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Stress-Testing EU-Taiwan Semiconductor Supply Chains: An Economic Security Assessment

by **Francesca Maremonti**

Semiconductors underpin virtually every domain of the modern economy, yet supply chains sustaining them were built for efficiency rather than resilience. Comparative mapping of EU and Taiwanese semiconductor ecosystems reveals structural complementarity: Europe leads in upstream equipment, Taiwan in advanced manufacturing. Though bilateral industrial cooperation is deepening, coordinated resilience strategies remain largely overlooked. Both ecosystems are vulnerable to external shocks: geographical chokepoints – including Hormuz and Taiwan Strait scenarios – the deliberate politicisation of supply architecture – particularly for artificial intelligence – and the weaponisation of critical input exports amid escalating US-China tensions. Greater EU-Taiwan cooperation on supply chain resilience entails early warning and stockpiling protocols, minilateral chip diplomacy and a joint roadmap toward strategic autonomy in EDA software.

As economic historian Mark Harrison has argued, in the last two centuries the disruption of supply has gradually moved to the centre of economic warfare – from the Napoleonic Wars through to the Second World War and beyond. Today, supply-side interventions have become an established framework, one that has acquired renewed urgency in recent years. From the weaponisation of supply chains and bottlenecks employed by a number of actors today, ranging from Russia's restricting energy exports to Iran closing the Strait of Hormuz. Simultaneously, escalating trade tensions between the United States and China, which peaked over the course of 2025, accelerated the weaponisation of trade – in particular of critical inputs. Maritime disruptions stemming from the Middle East conflict pushed global supply chain pressures to multi-year highs, with ramifications unfolding on a global scale.

These developments have brought into sharp relief how advanced technologies – permeating every dimension of modern life – and the supply chains that sustain them have become core instruments of geopolitical competition. The crosscutting nature of technology has gradually blurred the boundary between the economic and the security dimension, pushing economic security to the forefront of policymaking agendas worldwide. Economic security covers a wide range of interdependent concerns, from supply chain resilience and diversification to engagement with strategic partners and the

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protection of critical infrastructure. The European Union formalised this agenda in 2023 with its Economic Security Strategy – later integrated into the Economic Security Doctrine at the end of 2025 – which identifies supply chain resilience as one of four core risk categories, alongside technology security, critical infrastructure protection and economic coercion. For Taiwan, economic security sits at the heart of national security. Persistent cross-strait tensions and the strategic global importance of its high-technology industries have made the protection of critical infrastructure, the pursuit of technological independence and the management of external economic dependencies central pillars of Taipei's agenda.

Semiconductors sit at the intersection of these very economic security concerns. Chips underpin virtually every dimension of the modern economy, from consumer electronics and industrial automation to artificial intelligence (AI) and defence systems. As demand for semiconductors has grown, so too have supply chain vulnerabilities. The chip shortage of the Covid-19 pandemic exposed the risks of over-concentrated supply chains, while revealing the deep interdependence between the European and Taiwanese semiconductor sectors. Though the first and most emblematic, the chip crunch was not an isolated event. This paper analyses the exposure to disruptions of the European and Taiwanese semiconductor supply chains, examining how Brussels and Taipei can jointly reduce their vulnerabilities. It offers a comparative assessment of both chip ecosystems – mapping their respective strengths and structural weaknesses – before presenting a tiered risk analysis and a set of targeted policy recommendations.

1. Two ecosystems: Assets and vulnerabilities

1.1 The EU semiconductor ecosystem

Europe's semiconductor industry is strongest at the upstream end of the value chain, in the equipment necessary to chip fabrication, and weakest where the manufacturing of advanced chips occurs.

The most strategically significant European asset is ASML, the Dutch firm that holds a global monopoly on extreme ultraviolet (EUV) lithography machines – the equipment necessary to manufacture chips below 7 nanometres (nm).[1] A single EUV system costs up to 250 million US dollars,[2] contains up to 700,000 components (for the later

[1] Westberg, Peter, "ASML: Architecting Earth's Most Complex Machines", in *Quartr Insights*, updated 21 November 2025, https://quartr.com/insights/edge/asml-architecting-earths-most-complex-machines; ASML, Annual Report 2025, https://www.asml.com/en/investors/annual-report/2025.

[2] Sterling, Toby and Nathan Vifflin, "The $250 million ASML 'Printer' behind Nvidia's Chips", in *Reuters*, 28 January 2026, https://www.reuters.com/world/asia-pacific/250-

models)[3] – sourced from approximately eight hundred suppliers.[4] No other company in the world produces an equivalent, granting ASLM a single-firm monopoly on a chokepoint technology and, in turn, giving the Netherlands – and the EU by extension – a potential leverage in the global chip contest.

Two German companies reinforce this position: Carl Zeiss SMT, which manufactures the optical systems inside every ASML machine; and Trumpf, a leading manufacturer of high-power laser amplifiers necessary for EUV machines. Beyond lithography, the EU industrial base has significant presence in specialty chemicals and materials (Merck KGaA[5] and BASF), in power semiconductors (Infineon, STMicroelectronics, NXP) and in automotive-grade chips. Nexperia stands out for its high-volume discrete chips.

Europe's semiconductor research and development (R&D) ecosystem – led by hubs like the Belgium's Imec and France's CEA-Leti[6] – plays a critical role in advancing next-generation chip technologies and strengthening the region's technological sovereignty.

Although the EU's industrial base for semiconductors presents significant strengths, structural weaknesses are still persistent

Although the EU's industrial base for semiconductors presents significant strengths, structural weaknesses are still persistent. Europe has no advanced-node foundry capacity, with no facility currently manufacturing chips below 22 nm at commercial scale. The EU's share of global semiconductor manufacturing has declined from roughly 25 percent in 1990 to below 10 percent today.[7] Fabless chip design – the model in which firms design chips but outsource fabrication – remains grossly underdeveloped compared to the United States, with companies such as Nvidia producing the chip design for chips built abroad, especially Taiwan.

