

CHOKEPOINTS CUT BOTH WAYS: U.S. Advanced Semiconductor Controls and China's Critical-Mineral and Rare- Earth Controls, October 2022–June 2026

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Abstract

Export controls are increasingly central to U.S.-China economic competition. This article compares U.S. restrictions on advanced semiconductors and semiconductor-manufacturing capabilities with China's controls on selected critical minerals, rare-earth elements, magnets, and related technologies between October 2022 and June 2026. It distinguishes three forms of strategic leverage: denial, bargaining, and informational leverage. Drawing on weaponised-interdependence theory, the analysis examines regulatory design, implementation, disruption, and adaptation. The comparison suggests that U.S. controls can slow frontier capability accumulation but depend heavily on allied coordination, while Chinese controls can generate faster supply disruption but also stronger incentives for diversification. In both cases, leverage is conditional on administrative capacity, coalition cohesion, substitutability, and the speed of network escape.

Keywords: weaponised interdependence; semiconductors; critical minerals; rare earths; export controls; geoeconomics; United States-China rivalry; supply-chain security; economic statecraft

1. Introduction

International commercial interdependence was historically presumed to act as a deterrent to geopolitical conflict by raising the economic costs associated with wars. However, intensifying strategic rivalry between the United States and China has exposed the dual-edged nature of such integration. Contemporary global production systems, while highly interconnected, are structured around a limited set of critical nodes, comprising specialized technologies, discrete stages of processing, key firms, and specific legal jurisdictions, through which states can exert control, impose restrictions, or extract data. Modern economic statecraft thus extends beyond traditional instruments such as tariffs and comprehensive sanctions, increasingly relying on targeted constraints directed at essential inputs and services underpinning advanced manufacturing.

Since October 2022, the United States has systematically restricted China's access to advanced computing chips, semiconductor-manufacturing equipment, design software, and associated technical support. China's regulatory sequence developed in stages: licensing for gallium and germanium began in August 2023, selected graphite products followed in December 2023, antimony and other controls expanded in 2024, and selected medium and heavy rare-earth items were added in April 2025. Beijing announced a broader extraterritorial package in October 2025 but suspended it in November 2025 through November 2026.

Advanced semiconductors and rare-earth permanent magnets occupy fundamentally different positions within global value chains, and the categories "critical minerals" and "rare earths" are neither synonymous nor functionally equivalent. The semiconductor supply chain exhibits distributed chokepoints, dependent on U.S. leadership in chip design and intellectual property, Dutch expertise in photolithography, Japanese dominance in materials and precision equipment, Taiwanese foundry capacity, and South Korean memory production. By contrast, China's strategic advantage in rare earths is concentrated in downstream stages: specifically, separation, refining, and the manufacture of high-performance magnets. These regimes diverge significantly in the speed and mechanism of pressure application, reliance on third-party cooperation, and the feasibility of substitution by affected actors.

Against this background, the study asks: under what conditions, and through what mechanisms, have U.S. semiconductor controls and Chinese restrictions on critical minerals and rare earths generated strategic leverage between 2022 and 2026? Strategic leverage is treated as three distinct outcomes: denial, bargaining, and informational leverage. The central argument is that technological chokepoints tend to produce slower and less observable capability effects because they operate through distributed networks and allied coordination, whereas physical-processing chokepoints can generate faster and more visible disruption but may accelerate substitution and diversification. The contribution is to compare these mechanisms using a common evidentiary framework while distinguishing legal reach, observed disruption, bargaining claims, and adaptation.

2. Literature Review and Analytical Framework

2.1 Economic statecraft and weaponised interdependence

Research on economic statecraft distinguishes between strategies designed to erode an adversary's material capabilities and those intended to induce behavioral change. Classical scholarship on sanctions underscores the limitations of coercive measures when political stakes are high, evasion mechanisms exist, and the imposing state bears substantial economic costs (Drezner, 1999; Pape, 1997). In contrast to broad trade embargoes, export controls targeting dual-use technologies may prioritize capability denial over immediate behavioral concessions. Success in such cases is not necessarily measured by compliance but by constraints on scale, increased development timelines, or delayed access to critical inputs.

Farrell and Newman's (2019) theory of weaponized interdependence posits that states can convert structural asymmetries in global networks into strategic leverage by controlling pivotal nodes. This framework extends earlier work on complex interdependence, which recognized that deep economic integration generates both mutual benefits and asymmetric vulnerabilities (Keohane & Nye, 1977). Two central mechanisms underpin this dynamic: the chokepoint effect, whereby a state restricts access to a critical network juncture, and the panopticon effect, through which centralized transactional visibility enables surveillance and intelligence gathering. As illustrated in Figure 1, the conceptual model demonstrates how global interdependence produces uneven network centrality, thereby creating conditions for targeted economic coercion.

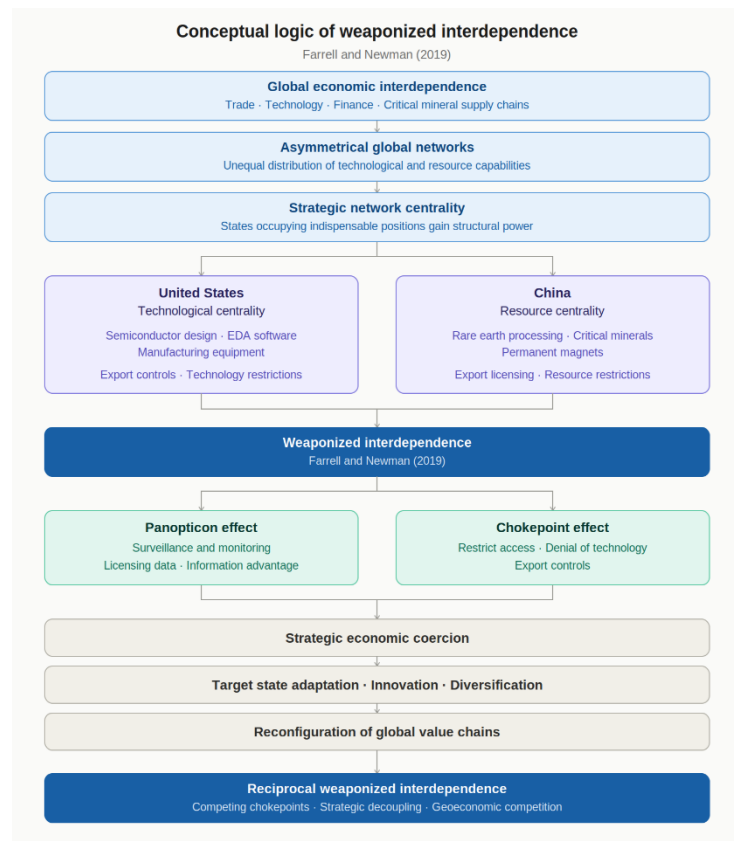


Figure 1. *Conceptual logic of weaponised interdependence, adapted from Farrell and Newman (2019).*

Heath (2025) elucidates the legal foundations of network power. Reporting obligations, licensing systems, end-user verification and jurisdictional rules make commercial relationships legible and enforceable. These legal constructs are instrumental in shaping the operational scope of chokepoints. This is particularly evident in U.S. foreign-direct-product rules and China’s proposed regulations on foreign-produced goods incorporating Chinese-sourced rare-earth materials. Law thus functions not merely as an enforcement mechanism but as a constitutive element in expanding the reach of strategic control.

