# How do US export controls on advanced semiconductors to China reshape the geopolitical power structures of global technology governance and alter the long-term systemic risk profiles for American national security?

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## Executive Summary

US export controls on advanced semiconductors to China are reshaping global technology governance by replacing interdependent market networks with state-managed chokepoints, leading to a bifurcated "One World, Two Systems" model [3, 7, 18]. While these controls consolidate short-term US strategic leverage by impeding Chinese military modernization and AI development [5, 6, 10], evidence suggests they simultaneously alter long-term systemic risk profiles for American national security by accelerating China's drive for technological self-sufficiency, straining allied consensus, and imposing significant economic costs on US firms [5, 7, 17, 18]. The long-term efficacy of these controls in preserving US technological dominance remains a subject of genuine debate, as China's algorithmic innovations and state-backed investments work to circumvent hardware bottlenecks, while US firms face revenue losses that domestic subsidies may not fully offset [2, 7, 13].

## Key Findings

### Reshaping Global Technology Governance through State-Managed Chokepoints

US export control policy explicitly restructures global technology governance by replacing interdependent market networks with state-managed chokepoints, ending the belief that economic interdependence promotes stability [7]. The US now uses its dominance over critical supply chain chokepoints-such as chip design, advanced manufacturing equipment, and high-end AI chips-to gain strategic advantage [6, 7]. This shift is driving global technology governance toward a bifurcated "One World, Two Systems" model, where both the US and China prioritize domestic capabilities to reduce reliance on adversaries [3, 7, 18]. US design companies like Qualcomm, Nvidia, Broadcom, and

Advanced Micro Devices control 68% of the market share for chip design, which accounts for 45% of the final chip value and requires the most capital and technologically-intense components [3]. The US strategy has shifted toward an explicit focus on AI [10].

This restructuring creates a tension between consolidating immediate strategic leverage and fragmenting allied consensus, which could erode long-term dominance. The policy consolidates short-term leverage by allowing the US to maintain significant control over key chokepoints in advanced semiconductor supply chains, securing a lead in force multiplier technologies like AI and directly impeding Chinese military modernization [3, 5, 6, 10]. However, US allies view these restrictions as serving protectionist goals rather than purely national security interests [5]. While Japan and the Netherlands cooperate, their regulatory authorities and covered equipment types differ from US rules, undermining a unified front [5].

## Impact on Chinese Capabilities: Accelerated Self-Sufficiency Amidst Persistent Bottlenecks

US export controls have triggered a self-reinforcing causal chain in China, where restricted access forces massive state R&D investment, accelerates domestic substitution, and drives algorithmic efficiency innovations [7, 8, 13]. Affected Chinese firms sharply reduced imports of controlled products while increasing R&D spending by 49.1%, patenting by 41.3%, and active inventors by 30.4% [4]. China is deploying up to $70 billion in state-backed semiconductor funding and forcing public-sector adoption of domestic chips through government procurement lists [5, 9]. To compensate for hardware deficits, Chinese AI labs have pioneered algorithmic efficiency innovations, such as mixture-of-experts architectures, sparse attention, and aggressive quantization techniques [2]. These software optimizations allowed models like DeepSeek's R1 to achieve competitive benchmark scores with substantially less computational resources than US counterparts [10, 13]. As Brookings notes, "China's top AI models continue to lag behind American frontier models by several months or more," and "Chinese AI labs, particularly startups, are constrained by access to compute, due to a combination of U.S. export controls on advanced AI chips and limited capital resources" [2].

However, fundamental bottlenecks in EUV lithography and advanced packaging create a persistent capability ceiling that prevents the complete neutralization of the gap. China lags an estimated three years behind the US and five years behind Taiwan in global semiconductor production [8]. While SMIC achieved a 7-nanometer processor for Huawei in September 2023, its ability to scale production is dramatically constrained, yielding only low tens of thousands of wafers monthly compared to planned hundreds of thousands [6, 7, 13]. Restrictions on EUV tools hinder memory chip firm CXMT from producing cutting-edge High-Bandwidth Memory (HBM), leaving a large performance gap between Chinese HBM2 and providers in Korea and the US [10, 18]. Consequently, China remains a marginal producer of AI chips; for 2025, Huawei was projected to produce only 200,000 AI chips, whereas China legally imported around 1 million downgraded Nvidia chips in 2024 [10]. These hardware deficits directly limit deployment, forcing firms like DeepSeek to restrict API access due to inference compute limitations [10].

