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THE SEMICONDUCTOR "CHIP WAR" AND THE RECONFIGURATION OF TECHNOLOGICAL SOVEREIGNTY: FINANCIAL, STRATEGIC, AND REGIONAL IMPLICATIONS FOR THE UNITED STATES, CHINA, AND THE EUROPEAN UNION (2020-2025)

„RĂZBOIUL CIPURILOR" DIN INDUSTRIA SEMICONDUCTORILOR ȘI RECONFIGURAREA SUVERANITĂȚII TEHNOLOGICE: IMPLICAȚII FINANCIARE, STRATEGICE ȘI REGIONALE PENTRU STATELE UNITE, CHINA ȘI UNIUNEA EUROPEANĂ (2020–2025)

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Abstract: *In the context of accelerating global transformations, semiconductors have evolved from essential electronic inputs into strategic assets positioned at the intersection of industrial policy, geopolitical rivalry, and technological sovereignty. This paper examines the financial and strategic dimensions of the semiconductor conflict among the United States, China, and the European Union over the period 2020-2025, with an in-depth case study of the Netherlands as a European chokepoint economy. Methodologically, the study combines policy analysis, financial comparison of major industry actors, and supply-chain assessment focused on critical minerals. The evidence shows that the contemporary semiconductor conflict has a dual effect. On the one hand, it stimulates large-scale public investment, technological upgrading, and new forms of industrial coordination. On the other hand, it increases market fragmentation, raises compliance and input costs, and redistributes profitability unevenly across the value chain. Frontier segments linked to artificial intelligence and lithography have captured exceptional returns, while mature-node manufacturing and latecomer substitution remain subject to margin pressure and strategic constraints. The Netherlands case demonstrates how export controls, regional investment, labour-market bottlenecks, and infrastructure policy have become integral to semiconductor governance. The paper concludes that the "chip war" is best understood as a structural reorganization of the global industrial order rather than a temporary trade dispute.*
Keywords: *semiconductors; geoeconomics; technological sovereignty; industrial policy; economic resilience; Netherlands; ASML.*
JEL CLASSIFICATION: O25, F13, L52, O14

INTRODUCTION

Semiconductors are essential to consumer electronics, telecommunications, defence, automotive production, artificial intelligence, and the broader digital economy. Because their supply chain is capital-intensive, highly specialized, and geographically concentrated, it is especially vulnerable to geopolitical intervention. After the pandemic, the return of industrial policy, the expansion of export controls, and the race for AI infrastructure transformed chips from ordinary industrial inputs into strategic assets. Recent research shows that semiconductors now stand at the centre of debates on national security, economic resilience, and global production networks (Bown & Wang, 2024; Branstetter, 2024).

This paper argues that the semiconductor conflict is not simply a dispute over trade restrictions or subsidies, but a deeper reorganization of the global industrial order. States are using industrial policy more aggressively, export controls are being deployed to slow technological catch-up, and

firms are shifting capital toward high-margin AI-related activities, while mature and constrained segments face weaker profitability. These developments have major implications for technological sovereignty, industrial competitiveness, and long-term growth.

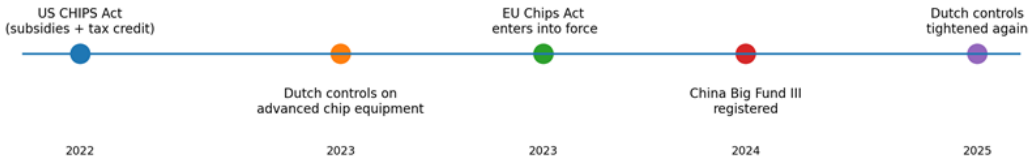


Figure 1. Timeline of key policy escalations in the semiconductor conflict
Source: author's synthesis based on U.S. Department of Commerce (2023), European Commission (2025a), Government of the Netherlands (2023, 2024, 2025a), and Reuters (2024a).