EU policymakers have tried to address this gap with a number of measures launched in recent years, though ambition has seemingly outpaced delivery. The EU Chips Act, adopted in 2023, set a target of doubling the block's share of global chip production to 20 per cent by 2030, mobilising 43 billion euros in public and private investment.[8] A special report released by the European Court of Auditors at the end of 2025 assesses that, despite the impetus provided by the Chips

million-asml-printer-behind-nvidias-chips-2026-01-28.

[3] Entropy Capital, "ASML's Supply Chain, Bill of Materials, and the Devastating Effects of Potential Tariffs on US Fabs", in *Substack*, 23 April 2025, https://entropycapital.substack.com/p/asmls-supply-chain-bill-of-materials.

[4] Westberg, Peter, "ASML: Architecting Earth's Most Complex Machines", cit.

[5] Merck website: *Semiconductors*, https://www.merckgroup.com/en/expertise/semiconductors/industries-served/semiconductor.html.

[6] CEA-Leti website: *Missions and Organization*, https://www.leti-cea.com/cea-tech/leti/english/Pages/Leti/About-Leti/mission-organization.aspx.

[7] van Wieringen, Kjeld, "Global Semiconductor Trends and the Future of EU Chip Capabilities", in *ESPAS Ideas Papers*, 2022, https://www.espas.eu/files/Global-Semiconductor-Trends-and-the-Future-of-EU-Chip-Capabilities-2022.pdf.

[8] European Commission, *European Chips Act*, last updated 18 December 2025, https://digital-strategy.ec.europa.eu/en/node/10695.

Act, progress is too slow to meet the Digital Decade target.[9] The Critical Raw Materials Act (2024) and the EU's broader Economic Security Strategy address upstream input vulnerabilities, including concentration – mostly in China – of supply of rare earth elements (REEs), though implementation remains at an early stage. As the EU's industrial ambitions have so far outpaced delivery, a Chips Act 2.0 is in the pipeline, expected in May 2026.

1.2 Taiwan's semiconductor ecosystem

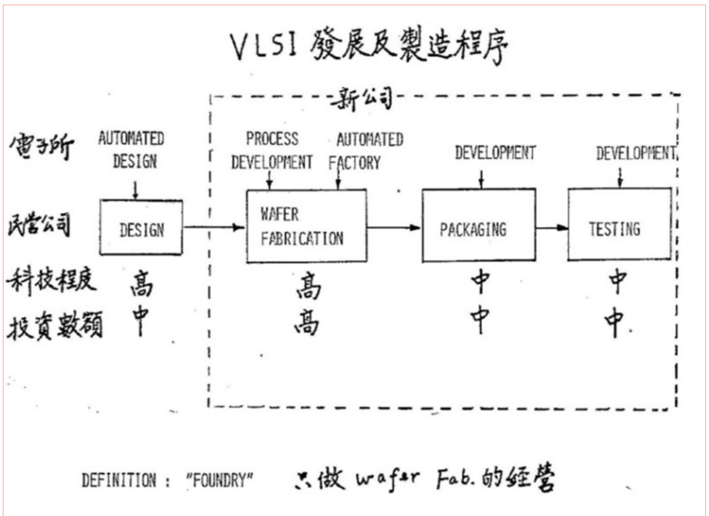
The strengths of Taiwan's semiconductor industrial base mirror the EU's weaknesses

The strengths of Taiwan's semiconductor industrial base mirror the EU's weaknesses. The island hosts the world's most important site of advanced semiconductor manufacturing, with a degree of concentration unmatched by any other critical industry.

Taiwan Semiconductor Manufacturing Company (TSMC), founded in 1987, pioneered the "pure-play foundry" model, thus manufacturing chips designed by other firms.[10] Withholding from chip design competition has proven to be a transformative business model for the Taiwanese company. By outsourcing fabless chip design (now concentrated in the United States), TSMC has addressed its financial capacity to process technology. In 2024, TSMC held over 55 per cent of the global foundry market,[11] with the company alone accounting for over 20 per cent of Taiwanese GDP.[12]

Figure 1 TSMC business model presentation from 1985

Source: Liu, Mark, "Taiwan and the Foundry Model", cit.



The final slide of Morris Chang's presentation to the Premier of Taiwan on the foundry business model in 1985. The bottom reads, "Definition: 'Foundry' only performs wafer fab operations". Credit: TSMC

[9] European Court of Auditors, "The EU's Strategy for Microchips", in *ECA Special Reports*, No. 12/2025, https://www.eca.europa.eu/en/publications?ref=sr-2025-12.

[10] Liu, Mark, "Taiwan and the Foundry Model", in *Nature Electronics*, Vol. 4, No. 5 (May 2021), p. 318-320, https://doi.org/10.1038/s41928-021-00576-y.

[11] IEK website: *IEKTechMap*, https://ieknet-eng.iek.org.tw/IndustryMap/IndMap.aspx.

[12] US International Trade Administration, *Taiwan Country Commercial Guide: Semiconductors including Chip Design for AI*, last updated 1 December 2025, https://www.trade.gov/country-commercial-guides/taiwan-semiconductors-including-chip-design-ai.

The concentration of advanced manufacturing in a small geographic area subjected to unresolved cross-strait tensions with China exposes the supply chain to significant geopolitical risk

Today, more than 90 per cent of leading-edge chips are manufactured in Taiwan, including virtually all of the advanced processors used in training infrastructure for AI.[13] Taiwan's exports reached a record high in 2025, rising by 35 per cent with a 167 billion US dollars jump from 2024.[14] This surge is largely driven by AI demand, as exports increase is concentrated around data processing machines, integrated circuits and related parts, making Taiwan's chip manufacturing all the more vital.[15] At the end of 2025, to keep up with the growing AI demand and with AI's need for energy-efficient computing, TSMC began 2 nm chip production, the most advanced in the semiconductor industry in terms of transistor density and energy efficiency.[16]

The Taiwan ecosystem extends beyond TSMC, as a dense cluster of suppliers, sub-contractors and specialist firms has developed around the foundry over four decades. Advanced packaging companies (ASE Group, SPIL), IC design houses (MediaTek, Novatek), testing and assembly firms, and a pool of semiconductor engineer talent are the building blocks of an ecosystem which is difficult to disentangle from its geography.

