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FDPR: Extraterritorial Control and Its Global Impact

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Highlights

- **The FDPR now functions as an important leverage point, extending U.S. control extraterritorially through technological dependence, self-policing by supply chains and the financial system.**
- **U.S. controls have shifted from firm-specific controls to an allied, system-wide regime.**
- **The controls may have intensified some of the risks they were designed to reduce, imposing persistent losses on Chinese and U.S. firms while spurring Chinese innovation, substitution, and reshoring.**

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1. Introduction

The United States has, over the past six years, used its dominance in semiconductor technology as a critical tool of national economic and security policy. The central instrument is the Foreign Direct Product Rule (FDPR), a provision of U.S. export control law that extends American regulatory jurisdiction to products manufactured entirely outside the United States when those products depend on American-origin technology at some point in their design or production. Because advanced semiconductors around the world often rely on U.S. electronic design automation software or U.S.-influenced manufacturing equipment, the FDPR gives the United States substantial leverage over parts of the global chip supply chain and extends U.S. jurisdiction well beyond its borders, without requiring any physical presence at a foreign border.

This note documents how that authority has been built and deployed. It proceeds in three parts. The first describes the legal architecture of the Export Administration Regulations and the FDPR, explaining how extraterritorial jurisdiction operates and how enforcement works in practice, mainly through supply-chain self-policing rather than direct government action, and increasingly through the financial system as an additional compliance channel. The second traces the evolution of U.S. semiconductor export control policy from 2019 to 2025, from firm-specific Entity List designations targeting the Chinese firms Huawei and Semiconductor Manufacturing International Company (SMIC), through the industry-wide controls of October 2022, to the multilateralization of restrictions through Japan and the Netherlands and the calibration measures of 2024. The third reviews the empirical evidence on the effects of these measures on U.S. semiconductor exports, on the revenue and operations of U.S.-listed firms with China exposure, and on the financial health and innovation behavior of affected Chinese firms.

2. U.S. Semiconductor Export Control Policy Evolution

Table 1 traces the evolution of U.S. semiconductor export controls. Early measures were targeted and reactive: legislation passed in 2019 barred U.S. government procurement of equipment produced by Huawei and another Chinese firm ZTE. By late 2020, the U.S. Bureau of Industry and Security (BIS) had added both firms to the Entity List – and later SMIC and dozens of affiliated firms – to the Entity List. A pivot shift occurred in May 2020, when The FDPR expansion of May 2020 marked a major early step—it significantly broadened U.S. jurisdiction to cover foreign-made chips designed using U.S. software or produced on U.S.-origin equipment, regardless of location. This brought Taiwan Semiconductor

Manufacturing Company (TSMC) and other non-U.S. foundries into the enforcement system through technological dependence rather than their domestic legal requirements.

A second inflection point came in August 2022, when BIS implemented the 2021 Wassenaar Arrangement decisions by adding a set of advanced semiconductor-related design and manufacturing technologies to the Commerce Control List. This move pushed controls further upstream and signaled growing multilateral alignment on restricting enabling technologies. Two months later, the October 2022 rules imposed broad controls on advanced computing chips, semiconductor manufacturing equipment, and related software, shifting policy from targeting specific firms to restricting an entire technological capability across China.

By 2023, these unilateral U.S. measures gained a multilateral dimension: Japan and the Netherlands adopted their own licensing requirements for advanced semiconductor equipment, extending effective controls to the Dutch firm ASML and Tokyo Electron—the leading non-U.S. suppliers in this segment. This coordination created an allied restriction regime, reflecting the fact that leading-edge chip fabrication requires access to U.S.-controlled or allied technology at critical production stages.

The policy volatility of 2025 exposed underlying tensions in this approach. In April, the United States banned exports of Nvidia's H20 and AMD's MI308 advanced chips to China; by August, the ban was reversed with a reported 15 percent revenue-sharing requirement; by December, exports of the powerful H200 chip were reportedly allowed under a 25 percent remittance arrangement. These reversals exposed a core challenge: U.S. market dominance creates both leverage over China and costs for American firms. The revenue-sharing approach signaled a structural shift in the instrument's purpose, transforming outright denial into conditional access.

