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KEEPING VALUE CHAINS AT HOME

How China controls foreign access to technology and what it means for Europe

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KEY FINDINGS

- In a shifting geopolitical environment, China's government is sharpening and testing its tools for controlling technology-related outflows. As domestic firms climb up value chains, there is increased emphasis on controlling foreign access to retain critical innovation capacity within China.
- The party state uses dual-use export controls flexibly. It seeks to present itself as a responsible stakeholder contributing to non-proliferation, while supporting its domestic industries and signalling the ability to mobilize controls for other ends if needs be, such as retaliation.
- China is unique in having a parallel, civilian technology export control regime geared towards protecting domestic innovation and industrial capacity. This regime is increasingly deployed to establish and defend China's supply chain dominance.
- Xi Jinping's push for "comprehensive national security" has resulted in other instruments also being repurposed to manage technology outflows. China's toolbox is unmatched by any OECD economy when monitoring and limiting cross-border flows of capital, data, talent and IP.
- European governments and firms must prepare for an era where China may be more willing and able to exploit its advantages and leverage along technology value chains, often in a highly opaque manner. At the same time, China still faces constraints and tradeoffs when it comes to instrumentalizing its strengths.

CHINA RAPIDLY BUILDS UP CAPACITY TO DEFEND AND LEVERAGE ITS VALUE CHAIN DOMINANCE

In recent years, China has become a more proactive adopter of export controls, affecting technology supply chains of huge economic and strategic importance for Europe. In August 2023, it began requiring a license for exports of gallium and germanium metals and several of their compounds. The move was widely seen as a response to coordinated restrictions on semiconductor technology exports from the United States, Japan and the Netherlands.¹ In December, China tightened export controls for some graphite products and banned the export of technology to make rare earth magnets.² These are just few high-profile cases, but they illustrate the critical importance of understanding how China uses export controls today and how it may do so in the future.

Beijing's actions reflect profound shifts in both the geopolitical landscape and the way China relates to it. Supply and value chains are being reconfigured and weaponized as countries fiercely compete for technological dominance and choose resilience over globalization. China, meanwhile, is turning from a technology seeker to a technology provider. While its aggressive efforts at appropriating foreign technology have long been a prime cause for concern, foreign governments and firms now face an additional challenge: As Chinese companies ascend critical technology value chains, Beijing appears intent on monitoring and limiting foreign access to those.

The end goal is to manage technology-related outflows to keep supply and value chains in China. Xi Jinping has been adamant about the need for China to become indispensable in global technology production.³ The official concept of “self-reliance and self-empowerment” (自立自强) is often associated with policymakers' push to make China more self-sufficient in science and technology (S&T). But the second part of the phrase masks a more offensive intent.⁴ According to Xi, “trump card” (杀手锏, literally “assassin's mace”) technologies should not only deter foreign governments from denying China the inputs it needs, but also be leveraged asymmetrically to attain technological superiority and hence geopolitical power.⁵

This trend is only poised to accelerate as the efforts by G7 members countries at establishing China-free supply chains (part of the so-called ‘de-risking’ strategy) threaten to erode China's indispensability and techno-industrial upgrading.⁶ This complex external environment provided the context for the recent Third Plenum of the Chinese Communist Party (CCP)'s Central Committee, which took place in July after an unexplained delay. The plenum pledged to “safeguard S&T security” and “build autonomous and controllable industrial and supply chains.” The latter shall be accomplished, inter alia, by reshoring key industries and improving the system of strategic national reserves.⁷

To anticipate potential risks and disruptions, it is crucial to understand how Chinese export controls sit within a wider drive to develop and retain critical innovation capacity within China. The government has a wide range of instruments not only to shore up China's value chain dominance but also to control and potentially leverage foreign access to technology inputs and outputs.⁸ Although many of these predate Western de-risking, how they may get mobilized in this new era of global technology competition deserves

attention. Beijing's strategic motives, means and constraints will significantly shape the nexus of geopolitics and technology in the years to come.

The party state's toolkit includes:

- **Dual-use export controls** (Export Control Law, ECL)
- **Civilian technology export controls** (Foreign Trade Law and Technology Import/Export Regulations, TIER)
- **Other instruments** (blacklists, localization of data, technical information and intellectual property (IP), restrictions on talent mobility, managed trade and investment, and party-state control of S&T development)

China is not the only country seeking to manage foreign access to 'sensitive' technology and the associated value chains, but it stands out for its comprehensive and opaque approach. Many OECD economies have stepped up measures to protect economic security, on top of traditional national security and non-proliferation goals. What makes China unique is the breadth of the instruments it has and the lack of transparency and predictability surrounding their application. The CCP's sweeping definition of national security,⁹ coupled with its track record of forcefully extracting geopolitical and strategic gains from economic interactions, are causes for concern.