Despite its leading position, Taiwan's chip-manufacturing capacity carries a structural vulnerability. The concentration of advanced manufacturing in a small geographic area subjected to unresolved cross-strait tensions with China exposes the supply chain to significant geopolitical risk. This concentration has constituted the foundation of the so-called "silicon shield" theory, which sees Taiwan's indispensability to global technology supply as a deterrent against military action. According to this theory, any disruption would inflict such a severe economic damage on China's own technology sector – highly dependent on chip imports from Taiwan – that Beijing is strongly disincentivised to bring it about through a forceful attempt to unify the island to the mainland.

The thesis has been widely debated from an academic standpoint and has also been challenged by developments in recent years.[17] Beijing is gradually alleviating its dependence on Taipei, with Taiwanese advanced chips entering Chinese market at a slower pace, decreasing from over 61 per cent in 2020 to 53.8 per cent in 2023, in just a three-year period.[18] This trend, coupled with recent

[13] Ibid.
[14] Irwin-Hunt, Alex, "Taiwan's AI Export Boom Is Highly Concentrated", in *FDI Intelligence*, 1 April 2026, https://www.fdiintelligence.com/content/65de3b41-d3b6-482e-90b1-ce3c1786dd35.
[15] Ibid.
[16] "TSMC Officially Begins 2nm chip Volume Production in Q4 2025", in *Focus Taiwan*, 30 December 2025, https://focustaiwan.tw/sci-tech/202512300026.
[17] Weil, Steffi et al., "The European Union. Taiwan, and the Silicon Shield Argument: A Conceptual Assessment through the Lens of Grand Theories", in *European Politics and Society*, Vol. 26, No. 3 (2025), p. 537-563, DOI 10.1080/23745118.2024.2417028.
[18] Šimov, Viktor, "The Silicon Shield Erosion: Fortifying Taiwan against Geopolitical

developments – including pressures from the United States to boost TSMC investments overseas and in particular Arizona – have the potential to disperse the initial concentration, thus eroding the "shield".

Overall, the EU and Taiwanese semiconductor ecosystems show a greater degree of complementarity, rather than competitiveness in the same segments of the supply chain. European equipment enables Taiwanese manufacturing, while Taiwanese manufacturing produces chips that European industry and consumers depend on. Though a positive starting point for any avenue for cooperation in this strategic sector, complementariness also defines the nature of the mutual exposure of the two ecosystems. Both parties are deeply embedded in a global supply chain whose architecture was built and integrated for efficiency purposes – not resilience – and whose most consequential disruption risks originate largely beyond the control of either of Taipei or Brussels.

2. Supply chain disruptions: A three-tiered analysis

Disruption of supply is not new. Going back to the historical evolution of economic warfare, Stephen Broadberry, in an article co-authored with Mark Harrison on the evolution of economic sanctions over three centuries, noted that

> [d]uring the Napoleonic Wars, the purpose of naval blockades was usually to stop the adversary from getting gold by blocking their ships from export markets and by stealing their cargoes. Deprived of market access, the adversary could not earn gold and would become unable to finance its war.[19]

Critical chokepoints can trigger supply shocks, create geographic bottlenecks or be deliberately politicised and weaponised by governments

This observation is particularly timely, as supply chains – and their vulnerabilities – are increasingly being leveraged amid political and economic tensions and conflicts. As the four-tier analysis below shows, critical chokepoints can trigger supply shocks, create geographic bottlenecks or be deliberately politicised and weaponised by governments.

2.1 Tier I: Geographical chokepoints

Developments of the recent years – from the Covid-19 pandemic to the Houthis attacks in the Red Sea since November 2023 to Iran's

Shocks", in *ISDP Voices*, No. 85 (7 May 2025), https://www.isdp.eu/?p=40637.

[19] Broadberry, Stephen and Mark Harrison, "Do Economic Warfare and Sanctions Work? Three Centuries of Evidence", in *Warwick Economics Research Papers*, No. 1547 (February 2025), p. 3, https://wrap.warwick.ac.uk/189434; Broadberry, Stephen and Mark Harrison, *Economic Warfare and Sanctions Since 1688*, Cambridge, Cambridge University Press, 2025.

closure of the Strait of Hormuz in 2026 – have exposed a series of vulnerabilities associated with the high concentration of supply and the disruption of vital sea lines of communication, often resulting in systemic shocks. For the case of the 2020-2022 "chip crunch", disruptions in Taiwanese chip supply following the outbreak of the pandemic rapidly translated into production halts across EU sectors, with severe ramifications, especially for the automotive sectors.[20] This episode – marking the first shock for the chip sector – was later followed by a series of additional disruptions.

Shocks and shortages of supply

The coordinated strikes launched by the United States and Israel on Iran, starting on 28 February 2026, have resulted in the blockade of the Strait of Hormuz imposed in retaliation by the Iranian authorities in mid-March. The blockade has disrupted flow of a number of vital inputs, causing both a supply shock and shortages for several goods. Firstly, the blockade has caused an 80 per cent decrease in traffic. As 20 per cent of global oil and liquefied natural gas (LNG) used to transit through this strategic waterway, an energy security shock has ensued.[21]

Energy dependencies constitute a significant risk factor for Taiwan, as the island relies on imports for approximately 97 per cent of its energy supply

Energy dependencies constitute a significant risk factor for Taiwan, as the island relies on imports for approximately 97 per cent of its energy supply.[22] The semiconductor industry, in turn, is extraordinarily energy- and materials-intensive: in 2023 TSMC alone consumed approximately 10 per cent of the island's total electricity output.[23] Higher energy costs at fabs are likely to impact Taiwanese chipmaker – as warned by a TSMC spokesperson in mid-April 2026 – causing an increase of component prices and affecting the already price-sensitive consumer market.[24]

Secondly, out of the goods no longer transiting through the Strait of Hormuz, helium may prove to be equally – if not more – consequential for the chip industry. This gas is instrumental for chip manufacturers to cool equipment and avoid contamination during chip fabrication – ASLM, for example, needs helium to cool down wafers.