Literature review and analytical framework

The recent literature treats semiconductors as an exemplary sector for the study of modern industrial policy. Bown and Wang (2024) argue that semiconductor policy now extends beyond subsidies to include export controls, tariffs, investment screening, and antitrust measures.Their contribution is especially important because it places today's policy activism within the longer historical evolution of the industry, from early U.S. dominance to the globalization of semiconductor design and manufacturing, and finally to the current return of state intervention.

Branstetter (2024) shows that current semiconductor export controls are designed less to alter Chinese behaviour than to slow the development of Chinese technological capabilities in advanced nodes. Yet such controls operate in an interdependent world, where allied firms continue to depend on Chinese demand and where talent, equipment, software, and manufacturing remain distributed across multiple jurisdictions. IMF modelling, Cerdeiro et al. (2024) show that reshoring and friend-shoring can generate significant permanent GDP losses and can lower input quality when export bans intensify. Although semiconductors are only one part of the broader fragmentation story, they are among the clearest cases in which security-oriented policy collides with efficiency-oriented globalization. This paper therefore adopts an analytical framework that links geoeconomic rivalry to three observable outcomes: policy escalation, differential firm performance, and territorial restructuring in regions where strategic semiconductor capabilities are concentrated.

Methodology and data

The analysis draws on official and corporate sources. For the United States, it uses CHIPS for America documentation, Treasury guidance on the advanced manufacturing investment credit, and BIS export-control announcements. For the European Union, it relies on the European Chips Act, the European Commission's 2025 milestone update, and the 2025 report of the European Court of Auditors. For China, it uses public information on Big Fund III and SMIC's annual-report disclosures.

At firm level, Nvidia is examined as a leader in AI-oriented semiconductor design, ASML as a strategic supplier of lithography equipment, and SMIC as a Chinese manufacturer operating under export-control constraints. To ensure comparability across firms reporting in different currencies and accounting systems, the analysis focuses on revenue growth, gross margin, net margin, and market-dependence indicators rather than absolute size alone.

The Netherlands is included to show how the semiconductor conflict generates regional policy responses in infrastructure, housing, labour markets, and education. The paper also considers critical minerals, especially gallium and germanium, because upstream disruptions shape the resilience of downstream semiconductor activity. In policy terms, the United States relies on incentives, R&D funding, tax credits, and export controls to rebuild domestic capacity and restrict China's access to advanced technologies; the European Union uses the EU Chips Act and related instruments to strengthen resilience, but remains constrained by fragmented implementation; and China relies on Big Fund III, localization, and domestic substitution, while still facing limited access to advanced equipment, software, and intellectual property.

Geoeconomic architecture of the chip war

The United States has combined large-scale industrial support with technological containment. CHIPS for America provides $39 billion in manufacturing incentives and $11 billion for R&D, while Treasury rules reinforced the 25% investment credit for qualifying semiconductor facilities (NIST, 2026; U.S. Department of the Treasury, 2024). In parallel, BIS expanded export controls in December 2024, targeting semiconductor equipment, software tools, high-bandwidth memory, and 140 entities, showing that U.S. policy seeks both to strengthen domestic production and constrain Chinese technological upgrading (Bureau of Industry and Security, 2024).

The European Union has approached semiconductors through resilience and strategic autonomy. The European Chips Act aims to reduce dependencies and support the goal of a 20% global market share by 2030 (European Commission, 2025b). By 2025, it had already helped mobilize over EUR 80 billion in manufacturing investment, including more than EUR 31.5 billion through seven first-of-a-kind state-aid decisions (European Commission, 2025a). Even so, the European Court of Auditors concluded that the 20% target is unlikely to be reached (European Court of Auditors, 2025).

China's creation of Big Fund III in May 2024, with capital of 344 billion yuan, or about USD 47.5 billion, confirms that semiconductor self-sufficiency remains a strategic priority (Reuters, 2024a). Rather than proving export controls ineffective, this shows that such restrictions can both slow access to frontier technologies and intensify domestic policy mobilization.