2.2 Chokepoint power, adaptation and network escape

A central concern in contemporary scholarships is the sustainability of network-based strategic advantages after coercive deployment. Karacali (2025) posits that weaponised interdependence

may entail an inherent self-undermining mechanism. Mechanisms such as the “double panopticon” and “architectural conservatism” suggest that activating a chokepoint not only reveals the target’s dependency but also exposes structural fragilities within the network itself. Over time, such revelations may erode the dominant node’s capacity for innovation and diminish its competitive edge.

Woods (2025a) identifies a parallel process, network escape, whereby sustained coercive measures incentivize targeted states and firms to cultivate indigenous capabilities, identify alternative supply sources, and reduce reliance on the sender-controlled network. These dynamics do not necessarily entail a deterministic decline in the initiator’s power. Indeed, network fragmentation may constitute a deliberate strategic objective, and any attenuation of influence hinges on the actual emergence and viability of substitute networks. As Bolhuis et al. (2023) underscore, claims of erosion must be substantiated empirically rather than presumed.

A comparable dynamic manifests in natural-resource supply chains. Kalantzakos (2017) contends that China’s dominance in rare earths stems from its integration across multiple stages of the value chain, including extraction, processing, and downstream manufacturing. Zhang (2024), however, observes that the impact of resource curtailments tends to peak in the short term, as scarcity and price escalation stimulate substitution efforts. The 2010 disruption in rare-earth supplies to Japan exemplifies this dual outcome: it revealed acute vulnerabilities arising from supply concentration while simultaneously prompting governments and firms to increase stockpiling, expand recycling infrastructure, diversify sourcing, and invest in alternative refining technologies (Kwon, 2017; Roth & VerWey, 2026; Vekasi, 2019). Bond and Trachtman (2016) further argue that even after the World Trade Organization resolved the dispute, the underlying strategic exposure linked to concentrated supply persisted.

These observations do not invalidate the framework of weaponised interdependence. Instead, they call for analytical refinement beyond mere identification of chokepoint control. Four additional dimensions merit scrutiny: the speed with which a chokepoint can be operationalised, the enforceability of restrictions, the economic and strategic costs borne by the sender, and the adaptive capacity of the target. Moreover, the role of multinational enterprises

must be systematically integrated. While states define the legal parameters and regulatory scope of export controls, implementation is mediated by firms; such as NVIDIA, ASML, TSMC, and rare-earth processors whose technological and commercial constraints ultimately shape the reach and efficacy of state-led measures.

2.3 Semiconductor and rare-earth chokepoints

The semiconductor value chain is exceptionally specialised. United States firms remain prominent in chip design, electronic-design-automation software and several equipment categories; the Netherlands is pivotal in advanced lithography; Japan supplies important materials and equipment; Taiwan leads advanced logic fabrication; and South Korea is central to memory production (U.S. Government Accountability Office, 2022). This distribution makes semiconductor coercion powerful but institutionally demanding. American jurisdiction can reach specified foreign-produced items through the Export Administration Regulations and foreign-direct-product rules, yet the regime's effectiveness still depends on cooperation from allied governments and firms.

Scholarship provides competitive assessments. Chorzempa (2023) contends that the October 2022 laws took advantage of true US-controlled chokepoints, shifting policy away from regulating specific enterprises and toward limiting a broader technical ecosystem. Branstetter (2024) warns that restrictions may be permeable, administratively under-resourced, and not properly integrated with long-term innovation policy. Goldberg *et al.* (2024) emphasize accumulated knowledge, scale, and access to foreign technology, meaning that constraints can slow down catch-up even when they cannot completely prevent it. Firm-level data links exposure to US regulations to increased volatility and R&D uncertainty among Chinese semiconductor businesses (Cai & Xie, 2025).

China's position is different across the mineral categories considered here. Gallium, germanium, graphite and antimony are critical-mineral controls but not rare-earth controls. Within the rare-earth chain, China's strongest leverage lies in midstream separation and refining and in downstream permanent-magnet production rather than in reserves alone. The

International Energy Agency (2025a) estimates that China accounted for 91% of global refined output for magnet rare earths and 94% of sintered permanent-magnet production in 2024. This concentration permits physical supply pressure, while licensing reveals information about foreign demand and dependence. That informational effect is narrower than the systemic visibility associated with financial or digital networks and should not be treated as equivalent without evidence.

2.4 Research gap and analytical expectations

Most research on weaponised interdependence examines coercion in a single direction, particularly financial sanctions or technology restrictions. Semiconductor controls and critical-mineral measures are also usually analysed separately. As a result, less is known about reciprocal coercion between major powers that control different nodes within the same production networks.

This comparison addresses that gap by examining technological and material leverage over the same 2022–2026 period using common indicators. It expects U.S. controls to have greater legal and informational reach, but slower and less observable effects on capability accumulation. Chinese controls should generate faster supply disruption because processing and magnet production are highly concentrated, while also increasing incentives to diversify. The key distinction is between denial, bargaining, and informational leverage: disruption does not demonstrate diplomatic capitulation, and legal authority does not by itself establish effective implementation.

Taken together, the literature suggests that chokepoint use changes the target's incentives. It can increase the expected returns to diversification, but network escape still depends on capital, technical capability, time, and alternative suppliers. The central question is therefore not whether leverage disappears after resistance, but how long the sender's advantage persists before adaptation catches up.

2.5 Operationalising strategic leverage

The analysis makes four key distinctions between related but ultimately different concepts. An export control is a legal limitation placed on the export, re-export, transfer, provision, or licensing of any particular category of goods, technology, software, or services; it refers to the instrument itself, not to whether it succeeds. Economic coercion has a broader scope: it refers to the use, or the threat of use, of economic measures to bring about a change in another actor's behaviour, so an export control counts as coercive only when it is being used to impose costs for a behavioural purpose.

Supply-chain dependence refers to the situation in which a state or firm is disproportionately reliant upon another jurisdiction or node for an input, technology, processing stage, or market; such dependence creates vulnerability, but by itself it does not establish coercion or leverage. Strategic leverage refers to the sender's ability to exploit that dependence for a measurable advantage to itself, through denial, bargaining, or information, subject to the enforcement, substitutability, coalition support, and the target's ability to exit the network. These distinctions run through the entire comparison, so that the presence of a control is not taken as proof of coercive success, and concentration is not taken as proof of leverage unless it can be linked with an observable effect.

