVL) or Entity List pose legitimate national security risks, but BIS should continue this process, but there is no similar process in place for other types of controls, such as technical specification-based controls. In August 2023 for example, BIS

removed 27 Chinese companies from the UVL after establishing the reliability of the companies as end-users.[108]

Public messaging surrounding U.S. semiconductor policy emphasizes the importance of maintaining a technological lead over China. The basic assumption is that China is following the same path as the US, albeit a few years behind and perhaps at a slower pace. This assumption may increasingly be challenged by developments such as Chinese AI company DeepSeek's release of an open-source Large Language Model (LLM) in January which rivals the capabilities of leading U.S. models. This was a shock to the public and to markets, with Nvidia stock plunging 20 percent in one day.[109] However, at least one industry leader in the United States sought to downplay the notion that DeepSeek's release represented an unforeseen Chinese technological AI breakthrough. Dario Amodei, CEO of Anthropic (the American AI company that developed the Claude LLM) estimated that DeepSeek spent similar amounts of money as U.S. AI companies to achieve a model with the technical sophistication of 7-10 month old U.S. models. He wrote that "DeepSeek-V3 is not a unique breakthrough or something that fundamentally changes the economics of LLM's; it's an expected point on an ongoing cost reduction curve."[110] Amodei concluded that export controls are even more crucial now, and "[i]f we can close [export control loopholes] fast enough, we may be able to prevent China from getting millions of chips, increasing the likelihood of a unipolar world with the United States ahead."[111]

Nonetheless, if Chinese development in chip manufacturing or cutting-edge areas such as AI is forced to occur in isolation from the US, there a chance that China embarks on a wholly different path that the U.S. will have no insight into. This may seem far-fetched given current U.S. technological leads, but should not be discounted, especially given uncertainties about the direction of AI development. Possibilities also exist for developing alternatives to existing chip manufacturing technology, including advanced lithography technology, an area that remains monopolized by ASML. To this effect, Huawei and SMIC reportedly have sought to push the limits of advanced deep ultraviolet (DUV) tools as an alternative to

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108.*Commerce to Remove 33 Parties from the Unverified List after Successful Completion of End-Use Checks*, BUREAU OF INDUSTRY AND SECURITY (Aug. 21, 2023), https://www.bis.doc.gov/index.php/documents/about-bis/newsroom/press-releases/3313-uvl-august-21-2023/file

109. *See* Nathan Borney, *Nvidia Shares Plunge as DeepSeek Promises New AI Path*, AXIOS (Jan. 27, 2025), https://www.axios.com/2025/01/27/nvidia-shares-deepseek-china-ai.

110. Dario Amodei, *On DeepSeek and Export Controls*, (Jan. 2025), https://darioamodei.com/on-deepseek-and-export-controls.

111. Id.

continued reliance on advanced EUV lithography technology from ASML.[112] Chinese firms are also exploring photonics-based alternatives to EUV, such as steady-state microbunching (SSMB).[113] Development of experimental alternatives are unlikely to be major factors in the near term but could have ramifications for the trajectory of Chinese chip and AI development a few years in the future.[114] In a May 2024 speech, Ye Tianchun, Chairman of the Integrated Circuit Branch of the China Semiconductor Industry Association emphasized the need to find new development paths, as "path dependence is currently restricting the [high-end] development of China's integrated circuit industry."[115] United States efforts to keep up with traditional chip technology with ever more stringent export controls could be futile if the technology is no longer relevant.

Lastly, current U.S. controls do not cover legacy, or "mature" chip technology. This is in-line with stated U.S. goals of only restricting cutting-edge development, but policymakers may be overlooking various security implications through this tactic. For example, most U.S. weapons systems, other than those that involve cutting-edge AI or supercomputing, depend on legacy chips (partially because service lives of weapons systems are long), and this is presumably the case for Chinese weapons as well.[116] Modern militaries can still function at a high level even under restricted access to advanced node chips, as shown by the Russian military in Ukraine.[117] China is a dominant player in manufacturing legacy chips, accounting for 30% (projected to increase to 46% in 10 years) of global production of

112. Paul Triolo, *The Evolution of China's Semiconductor Industry Under U.S. Export Controls*, American Affairs Journal (Nov. 20, 2024), https://americanaffairsjournal.org/2024/11/the-evolution-of-chinas-semiconductor-industry-under-u-s-export-controls/#_ednref73.