[20] Nienaber, Michael, "Germany Urges Taiwan to Help Ease Auto Chip Shortage", in *Reuters*, 24 January 2021, https://www.reuters.com/article/idUSKBN29T04V.
[21] Ramírez, Rafael, "The Heavy Price of the Iran War on the Energy Markets – and Beyond", in *IAI Commentaries*, No. 26|15 (March 2025), https://www.iai.it/en/node/21835.
[22] Levine, Ben, "Taiwan's Bumpy Road to Energy Resilience", in *Global Taiwan Brief*, Vol. 11, No. 3 (11 February 2026), https://globaltaiwan.org/?p=35247.
[23] Lee, Zoe et al., "Powering AI: How Much Electricity Will Taiwan Need to Fuel Its AI Ambitions?", in *Earth Journalism Network*, 5 November 2025, https://earthjournalism.net/node/13346.
[24] Cheng, Ting-Fang and Lauly Li, "TSMC Warns Higher Gas Prices amid Middle East Conflict Could Impact Profit", in *Nikkei Asia*, 16 April 2026, https://asia.nikkei.com/business/tech/semiconductors/tsmc-warns-higher-gas-prices-amid-middle-east-conflict-could-impact-profit.

Taiwan and South Korea import most of their helium from Qatar

This non-renewable gas is produced by a handful of countries worldwide, with Qatar (33 per cent) and the United States (43 per cent) accounting for three quarters of global supply.[25] Taiwan and South Korea import most of their helium from Qatar.[26] Helium cannot be synthesised or substituted, but can be recycled. Many advanced chip manufacturer feature recycling systems capable of recovering 90-95 per cent of the helium, with the Korean Samsung being the first to install such a system.[27]

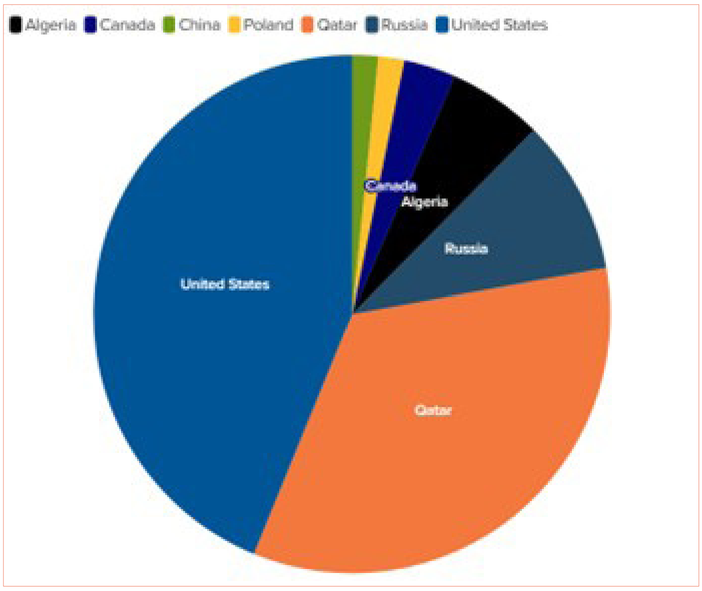


Figure 2 Helium production by country

Source: Burnett, Kate et al., "15 Charts that Explain Why the Strait of Hormuz Shutdown Matters", cit.

As of mid-April 2026, both Taiwan and South Korea have declared that their helium inventories will sustain chip production until mid-May and mid-June respectively. However, Iranian strikes on Qatar's Ras Laffan complex have knocked out roughly 17 per cent of the country's LNG export capacity, with a recovery timeline of three to five years.[28] Given helium's presence in LNG evaporation gas, the damage is likely to weigh on global helium supply well beyond the existing ceasefire, even assuming it holds.

[25] Burnett, Kate et al., "15 Charts that Explain Why the Strait of Hormuz Shutdown Matters for the Global Economy", in *Atlantic Council Dispatches*, 14 April 2026, https://www.atlanticcouncil.org/?p=918828.

[26] Mukherji, Biman, "Helium Supply Shock Threatens Asian Chipmakers as Economic Slowdown Fears Mount", in *South China Morning Post*, 3 April 2026, https://www.scmp.com/week-asia/economics/article/3348954/helium-supply-shock-threatens-asian-chipmakers-economic-slowdown-fears-mount.

[27] Sansarlıoğlu, Burhan and Ali Canberk Özbuğutu, "Mideast Conflict Risks Helium Supply, Threatening Semiconductor Industry", in *Anadolu Ajansı*, 1 April 2026, https://v.aa.com.tr/3888157.

[28] El Dahan, Maha, "Iran Attacks Wipe out 17% of Qatar's LNG Capacity for up to Five Years, QatarEnergy CEO Says", in *Reuters*, 19 March 2026, https://www.reuters.com/business/energy/iran-attack-damage-wipes-out-17-qatars-lng-capacity-three-five-years-qatarenergy-2026-03-19.