Each form is assessed against a different set of criteria. Denial is considered in terms of the legal scope actually enforced, the compliance requirements, the disruption to exports or production, the effects at the firm level, and the evidence of substitution. Bargaining is assessed in terms of policy changes, licensing changes, negotiated responses, and documented reactions from counterparts, while alternative explanations are considered. Informational leverage is assessed in terms of the information that the control system produces and the authority's ability to use it. Supply-chain dependence is measured in terms of concentration and the presence of credible substitutes; it is considered as a precondition for leverage rather than as an outcome of leverage. Economic effects are recorded separately from strategic effects, encompassing changes in trade value or volume, production interruptions, price movements, compliance costs, and adaptation. Confidence in the evidence is differentiated between legal reach, observed economic disruption, and causal attribution.

3. Method and Comparative Structure

The article uses a structured comparison of two cases: U.S. controls on advanced semiconductors and associated manufacturing capabilities, and Chinese controls on non-rare-earth critical minerals, rare-earth products, and related technologies. The cases are not treated as equivalent industries; they are compared at the mechanism level as instances of state attempts to exercise leverage through strategically central nodes in global production networks.

To ensure comparability, each case is examined across the same five core dimensions: (1) policy objective: what the issuing government formally seeks to protect or achieve; (2) target: what goods, technologies, firms, transactions, or supply-chain stages are restricted; (3) mechanism: how legal authority is converted into a restriction, including licensing, thresholds, entity controls, end-use rules, or foreign-direct-product jurisdiction; (4) economic effect: the observable changes in trade, production, prices, inventories, compliance costs, or other economic outcomes; and (5) strategic objective: the broader purpose inferred from the policy design and stated objectives, while distinguishing inference from documented government claims. A sixth cross-cutting dimension, adaptation, records substitution, rerouting, stockpiling, domestic capacity-building, and coalition responses. Official regulations and announcements establish legal scope and implementation status, while IEA, USGS, USITC and UN Comtrade materials establish production concentration and observed trade or supply effects. Peer-reviewed research and policy studies are used to assess interpretation and adaptation.

Table 1. Comparative operationalisation and evidence assessment

DIMENSION	UNITED STATES	CHINA
A. CORE COMPARISON DIMENSIONS		
1. Policy objective	Restrict PRC access to advanced computing and semiconductor-manufacturing capabilities relevant to U.S. national security.	Safeguard national security and interests and fulfil stated international obligations while regulating selected strategic mineral and rare-earth exports
2. Target	Advanced computing chips, semiconductor-manufacturing equipment, software/technology, specified entities, end uses and supporting transactions.	Specified gallium, germanium, graphite, antimony, tungsten/tellurium and selected medium/heavy rare-earth items, magnets and related technologies.
3. Mechanism (legal design and implemented reach at cutoff)	Licensing requirements, technical thresholds, end-use and U.S.-person controls, Entity List restrictions, due diligence and foreign-direct-product rules. Case-by-case	Product-specific export licensing, dual-use controls, technology controls and customs enforcement, covering gallium, germanium, graphite, antimony and April 2025 rare-earth items. The October 2025

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	flexibility for specified chips in 2026.	extraterritorial package was suspended.
4. Economic effect (observed)	Restricted access, higher compliance costs and firm uncertainty. Regulatory reach is strongly evidenced, but the long-run capability effect is difficult to quantify from public data.	Sharp short-run export declines and supply disruption for selected materials (some automaker curtailments in April–May 2025), followed by partial recovery as licences were granted.
5. Strategic objective (inferred from design and stated aims, not documented claims)	Slow the acquisition and production of frontier computing capability.	Retain control over strategically concentrated processing and magnet-production nodes and preserve policy space. Bargaining success is not assumed.
B. STRUCTURAL PRECONDITION (SOURCE OF DEPENDENCE)		
Where dependence sits	Distributed across U.S. design software, IP, advanced equipment and allied lithography/foundry capacity in a multinational ecosystem.	Concentrated in Chinese separation, refining, processing knowledge and permanent-magnet production, not reserves alone.

C. CROSS-CUTTING

DIMENSION:

ADAPTATION

Speed and third-party dependence	Slower capability effects; high dependence on allied governments and multinational firms.	Faster inventory and production effects; lower initial coalition dependence.
Adaptation and durability	Rerouting, redesign, indigenous tools, mature-node expansion and more efficient use of available computers.	Stockpiling, recycling, substitution, alternative refining and non-Chinese magnet capacity.

D. INDICATORS OF LEVERAGE TYPE

Denial	Reduced access, higher cost or delay, and verifiable firm/foundry compliance.	Export-volume decline, licensing delay, inventory pressure and production disruption.
Bargaining	Licence conditions and documented policy responses; no assumption that denial equals capitulation.	Selective approvals, timing and negotiated adjustments; suspension alone does not prove causation.

Information	End-user statements, foundry due diligence, customer screening and compliance reporting.	Licence applications reveal users and demand; visibility is narrower and less systemic.
E. EVIDENCE CONFIDENCE	High on legal scope; medium on observed disruption; low-to-medium on long-run capability attribution.	High on concentration and legal scope; medium on short-run disruption; low on bargaining causality.

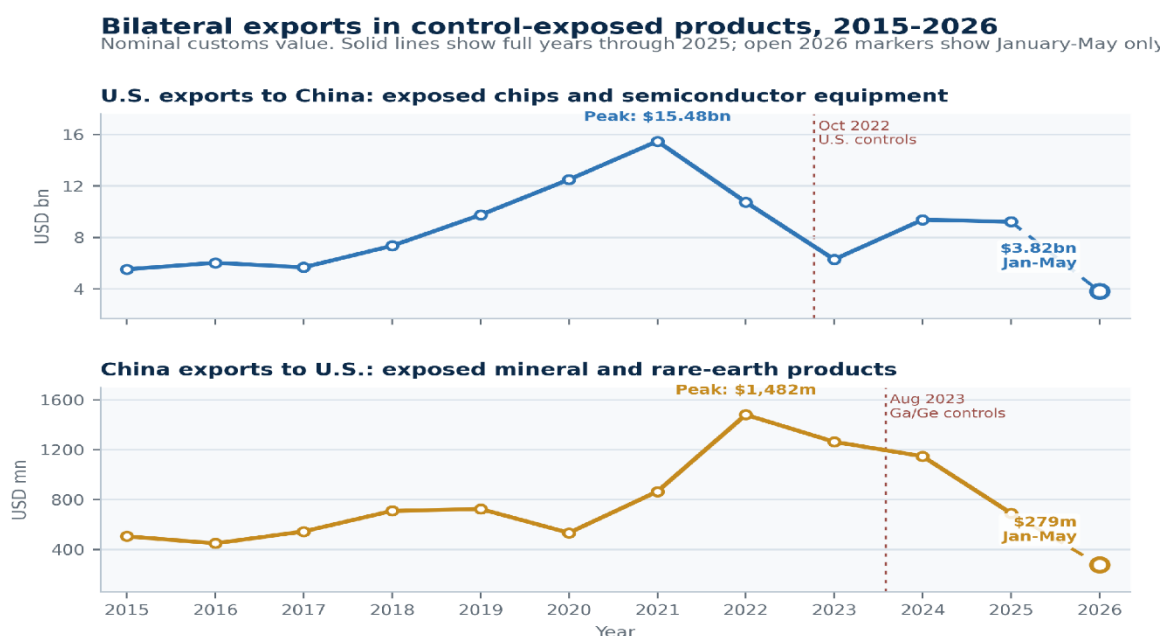
The study is interpretive rather than a causal estimate of the controls' overall economic effects. It does not estimate the counterfactual pace of Chinese semiconductor development, isolate export controls from subsidies and macroeconomic conditions, or treat concentration as proof of coercive success. Outcomes are assessed against each regime's stated objectives and mechanisms, distinguishing announced authority, implemented restrictions, observed disruption, and longer-run strategic effects. Continued Chinese technological progress does not by itself demonstrate U.S. failure; likewise, a temporary export decline or large Chinese market share does not establish bargaining success. The comparison therefore identifies where dependence was converted into observable pressure and where the evidence remains insufficient to attribute a strategic outcome to the controls alone.