113. *Id.*

114. *Id.*

115. Ye Tianchun, Remarks at the 26th Annual Integrated Circuit Manufacturing Conference (May 23, 2024) (trans. Google Translate), https://www.eetrend.com/content/2024/100581277.html.

116. JARED MONDSCHEIN, JONATHAN W. WELBURN, DANIEL GONZALES, SECURING THE MICROELECTRONICS SUPPLY CHAIN 5-6 (RAND, Feb. 2022). *See also* Robert D. Atkinson, *Stronger Semiconductor Export Controls on China Will Likely Harm Allied Semiconductor Competitiveness*, INFORMATION TECHNOLOGY & INNOVATION FOUNDATION (Oct. 12, 2023), https://itif.org/publications/2023/10/12/stronger-semiconductor-export-controls-on-china-will-likely-harm-allied-semiconductor-competitiveness/.

117. *See* The Critical Effort to Combat Illicit Chip Diversion, SEMICONDUCTOR INDUSTRY ASSOCIATION (Apr. 11, 2024), https://www.semiconductors.org/the-critical-effort-to-combat-illicit-chip-diversion/.

chips in the 50 to 180 nm range.[118] Doubling down on investment in legacy chips instead of developing domestic alternatives to advanced node technology could also serve as an alternative pathway for driving domestic innovation.[119] China continues to invest heavily in this area, where they hold a competitive advantage vis-a-vis U.S. industry. This is no secret; U.S. lawmakers have already expressed concern at the potential for China dumping cheap legacy chips on the U.S. market and have suggested tariffs to address this risk.[120] However, U.S. politicians and policymakers have not expressed similar concerns about the military implications of Chinese investment in legacy chipmaking.

X. POSSIBLE STEPS FOR THE NEAR FUTURE

U.S. export controls are not going anywhere anytime soon. Even with the re-election of Donald Trump in November 2024, U.S. policy seems likely to stay on the same trajectory. Rescinding export controls in any way is a political dead end. However, there are measures that the United States can take to reduce negative consequences from export controls.

One (admittedly unlikely) measure is opening up opportunities for investment by Chinese firms in U.S. semiconductor manufacturing, whether it be through extending CHIPS subsidies or other methods. It should be noted that CHIPS funding in some cases is now in limbo due to the Trump administration's hostility towards the CHIPS Act. Wolfspeed, for example, has seen its stock plummet and has been forced to cut jobs as its funding has stalled.[121] The United States has a technological lead for the time being in cutting-edge chip technology, China has an edge in other areas, namely efficient large-scale manufacturing of legacy node chips. U.S. politicians have long decried Chinese industrial espionage, which, although real, is only a part of how Chinese firms acquired manufacturing expertise. Over the years, Chinese firms welcomed foreign investment in manufacturing facilities, which allowed them to access foreign technology—in effect, trading market access for process knowledge. The United States can do the

118. Ken Moriyasu, *U.S. Nervous About Flood of Older Generation Chips From China*, NIKKEI ASIA (Jan. 9, 2024), https://asia.nikkei.com/Business/Tech/Semiconductors/U.S.-nervous-about-flood-of-older-generation-chips-from-China.

119. He Pengyu, *Chinese Semiconductors and Alternative Paths to Innovation*, HIGH CAPACITY (SUBSTACK) (Mar. 19, 2025), https://www.high-capacity.com/p/chinese-semiconductors-and-alternative.