At a global level, a naval blockade scenario of the Taiwan Strait would choke supply of chips bringing the tech industries into depression and global economies to their knees

A potential future chokepoint

An additional geographical chokepoint is nested in the Taiwan Strait itself. At the 2026 World Economic Forum in Davos, US Treasury Secretary Scott Bessent candidly noted that: "The single biggest threat to the world economy, the single biggest point of single failure, is that 97 percent of the high-end chips are made in Taiwan".[29]

TSMC's leading-edge fabs – located primarily in the Hsinchu and Tainan science parks – cannot be rapidly relocated. The tacit assumption of "scorched earth" protocols, whereby TSMC would render its equipment inoperable in case of conflict, is plausible as a deterrent but profoundly disruptive as an outcome. In a blockade of the Taiwan Strait scenario, the disruption would materialise through shipping insurance withdrawal, shipping lane avoidance and the departure of foreign engineering talent from the island – all of which would degrade fab ecosystem dramatically.

At a global level, a kinetic conflict or naval blockade scenario of the Taiwan Strait would choke supply of chips bringing the tech industries into depression and global economies to their knees. A confidential 2022 report from the Semiconductor Industry Association warned that a disruption to chip supplies from Taiwan would trigger an economic shock on a scale not seen since the Great Depression. According to Bloomberg projections, a Chinese blockade of Taiwan by air and sea could contract global GDP by about 5 per cent and – should the situation escalate into a full-scale conflict involving the United States and China – the global economy could shrink by nearly 10 per cent.[30] For the EU, which has no advanced-node manufacturing of its own and no alternative source for leading-edge chips, even a short-term disruption would ripple through the automotive, defence and telecommunications supply chains within weeks.

2.2 Tier II: Politicisation of supply

This Taiwan Strait blockade scenario looming over administrations across the world has led to an attempt to "politicise" manufacturing. The EU and Taiwan find themselves being exposed to the deliberate politicisation of semiconductor supply chain architecture, leveraged by other actors as an instrument of strategic competition.

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[29] Tripp, Mickle, "The Looming Taiwan Chip Disaster That Silicon Valley Has Long Ignored", in *The New York Times*, 24 February 2026, https://www.nytimes.com/2026/02/24/technology/taiwan-china-chips-silicon-valley-tsmc.html.

[30] Bland, Ben, "A Taiwan Crisis Would Cause Far More Global Economic Damage than Strait of Hormuz Disruption", in *Chatham House Expert Comments*, 22 April 2026, https://www.chathamhouse.org/node/38387.

Under sustained pressure across US administrations, Taipei has ramped up its financial outreach overseas

The "silicon shield" dispersion

Under sustained pressure across US administrations – incentivised by the 2022 CHIPS and Science Act's 52 billion US dollars in subsidies – Taipei has ramped up its financial outreach overseas. Since 2020, TSMC has committed to investing 165 billion US dollars in the production of chip plants in Phoenix, Arizona – including six semiconductor wafer fabs, two advanced packaging facilities and an R&D team centre.[31] Current volume production is at 4 nm – begun in 2025 with the first fab – and e 2 nm targeted for the end of the decade with the third plant.[32]

Japan also secured a deal with TSMC in 2024 – through a joint venture between TSMC and e Sony, Denso and Toyota – to manufacture logic chips for the automotive sector. A second facility, announced in 2024, is expected to be active by 2028 to produce advanced 7 nm and 3 nm chips.[33]

In a similar fashion, the EU managed to attract Taiwanese chip investments in Dresden, secured through 5 billion euros in German state aid. The TSMC-led joint venture with the European Semiconductor Manufacturing Company (ESMC) – involving Bosch, Infineon and NXP – aims to produce 28/22 nm and 16/12 nm chips by 2027, to meet the needs of the European automotive. While this prospect represents a significant progress for the EU industrial base, the chips produced would be far from the frontier of innovation, leaving the EU several generations behind leading-edge production.[34]

Taiwan's semiconductor ecosystem extends beyond TSMC, with other firms increasingly expanding their industrial presence overseas. Italy illustrates this trend: the Taiwanese semiconductor company GlobalWafers has invested 450 million euros in its "FAB300" project in Novara, a cutting-edge, fully integrated 300 mm silicon wafer facility developed as an expansion of a site operating since 1976 and backed by 103 million euros provided under the EU-funded Important Project of Common European Interest (IPCEI) framework.[35] Opened in October 2025, the plant has since been supplying major European customers, including Franco-Italian STMicroelectronics.[36]

31 TSMC website: *TSMC Arizona*, https://www.tsmc.com/static/abouttsmcaz/index.htm.
32 Ibid.
33 "TSMC Wins Approval to Produce 3-Nanometer Chips in Kumamoto", in *NHK News*, 31 March 2026, https://www3.nhk.or.jp/nhkworld/en/news/20260401_02.
34 TSMC, *ESMC Breaks Ground on Dresden Fab*, 20 August 2024, https://pr.tsmc.com/english/news/3169.
35 Duchâtel, Mathieu, "Semiconductors in EU–Taiwan Relations: Bridging Gaps, Building Trust", in *ChipDiplo Policy Papers*, April 2026, https://www.institutmontaigne.org/en/publications/semiconductors-eu-taiwan-relations-bridging-gaps-building-trust.
36 Sottocornola, Fabio, "Microchip a Novara un nuovo impianto da 450 milioni per i wafer", in *Corriere*, 15 October 2025, https://www.corriere.it/economia/aziende/25_ottobre_15/microchip-a-novara-un-nuovo-impianto-da-450-milioni-per-i-wafer-qual-e-la-sfida-a-usa-e-asia-a9fec5ff-6f7e-4807-8947-18ff62d63xlk.shtml.

The pattern reveals a cross-continental intent to attract Taiwanese investments and the manufacturing capacity that other countries lack, with the potential to disperse the "silicon shield". In fact, in 2025, under sustained external pressure, Taiwan has lifted restrictions which previously required TSMC to keep the chip production abroad one to two generations behind domestic manufacturing. This measure has the potential to facilitate reshoring of chip production for countries in the near future, although reconfiguring the whole Taiwanese semiconductor ecosystem may prove to be a generational challenge.