However, weaponizing one's advantage risks weakening one's leverage by encouraging others to speed up diversification. In fact, Beijing appears aware that restricting technology-related outflows is a double-edged sword and entails a careful balancing act. While remaining mindful of these limitations and avoiding overreactions, the PRC's trading partners should take seriously China's long game to shore up and leverage its technological dominance.¹⁰

Keep it at home: China's comprehensive toolbox for controlling technology outflows



| | |
|--|---|
|  <p>DUAL-USE EXPORT CONTROLS</p> | <ul style="list-style-type: none"> ■ Export Control Law (2020) ■ Related regulations, measures and lists |
|  <p>CIVILIAN TECH EXPORT CONTROLS</p> | <ul style="list-style-type: none"> ■ Foreign Trade Law (1994, last revised 2023) ■ Regulations for the Administration of Technology Import/Export (2002, last revised 2020) ■ Catalogue of Technologies Prohibited or Restricted from Export (2008, last revised 2023) |
|  <p>BLACKLISTS</p> | <ul style="list-style-type: none"> ■ Unreliable Entities List (2020) ■ Counter List under Anti-Foreign Sanctions Law (2021, replacing previous system of ad-hoc sanctions) |
|  <p>LOCALIZATION OF DATA AND TECHNICAL INFORMATION</p> | <ul style="list-style-type: none"> ■ Data Security Law and Personal Information Protection Law (2021) ■ Outbound Data Transfer Security Assessment Measures (2022, last revised 2024) ■ Cybersecurity Law (2017) ■ Cybersecurity Review Measures (2020, last revised 2022) ■ Administrative Measures for Scientific Data Management (2018) ■ Biosecurity Law (2021) ■ Human Genetic Resources Regulations (2019); related measures ■ S&T Progress Law (1993, last revised 2022) ■ Regime for the protection of S&T secrets (1998, current regulations revised 2015) |
|  <p>IP TRANSFER RESTRICTIONS</p> | <ul style="list-style-type: none"> ■ Measures for the Overseas Transfers of IP Rights (2018) ■ Foreign filing license under Patent Law (1984, last revised 2020) ■ Competition rules enabling IP monitoring and management |
|  <p>LIMITS ON TALENT FLOWS AND SCIENTIFIC EXCHANGE</p> | <ul style="list-style-type: none"> ■ State Secrets Law (1988, last revised 2024) ■ Counterespionage Law (2014, last revised 2023) ■ Criminal trade secret misappropriation laws ■ Rules and administrative measures limiting academics' foreign engagements |
|  <p>TRADE AND INVESTMENT RESTRICTIONS</p> | <ul style="list-style-type: none"> ■ Export quotas ■ Reporting requirements; unofficial export bans ■ Capital account and foreign exchange controls ■ Overseas listing regime ■ Export value-added tax rebate system ■ Outbound FDI screening (Administrative Measures for the Outbound Investment of Enterprises, 2018, replacing prior regulations from 2014) ■ Merger control under Anti-Monopoly Law (2008, last revised 2022) ■ Inbound FDI screening (Foreign Investment Law, 2020; Foreign Investment Catalogue; Measures for Security Review of Foreign Investments, 2021, replacing prior rules from 2011) |
|  <p>PARTY-STATE CONTROL OVER S&T DEVELOPMENT</p> | <ul style="list-style-type: none"> ■ Mandate for state-owned enterprises (SOEs) to develop and control strategic technologies ■ Enterprise State-Owned Assets Law (2009, replacing previous statutes) ■ Public investment in research centers, labs and firms (e.g., National Labs and Research Centers, State Key Labs, etc.) ■ Corporate governance of private enterprises |

Source: MERICs

BEIJING'S FLEXIBLE ADOPTION OF DUAL-USE EXPORT CONTROLS: NATIONAL SECURITY MEETS INDUSTRIAL POLICY

China's export control regime¹¹ serves disparate goals, spanning retaliation and technology dominance as well as more consensual national security interests and international non-proliferation aims. The State Council's 2021 White Paper on export controls directly reflects this broader focus, referencing Xi's "comprehensive national security concept" (总体国家安全观) as a core guiding principle.¹² For Xi, national security also encompasses S&T self-reliance and competitiveness.

The notoriously opaque way in which China's government handles licenses for exporters of controlled items diverges from international standards, particularly as it gives the authorities wide scope for discretion. For instance, from 2020 to 2023, Swedish battery startup Northvolt was suddenly unable to get artificial graphite from China, whereas Chinese battery makers building plants in Hungary had no such problems.¹³ China's unofficial rare earth export embargo against Japan in 2011 was, officially, to address environmental concerns, though the coercive intent was apparent.¹⁴

Although China's government has sought to make the system more transparent and predictable, the outcome has been a mixed bag. Before the 2020 Export Control Law (ECL) was passed, export controls were spread over multiple lists and bureaucracies. Most have been consolidated into two lists.¹⁵ However, no available list is complete, nor is China's end-user blacklist public.

Recent cases offer useful lessons about China's flexible and untransparent use of export controls.