## Altering US National Security Risk Profiles: Economic Costs and Supply Chain Vulnerabilities

Export controls inflict severe economic costs on US firms, threatening American technological leadership. US semiconductor companies face projected annual sales losses of $83 billion and 124,000 job losses [7, 17]. Major industry players like Nvidia, Intel, and Qualcomm collectively generate over $50 billion in annual revenue from the Chinese market [5]. Affected US suppliers have already experienced a $130 billion decline in market capitalization, alongside reductions in profitability and employment [11]. This financial drag directly threatens research and development (R&D) budgets, potentially compromising the global competitiveness of US semiconductor firms [7, 17].

To counteract these losses, the CHIPS Act of 2022 authorizes $280 billion in funding to boost domestic research and manufacturing [11, 15]. However, evidence suggests these subsidies are insufficient to fully offset the financial drag. In the three years following the implementation of export controls, US firms failed to form new supply chain relations with alternative customers either domestically or in politically aligned regions, indicating a lack of successful reshoring or friendshoring [11].

The forced decoupling of advanced semiconductor supply chains also increases systemic national security risks for the US by over-concentrating manufacturing dependencies in politically volatile regions like Taiwan [3, 13]. TSMC produces 50% of the world's semiconductors and over 90% of advanced nodes, establishing a critical chokepoint that leaves US strategic autonomy highly vulnerable to regional geopolitical shocks or conflict in the Taiwan Strait [3, 13, 14]. Critically, 100% of the world's most advanced semiconductor manufacturing capacity (below 10 nanometers) is located in Taiwan (92%) and South Korea (8%) [2]. Approximately 75% of global semiconductor manufacturing capacity is located in China and East Asia [2].

This concentration creates vulnerabilities that may outweigh the security gains from restricting Chinese access. The restrictions have inadvertently catalyzed a "Manhattan Project-like program" in China, driving massive state-backed investments and algorithmic innovations aimed at achieving technological sovereignty [2, 9]. If China successfully builds an independent chip ecosystem, the US will lose its chokepoint dominance over critical design and equipment sectors, eroding long-term strategic leverage [7, 9, 13]. Furthermore, China controls around 24% of global capacity for mature node (50-180 nm) chips, a share projected to surge to 50% by 2030 [7, 18]. China extracts 60% of the world's rare earth minerals and handles over 85% of their processing [7]. This dominance provides Beijing with significant leverage to weaponize foundational supply chains or restrict critical materials in retaliation, threatening US industrial bases [7].

## Allied Cooperation and Unilateralism

While the US has aggressively expanded its unilateral jurisdictional reach-such as through December 2024 Foreign Direct Product Rule (FDPR) updates that potentially capture "all of the SME made by any company on Earth"-it has still secured cooperation from Japan and the Netherlands on advanced chipmaking tools like ASML lithography [5, 6, 10, 13, 22]. However, this unilateralism has generated significant skepticism among allies, who view US economic restrictions as serving protectionist goals rather than purely national security interests [5]. This tension manifests in differing authorities and scopes of equipment covered by allied nations compared to the US, preventing a fully unified technology governance framework [5]. For instance, Japan's law lacks re-export restrictions, does not restrict non-resident Japanese citizens working on semiconductor projects abroad, and permits outward investment on an after-the-fact reporting basis without security screening [5, 12, 20]. The Netherlands' framework has a narrower scope of lithography controls, only banning DUV equipment for specific Chinese companies rather than imposing a country-wide ban [19].

These regulatory differences have been actively used by Chinese entities to secure advanced equipment. ASML exploited the DUV exemption category by selling a majority of its DUV immersion lithography systems to China in 2024 and dry lithography systems in 2023 and 2024 [19]. The Chinese Communist Party (CCP) stockpiled this DUV equipment at sophistication levels just below current restrictions [1, 16]. Chinese companies used "entity obfuscation," such as Huawei utilizing sprawling networks of affiliated companies, to circumvent end-user controls and acquire older but highly capable ASML DUVi machines [1, 9]. Japanese firm Tokyo Electron (TEL) also increased its sales to China, receiving 44% of its revenue from Chinese entities in 2024 as US controls tightened [1, 16]. Ultimately, these regulatory divergences contribute to a fragmented global technology ecosystem moving toward a "One World, Two Systems" model, where the coalition's enforcement capabilities are diluted by inconsistent allied participation and varying control boundaries [5, 12, 18].