Implementation chronology and bilateral exposure.

Figure 2 compares the customs value of the bilateral product categories most directly exposed to the two control regimes. The first U.S. marker is the October 2022 advanced-computing and semiconductor-manufacturing rule; China's current sequence began with gallium and germanium in August 2023 and expanded through graphite, antimony, additional rare metals and selected medium and heavy rare-earth items by April 2025. Because U.S. controls are defined by Export Control Classification Numbers (ECCNs) and performance thresholds, while China's announcements use 10-digit reference tariff lines and technical specifications, public HS6 trade records provide a reproducible exposure proxy rather than an exact measure

of the legally controlled universe (BIS, 2022; MOFCOM, 2023a, 2024a, 2025a; MOFCOM & GACC, 2023, 2025).

U.S. exports in the exposed customs categories peaked at \$15.48 billion in 2021, fell to \$10.75 billion in 2022 and \$6.29 billion in 2023, then recovered to \$9.38 billion in 2024 and remained near \$9.22 billion in 2025. January–May 2026 exports were \$3.82 billion, 13.5% below the same period of 2025. China’s exposed material exports to the United States peaked at \$1.48 billion in 2022 and declined to \$1.27 billion in 2023, \$1.15 billion in 2024 and \$0.69 billion in 2025. January–May 2026 was \$279 million, 25.6% below January–May 2025. The aggregate China result masks divergence: rare-earth parent categories rose 21.0% year on year, while the selected non-rare categories fell 68.6%. These figures are reported as descriptive exposure measures, not causal estimates. They combine prices and quantities, mirror statistics can differ from exporter records, and HS6 categories remain broader than the exact legally controlled items. The bilateral exposure series in Figure 2 can therefore be interpreted as a control-specific trade measure rather than as a measure of total U.S. semiconductor-industry trade. **Figure 2:**



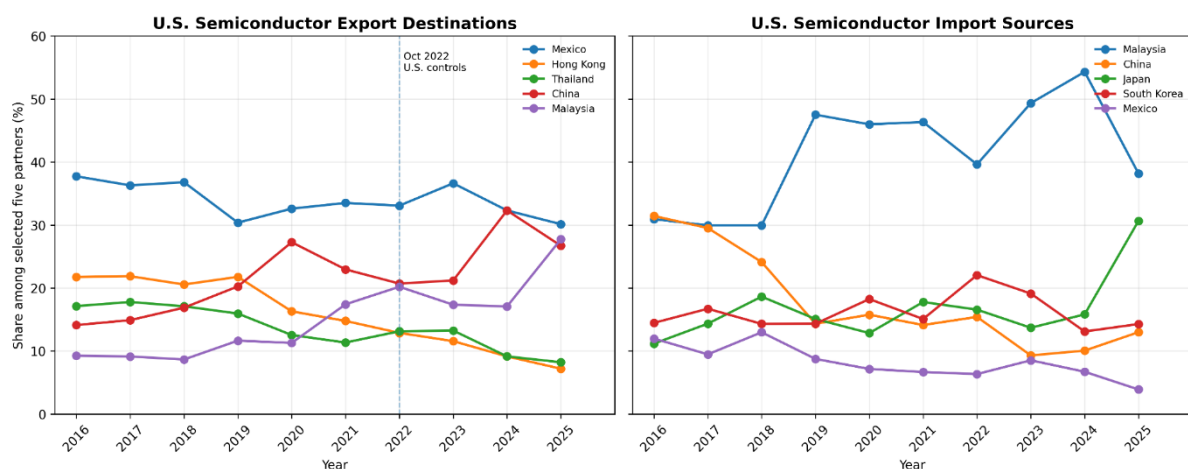
Source: Authors’ compilation using data using [UN Comtrade](#) Database (2026), using annual observations through 2025 and January–May 2026 for the partial-year comparison.

***Note.** Nominal customs value. The U.S. series is U.S.-reported exports to China in HS 854231, 854232, 848610, 848620 and 848640. The China series is U.S.-reported imports from China (mirror exports) in narrow HS6 parent categories covering specified rare-earth metals, compounds and metal permanent magnets, natural and artificial graphite, antimony, tungsten, tellurium, bismuth, molybdenum, gallium, germanium and indium. Full-year observations run through 2025; 2026 covers January–May. These HS6 categories are narrower than the former world-export baskets but cannot isolate U.S. ECCN performance thresholds or China’s controlled 10-digit products exactly.*

4. Case One: United States Semiconductor Export Controls

Figure 3 presents the geographical distribution of U.S. semiconductor trade across selected partner economies using percentage shares rather than bilateral trade values. The purpose of the figure is descriptive: to identify changes in the relative importance of major trading partners and to provide context for possible supply-chain reconfiguration. This measure is distinct from Figure 2, which uses a specifically constructed HS-based basket of products directly exposed to the U.S. export-control regime, including selected semiconductor-manufacturing equipment.