Export controls for non-proliferation - and to bolster domestic industries

Beijing carefully uses export controls to present itself as a responsible stakeholder that strives to prevent arms proliferation, without hurting its industry's interests. For instance, it first included drones under export controls in 2002 on the Export Control List for Missiles and Related Items and Technologies. It also included autopilots for unmanned aerial vehicles (UAVs), precise gyroscopes, and UAVs able to carry a payload of more than 500 kilograms for at least 300 kilometers.¹⁶

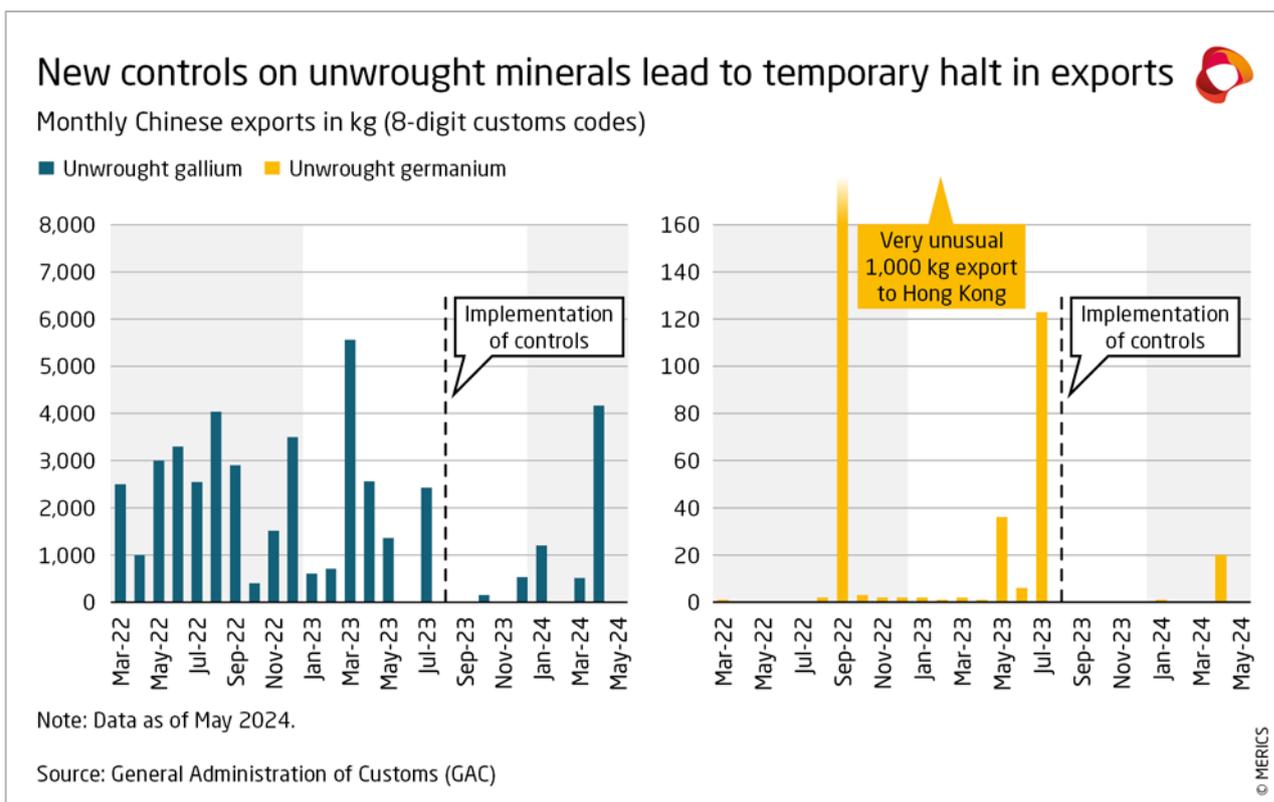
The narrow parameters (a Mavic-3, a common Chinese drone, only has a flight range of 50 km) meant China could still permit many drone exports. Domestic commenters have argued that these controls served China's core competitiveness, and their expansion in 2015 was "conducive to the healthy development of China's drone industry".¹⁷

Russia's invasion of Ukraine has put Beijing's opportunistic stance in the spotlight. In 2023, as Chinese drones popped up among Russian armaments on Ukrainian battlefields, Beijing imposed extra controls to signal its constructive stance.¹⁸ However, these were designed in a way that most Chinese commercial exports were not affected. More recently, Beijing has included certain aerospace and aviation sector equipment, software and technologies, as well as bulletproof vest components in its control list.¹⁹ It remains to be seen whether and how this will be enforced, considering that China remains Russia's top supplier of dual-use components used in Moscow's war of aggression against Ukraine.²⁰

Leveraging critical minerals to rebuff Western export controls and hinder de-risking

Trade data suggests that some worries regarding Beijing’s weaponization of strategic inputs are legitimate, even though fears of a trade blockade were overblown. On the one hand, China’s mineral export controls mostly covered a handful of minerals and their importers. Export volumes for the vast majority of the 22 custom lines for gallium, germanium and graphite products on China’s 2023 control lists were unaffected. On the other hand, regional disparities in trade patterns following the controls fuel legitimate fears among partners of a geopolitical bias to licensing decisions (see details below), with clear retaliatory intent in some cases.