120. *Id.*

121. Zachery Eanes, *Wolfspeed Cuts More Jobs as Trump Calls CHIPS Act "Horrible"*, AXIOS (Mar. 7, 2025), https://www.axios.com/local/raleigh/2025/03/07/wolfspeed-cuts-more-jobs-as-trump-calls-chips-act-horrible.

same with semiconductor manufacturing.[122] China's use of this approach in the automotive sector was not entirely successful with internal combustion engine cars, but Chinese companies developed expertise with EV's to the point where European firms are engaging in joint ventures to gain access to Chinese EV technology.[123] In parallel, most current U.S. chipmaking capacity is in legacy nodes; perhaps, U.S. production could be improved through the same avenues China improved electric vehicle technologies.[124] Moreover, while Chinese involvement in domestic U.S. chip manufacturing could raise security concerns, the United States has stepped up national security review through CFIUS and other measures.[125]

Yet, political constraints may preclude the point above; a more realistic, though perhaps equally unlikely, measure the United States can take now is easing restrictions on scientific research collaboration between American and Chinese scientists, and maintaining pathways for Chinese students and academics to study in the US. At a basic level, the Trump administration is going in the wrong direction with ongoing revocations of student and employment visas. Reports say upwards of 1300 students have lost visas, many of them Chinese.[126] The ultimate extent of these revocations is unclear. Restrictions in the form of criminal prosecutions exist as well. In 2022, the DOJ shut down its China Initiative, which was implemented under the Trump administration and was aimed at prosecuting industrial espionage cases. The initiative stumbled on multiple occasions when prosecutions targeted professors on charges such as grant fraud which either lacked evidentiary bases or had little relevance to national security.[127] Nevertheless, it is unclear whether the DOJ actually changed its approach, even under the Biden administration—the number of China-related

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122. *See* Noah Smith, *Interview: Dan Wang, China Specialist*, NOAHPINION (May 18, 2023), https://www.noahpinion.blog/p/interview-dan-wang-china-specialist.

123. Yueyuan Selina Xue et al., *China's Automotive Odyssey: From Joint Ventures to Global EV Dominance*, IMD (Jan. 26, 2024), https://www.imd.org/ibyimd/innovation/chinas-automotive-odyssey-from-joint-ventures-to-global-ev-dominance/.

124. SEMICONDUCTOR FABS: CONSTRUCTION CHALLENGES IN THE UNITED STATES (MCKINSEY & COMPANY, Jan. 27, 2023), https://www.mckinsey.com/industries/industrials-and-electronics/our-insights/semiconductor-fabs-construction-challenges-in-the-united-states. (See Exhibit 2).

125. Brooks E. Allen et al., *CFIUS' Proposed Rule: More Questions, Tighter Time Frames and Higher Penalties*, SKADDEN (Apr. 24, 2024), https://www.skadden.com/insights/publications/2024/04/cfius-proposed-rule?sid=61e28767-20e0-4ec1-89e4-5daf539959e8.

126. *See* Philip Marcelo, *International Student's College Plans Derailed After U.S. Revokes Visa*, AP NEWS (Apr. 13, 2025), https://apnews.com/article/international-student-f1-visa-revoked-college-f12320b435b6bf9cf723f1e8eb8c67ae.

127. Josh Gerstein, *DOJ Shuts Down China-Focused Anti-Espionage Program*, POLITICO (Feb. 23, 2022), https://www.politico.com/news/2022/02/23/doj-shuts-down-china-focused-anti-espionage-program-00011065.

prosecutions remained high after the China Initiative shut down, to over 2,000 cases in May 2022, doubling from 2020.[128] Perhaps this is already the case, but the DOJ should ensure that the scale of its enforcement efforts matches the scale of the Chinese industrial threat. Despite the existence of some Chinese industrial espionage, the United States arguably benefits more from scientific collaboration than China does. The Wall Street Journal reported last year that "between 2017 and 2021, U.S.-China collaborations accounted for 27% of U.S.-based scientists' high-quality research in nanoscience, for example, but only 13% of China-based scientists.' The gap in telecommunications was even wider, with collaborations accounting for 10% of China's output but more than 33% of the United States'."[129] U.S. intelligence agencies should also stop pressuring U.S. academic institutions from restricting unclassified research, which is unclassified for a reason—it's often basic research not directly related to national security.[130]

At a broader level, the US needs a much clearer strategy for ensuring that U.S. companies are able to continue to fund R&D at an adequate level. Much of the funding and public messaging in particular around the CHIPS Act focuses on investing in domestic fabrication abilities. While this may be an important part of partially on-shoring supply chains, any effort to pursue even partial decoupling via export controls needs to be paired with industrial policy that recognizes the importance of design and R&D, the foundation of our domestic industry. Industrial policy should take seriously the question of how to ensure continued R&D funding streams in the context of increasingly restricted access to the China market for U.S. firms.