Figure 3. U.S. Semiconductor Trade: Selected Partner Shares, 2016–2025



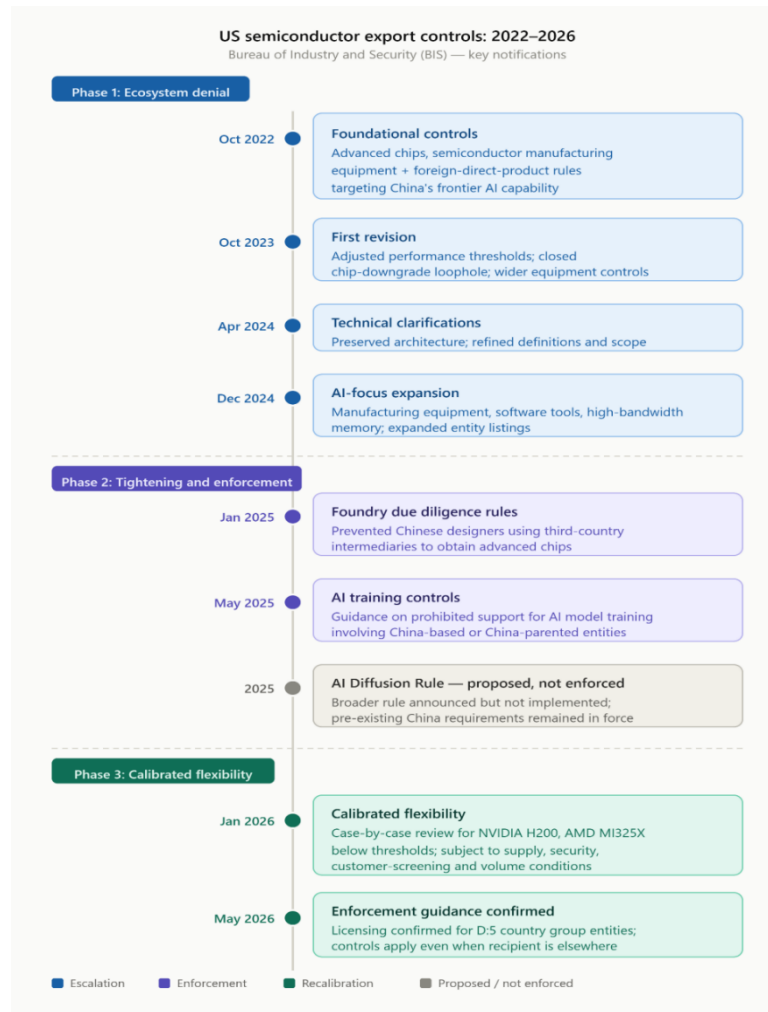
***Source:** Authors’ compilation from Trade Map and U.S. Census Bureau trade data; historical partner series as used in the original extraction.*

The percentage-share series reveal substantial changes in the composition of U.S. semiconductor trade among the selected partner economies. On the export side, Mexico and China account for large shares for much of the period, while Malaysia becomes increasingly prominent. On the import side, Malaysia represents a particularly large share among the selected sources, while the relative positions of China, Japan, South Korea and Mexico vary over time. These movements are consistent with changing patterns of regional production, sourcing and supply-chain organisation, but they do not by themselves establish that U.S. export controls caused the observed changes. The figure is therefore interpreted as evidence of trade exposure and partner concentration rather than as a direct measure of strategic effectiveness.

4.1 From entity controls to ecosystem denial

Figure 4 traces the chronology of BIS notifications from October 2022 through May 2026, showing the regime's progression across three phases: ecosystem denial, tightening and enforcement, and calibrated flexibility.

Figure 4. *Chronology of US Bureau of Industry and Security (BIS) semiconductor export control notifications, October 2022 – May 2026, organised by phase of implementation.*



Source: Authors' compilation using data using [US BIS](#), data through May 2026

The innovation of the October 2022 package lay in its inclusion of technical thresholds, end-use regulations, entity restrictions, and foreign-direct-product jurisdiction to restrict China's ability to buy advanced chips and manufacture them internally (BIS, 2022). Later updates, including the elimination of the chip-downgrade loophole in 2023, the addition of high-bandwidth memory in December 2024, and the introduction of foundry due diligence

guidelines in 2025, maintained this architecture while enhancing its scope (BIS, 2023; BIS, 2024b; BIS, 2025a). The January 2026 modification applied calibrated flexibility instead of a complete overturn: this change highlights the managed nature of the regime, which merges denial and oversight with regard for commercial presence and domestic industrial strength, rendering it more specific and adaptable than an overall embargo (BIS, 2026a; Federal Register, 2026).

4.2 Observed leverage, evidence and limits

U.S. leverage is strongest when several scarce capabilities reinforce one another. Design software, advanced equipment, intellectual property, and technical services create multiple points of control, while licensing, end-user statements, foundry due diligence, and customer screening increase visibility over buyers, intermediaries, and intended uses (BIS, 2025a, 2026b). China's reliance is spread across several kinds of capability, not a single physical input. The evidence supports the view that U.S. controls have wide reach, both in legal authority, and in visibility over who buys and uses the technology. Still, the evidence on its own does not demonstrate that China's total computing capacity has fallen.

Firm-level evidence is consistent with meaningful effects at the margin. Exposure to U.S. semiconductor controls is associated with greater stock-price volatility and R&D uncertainty among Chinese firms (Cai and Xie, 2025). Repeated rule changes have also raised compliance burdens for foundries and suppliers. The best-supported conclusion is narrower: the controls have raised costs, added uncertainty, and expanded compliance burdens. The public record does not show how much they have slowed China's progress at the technological frontier over the long run. Economic disruption and strategic denial are therefore different outcomes and should not be treated as the same thing.

The design also establishes dependencies for the sender. Restrictions on imported goods necessitate collaboration among partner jurisdictions and firms, making enforcement more challenging when standards shift, products are modified, or middlemen conceal end users.

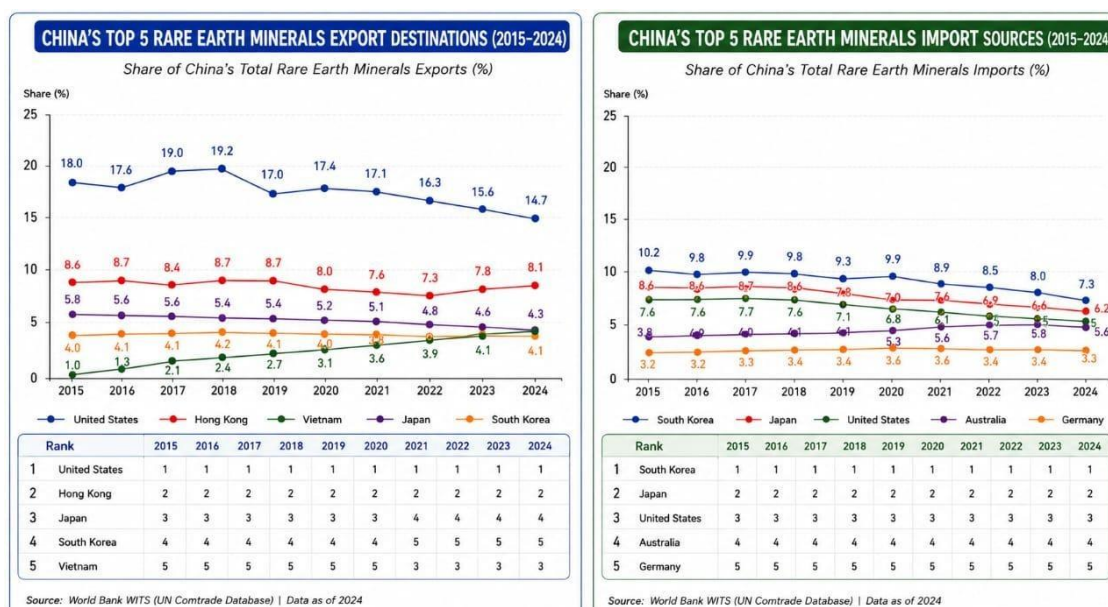
Decreased sales can diminish funds allocated for research and development, whereas unpredictable policies may hinder long-term business strategies. Chorzempa (2023) points out disparate impacts among affiliated companies, whereas Branstetter (2024) emphasizes limitations related to administration and innovation policies.