China announced export controls on gallium and germanium in July 2023, months after the United States, alongside Japan and the Netherlands, barred Chinese firms from buying advanced computing chips and related tools. Both metals are used across important electronics supply chains, including semiconductors. Around 90 percent of global production of both metals is in China.²¹ Gallium and germanium are also crucial for US and NATO defense-industrial bases. They fall under the multilateral Wassenaar Arrangement²², which allows China to justify the export controls on national security grounds.



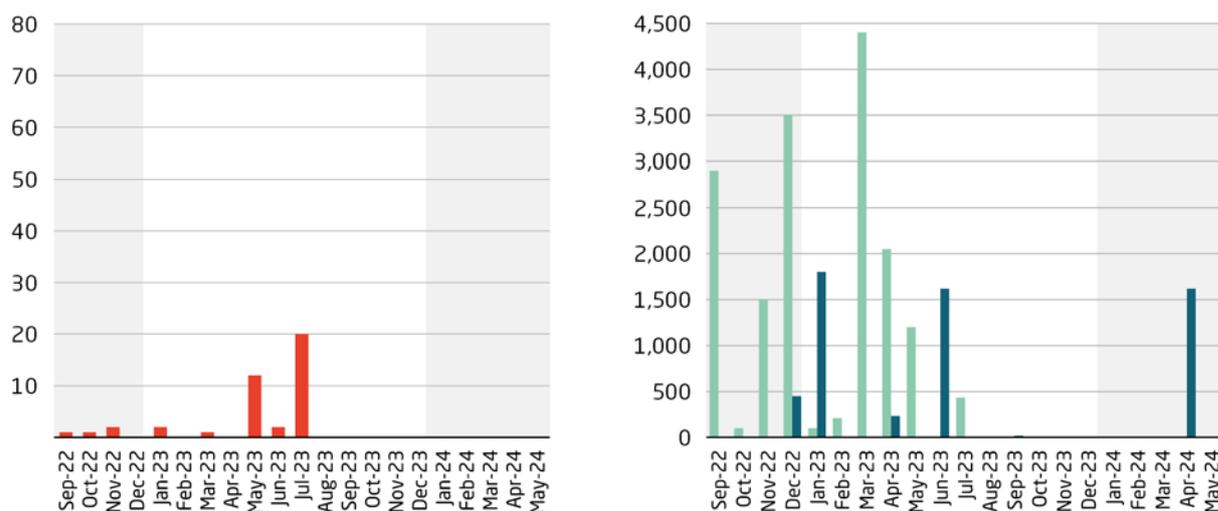
The controls seem to have been used to retaliate against what China views as the abuse of export controls by other partners. Exports of unwrought gallium and germanium as well as phosphide from China to the US, Japan and the Netherlands disappeared completely once the new controls were enforced. The brief uptick before the implementation suggests importers were stockpiling. Exports to OECD countries have since rebounded to slightly below pre-control levels, but not for the United States, Japan and the Netherlands.

Controls on unwrought gallium led to complete export stop to US, Japan and the Netherlands



Three-month rolling exports of Gallium, Germanium and Phosphides to the three selected countries, in volume (kilograms)

- Unwrought germanium: United States, Japan and the Netherlands
- Unwrought gallium: United States, Japan and the Netherlands
- Phosphides: United States, Japan and the Netherlands



Note: Data as of May 2024.

Source: General Administration of Customs (GAC)

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Again, these controls allow China to show its capacity to hurt the United States and partners without affecting domestic industries. Only the exports of unwrought metals, which need extensive processing to make usable materials, and phosphides, vital in LED manufacturing, have been affected among the many customs categories included in the export controls. Exporting final products rather than raw materials is in the interest of China’s industries.