A US-centred supply chain

Reconfiguration of supply chains can develop around one core element – as shown by the case the Trump's administration initiative branded as "Pax Silica". Launched in December 2025, this US-led initiative aims to build a "secure, prosperous, and innovation driven" AI (or silicon) supply chain – from critical minerals and energy inputs to advanced manufacturing, semiconductors, AI infrastructure and logistics.[37]

Pax Silica consists of a US-led architecture of an emerging AI supply chain

Although the initiative formally calls for an economic security consensus among aligned partners to secure AI development at scale, Pax Silica rather consists of a US-led architecture of an emerging AI supply chain. As mentioned, Taiwan's export profile has shifted sharply toward the high-bandwidth memory and advanced logic chips used in AI training infrastructure.[38] Taipei is trying to integrate chip production into its growing AI sector – leading some experts to hypothesise the potential rise of an "AI shield", intertwined with the already existing "silicon shield".

As advanced manufacturing is a core segment of this Washington-led architecture, Taiwan is the pivotal member of this emerging order, although with little voice in shaping it. Being currently a non-signatory participant in Pax Silica, Taipei risks diluting its heft. For the EU – which is not a member of the Pax Silica (Greece is the only EU state part of the initiative) – the main risk is not nested in exclusion per se but in dependency. Positioned as a downstream consumer of the AI infrastructure, the EU risks facing a scenario where its companies operate within a technology governance framework crafted by Washington to benefit its own industrial base.

[37] US Department of State, *Pax Silica Summit*, 11 December 2025, https://www.state.gov/releases/office-of-the-spokesperson/2025/12/pax-silica-initiative.

[38] Products almost entirely consumed by US hyperscalers (Nvidia, AMD, Apple, Qualcomm) and the data centres they supply.

2.3 Tier III: Weaponisation of supply

US-China trade tensions have reached new heights. Next to a strong proliferation of wide-ranging tariff measures, there has been an increased weaponisation of semiconductor supply chains. The United States has justified these measures on national security grounds, through expanded export controls and entity-based restrictions to limit China's access to advanced technologies. The EU and Taiwan – both critical nodes in the semiconductor ecosystem – are increasingly exposed to both US restrictions and Chinese countermeasures.

Export controls

The US strategy relied on aligning key "chokepoint" economies – Japan, South Korea and the Netherlands – to close supply gaps for manufacturing and equipment providers

The so-called October 2022 export controls adopted by the Joe Biden Administration marked a major escalation. They prohibited transfers to China of advanced chips, semiconductor manufacturing equipment and related expertise, while extending jurisdiction through the Foreign Direct Product Rule. The US strategy relied on aligning key "chokepoint" economies – Japan, South Korea and the Netherlands – to close supply gaps for manufacturing and equipment providers.

The case of Dutch advanced semiconductor equipment manufacturer ASML is central. In 2019, following US measures introduced under the first Administration of Donald Trump,[39] the Dutch government blocked exports of EUV lithography machines to China. This was formalised and expanded after a January 2023 agreement between the United States, the Netherlands and Japan, which the Administration of Joe Biden pushed for in line with the strict export controls over advanced chips exports to China it had adopted in October 2022.[40] In June 2023, the Netherlands introduced new export controls (effective September 2023) covering advanced deep ultraviolet (DUV) systems as well – effectively removing China as a destination for ASML's most advanced tools. This stance, negotiated bilaterally between the Netherlands and the Biden Administration, underscored the limitations of the EU policy responses, as fragmented decision-making allows individual member states to impose measures on issues affecting the economic security of the bloc as a whole.

After a measured initial reaction with export controls on gallium and germanium, two essential inputs for advanced semiconductor

[39] Sutter, Karen M., "U.S. Export Controls and China: Advanced Semiconductors", in *CRS Reports*, No. R48642 (19 September 2025), https://www.congress.gov/crs-product/R48642.

[40] US Department of Commerce Bureau of Industry and Security, *Implementation of Additional Export Controls: Certain Advanced Computing and Semiconductor Manufacturing Items; Supercomputer and Semiconductor End Use; Entity List Modification*, 13 October 2022, https://www.govinfo.gov/content/pkg/FR-2022-10-13/pdf/2022-21658.pdf.

manufacturing, China eventually responded with its own wide-ranging supply-side measures. This happened in conjunction, and ostensibly in response to, a set of high tariffs and additional export controls adopted by the second Administration of Donald Trump in April and September 2025, respectively.

First, Beijing introduced export controls on a wide array of rare earth elements. Then, when Washington strengthened its strict export control regime on companies affiliated with the blacklisted companies – amongst whom a variety of Chinese technology firms like Huawei – Beijing retaliated even more forcefully by tit-for-tat export control measures on even more rare-earth elements and permanent magnets, critical raw materials and related technologies. The immediate effect of Beijing's tighter grip on REEs exports was limited for the semiconductor sector, impacting the defence and automotive sectors more severely. Nonetheless, this dynamic exacerbated a structural risk: Beijing's weaponisation of critical inputs exposed how Taiwan and the EU depend heavily on Chinese supply, making their semiconductor sectors vulnerable to potential future disruptions.

The Nexperia case

US restrictions apply extraterritorially, directly affecting EU and Taiwanese companies integrated into global supply chains

Since 2019, major firms such as Huawei and SMIC have been blacklisted by the US and designated on the so-called "Entity List", limiting their ability to procure semiconductors and equipment incorporating US technology. These restrictions apply extraterritorially, directly affecting EU and Taiwanese companies integrated into global supply chains. In September 2025, the US Bureau of Industrial Security introduced an extension of export restrictions on foreign companies that are 50 per cent or more owned by a company on the entity list, the so-called "Affiliate Rule".