## Historical Context: Delaying Capabilities While Accelerating Indigenous Development

The provided research context does not contain information regarding the historical record of COCOM restrictions or 1980s supercomputing limits. However, the impact of early Huawei entity list actions beginning in 2019 and subsequent export controls reveals a dual outcome where measures simultaneously delay specific high-end capabilities while accelerating indigenous development cycles [4, 6, 8].

Evidence suggests these controls successfully delay adversary capabilities in the short term by creating significant production bottlenecks. US restrictions have caused Chinese semiconductor output to plummet and left China lagging an estimated three years behind the United States and five years behind Taiwan in global production [7, 8]. For instance, while Huawei managed to produce a 7-nanometer processor for its Mate 60 Pro smartphone in September 2023 using domestic SMIC chips, the ability to scale this production was dramatically constrained, with output limited to the low tens of thousands of wafers monthly [6, 13]. Restrictions on extreme ultraviolet (EUV) tools have hindered Chinese firms like ChangXin Memory Technologies from producing cutting-edge high-bandwidth memory (HBM), maintaining a large performance gap compared to US and Korean providers [10, 18]. As of 2026, Nvidia's data center infrastructure accounts for over 85% of global AI accelerator spending, which crosses $120 billion annually [8]. By 2025, over 70% of global AI workloads in defense research, military simulation, and intelligence data analytics utilized Nvidia GPU architecture [8].

Conversely, the research strongly indicates that these embargoes consistently accelerate indigenous development cycles and spur innovation in targeted states. Affected Chinese firms sharply reduced imports of controlled products while increasing R&D spending by 49.1%, patenting activity by 41.3%, and active inventors by 30.4% [4]. Viewing semiconductor self-reliance as a sovereign imperative, China has launched state-backed investment funds totaling up to $70 billion to build a resilient domestic supply chain [2, 9]. This accelerated development has yielded competitive results despite hardware deficits; Chinese AI labs have compensated for limited compute by pioneering algorithmic efficiency innovations [2]. Consequently, firms like DeepSeek have produced highly competitive large language models that rival US counterparts using substantially fewer computational resources [10, 13].

## Implications

The US export controls on advanced semiconductors to China have profound implications for global technology governance and American national security. The shift from interdependent market networks to state-managed chokepoints signifies a fundamental reorientation towards technological sovereignty, fostering a bifurcated global technology ecosystem [3, 7, 12, 18]. For the US, this strategy creates immediate strategic advantages by impeding China's access to critical AI and advanced computing capabilities, thereby slowing its military modernization [5, 6, 10]. However, this comes at the cost of significant economic strain on US semiconductor firms, with projected annual sales losses of $83 billion and a $130 billion decline in market capitalization for affected suppliers [7, 11, 17]. These financial pressures risk undermining the very R&D and innovation velocity necessary for long-term US technological leadership, as domestic subsidies like the CHIPS Act may not fully offset the revenue drain [7, 11, 15, 17].

Furthermore, the policy inadvertently accelerates China's drive for self-sufficiency, evidenced by massive state investments and algorithmic innovations that aim to circumvent hardware limitations [2, 4, 9, 13]. While fundamental bottlenecks in advanced manufacturing persist, China's growing dominance in mature node chips (projected to reach 50% of global capacity by 2030) and rare earth processing provides Beijing with significant retaliatory leverage against global supply chains [7, 18]. The unilateral expansion of US jurisdictional reach also strains allied cooperation, leading to divergent regulatory frameworks and diluting the collective ability to enforce a unified technology governance approach [5, 12, 18]. This fragmentation, coupled with the over-concentration of advanced manufacturing in politically volatile regions like Taiwan, introduces systemic national security risks that could outweigh the short-term gains from restricting Chinese access [3, 7, 13, 14].

## Limitations and Caveats

The long-term outcomes of US export controls are still unfolding, and the available evidence presents a complex picture with genuine debate on the interpretation of current trends. Direct quantitative data on specific R&D budget cuts for major US semiconductor firms attributable to these controls is not provided, making it difficult to precisely assess the impact on long-term innovation velocity [7, 17, 21]. While the CHIPS Act authorizes $280 billion, the annual allocation and its effectiveness in offsetting revenue losses are not fully detailed [11, 15]. The precise technical specifications and quantified performance gaps of Chinese domestic chips in AI training workloads are also limited, with current data focusing more on node size and production volume rather than direct computational benchmarks against leading-edge US or TSMC chips [8, 10]. Additionally, the historical record of prior US technology embargoes (e.g., COCOM restrictions, 1980s supercomputing limits) is not covered in the provided research, limiting a broader historical comparison [4, 6, 8]. No US semiconductor firms have publicly reported canceling or defunding named advanced-node research projects due to export controls [21].