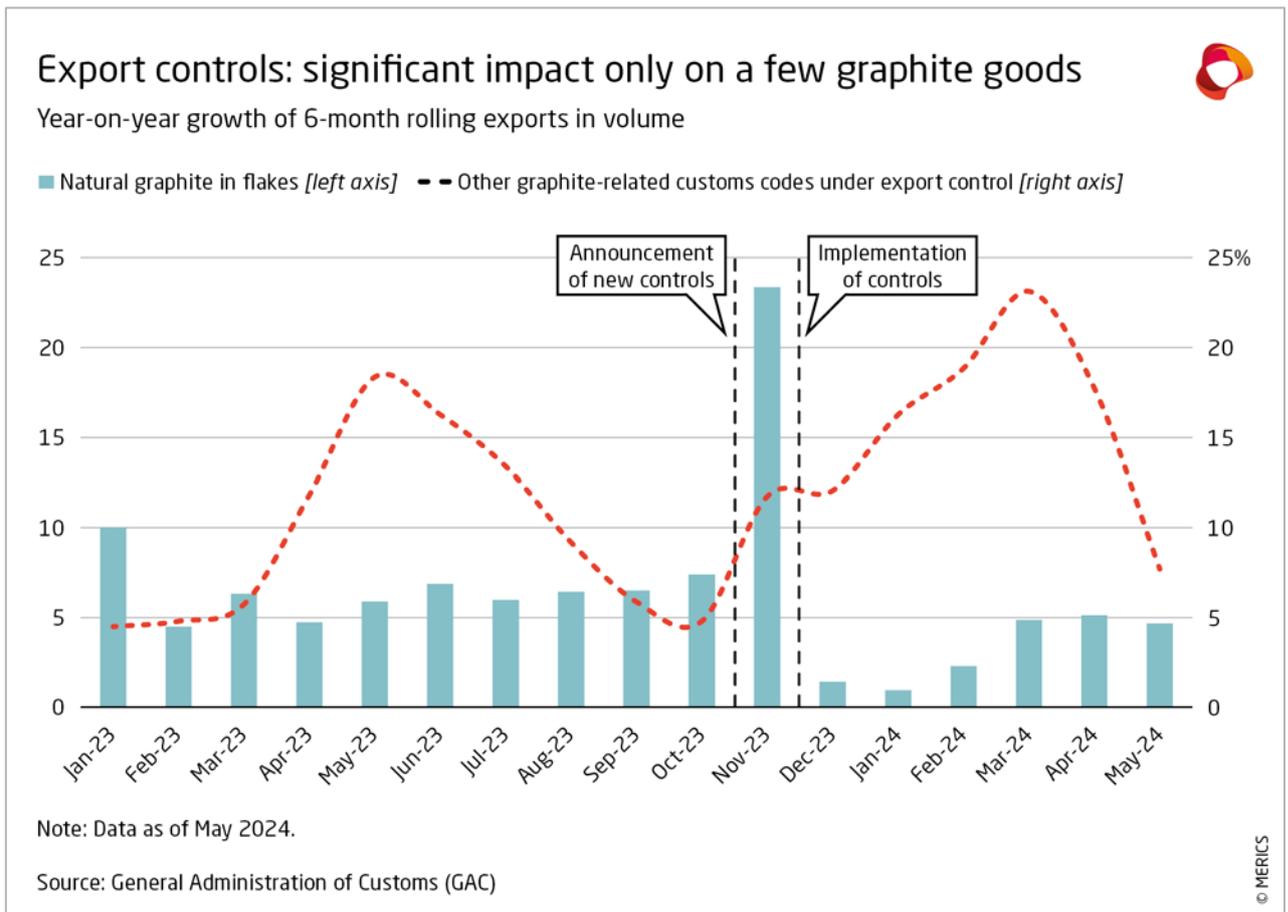
In fact, China selects its targets carefully. Beijing could have chosen silicon carbide (SiC), a semiconductor material showing promise for specific, economically important chips for which China makes 44 percent of the world exports.²³ No other country supplied more than 10 percent of exports, while the United States, Japan and the Netherlands are key importers. China seeks to dominate both the production of SiC-based chips (often called compound semiconductors) and the growth of SiC crystals (also called ingots) which these chips are cut from.²⁴

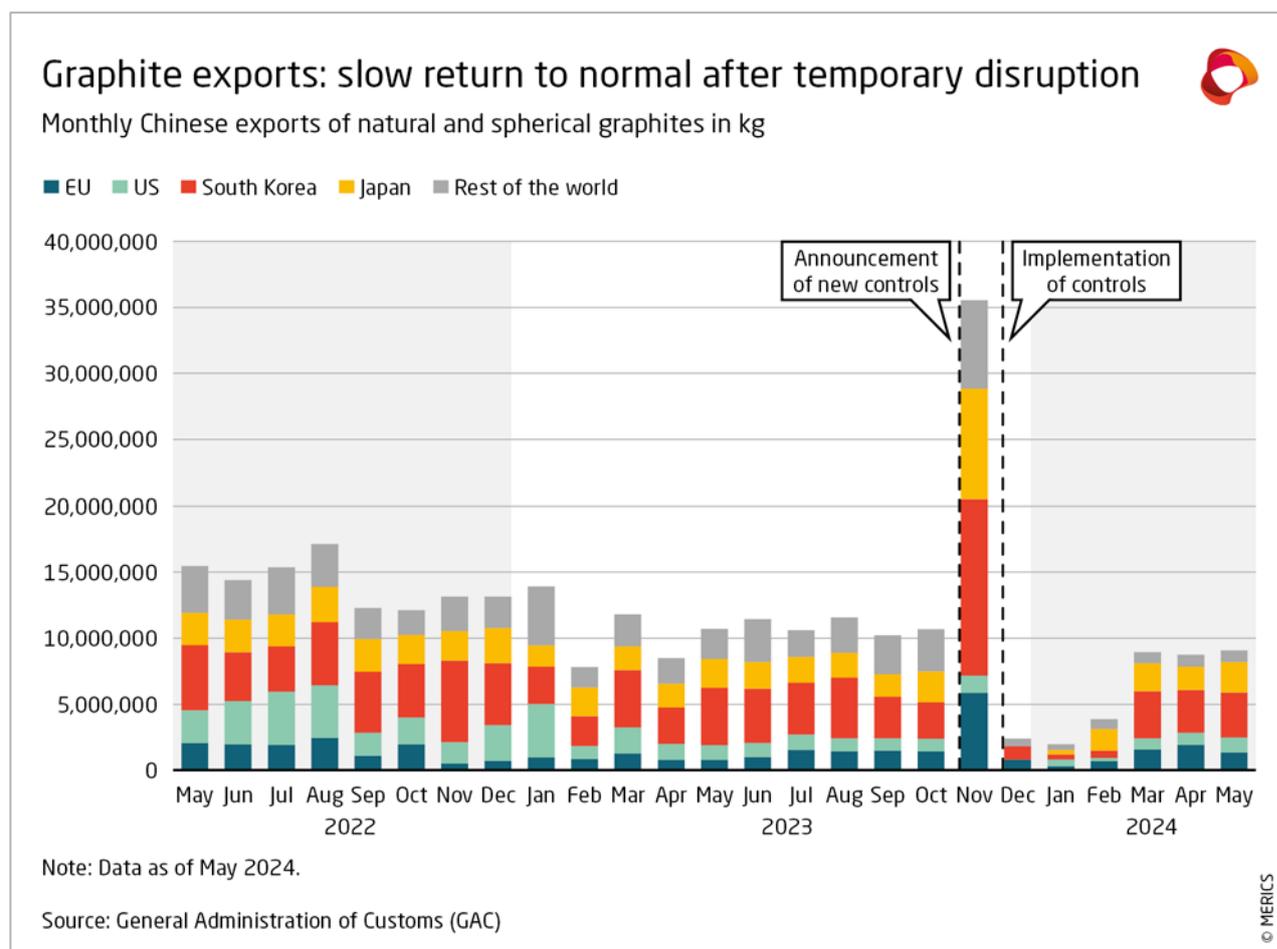
However, SiC is not a raw material. Silicon and carbon are both relatively abundant materials with wide applications; this and China’s large imports of both make them poor targets for export controls. China could restrict the export of finished SiC ingots or wafers, but doing so would jeopardize an emerging strategic industry by disincentivizing foreign companies from sourcing there. China does not have a decisive technological lead, and its nascent SiC industry must compete with others.