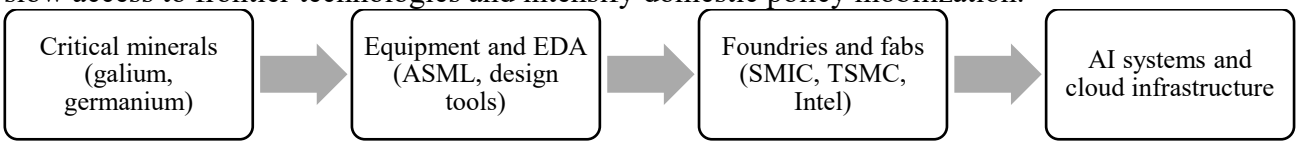


Figure 2. Strategic pressure points across the semiconductor value chain
Source: author's synthesis informed by Bown and Wang (2024), Eurostat (2025), and USGS (Nassar et al., 2024).

Financial analysis of selected semiconductor firms

Firm-level evidence reveals that the semiconductor conflict has not affected all segments equally. Nvidia illustrates the concentration of value in AI-intensive compute. In fiscal 2025, the company reported revenue of USD 130.5 billion and net income of USD 72.9 billion; the same 2026 disclosure shows that fiscal 2025 gross margin was 75.0% (NVIDIA, 2026). Such profitability is exceptional even within technology sectors and reflects the scarcity rents associated with AI accelerators, software ecosystems, and hyperscale infrastructure demand.

As the dominant supplier, ASML occupies a different strategic position, of advanced lithography, it benefits from a structural chokepoint in the value chain, but it is also deeply exposed to the geopolitical regulation of its customer base. ASML reported net sales of EUR 28.3 billion and net income of EUR 7.6 billion in 2024, rising to EUR 32.7 billion and EUR 9.6 billion respectively in 2025 (ASML, 2025a, 2026). SMIC demonstrates the more constrained economics of catch-up under restriction. In 2024, the company generated revenue of USD 8.03 billion, with gross margin of 18.0%; profit attributable to owners fell to USD 492.7 million, even as revenue increased by 27.0% year over year (SMIC, 2025). This pattern is analytically important. Revenue growth in a localized market can coexist with margin compression when firms face technology bottlenecks, substitution costs, and the need to expand under restrictive conditions.

At firm level, Nvidia recorded the strongest financial performance. In fiscal year 2025, it reported revenue of USD 130.5 billion, net income of USD 72.9 billion, a gross margin of 75.0%, and a net margin of 55.8%, confirming its leading position in AI-oriented semiconductor design and computing infrastructure. ASML also showed strong results as a strategic lithography chokepoint supplier. In 2024, it reported revenue of EUR 28.3 billion, net income of EUR 7.6 billion, a gross margin of 51.3%, and a net margin of 26.9%. In 2025, its performance improved further, with revenue reaching EUR 32.7 billion, net income EUR 9.6 billion, a gross margin of 52.8%, and a net margin of 29.4%.

By comparison, SMIC operated with much weaker profitability. In 2024, the company reported revenue of USD 8.03 billion, net income of USD 0.49 billion, a gross margin of 18.0%, and a net margin of 6.1%, reflecting its position as a Chinese foundry operating under significant technological and geopolitical constraints.

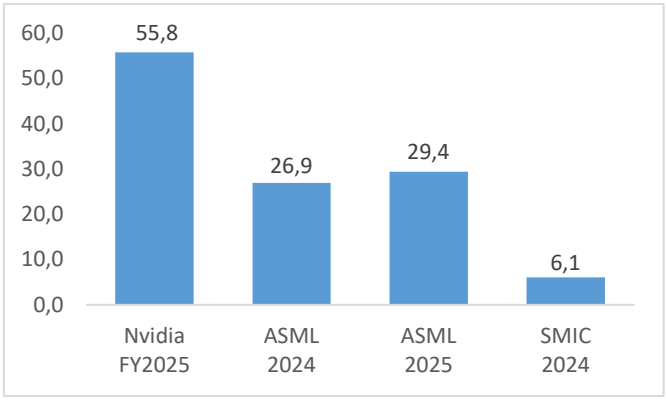


Figure 3. Net margin comparison for selected semiconductors firms
Source: author's calculations based on annual reports and financial releases from NVIDIA, ASML, and SMIC.