## Sources


[1] [gov] Crs Product - congress.gov - https://www.congress.gov/crs-product/R48642

[2] [edu] Competing Ai Strategies For The Us And China - brookings.edu - https://www.brookings.edu/articles/competing-ai-strategies-for-the-us-and-china/

[3] [edu] Us China Semiconductor Production Capacities - saisreview.sais.jhu.edu - https://saisreview.sais.jhu.edu/us-china-semiconductor-production-capacities/

[4] [edu] Download.Aspx - hbs.edu - https://www.hbs.edu/ris/download.aspx?name=25-004.pdf

[5] Small Yard High Fence U S Economic Restrictions On The Peopl - gssr.georgetown.edu - https://gssr.georgetown.edu/the-forum/topics/geoeconomics/small-yard-high-fence-u-s-economic-restrictions-on-the-peoples-republic-of-china/

[6] Where Chips Fall Us Export Controls Under Biden Administrati - csis.org - https://www.csis.org/analysis/where-chips-fall-us-export-controls-under-biden-administration-2022-2024

[7] Breaking The Circuit Us China Semiconductor Controls - fpri.org - https://www.fpri.org/article/2024/09/breaking-the-circuit-us-china-semiconductor-controls/

[8] The Chip War Assessing Us Policy Against China Moving Forwar - cpreview.org - http://www.cpreview.org/articles/2024/11/the-chip-war-assessing-us-policy-against-china-moving-forward

[9] [blog] Chinas Chip War Strategy Is Fixed Heres Why Americas Should  - nationalinterest.org - https://nationalinterest.org/blog/techland/chinas-chip-war-strategy-is-fixed-heres-why-americas-should-be-too

[10] Us Chip Export Controls China Ai - ai-frontiers.org - https://ai-frontiers.org/articles/us-chip-export-controls-china-ai

[11] Staff Reports - newyorkfed.org - https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr1096.pdf?sc_lang=en

[12] Us China Technological Decoupling A Strategy And Policy Fram - carnegieendowment.org - https://carnegieendowment.org/research/2022/04/us-china-technological-decoupling-a-strategy-and-policy-framework

[13] Us Export Controls On Ai And Semiconductors Two Divergent Vi - laweconcenter.org - https://laweconcenter.org/resources/us-export-controls-on-ai-and-semiconductors-two-divergent-visions/

[14] SiliconTriangle Conclusion 230828 - hoover.org - https://www.hoover.org/sites/default/files/research/docs/SiliconTriangle_Conclusion_230828.pdf

[15] 7 Steinfeld Formatted EDT 2 - nyujilp.org -
https://nyujilp.org/wp-content/uploads/2025/09/7-Steinfeld_Formatted_EDT-2.pdf
[16] Us Policy Chip Sales China Semiconductor Global Tech - weforum.org -
https://www.weforum.org/stories/2025/08/us-policy-chip-sales-china-semiconductor-global-tech/
[17] Decoupling Risks Semiconductor Export Controls Harm Us Chipm - itif.org -
https://itif.org/publications/2025/11/10/decoupling-risks-semiconductor-export-controls-harm-us-chipmakers-innovation/
[18] The Comparison Of The Us China Semiconductor Competition Pol - ine.org.pl -
https://ine.org.pl/en/the-comparison-of-the-us-china-semiconductor-competition-policies/
[19] [gov] Selling The Forges Of The Future - chinaselectcommittee.house.gov -
https://chinaselectcommittee.house.gov/sites/evo-subsites/selectcommitteeontheccp.house.gov/files/evo-media-document/selling-the-forges-of-the-future.pdf
[20] Key Differences Remain Between Us And Japanese Advanced Semi - csis.org -
https://www.csis.org/blogs/perspectives-innovation/key-differences-remain-between-us-and-japanese-advanced-semiconductor
[21] Report Emerging Resilience In The Semiconductor Supply Chain - semiconductors.org -
https://www.semiconductors.org/wp-content/uploads/2024/05/Report_Emerging-Resilience-in-the-Semiconductor-Supply-Chain.pdf
[22] Us Strengthens Export Controls On Advanced Computing Items - hklaw.com -
https://www.hklaw.com/en/insights/publications/2024/12/us-strengthens-export-controls-on-advanced-computing-items