China’s controls on graphite seem to follow the logic of industrial and technological competition, even though graphite, too, has military applications and features in Wassenaar. The sudden and unannounced halting of artificial graphite exports to Sweden in early 2020 conveniently coincided with the expansion of Chinese EV battery makers in the EU. Politically motivated economic coercion cannot be ruled out as bilateral relations became fraught in 2019. It is worth noting, however, that exports briefly resumed in January 2023, shortly before Chinese company Putailai announced plans to make battery anodes from synthetic graphite in Sweden.²⁵ Chinese supplies to Sweden suddenly resumed in 2024, without any public announcement or explanation.

Against this backdrop, it is hardly surprising that the announcement of the new measures in October 2023 led to massive orders by OECD countries, especially those that are striving to shift battery and EV value chains away from China. G7 countries and South Korea saw the biggest frontloading and subsequent drop in Chinese sales of both spherical and natural graphite. The United States and Japan even had an unprecedented month of zero imports in December, possibly indicating that the authorities were delaying licenses for imports to those countries.

It must be noted that exports of those two graphite products seem to have returned to normal since March 2024, at slightly lower levels than before but rather homogeneously for all trading partners.





In summary, China uses dual-use export controls flexibly. It seeks to portray itself as a responsible stakeholder yet seems to carefully design controls to develop and support domestic industries in key dual-use areas. Within the global technology rivalry, export controls signal not only China's ability to hit back at similar measures taken by other countries, but also an intent to keep them dependent on China.

CHINA'S CIVILIAN TECHNOLOGY EXPORT CONTROL REGIME PRIORITIZES ECONOMIC SECURITY

While China's dual-use export controls are partially consistent with multilateral regimes and international practices, Beijing's parallel export control regime for civilian technologies is more unique. It centers on innovation and industrial policy motives and is anchored by the "Catalogue of Technologies Prohibited or Restricted from Export", last amended by MOFCOM in December 2023. The catalogue sits under the Foreign Trade Law and related regulations, chiefly the Technology Import-Export Regulations (TIER).²⁶ The regulations explicitly allow China's government to protect economic security, so they are even more versatile than control lists under the ECL, whose main policy objectives are safeguarding national security and contributing to non-proliferation.

The economic security logic was underscored by a move to preserve "China's indigenous development and controllability of key and core technologies."²⁷ Since 2018, a security assessment has been needed for transfers to foreign parties of Intellectual Property Rights

(IPR) tied to technologies marked as restricted in the catalogue. This includes patents, exclusive rights to integrated circuit layout designs, computer software copyrights or new plant varieties.

Importantly, the rule applies to any transfer of IP to a foreign entity, including if they are based in China or if the transfer results from the purchase of Chinese firms.²⁸ For example, China applied export controls on TikTok's content recommendation algorithm in 2020 after the US government tried to force mother company ByteDance to divest from the live-streaming app.²⁹

Limiting technology exports to keep industrial chains in China

One sector Beijing has moved to protect is rare earth manufacturing technology, by banning the export of technology to make rare earth-based magnets. These can be seen to complement the controls on the exports of the minerals themselves. China's controls do not limit the export of finished magnets: the goal is to retain China's dominance of rare earth processing and to prevent production capacity being built outside of China with Chinese technology.³⁰ A ban on the export of rare earth extraction and separation technology was already in place.