The Trump–Xi summit in South Korea in October 2025 produced the sequence's most significant outcome: China agreed to pause rare earth export licensing controls for one year, while the United States suspended the Affiliates Rule—which restricts exports to companies more than 50 percent owned by listed entities—for the same period. This reciprocal pause reflects mutual recognition of each side's capacity to impose economic costs. Whether it evolves into lasting accommodation or remains a temporary measure—with Chinese implementation still uncertain—will determine its longer-term impact.

Table 1. A Chronology (2019–2025)

Phase	Date	Policy Action
Phase 1 Targeting Huawei	May 2019 (Entity List) May 2020 (FDPR)	Huawei designated a national security threat and added to the BIS Entity List, requiring licenses for all U.S.-origin exports. In May 2020, BIS expanded the FDPR to cover foreign-made chips designed using U.S. Electronic Design Automation (EDA) software or produced on U.S.-origin equipment, bringing TSMC and other non-U.S. foundries under U.S. jurisdiction for the first time.
Phase 2 Targeting the Industry	August 2022 (Wassenaar precursors) October 2022	Aug 15, 2022 (Wassenaar): BIS added global controls on emerging techs (wide-bandgap chips, next-gen chip design software, turbine tech) per 2021 Wassenaar decisions. Oct 7, 2022: BIS imposed sweeping controls on the entire Chinese semiconductor sector, blocking exports of advanced AI chips above specified performance thresholds, chip-making equipment, and EDA software to China.
Phase 3 Allied Coordination & Tightening	January 2023 (Allied deal) October 2023 (Expansion)	The U.S. secured agreements with Japan and the Netherlands to align their export controls on advanced chip-making equipment with the FDPR framework, closing third-country loopholes. In October 2023, BIS expanded the list of controlled chips and equipment, closing workarounds that Chinese firms had begun to exploit.
Phase 4 Calibration & Trusted Partners	December 2024	BIS introduced the Restricted Fabrication Facility (RFF) exception, permitting tool shipments to pre-approved Chinese factories producing only mature-node chips under strict oversight. A trusted country list was established, exempting them from most licensing requirements for covered items.
Phase 5 Controlling AI Model Weights	January 2025	The AI Diffusion Rule extended U.S. export controls to AI model weights — the trained digital files encoding a model's capabilities — for the first time applying controls to purely digital outputs rather than physical hardware.

Phase	Date	Policy Action
Phase 6 Escalation, Truce & Relaxation	April 2025 – December 2025	April 2025: The Trump administration banned exports of Nvidia's H20 and AMD's MI308 advanced-computing chips to China. May–August 2025: As part of the negotiation rounds, the United States rescinded the January 2025 AI Diffusion Rule, removing licensing requirements on the transfer of AI model weights, and eased several chip-design software restrictions by clarifying licensing thresholds for EDA-related updates and interoperability tools. May-November 2025: Technology-related measures unfolded alongside a parallel tariff truce negotiated through Geneva, London, and Stockholm, which stabilized bilateral tariff rates and reduced the risk of further escalation; the truce was subsequently extended for one year as part of the broader de-escalation package negotiated that autumn. July 2025: The administration reversed the H20/MI308 ban and approved limited exports under a 15 percent revenue-sharing condition. October 30, 2025: At the APEC Leaders' Meeting in Busan, Presidents Trump and Xi agreed to a one-year pause on China's extraterritorial rare-earth controls and a parallel U.S. delay of the '50 percent Affiliates Rule,' which BIS had published on September 29, ten days before MOFCOM issued its six-announcement response. December 8, 2025: The administration reportedly approved exports of Nvidia's more powerful H200 chip under a 25 percent remittance arrangement.

3. Effects on exports

The semiconductor industry spans many countries, but production remains highly concentrated in specific regions that dominate manufacturing stages others cannot easily replicate. The United States leads in high-value R&D, chip design, and semiconductor intellectual property—particularly advanced logic chips. South Korea specializes in advanced memory chips, with Samsung and SK Hynix controlling global DRAM (Dynamic Random-Access Memory) and NAND (NAND flash) supply. Supporting industries show similar specialization: the Netherlands and Germany dominate manufacturing equipment and precision optics, while Japan leads in etching, cleaning, and deposition tools. Because these national specializations

correspond directly to specific six-digit codes used to track exports in the Harmonized System (HS), trade flows in these categories serve as reliable indicators of countries' exposure to semiconductor export controls.