The chip war does not reduce welfare uniformly; it redistributes rents across the semiconductor sector. Chokepoints and AI-related segments attract both capital and public support, while latecomer manufacturers and mature-node producers remain more exposed to profitability pressures. This asymmetry is important because it influences which forms of innovation will be financed in the next technological cycle.

The Netherlands offers a clear example of this transformation. It occupies a strategic position in the global semiconductor value chain, with direct importance for both economic prosperity and national security (Government of the Netherlands, 2025). Since 2023, Dutch policy has followed two directions: tighter export controls and stronger domestic reinforcement. Export-control measures were introduced in 2023, expanded in 2024, and tightened again in 2025 to cover additional measuring and inspection equipment (Government of the Netherlands, 2023, 2024, 2025b). At the same time, Project Beethoven, launched in 2024, committed EUR 2.51 billion to strengthen the Brainport Eindhoven ecosystem through investment in talent, housing, accessibility, energy, and infrastructure (Government of the Netherlands, 2024, 2025). This shows that semiconductor policy now extends well beyond direct subsidies.

The ASML case further illustrates this shift. Reuters reported that China accounted for 29% of ASML's sales in 2023, 41% in 2024, and 33% in 2025, with guidance of around 20% for 2026 as restrictions deepen (Reuters, 2024b, 2025, 2026). This suggests that export controls do not eliminate interdependence, but reorganize it. More broadly, the Dutch case shows that semiconductor sovereignty is not only industrial, but also regional and territorial.

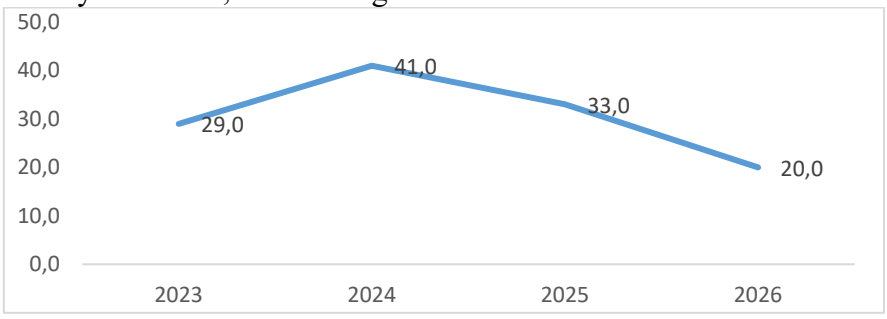


Figure 4. China as a share of ASML sales / guidance
Source: Reuters (2024b, 2025, 2026). The 2026 value reflects company guidance reported by Reuters rather than realized sales.

Supply-chain vulnerability, critical minerals, and discussion

Upstream mineral concentration remains a major source of vulnerability. Eurostat's 2025 update on critical raw materials shows that the EU was heavily dependent on China for gallium and magnesium, and specifically notes that China was the origin of 73% of all gallium imports into the EU in 2023; Eurostat also reports that EU gallium imports and exports fell sharply between 2022 and 2024 while prices continued to rise (Eurostat, 2025). The U.S. Geological Survey similarly quantified the economic importance of this dependence. Nassar et al. (2024) estimate that a complete restriction of China's net exports of gallium and germanium could reduce U.S. GDP by about USD 3.4 billion if both were disrupted simultaneously. The International Energy Agency (2025) adds a wider structural point: concentration in critical-mineral refining remains very high, and China continues to dominate the refining of many strategic minerals.

From a broader interpretive perspective, the semiconductor conflict generates both opportunities and constraints. It creates opportunities for industrial upgrading, targeted public investment, and the formation of new regional innovation ecosystems. The IMF's evidence on de-risking suggests that large-scale fragmentation can impose long-term economic costs, even when motivated by resilience (Cerdeiro et al., 2024). The policy challenge, therefore, is not simply to maximize autonomy, but to balance resilience, innovation, and openness under conditions of strategic rivalry.