Rare earths are key value chains where the PRC has a massive footprint. Despite only producing 60 percent of the world's rare earths, the country processes nearly 90 percent.³¹ Chinese firms have amassed IP and technical expertise so restricting the export of processing technology protects domestic industry.³² Permanent magnets (especially neodymium-iron-boron NdFeB magnets), for instance, are used in EV engines and wind turbine generators, and are therefore vital for the green transition. At the end of 2021, China controlled 87 percent of the global market for these magnets, which amounts to a strategic sourcing dependency for the EU.³³

However, it appears that China's restrictions cannot effectively impede the viability of alternative value chains. The Chinese footprint in some areas of the value chain largely stems from massive domestic demand and obscures foreign firms' advantage in some high-end segments.³⁴ For example, South Korean group POSCO International claims to have developed a China-free NdFeB magnet supply chain jointly with Star Group.³⁵ E-Vac Magnetics, a subsidiary of German magnet manufacturer Vacuumschmelze, is building a US plant in South Carolina with Pentagon funds, while Canadian Neo Performance Materials is constructing one in Estonia.³⁶

The double-edged sword of weaponization

Ultimately, banning technology exports – or tightly restricting licenses – could backfire for China. Where foreign firms hold relevant technical expertise and IP, imposing export controls can erode rather than protect a country's advantage by further incentivizing de-risking efforts elsewhere. China's policymakers seem aware of the pitfalls of weaponizing 'choke points'³⁷ along highly complex and global value chains. They are testing different ideas, likely to see where China can exploit dependencies without scoring an own goal.³⁸

Domestic technologists and industry insiders are debating such tradeoffs. For example, MOFCOM imposed export restrictions on 3D laser scanning technology (also called

LiDAR), which has applications ranging from drones to self-driving cars. Chinese companies like Hesai mainly compete on price, so there is uncertainty whether controls would strengthen their competitive position or rather hamper overseas expansion and cooperation.³⁹ Going forward, the TIER-based controls could make it harder for Chinese firms to license their technology to European partners.

These kinds of discussions have influenced export control decisions in some cases, leading to more restraint on the part of the authorities. In an earlier draft of the catalogue, MOFCOM proposed banning exports of certain core technologies for making solar panels but dropped the idea from the final version. Chinese companies and experts had raised concerns, pointing out some European and US competitors had already responded by restarting their own production.⁴⁰

Nevertheless, the advantages Chinese authorities can gain from improving their ability to monitor technology-related outflows should not be discounted. This benefit is strong when the catalogue introduces a licensing requirement rather than a blanket ban. Through processing the license applications of Chinese and foreign companies the government could be gathering useful supply chain data for industrial policy purposes.⁴¹

BEIJING'S TOOLKIT FOR CONTROLLING TECH-RELATED OUTFLOWS GOES BEYOND EXPORT CONTROLS

China's capacities and tools to preserve national technological leadership go much farther than export controls and are unmatched by any OECD economy. Some of these are not specific to China, and indeed the United States also considers long-term competitiveness a national security objective.⁴² What sets China apart are the number of instruments it has and its tendency to use them beyond their designated purpose, based on a broad definition of "national security and interests".

Xi's national security push has created multiple new legal and regulatory tools. His emphasis on the geostrategic importance of S&T, coupled with China's track record of economic coercion and absence of rule of law, sparks legitimate worry of discretionary application among its trading partners. Noteworthy clauses even allow retaliatory measures to actions by a foreign government.⁴³ By tightly managing outflows of technology, raw materials, capital, IP, S&T personnel, as well as data and technical information, Beijing can onshore value chains and control foreign access.

Monitoring and controlling S&T development, talent and IP

For starters, Chinese authorities have an extra lever to control S&T inputs and outputs that OECD countries lack, namely their outsized involvement in technology research, development and commercialization. The party state directly manages a lot of R&D activity in strategic sectors. Research centers are undergoing tighter centralized monitoring and guidance.⁴⁴ State-owned enterprises, abnormally prevalent in patenting, have been ordered to contribute more to S&T development. Their new tasks include better controlling strategic value chains, especially tech-intensive sectors.⁴⁵ There has been an uptick in state involvement even in areas that tend to be privately driven, such as startup funding.⁴⁶

China's government also has unique powers over the outflow of talent.⁴⁷ The Ministry of Education (MOE) has required university approval for all academic overseas trips and collaborations since 2016, though it seems enforcement only began more recently, generating complaints from prominent Chinese academics.⁴⁸ Top talents even face travel restrictions.⁴⁹

Foreign access to Chinese IP, meanwhile, is tightly monitored. As mentioned in the previous section, a review process is required for any foreign transfer of IPR related to technology on the civilian technology export control catalogue. The S&T Progress Law, meanwhile, hinders the overseas transfer of IP generated by government-funded projects, even after its 2021 amendment made some concessions to foreign scientists.⁵⁰

The 2020 Patent Law governs a non-public patent registry for applications relevant to "national security or major interests". Moreover, any preliminary "invention developed in China" must undergo a "confidentiality examination" before any international patent application.⁵¹ Other jurisdictions have roughly equivalent rules around patent classification and (notably the United States) foreign filing licensing.