To quantify the effects of export controls, we employ a so-called "gravity-based" empirical approach—following Hayakawa (2024)—in examining monthly bilateral trade data at the six-dight HS code level from January 2018 to December 2025. The model uses a triple-difference (Diff-in-Diff-in-Diff) design, which compares changes in China-bound exports of controlled products relative to (1) non-China destinations, (2) uncontrolled products, and (3) pre/post-policy periods, measuring impacts after four major U.S. policy events: the August 2020 Huawei FDPR expansion, the October 2022 controls on advanced computing and manufacturing equipment, the October 2023 update, and reported 2025 adjustments for older technologies.[2]

Table 2: Impacts of U.S. Export Controls on Semiconductor Exports, by HS Code and Country

	US		KOR	JP		GER	NL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Mfg. Equip.	Logic Chips	Memory Chips	Handle Equip	Mfg. Equip.	Mfg. Equip.	Mfg. Equip.
china_post20_product	0.163***	0.032	0.023	-0.243***	0.183***	-0.186***	-0.920***
	(0.019)	(0.020)	(0.032)	(0.023)	(0.023)	(0.024)	(0.039)
china_post22_product	-0.578***	-0.992***	-0.248***	0.049**	0.276***	-0.807***	0.308***
	(0.021)	(0.021)	(0.036)	(0.023)	(0.022)	(0.026)	(0.042)
china_post23_product	0.472***	1.035***	-0.071*	0.707***	0.761***	0.584***	1.256***
	(0.024)	(0.024)	(0.037)	(0.026)	(0.026)	(0.027)	(0.044)
china_post24_product	-0.496***	0.427***	-	0.011	-0.078***	0.710***	0.376***
	(0.023)	(0.023)		(0.021)	(0.020)	(0.024)	(0.046)
Constant	11.081***	11.081***	9.711***	11.075***	11.075***	10.313***	8.950***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	2,939,671	2,939,671	1,380,848	1,448,376	1,448,376	4,486,407	3,205,791
R-squared	0.779	0.779	0.747	0.840	0.840	0.811	0.779

[2] See Appendix: Empirical Estimation Strategy for the estimation equation, lists of affected six-digit HS codes, control group construction, and robustness checks.

Imp-Prod FE	YES	YES	YES	YES	YES	YES	YES
Prod-Time FE	YES	YES	YES	YES	YES	YES	YES
Imp-Time FE	YES	YES	YES	YES	YES	YES	YES
Robust standard errors in parentheses							
*** p<0.01, ** p<0.05, * p<0.1							

Note: Export data for South Korea ends in 2024, while data for the remaining countries is available through 2025. Columns (1), (5)–(7): HS 848620 (semiconductor manufacturing equipment); column (2): HS 854231 (processors and controllers, logic chips); column (3): HS 854232 (memory, including DRAM and NAND); column (4): HS 848640 (other semiconductor manufacturing equipment).

Table 2 reports triple-difference estimates of the impact of U.S. export controls on China-bound semiconductor trade. Each coefficient captures the differential change in exports of controlled products to China, relative to (i) the same products exported to other destinations, (ii) uncontrolled products, and (iii) the pre-policy period. Consider column (1), which examines U.S. exports of semiconductor manufacturing equipment (HS 848620). The coefficient on the October 2022 expansion (-0.578, $p<0.01$) implies a decline of roughly 44 percent in China-bound exports of controlled equipment compared to what would have happened otherwise. This sharp contraction contrasts with the earlier 2020 Huawei-related restrictions, which are associated with a modest increase (0.163), and highlights the much broader scope of the 2022 measures. The 2023 update is associated with a temporary rebound (0.472), consistent with short-term adjustment or front-loading behavior, while the 2024 tightening again produces a sizable decline (-0.496). Across countries and product categories, the October 2022 FDPR expansion generated the most consistent and economically large reductions. U.S. logic chip exports (HS 854231) fell sharply (-0.992), Korean memory exports (HS 854232) decline (-0.248), and German semiconductor equipment exports (HS 848640) also contracted (-0.243), all statistically significant at conventional levels.