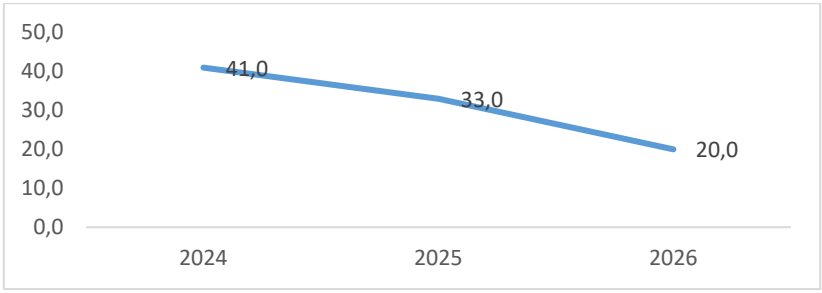


Figure 5. ASML: China share of sales

Source: ASML disclosures and guidance cited in recent reporting

The semiconductor conflict has redirected innovation toward AI chips, high-bandwidth memory, and advanced equipment, allowing frontier segments to capture a disproportionate share of profits and strategic value. It has also reshaped industrial geography by encouraging new clusters around subsidized fabs and regional technology hubs, showing that public policy now plays a direct role in reorganizing production spaces. In trade and governance, the growing use of licensing systems, investment screening, and export-control coordination indicates that security considerations increasingly determine the circulation of technology. At the same time, supply-chain vulnerabilities remain visible in critical minerals, equipment, and skilled labor, which means that technological sovereignty is still partial and deeply interdependent. For Europe, the conflict highlights a mixed position: the Union is strong in certain strategic control points, but weaker in production scale and policy coordination. As a result, selective sovereignty appears more realistic than full technological autonomy.

Conclusions

The evidence in this paper supports three main conclusions. First, the semiconductor conflict is not temporary, but a structural feature of the global economy, with subsidies, export controls, and strategic finance now functioning as normal instruments of competition. Second, its financial effects are uneven: Nvidia and ASML benefit from frontier demand and strategic market positions, while SMIC reflects the difficulties of expanding under restriction. Third, the Dutch case shows that semiconductor policy now extends beyond factories and patents to housing, transport, skills, energy, and regional development. Overall, the paper argues that the semiconductor "chip war" has become

a major mechanism through which economic, social, and technological development is being reshaped in the context of global transformation.