Tightly managing capital, information and trade flows

Beijing's broad toolbox for managing cross-border capital flows contains an extra layer to keep domestic technology out of foreign hands. Except for a few sectors and small transactions, foreign direct investment (FDI) in and out of China has long been subject to administrative approval. By contrast, most OECD countries screen only inbound investments under narrowly defined conditions.⁵² Moreover, since 2023 companies wishing to list on stock markets abroad have needed an administrative approval, with a national security review for strategic sectors. China's stringent cross-border capital controls allow further monitoring of Chinese companies' outbound investment.

There is also a comprehensive framework for monitoring outward flows of data and technical information. The Cybersecurity Law, Data Security Law, Personal Information Protection Law and related regulations, as well as specific localization requirements for scientific data and human genetic resources, amount to stringent data export controls. They impact foreign firms' R&D, for example in the pharmaceutical sector.⁵³ In another illustration of how data rules allow Beijing to onshore value chains, Tesla recently accepted to train its autonomous driving algorithms in China.

Moreover, China has a longstanding regime that protects S&T secrets which also affects scientists' foreign collaborations.⁵⁴ Fresh amendments to the State Secrets Law, in force since May 1, 2024, expand investigative and enforcement powers - highlighting the scope for mission creep in national security work.⁵⁵ Authorities have also cracked down on foreign due diligence and corporate research firms alongside an expansion in counterintelligence legislation.⁵⁶ This quest for secrecy is partly to obscure the state of China's S&T progress to prevent further US government restrictions.⁵⁷

Finally, China also manages cross-border exchanges through duties, quotas and reporting requirements, especially for commodities, which it has used to give domestic component makers preferential access to rare earths and other critical raw materials.⁵⁸ In November

2023, MOCFOM ordered rare earth exporters to report to how much they ship and to whom.⁵⁹

OUTLOOK: EUROPE MUST COORDINATE WITH INDUSTRY AND PARTNERS TO MONITOR CHINA'S ACTIONS

China's newly proactive adoption of export controls should not merely be seen as tit-for-tat retaliation against US measures. It is part of a wider trend for Beijing to protect industrial and innovation interests more forcefully. After decades of chasing foreign technology, the Chinese government is now intent on managing technology-related outflows and limit foreign access to favor domestic champions while hindering Western de-risking.

Many of the instruments we have discussed are still being developed and tested. There are not many technologies where China has a sufficiently unassailable lead to give its toolbox similar firepower to US export controls on semiconductor technology. Even in segments where China has a strong leverage, such as strategic minerals, the government has arguably shown restraint in restricting exports. Moreover, China is careful not to hurt domestic industries and strategically picks its targets, which makes it difficult for foreign companies and governments to predict the impact of its measures. This sometimes leads to overreaction by China's trading partners.

Nevertheless, China's toolbox plays a valuable role in providing the government with intelligence about industrial and technological developments and progress. It can enable the government to identify frontrunners and their technological lead early, monitor their international partnerships and protect them where necessary.

Intelligence about China's progress along key technology value chains

While China's success is no foregone conclusion, EU governments should invest more in tracking China's progress in technology value chains, especially in areas where it is already a frontrunner such as the so-called "new three industries" (EVs, solar panels and lithium-ion batteries), third-generation semiconductors and quantum communications. After all, clear-cut dominance in such value chains is a precondition for credibly restricting foreign access. Combined with continued monitoring of European dependencies on China, this could serve as an early warning system against future Chinese attempts at exploiting technological advantages.

Coordination with the private sector to track Chinese actions

European governments should improve coordination and communication with industry in a confidential and effective manner. Companies who source from or do business in China could share information about their on-the-ground experiences with governments – for example, regarding China's licensing practices. It could help countries monitor and respond to instances where Beijing uses discriminatory licensing to orchestrate Chinese supply chains overseas. Governments should first build up the necessary expertise in critical sectors and technologies, so they can understand the insights they receive. Each

industry's specific vulnerabilities that Beijing might, at some point, exploit, need to be considered.

Information sharing among like-minded partners to bolster resilience

Like-minded OECD partners should coordinate to counter Chinese export restrictions and other actions that limit technology-related flows, especially those of critical inputs. Beijing has demonstrated its readiness to apply such measures in a discriminatory, opaque and at times overtly coercive way.⁶⁰ Countries should share information to counteract China's habit of trying to drive wedges. Within the EU, information sharing obligations could be made more stringent to make sure member states are not played off against one another.

The EU-US Trade and Technology Council created a first early warning mechanism after China announced controls on gallium and germanium. It could become more structured and extended to manage disruptions beyond the semiconductor supply chain. Whether such coordination would even be possible in the event of a reelection of Donald Trump as US president, though, is a big question mark.

ENDNOTES

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