The introduction of the Affiliate Rule complicated an already ongoing investigation by the Dutch government over corporate misgovernance in Dutch-based semiconductor firm Nexperia, which in 2019 had been acquired by the Chinese technology company WingTech, a company included in the Entity List. The adoption of the Affiliated Rule involved that the Dutch company would be treated by US authorities as an effectively sanctioned entity.[41] In a dramatic escalation, the Dutch government invoked an emergency law, taking control of the company's operations virtually at the same time as the publication of the US Affiliate Rule.[42] Perceived by Beijing as a

[41] García-Herrero, Alicia, "The Nexperia Crisis: A Wake-Up Call for Europe's Approach to Chinese Investment", in *Bruegel Newsletter*, 23 December 2025, https://www.bruegel.org/node/11652.

[42] Hijink, Marc, "Nexperia in No-Man's-Land: How a Chip Company Became Caught between Two World Powers", in *NRC*, 30 December 2025, https://www.nrc.nl/nieuws/2025/12/30/nexperia-in-no-mans-land-how-a-chip-company-became-

coordinated Dutch-American plot, within days Chinese authorities imposed a retaliatory export ban on all Nexperia's activities in China, on which the Dutch facilities are reliant for their operations.

This case illustrates how a security American framework – the effective expansion of the US Entity List – is reshaping European industrial policy, limiting Chinese participation in the EU chip ecosystem and exposing EU companies to potential retaliation from Beijing. At the same time, the lack of harmonised FDI screening mechanisms at the EU level prevents the introduction of shared thresholds, allowing Chinese acquisitions of semiconductor assets to proceed in some member states while being blocked in others – thus leaving the bloc's industrial base unevenly exposed.

Compared to the Netherlands, Taiwan moved towards a full integration into the US export control regime

Compared to the Netherlands, Taiwan moved towards a full integration into the US export control regime.[43] In June 2025, Taipei updated its entity list under the Strategic High-Tech Commodities regime, adding major Chinese firms including Huawei and SMIC.[44] While strengthening coordination with Washington can offer Taipei better security guarantees from its main ally, it also constrains Taiwan's cross-strait semiconductor trade and reduces the government's policy autonomy.

A neglected vector: EDA software dependency

Electronic design automation (EDA) software is a foundational layer of semiconductor production. It enables chip design, simulation and verification.[45] Without it, advanced semiconductor development is not feasible.

Despite efforts by Chinese firms to gain a share of the market, the United States holds a de facto monopoly over this sector. The market is overwhelmingly controlled by three firms – the American Cadence Design Systems and Synopsys plus Siemens EDA, an Oregon-registered affiliate of the German company Siemens[46] – all of which rely on US technology, jurisdiction and thus export control frameworks.[47] This concentration of power gives Washington direct control over a critical upstream input across the global semiconductor value chain. Thus,

caught-between-two-world-powers-a4916395.

[43] Hiciano, Lery, "How Taiwan's Chip Industry Navigates US Industrial Policy and Export Controls", in *Global Taiwan Brief*, Vol. 10, No. 5 (5 March 2025), p. 6-9, https://globaltaiwan.org/?p=30795.

[44] Lin, Ching-Fu and Han-Wei Liu, "Silicon Statecraft Alignment: Taiwan's Strategic Bet on US-Led Export Controls", in *The Diplomat*, 1 July 2025, https://thediplomat.com/2025/07/silicon-statecraft-alignment-taiwans-strategic-bet-on-us-led-export-controls.

[45] Siemens website: *Electronic Design Automation*, https://www.siemens.com/en-us/technology/electronic-design-automation-eda.

[46] In 2017, the German company acquired Mentor Graphics – a leading global provider of EDA software –, integrating it into the Siemens Digital Industries Software division, or Siemens EDA.

[47] Sutter, Karen M., "U.S. Export Controls and China: Advanced Semiconductors", cit.

EDA represents the most restrictive chokepoint in the semiconductor ecosystem

EDA represents the most restrictive chokepoint in the semiconductor ecosystem. Unlike equipment or materials, it cannot be stockpiled, substituted easily or sourced outside the US chip ecosystem. It depends on continuous updates, licensing and often cloud-based access, meaning restrictions take effect immediately. This leverage is already being exercised.[48] In May 2025, US authorities required licenses for EDA software exports to China, directly restricting access to essential design tools.[49]

If the United States expands restrictions, the impact would be immediate across design pipelines, R&D and innovation cycles – not in the least for the EU and Taiwan.[50] As US-China competition deepens, EDA is likely to become the most decisive lever of technological control – and the most critical vulnerability for allied semiconductor ecosystems.

3. Avenues for cooperation: Present and future

3.1 State of affairs

The EU-Taiwan semiconductors ecosystems are structurally complementary, yet their cooperation on supply chain resilience remains thin. The European Economic and Trade Office (EETO) in Taipei facilitates commercial dialogue but operates without treaty status, constrained by the One China policy which imposes a diplomatic ceiling that rules out a treaty framework, binds the EU to informal-only channels and limits the political visibility of engagement.

At the industry level, forums such as the Taiwan-Europe Chip Innovation Forum (TECIF),[51] co-organised by Imec, the Technical University of Dresden, and Taiwan's National Institutes of Applied Research (NIAR), and the EU-Taiwan Semiconductor Industry Dialogue launched by the European Commission and the ChipDiplo consortium in November 2025, provide platforms for R&D exchange and business-matching.[52] In March 2026, the industry association SEMI Europe formalised a memorandum of understanding with

[48] Freifeld, Karen, "US Curbs Chip Design Software, Chemicals, Other Shipments to China", in *Reuters*, 29 May 2025, https://www.reuters.com/world/china/trump-tells-us-chip-designers-stop-selling-china-ft-reports-2025-05-28.
[49] Ibid.
[50] Yang, Zeyi, "Inside the Software that Will Become the Next Battle front in US-China Chip War", in *MIT Technology Review*, 18 August 2022, https://www.technologyreview.com/2022/08/18/1058116/eda-software-us-china-chip-war.
[51] National Institutes of Applied Research (NIAR), *The Taiwan-Europe Chip Innovation Forum 2025 Blooms in Dresden: NIAR Joins Hands with imec, Europractice, and TU Dresden to Deepen Taiwan-Europe Semiconductor Collaboration*, 30 November 2025, https://www.niar.org.tw/en/xmdoc/cont?sid=0P338692369787324915&xsmsid=0I160457997407279810.
[52] European Commission, *Europe-Taiwan Semiconductor Industry Dialogue*, 19 November 2025, https://digital-strategy.ec.europa.eu/en/node/15046.