Beginning in 2023, however, export patterns diverge. While U.S. and Korean exports to China remain below pre-policy levels, European and Japanese suppliers expand shipments. Coefficients for Germany, the Netherlands, and Japan range from 0.584 to 1.256 ($p<0.01$), implying increases of roughly 80 to 250 percent relative to the counterfactual. This pattern is consistent with Chinese firms stockpiling equipment ahead of the Netherlands' 2023 licensing regime and its 2024 expansion, as well as substitution toward Japanese suppliers not initially subject to equivalent restrictions. The results indicate that U.S. export controls have substantially restricted China's access to advanced logic chips, memory, and leading-edge

manufacturing equipment. At the same time, continued access to available equipment and technologies appears to have supported Chinese efforts to build domestic capabilities.

4. Effects on Chinese Firms

Albertson, Howard, and Sarzosa (2026) provide the most comprehensive firm-level analysis of U.S. export controls' financial impact on Chinese companies, using a large panel of public and private firms. They find that BIS Entity List designation is associated with substantial declines in operating revenue (58 percent), employment (33 percent), and total assets (36 percent), with effects increasing over time. Notably, standard measures of financial stability show little change, suggesting that export controls reduce firm scale and operating capacity without typically driving affected firms into insolvency, likely in part because Chinese state support and financing channels can mitigate acute distress.[3] Impacts are largest and fastest in electronics and computer sectors, consistent with their reliance on U.S.-linked supply chains.

Albertson et al. do not analyze innovation effects, which other studies address. Liu, Liu, and Makarin (2025) document increased R&D spending (nearly 50 percent) and patenting (over 40 percent) among firms facing earlier restrictions, as they sought domestic substitutes for restricted inputs. Liu and Wen (2025) find Entity List firms pursuing more exploratory AI research. However, Cao et al. (2024) show controls also reduce Chinese patent volume and quality by limiting collaboration with U.S. researchers—a historically important innovation channel.

Together, these studies indicate that U.S. export controls impose persistent financial costs on targeted firms while generating complex innovation effects: some studies show accelerated domestic R&D, while others document losses from severed international collaboration.

5. Conclusions

The FDPR has become the central instrument through which the United States exercises extraterritorial leverage over the global semiconductor supply chain. By extending U.S. jurisdiction to foreign-made products that depend on American design software or manufacturing equipment, the rule requires no physical border presence—it operates instead through the technological dependence of firms worldwide on

[3] This does not rule out state-backed refinancing or other forms of support that may prevent insolvency despite large real-side losses.

U.S.-origin inputs. Compliance is enforced not primarily by government inspectors but through supply-chain self-policing and, increasingly, through the financial system, as banks and intermediaries avoid transactions that could expose them to U.S. regulatory risk. This architecture gives Washington substantial reach well beyond what conventional export licensing could achieve.

What began as firm-specific restrictions targeting Huawei has evolved into an allied, system-wide control regime. The October 2022 rules marked the decisive shift—from entity-level licensing to broad capability-based controls covering advanced logic chips, memory, and manufacturing equipment across China as a whole. Subsequent coordination with Japan and the Netherlands extended effective restrictions to the leading non-U.S. equipment suppliers, closing the most significant third-country loopholes.

Yet these controls have intensified some of the very risks they aimed to mitigate. They impose persistent losses on both Chinese and U.S. firms while spurring Chinese innovation, substitution, and even reshoring—transforming a tool of denial into one that accelerates global decoupling. The FDPR now stands as a pivotal leverage point in an era of technological rivalry, reshaping supply chains in enduring ways that neither side can readily reverse.

AI Disclosure

The authors used large language models (LLMs)—including ChatGPT, Claude, Gemini, Copilot, and Perplexity— to assist in language editing and summarizing notes under human supervision. The authors take full responsibility for the content.