China's reaction aligns with network evasion. Companies and government entities have increased stockpiles, grown mature-node capacity, developed local equipment, and reengineered chips, all while aiming to utilize existing computing resources more effectively. These initiatives started prior to October 2022, yet the measures enhanced the strategic importance of self-sufficiency and bolstered the political arguments for ongoing assistance (Woods, 2025a). This analysis does not suggest a speedy replacement. Semiconductor competence is built on acquired manufacturing experience, specialized equipment, and scale, which cannot be replicated just by capital investment (Goldberg et al., 2024). US constraints can therefore delay and increase the cost of border capabilities without ensuring permanent denial; their permanence is dependent on enforcement, stable technological thresholds, and partner collaboration.

5. Case Two: China's Critical-Mineral and Rare-Earth Controls

Figure 5 depicts China's top export destinations and import sources where the United States remains China's top export country, from 18% in 2015 all the way to 14.7% in 2024 with a continued drop in 2021, reflecting the tariff and supply chain shift pressures. Hong Kong is mostly steady with a slight dip in 2022 followed by recovery. Vietnam overtakes both Japan and South Korea to become China's 3rd largest export destination. Japan saw a steadily slow decline while South Korea remained relatively stagnant.

Figure 5: Top 5 Export Destinations and Import Sources of China in Rare Earth Minerals, 2016-2024



Source: Authors' compilation using data from [World Bank WITS](#) (UN Comtrade Database), data as of 2024

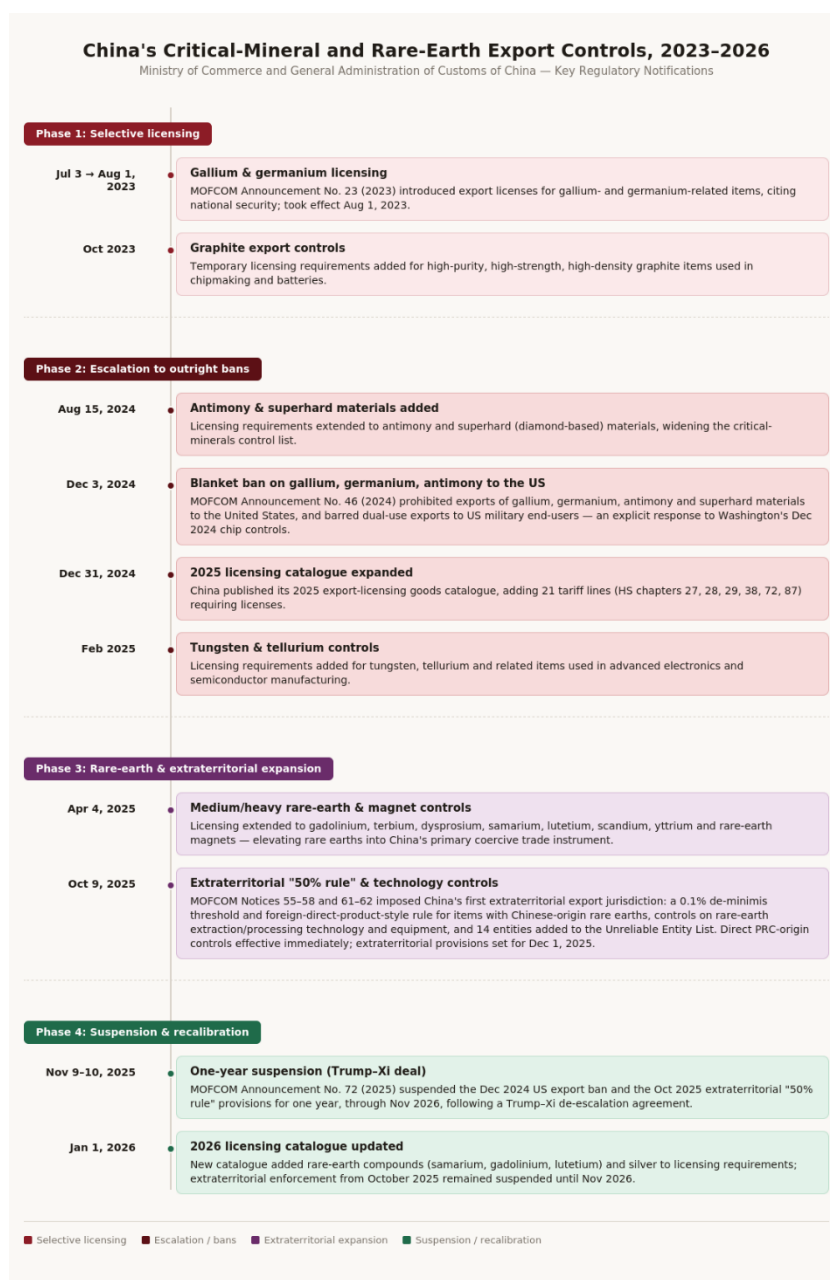
South Korea maintained its position as the top import source for China during the decade, however, its share has fallen hugely from 10.2% in 2015 to 7.3% by 2024. While Japan consistently ranked second with a gradual decline, the United States, although steady for the most part, experienced a sharp fall after 2019, going from 7.6% in 2015 to 5.6% in 2024. Australia is the only partner to have risen in the past decade, from 3.8% in 2015 to 5.6% by 2024 and Germany turned out to be the most stable out of the five partners, ranging narrowly between 3.2% and 3.6% throughout the decade. Both charts signal broader shifts in the global supply chain and trade relations as China's initial top ranked partners erode to make way for emerging markets, becoming more balanced and diversified.

Figure 6 traces the implementation timeline of China's export control measures from 2023 to 2026, showing a regime that expanded steadily rather than emerging fully formed. The initial

actions focused on gallium and germanium in July 2023, resources for which China possesses a leading share of the worldwide refining capacity, before expanding to graphite by October of that same year. By 2024, the list expanded to encompass antimony and superhard materials in August, culminating in the first full ban on gallium, germanium, and antimony exports to the United States in December, which was declared on the same day that Washington strengthened its chip export regulations. In February 2025, tungsten and tellurium were introduced, and by April, the regulations had expanded to include medium and heavy rare earths such as gadolinium, terbium, dysprosium, and rare-earth magnets, establishing rare earths as China's main leverage in the relationship.