the Polish-Taiwanese Chamber of Commerce to advance Polish semiconductor ambitions – another bilateral thread in a tapestry of initiatives.[53] EU member states are intensifying their outreach to Taiwan. In January 2026, for example, a cross-party Italian parliamentary delegation met Minister of Foreign Affairs Lin Chia-lung in Taiwan, with delegates from Rome underlying the centrality of semiconductors and AI cooperation with Taipei.[54]

These initiatives feature a shared trend, targeting industrial capacity and innovation while overlooking supply chain resilience. Some measures towards greater supply chain resilience have been taken, but only unilaterally. The third pillar of the EU Chips Act's, for example, aims at creating a monitoring and crisis-response framework.[55] Nonetheless, the European Semiconductor Board, its main coordination body, has suffered from ineffective governance and limited industry trust, resulting in the lack of actionable crisis preparedness. The Taiwanese semiconductor ecosystem, on the other hand, presents a number of policies and initiatives aimed at strengthening semiconductor supply chain resilience, though mostly industry-driven and lacking a centralised approach. Overall, a coordinated EU-Taiwan approach to supply chain resilience remains an unmet need.

A coordinated EU-Taiwan approach to supply chain resilience remains an unmet need

3.2 Policy recommendations

Tier I: Early-warning protocol, stockpiling and redundancy

To strengthen cooperation and reduce shared vulnerabilities, the most immediate priority for the EU and Taiwan is building the infrastructure for early warning and coordinated response. The EU and Taiwan should establish a standing technical working group – operating through the EETO and the Taipei Representative Office in Brussels – for real-time exchange of supply chain stress indicators: shipping insurance withdrawals, port congestion, spot price anomalies for critical inputs. Data-sharing protocols would be coupled with a swift communication channel to senior policymakers, to monitor disruptions and translate monitoring into actionable responses, if needed.

Early warning, however, is only as valuable as the buffer it buys. Both parties should therefore build coordinated reserves of critical

[53] SEMI, *SEMI Europe and the Polish Taiwanese Chamber of Commerce Partner to Accelerate Semiconductor Industry Expansions in Poland*, 13 March 2026, https://www.semi.org/en/node/170121.

[54] Fang, Wei-li and Jonathan Chin, "Foreign Minister Meets Italian Delegation", in *Taipei Times*, 10 January 2026, https://www.taipeitimes.com/News/taiwan/archives/2026/01/10/2003850369.

[55] European Commission, *European Chips Act: Monitoring and Crisis Response*, 28 March 2025, https://digital-strategy.ec.europa.eu/en/node/12008.

inputs – helium, neon, krypton and palladium – sufficient for ninety days of production, paired with supply diversification. Semiconductor-specific annexes to the EU's Critical Raw Materials Act could provide the legislative framework for this effort, with the Taiwanese industry being a natural partner in the development of benchmarks. Logistical resilience deserves equal attention: both sides should jointly map alternative shipping corridors and pre-certify air freight routes, with government facilitation to aggregate commercially sensitive routing data and mutual recognition of emergency customs procedures for semiconductor shipments.

Tier II: Minilateral chip diplomacy and AI supply chain mapping

Neither the EU nor Taiwan holds significant influence over the architecture of US-led initiatives such as Pax Silica, but both have a shared interest in ensuring that multilateral chip diplomacy does not further entrench asymmetric dependency. Rather than engaging with these frameworks individually, Brussels and Taipei should develop a coordinated approach toward a more resilient semiconductor architecture – one that reflects a broader coalition of chokepoint economies, including South Korea and Japan. At the same time, cooperation between individual EU member states such as Italy and Taiwan should also promote greater coordination within a cohesive European framework, to avoid redundancy of initiatives and policy fragmentation.

Minilateral engagement between chokepoint economies should be complemented by a joint AI supply chain mapping exercise. As AI-driven demand for advanced logic chips accelerates, the risk of demand concentration is rising. A structured mapping effort – building on the ChipDiplo framework and Taiwan's NIAR data capabilities – would generate scenarios to anticipate and respond to these pressures before they translate into vulnerabilities.

Tier III: EDA strategic autonomy roadmap

The longer-term agenda requires addressing the major a structural gap represented by the US hold on EDA. The EU and Taiwan share a deep and largely undetected dependency on US-controlled EDA software. To strengthen resilience in this critical segment of the semiconductor supply chain, they should reinforce their chip design ecosystems by expanding design capabilities and intellectual property. Within this framework, the EU and Taiwan should develop a joint roadmap aimed at gradually increasing EDA autonomy. An EDA strategic autonomy roadmap should include integrating EDA into EU and Taiwanese respective economic security strategies, boosting coordinated investment, cooperation on R&D and at the start-up level, and jointly channelling the talent pipelines needed to reduce that dependency, over the medium to long term.

Abbreviations

AI	Artificial intelligence
DUV	Deep ultraviolet
EDA	Electronic design automation
EETO	European Economic and Trade Office
ESMC	European Semiconductor Manufacturing Company
EU	European Union
EUV	Extreme ultraviolet
FDI	Foreign direct investment
GDP	Gross domestic product
IC	Integrated circuits
IPCEI	Important Project of Common European Interest
LNG	Liquefied natural gas
NIAR	National Institutes of Applied Research
nm	Nanometres
R&D	Research and development
REE	Rare earth element
TECIF	Taiwan-Europe Chip Innovation Forum
TSMC	Taiwan Semiconductor Manufacturing Company
US	United States

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