References

Albertson, M., Howard, J., and Sarzosa, M. 2026. “Effects of U.S. Export Controls on Chinese Firms.” MITRE Corporation Working Paper.

Cao, Y., et al. 2024. “Technological Decoupling? The Impact on Innovation of US Restrictions on Chinese Firms.” World Bank.

Liu, W., and Wen, K. 2025. “Does US Entity List Impel Chinese AI Enterprises to Exploratory Innovation?” *Journal of Strategy & Innovation* 36 (1).

Liu, X., Liu, Y., and Makarin, A. 2025. “Export Controls and Innovation in Sanctioned Countries.” Working Paper.

Appendix: Empirical Estimation Strategy

The following empirical framework is used to estimate changes in the exports of five countries—the United States, South Korea, Japan, the Netherlands, and Germany—to China resulting from the imposition of U.S. export controls. Study products are defined at the HS six-digit level and are restricted to intermediate and capital goods in HS 84 (general machinery) and HS 85 (electric machinery), covering 672 products in total. Partner (importing) countries number 190. The study period runs from January 2018 to December 2025. We estimate a gravity-style specification for each exporting country's shipments of HS six-digit product p to country c in year-month t:

$$\ln(Export)_{cpt} = \beta_1 CHN_c * Aug2020_t * Product_p + \beta_2\, CHN_c * Oct2022_t * Product_p + \beta_3\, CHN_c * Oct2023_t * Product_p + \beta_4\, CHN_c * Jan2025_t * Product_p + \delta_{cp} + \delta_{pt} + \delta_{ct} + \varepsilon_{cpt}$$

where $\ln(Export)_{cpt}$ indicates exports of product *p* (an HS code associated with final products (chips or manufacturing equipment), to country *c* at time *t*. CHN is a 0–1 dummy variable taking the value of one if export destination c is China, and zero otherwise. Aug2020 is a 0–1 dummy variable taking the value of one after August 2020, which is when the Huawei FDPR was introduced, and zero otherwise. Oct2022 is a 0-1 dummy variable taking the value of one after October 2022, which is when the FDPR was expanded to include advanced computing chips, HPC components, and semiconductor manufacturing equipment, and zero otherwise. Oct2023 is a 0-1 dummy variable taking the value of one after October 2023, which is when the October 2022 FDPR was expanded, and zero otherwise. Lastly, Jan2025 is a 0-1 dummy variable taking the value of one after January 2025, which is when the rules are eased for older technology and trusted countries, and zero otherwise. The triple-interaction coefficients, β_1, β_2, β_3, and β_4 isolate how exports of treated products to China changed relative to exports of the same products to all other destinations, following each policy event.

The specification includes three sets of fixed effects. Importer-product fixed effects (δ_{cp}) control for time-invariant bilateral preferences and capture product-level demand in each destination country. Product-time fixed effects (δ_{pt}) absorb changes in technology and factor prices at the product level in the exporting countries. Importer-time fixed effects (δ_{ct}) control for time-varying aggregate demand in each destination. Together, these fixed effects ensure that the estimated coefficients reflect variation attributable to the policy

changes rather than general trade trends or macroeconomic fluctuations. Because these fixed effects already absorb the bilateral, product, and time dimensions that standard gravity controls are meant to capture, adding the usual log distance, common language, colonial ties, or border variables would not identify separate effects and would be collinear with the fixed effects. Given the very large importer-product-time panel, the equation is estimated by OLS after dropping zero-valued export observations. Standard errors are clustered at the product level. This approach focuses identification on within-product changes in China relative to other destinations over time, which is the relevant variation for assessing export-control effects.

One caveat is that HS six-digit codes are imperfect proxies for controlled goods. Some items within a code may be restricted while others are not. For example, products capable of supporting 5G networks may be denied for export while equivalent 4G products are approved. This variation within codes means our estimates are likely to understate the true trade effects of the controls. More broadly, while the model accounts for global semiconductor cycles and country-specific trends through fixed effects, several other factors complicate interpretation: Chinese firms building up inventories in advance of restrictions, volatile chip pricing, and trade being rerouted through intermediary countries can all reduce or even reverse the apparent effect of formal controls.