The major change occurred in October 2025, when China implemented a 0.1 percent de-minimis threshold and a foreign-direct-product-style regulation, for the first time broadening its jurisdiction to include foreign-made products containing Chinese-origin rare earth elements. Until that moment, all regulations managed direct exports from China; the October rules, however, extended into overseas supply chains, reflecting a type of long-arm jurisdiction typically linked to US export policy. This escalation turned out to be temporary, as a Trump-Xi deal in November 2025 halted both the 2024 prohibition and the extraterritorial regulation for one year, until November 2026, while maintaining the fundamental licensing structure intact. The January 2026 catalog revision, which included additional rare-earth materials and silver, indicates that the licensing framework continued to grow despite the suspension of the strictest enforcement actions. Overall, the timeline illustrates a control system developed gradually around particular chokepoints and finely tuned to align with US policy actions, resulting in a suspension that maintains the legal foundation for potential escalation rather than eliminating it.

Figure 6: *Implementation Timeline of China's Critical-Mineral and Rare-Earth Export Controls, 2023–2026*



Source: Authors' compilation using data from [MOFCOM](#), data as of 2026

5.1 Legal foundation and separate policy tracks

China's regulations are based on a legal framework that existed before the intensification in 2022. The Export Control Law of 2020 allows for limitations to protect national security and interests while meeting international commitments (State Council of the People's Republic of

China, 2020). The Ministry of Commerce (MOFCOM) oversees important licensing procedures. To enhance analytical clarity, the policy sequence is split into controls on non-rare-earth critical minerals and rare-earth controls, instead of considering all affected materials as rare earth elements.

The non-rare-earth path expanded gradually. From August 2023, Gallium, Germanium, and related compounds were subject to licensing, with specific graphite products following in December 2023 (MOFCOM, 2023a; MOFCOM & GACC, 2023). In December 2023, China took control of rare-earth technologies, followed by antimony-related products in 2024, and certain dual-use exports to the United States in December 2024 (MOFCOM, 2023b, 2024a, 2024b). These actions vary in product coverage and legal foundation and must not be combined into a singular "rare-earth prohibition."

The rare-earth situation intensified on April 4, 2025, when China enacted licensing regulations on certain medium and heavy rare-earth materials, associated compounds, and magnets, such as products containing samarium, gadolinium, terbium, and dysprosium (MOFCOM, 2025a). In October 2025, Announcements 55–58, 61, and 62 suggested a more extensive package, incorporating foreign goods with Chinese-origin components or produced using particular Chinese technologies. The suggested extraterritorial scope was analytically significant, yet it wasn't the functioning baseline at the cutoff date.

Announcement No. 70 halted the October package, comprising Announcements 55–58, 61, and 62, until 10 November 2026 (MOFCOM, 2025d). Announcement No. 72 separately suspended Paragraph 2 of the December 2024 measure until November 27, 2026 (MOFCOM, 2025e). This is a significant difference. The October statements showcased Beijing's intent to expand its legal jurisdiction, whereas the November suspensions limited what was truly active by the deadline. Since the Export Control Law has been effective since 2020, the legal capacity was not broadened to address a sole dispute. The license shock in April 2025 and the short-term production reductions showed how quickly that power could be converted into market pressure (Goreczky, 2025). It cannot be established if subsequent license approvals or suspensions indicate negotiation success solely based on timing.

The 2024 Rare Earth Management Regulations create a lasting administrative framework for production limits, tracking, and validation. The combination of these laws with export licensing can transform industry concentration into state influence; however, the effects differ based on the material, licensing practices, and the availability of stockpiles or alternative supplies.

5.2 Observed disruption, information and limits

China's strongest rare-earth leverage derives less from geological ownership than from industrial concentration in processing and magnet production. United States Geological Survey (USGS, 2026) data show a large share of global mine production, but the more difficult chokepoints are separation, refining and magnet manufacturing. The International Energy Agency (2025a) reports that in 2024, China accounted for 60% of global mined production of magnet rare earths, 91% of global refined output, and 94% of sintered permanent-magnet production. These figures show that structural dependence exists at different stages of the value chain. They do not, by themselves, show that every licensing decision amounted to denial.

Observed disruption varies by episode. U.S. International Trade Commission data show Chinese germanium exports dropping from 7,965 kilograms in July 2023 to 590 kilograms in October 2023; while gallium exports fell from 6,876 kilograms to 227 kilograms over the same period (United States International Trade Commission, 2023). Following the April 2025 rare-earth controls, volumes fell sharply in April and May; some automakers reduced utilisation or temporarily halted production before exports recovered as licences were granted (International Energy Agency, 2025b). This evidence therefore supports short-run supply disruption, followed by partial easing, rather than a permanent cutoff.

Licensing also increases informational leverage and ambiguity. While unclear approval dates might lead to hoarding and hedging, applications can disclose international users, quantities, and ultimate uses (Woods, 2025b). Because visibility is transaction-specific, data is still somewhat opaque, and rerouting may obscure final demand, this does not equate to a financial-style panopticon. Over time, declining direct supply to the US and rising exports to

intermediary locations are more compatible with partial redistribution than overall denial (Stimson Center, 2025).

5.3 Bargaining claims and adaptation

The 2010 conflict with Japan offers a useful comparison as it encompasses both immediate pressure and long-term adaptation. Kalantzakos (2017) considers the disruption as a form of economic statecraft, while Kwon (2017) associates it with diplomatic coercion. Vekasi (2019), on the other hand, illustrates how political experiences influenced Japan's later diversification, whereas Roth and VerWey (2026) report a significant drop in Japanese reliance on imports from China. Gröniger (2026) situates this reaction within a broader framework of institutional adjustment in Japan, the United States, and the European Union.

The 2025 regulations heightened supply worries and sped up investment in alternative processing, magnet manufacturing, and recycling. Goreczky (2025) considers the measures as proof of strategic leverage, while also pointing out that every instance of coercion reinforces the argument for diversification. Cha (2023) highlights coalition-building, such as partnerships in critical minerals, as a reaction to economic weaponisation. These advancements indicate motivations for network exit; however, they have not yet proven that China's central role has significantly vanished.

Collectively, the Chinese case produces three distinct levels of confidence. Denial leverage is most evident when export volumes and production timelines were visibly affected. Informational leverage is feasible but more limited, based on license applications and the discretion of approvals. Bargaining power is the most uncertain since it's challenging to pinpoint the reasons behind approvals, suspensions, and negotiated changes. The suspension in October 2025 should be viewed as a measured execution rather than evidence of success or failure for China.

6. Comparative Discussion

6.1 Denial leverage: different sources and speeds

Both regimes work as chokepoint strategies, since each tries to turn structural supply-chain dependence into state leverage. They differ in the location and operation of the chokepoint. Across five common dimensions, the U.S. approach aims to limit China's access to advanced computing and chipmaking capabilities that matter for national security. Its targets include advanced chips, manufacturing equipment, software, specified entities and supporting transactions and its mechanism combines licensing, thresholds, end-use controls, entity restrictions and foreign-direct-product rules. In practice this has meant restricted access, higher compliance costs and uncertainty for firms. The wider strategic goal is to slow China's build-up of frontier capability.