REFERENCES

1. ASML. (2025a, January 29). ASML reports €28.3 billion total net sales and €7.6 billion net income in 2024. https://www.asml.com/news/press-releases/2025/q4-2024-financial-results
2. ASML. (2026). 2025 annual report. https://www.asml.com/investors/annual-report/2025
3. Bown, C. P., & Wang, D. (2024). Semiconductors and modern industrial policy (Working Paper 24-3). Peterson Institute for International Economics. https://www.piie.com/sites/default/files/2024-08/wp24-3.pdf
4. Branstetter, L. (2024). Export controls and U.S.-China technology competition in an interdependent world. Brookings Institution. https://www.brookings.edu/wp-content/uploads/2024/07/20240701_Branstetter_Sanctions.pdf
5. Bureau of Industry and Security. (2024, December 2). Commerce strengthens export controls to restrict China's capability to produce advanced semiconductors for military applications. U.S. Department of Commerce. https://www.bis.gov/press-release/commerce-strengthens-export-controls-restrict-chinas-capability-produce-advanced-semiconductors-military
6. Cerdeiro, D. A., Kamali, P., Kothari, S., & Muir, D. V. (2024). The price of de-risking: Reshoring, friend-shoring, and quality downgrading (IMF Working Paper 2024/122). International Monetary Fund. https://doi.org/10.5089/9798400269646.001
7. European Commission. (2025a, April 28). European Chips Act – Update on the latest milestones. Shaping Europe's Digital Future. https://digital-strategy.ec.europa.eu/en/news/european-chips-act-update-latest-milestones
8. European Commission. (2025b). European Chips Act. Shaping Europe's Digital Future. https://digital-strategy.ec.europa.eu/en/policies/european-chips-act
9. European Court of Auditors. (2025, April 28). Microchips: EU off the pace in a global race. https://www.eca.europa.eu/en/news/NEWS-SR-2025-12
10. Eurostat. (2025). International trade in critical raw materials. Statistics Explained. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_trade_in_critical_raw_materials
11. Government of the Netherlands. (2023, March 10). Letter to Parliament on additional export control measures concerning advanced semiconductor manufacturing equipment. https://www.government.nl/documents/parliamentary-documents/2023/03/10/letter-to-parliament-on-additional-export-control-measures-concerning-advanced-semiconductor-manufacturing-equipment
12. Government of the Netherlands. (2024, March 28). The Netherlands to invest €2.5 billion to strengthen business climate for chip industry in Brainport Eindhoven. https://www.government.nl/latest/news/2024/03/28/the-netherlands-to-invest-%E2%82%AC2.5-billion-to-strengthen-business-climate-for-chip-industry-in-brainport-eindhoven
13. Government of the Netherlands. (2025a, May 27). Progress report on the semiconductor industry in a changing geopolitical climate. https://www.government.nl/binaries/government/documenten/parliamentary-documents/2025/05/27/progress-report-on-the-semiconductor-industry-in-a-changing-geopolitical-climate/Progress%2Breport%2BSemiconductor%2BIndustry%2Bin%2Ba%2Bchanging%2Bgeopolitical%2Bclimate.pdf
14. Government of the Netherlands. (2025b, January 15). Klever: export controls on advanced semiconductor manufacturing equipment to be tightened. https://www.government.nl/latest/news/2025/01/15/klever-export-controls-on-advanced-semiconductor-manufacturing-equipment-to-be-tightened
15. International Energy Agency. (2025). Global critical minerals outlook 2025. https://www.iea.org/reports/global-critical-minerals-outlook-2025
16. Nassar, N. T., Shojaeddini, E., Alonso, E., Jaskula, B., & Tolcin, A. (2024). Quantifying potential effects of China's gallium and germanium export restrictions on the U.S. economy (Open-File Report 2024-1057). U.S. Geological Survey. https://doi.org/10.3133/ofr20241057
17. National Institute of Standards and Technology. (2026). CHIPS for America. https://www.nist.gov/chips
18. NVIDIA. (2026, February 25). NVIDIA announces financial results for fourth quarter and fiscal 2026. https://nvidianews.nvidia.com/news/nvidia-announces-financial-results-for-fourth-quarter-and-fiscal-2026
19. Reuters. (2024a, May 27). China sets up third fund with $47.5 bln to boost semiconductor sector. Reuters. https://www.reuters.com/technology/china-sets-up-475-bln-state-fund-boost-semiconductor-industry-2024-05-27/
20. Reuters. (2024b, January 24). ASML expects U.S., Dutch export rules to hit China sales by 10-15%. Reuters. https://www.reuters.com/technology/asml-expects-us-dutch-export-rules-hit-china-sales-by-10-15-2024-01-24/
21. Reuters. (2025, July 14). ASML's 2026 growth outlook hinges on second-quarter bookings. Reuters. https://www.reuters.com/world/china/asmls-2026-growth-outlook-hinges-second-quarter-bookings-2025-07-15/
22. Reuters. (2026, January 28). ASML lifts outlook on record AI chip orders but analysts see risk in China exposure. Reuters. https://www.reuters.com/business/asml-q4-bookings-beat-expectations-chipmakers-order-more-satisfy-ai-demand-2026-01-28/

23. Semiconductor Manufacturing International Corporation. (2025). 2024 annual report. https://www.hkexnews.hk/listedco/listconews/sehk/2025/0409/2025040900322.pdf
24. U.S. Department of Commerce. (2023, February 28). Biden-Harris Administration launches first CHIPS for America funding opportunity. https://www.commerce.gov/news/press-releases/2023/02/biden-harris-administration-launches-first-chips-america-funding
25. U.S. Department of the Treasury. (2024, October 22). U.S. Department of the Treasury releases final rules to strengthen U.S. semiconductor industry. https://home.treasury.gov/news/press-releases/jy2664

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