XI. CONCLUSION

Ultimately, the United States should seek to limit decoupling with China in the realm of semiconductors as much as possible. The impetus behind export controls and the recognition that advanced Chinese military capabilities could pose a national security threat to the United States is not

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128. Leo Tsao et al., *The End of the China Initiative and the Future of U.S. Enforcement Against Chinese Companies*, PAUL HASTINGS (May 23, 2022), https://www.paulhastings.com/insights/client-alerts/the-end-of-the-china-initiative-and-the-future-of-u-s-enforcement-against#_edn6. For examples of recent enforcement actions, *see FACT SHEET: Disruptive Technology Strike Force Efforts in First Year to Prevent Sensitive Technology from Being Acquired by Authoritarian Regimes and Hostile Nation-States*, DEPARTMENT OF JUSTICE (Feb. 16, 2024).

129. Karen Hao & Sha Hua, *The U.S. Is Turning Away From Its Biggest Scientific Partner at a Precarious Time*, WALL STREET JOURNAL (Aug. 16, 2023), https://www.wsj.com/world/china/the-u-s-is-turning-away-from-its-biggest-scientific-partner-at-a-precarious-time-9fb9adaa.

130. Philip H. Bucksbaum, et al., *China at Risk: National Security Implications of U.S. Science and Technology Policy*, AMERICAN PHYSICAL SOCIETY (Aug. 9, 2021), https://www.aps.org/publications/apsnews/updates/china-risk.cfm.

necessarily misguided. The Biden administration was also aware of the need to ensure that the U.S. chip industry is not unnecessarily harmed by export controls and took major steps to this end, as exemplified by the CHIPS Act. Now, the second Trump administration should be more clear-eyed about the longer term ramifications of export controls on U.S. industry in particular. It should seek to more clearly define how hobbling the Chinese semiconductor industry protects U.S. national security.[131] An ever-expanding set of export controls, which is the pattern suggested by officials in both the Biden and Trump administrations, as well as by lawmakers in Congress, only feeds into Chinese government claims that the United States is using export controls as a protectionist economic measure under the guise of national security. In 2022, China initiated a WTO dispute complaint against the United States along these lines, which remains unresolved.[132] Swift WTO action is unlikely, due to an ongoing blockade by the United States of new WTO Appellate Body member appointments.[133] At some point in the not-too-distant future, Chinese development may not be reliant at all on the United States or even exceed it. If this becomes the case, existing rationales for maintaining export controls become moot and the controls become self-defeating, as U.S. technology falls further behind while remaining isolated from Chinese advances. There is no objective way of determining whether we are nearing or at this point, and it only becomes harder as Chinese development takes paths that U.S. policymakers have ever-more limited insight into. Decoupling in the chips and AI realm also has consequences beyond U.S.-China dynamics, as it limits prospects for cooperation on areas of global concern, such as AI governance frameworks and safeguards.[134]

U.S. policymakers should be aware of potential national security threats posed by Chinese semiconductor development and associated applications to weapons development. But when it comes to simply maintaining a lead in advanced chip technology, the United States should focus on strengthening its domestic semiconductor industry—and national security-based controls targeted at China will not further this objective in the long run.

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131. *See generally,* Jon Bateman, *supra* note 41.

132. *China initiates WTO dispute complaint targeting US semiconductor chip measures*, WORLD TRADE ORGANIZATION (Dec. 15, 2022), https://www.wto.org/english/news_e/news22_e/ds615rfc_15dec22_e.htm.

133. *See U.S. Views on the Functioning of the WTO Dispute Settlement System*, U.S. OFF. TRADE REP., https://ustr.gov/issue-areas/enforcement/us-views-functioning-wto-dispute-settlement-system, (last visited May 5, 2025).

134. Paul Triolo, *The Confusion Around AI Diffusion*, AISTACKDECRYPTED (SUBSTACK) (Apr. 2025), https://pstaidecrypted.substack.com/p/the-confusion-around-ai-diffusion.