China's export-control notices present its measures as protecting national security, interests and complying with international trade law. These cover specified critical minerals, rare earths, magnets and related technologies, and work mainly through export licensing and product-specific controls. The visible effects have been steep short-term export falls and supply disruption in the affected rare-earth markets. Strategically, China retains control over highly concentrated processing and magnet-production nodes to create potential bargaining space; whether this translated into successful bargaining remains difficult to establish from the available evidence.

The evidence is uneven across the two cases. The U.S. case provides stronger evidence of extensive legal and compliance reach, whereas the Chinese case provides clearer evidence of near-term physical supply disruption.

6.2 Bargaining and informational leverage

The information asymmetry in each regime also differs. U.S. end-user rules, due diligence, customer screening and corporate reporting create a relatively dense compliance record, although visibility remains incomplete. China's licensing system reveals exporters, declared

users and end uses, but its informational reach is narrower and more transaction-specific. In neither case does information alone demonstrate bargaining success. Bargaining requires evidence that the counterpart changed policy or negotiating behaviour because of the control, rather than merely adapting economically to it.

The declared reach should be differentiated from the actual reach and its causal impact. Restrictions in the United States continued to apply even after multiple updates, including the individual evaluation method for specific chips starting in January 2026. China's October 2025 package revealed extensive extraterritorial regulations, but its halt guaranteed that it wouldn't serve as the operational standard by June 2026. The schedule for a suspension or license approval might align with negotiations, but linking it to foreign influence requires proof beyond mere timing.

6.3 Durability and self-eroding incentives

Both cases reveal a temporal trade-off rather than an automatic decline in chokepoint power. Controls can impose immediate costs while increasing incentives for rerouting, substitution, stockpiling, and competing capacity. This demonstrates two-way dependence: the target depends on the sender-controlled node for access, but the sender may depend on the target or on allied firms and jurisdictions for market demand, complementary technologies, investment, or enforcement. U.S. semiconductor controls therefore depend materially on allied coordination and multinational compliance, while China's mineral leverage is strengthened by concentrated processing capacity but faces adaptation through recycling, alternative refining, substitution and new non-Chinese magnet capacity. Chokepoint power is greater when the sender controls a scarce node, substitutes are costly or slow, enforcement is credible, and the sender can coordinate complementary nodes before the target escapes the network. It is weaker when substitutes emerge quickly, coalition partners resist, or the sender bears large commercial costs.

Karacali (2025) and Woods (2025a) provide frameworks, namely self-sabotaging interdependence and network-evading dynamics, that help explain this tension. Stricter

limitations could improve immediate refusal but might hasten long-term adjustment; nonetheless, the true pace and degree of this deterioration rely on practical circumstances. Cha (2023) emphasizes that the influence of Chinese economic pressure has motivated joint resilience initiatives like the Quad, Chip 4, and the Minerals Security Partnership. These initiatives can share adjustment burdens and strengthen deterrence, but their success depends on goal alignment and equitable burden-sharing. The effectiveness of control strategies hinges on whether security gains are realized prior to substitution, coalition breakdown, financial losses, or industrial policy actions diminishing the original edge (Zhang, 2024).

6.4 Actor-specific policy implications

For governments designing controls, comparative evidence suggests that policy objectives should be stated in measurable terms and evaluated against the same dimensions used in this study: objective, target, mechanism, economic effect and strategic effect. For China, licensing standards and execution timelines can affect how quickly physical supply pressure is transmitted; for the United States and its partners, enforcement consistency and allied coordination are central to maintaining a distributed technological chokepoint. In both cases, ambiguity may increase short-run uncertainty, but persistent uncertainty can also encourage stockpiling, substitution, rerouting and investment in competing supply networks.

For countries and firms exposed to either regime, the evidence supports diversification and de-risking rather than an assumption that complete separation is either necessary or imminent. Mineral resilience should address every stage of the chain (mining, separation, refining, magnet production, recycling) as well as skills and inventories, while semiconductor resilience requires attention to design, equipment, foundries, materials and supporting services. The objective is to reduce excessive dependence and preserve continuity under disruption, not to infer that all bilateral trade must disappear. Because new capacity cannot emerge instantly, diversification is most effective when undertaken before a crisis and coordinated across partners.

7. Limitations

This analysis faces three key constraints. First, the control regimes differ in their intended timeframes: short-term disruptions to exports and production are more readily observable than long-term impacts on semiconductor capability development, limiting direct comparability despite similar indicators. Second, public data is inherently fragmented: licensing decisions, inventories, end-use audits, corporate restructuring, and negotiation records are often confidential or selectively reported. As a result, assessments of legal scope and market concentration are more robust than those of causal impact.

Third, timing affects interpretation. Both sets of controls undergo frequent revisions, and China's suspended measures were set for reassessment beyond the study window. Findings reflect implementation status as of 30 June 2026 and do not forecast. These factors necessitate calibrated confidence levels: high certainty regarding the existence and structure of chokepoints, moderate confidence in observed near-term disruption, and lower confidence in bargaining effectiveness or sustained strategic erosion.

8. Conclusion

The United States semiconductor restrictions and China's controls over critical minerals and rare earths are comparable uses of network-based economic statecraft, but they operate through different chokepoint structures. The United States (U.S.) acts through a distributed technological ecosystem in which design, equipment, software, intellectual property and allied production capacity interact. China's strongest position lies in concentrated processing, refining and permanent-magnet production. The comparison therefore shows that dependence can operate in both directions: targets depend on restricted nodes for access, while senders depend on allies, firms, markets and complementary capabilities to make controls effective.

The evidence supports a conclusion that varies by case. U.S. controls demonstrate extensive legal and informational reach and measurable compliance and firm-level effects, but the public record does not permit a precise estimate of the long-run reduction in Chinese frontier capability. China's licensing measures produced documented short-run disruption in selected mineral exports and rare-earth-related production, especially in April–May 2025, but

subsequent licence approvals and recovering export volumes reduced the immediate effect. The evidence is therefore stronger for denial and short-run disruption than for bargaining success in either case. These findings justify de-risking and diversification as responses to concentrated dependence, but do not prove that full economic decoupling has happened or is necessary.

The policy implication flows directly from the comparison: chokepoint policies must be evaluated in terms of the specific end they are intended to serve and the time horizon over which they generate an advantage before adaptation occurs. Governments have accordingly proceeded to make the distinction between export control and coercion, between dependence and leverage, and between short-term disruption and long-term strategic change. Resilience policies should be directed towards developing credible alternatives, diversified processing and manufacturing capabilities, inventories, recycling, technological capability and coalition management. These efforts will reduce vulnerability to future shocks without asserting that the evidence supports decoupling as a whole.

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