

Online annex for BIS Bulletin no 139: Chokepoints in global supply chains: lessons from rare earths and hard disk drives

Mitigation measures when substitutes are limited

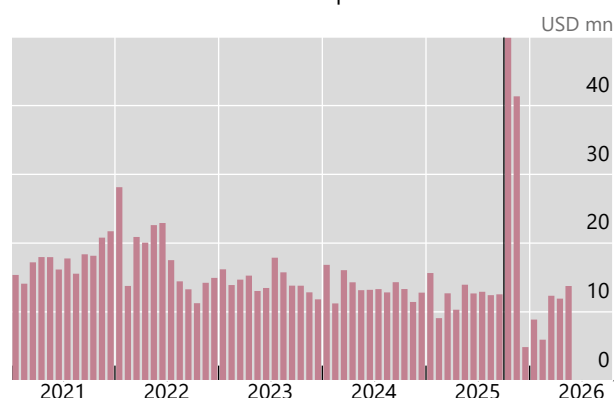
When substitution is difficult, inventories can provide an important first line of defence. Their usefulness depends, however, on the expected duration of the disruption. Trade restrictions often create a short period between announcement and implementation. Importers can use this window to accumulate inventories. In October 2025, for example, China announced a new licensing scheme covering certain rare earth elements (REEs) and artificial diamonds, which are used as heat-management materials in microelectronic devices. Chinese exports of artificial diamonds subsequently rose to nearly four times their normal monthly level as foreign buyers brought purchases forward. Exports returned towards previous levels after implementation of the licensing scheme was postponed (Graph A1.A).

Another short-term market response to supply restrictions is the rerouting of trade through third countries. While export bans prohibit the direct export of specific goods from a country, some traders may reroute these products through third countries, a practice that can constitute illegal circumvention of trade restrictions and is therefore difficult to document. Following the announcement of China's new export licensing scheme, for example, Chinese exports of yttrium compounds to ASEAN (Association of Southeast Asian Nations) countries rose sharply. This pattern is consistent with possible transshipment, as it seems unlikely that demand for these products within the ASEAN region would have increased so rapidly. US import data from the same period also point to the possibility that some yttrium compounds reached the United States through ASEAN countries (Graph A1.B).

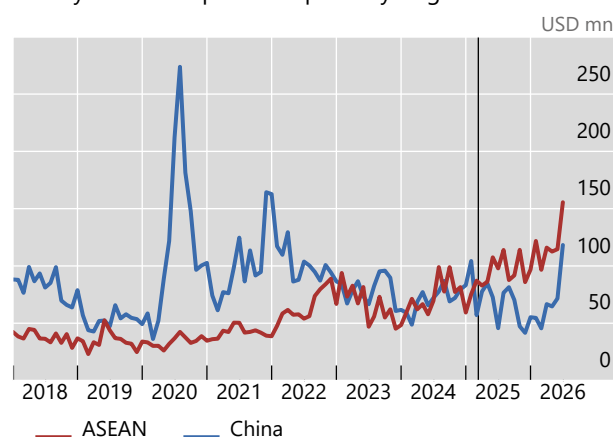
Stockpiling and changes in trade routes can provide short-term relief¹

Graph A1

A. China's artificial diamond exports²



B. US yttrium compound imports by origin



¹ Vertical lines represent the dates when restrictive trade measures were announced. ² Includes HS codes 68042110; 71051020; 84798999.

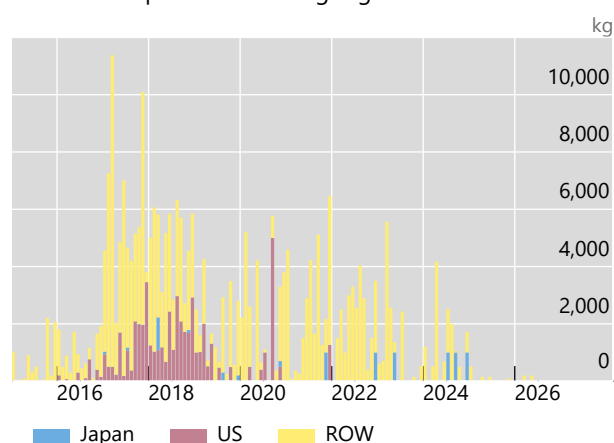
Sources: Chinese Ministry of Commerce; US International Trade Commission.

However, such responses have clear limits. Inventories eventually run down, while governments can tighten enforcement against the circumvention of trade restrictions. These limits are particularly relevant for materials considered critical to national security, for which export controls may be more tightly enforced. Uranium is an extreme example, with many countries imposing strict controls to prevent proliferation of nuclear weapons. A less extreme case is gallium, a critical input for military equipment such as proximity sensors and radio-frequency electronics. In December 2024, China added gallium to the list of minerals subject to export controls. An inter-agency crackdown on smuggling and transshipment initiated in May 2025 subsequently brought China's exports of unwrought gallium to an almost complete halt (Graph A2.A). As exports dwindled, gallium prices outside China diverged sharply from those quoted in Shanghai. Despite its strategic importance, however, gallium appears to have relatively limited aggregate economic significance. Using input-output data, Nassar et al (2024) estimate that a complete one-year Chinese embargo on gallium exports would reduce US GDP by about \$3.1 billion, or only 0.01% of GDP (Graph A2.B).¹ Nearly half of these losses would be borne by the semiconductor and related device manufacturing industry. The example underscores an important distinction: an input may be highly concentrated and strategically important without necessarily posing a large aggregate macroeconomic risk.

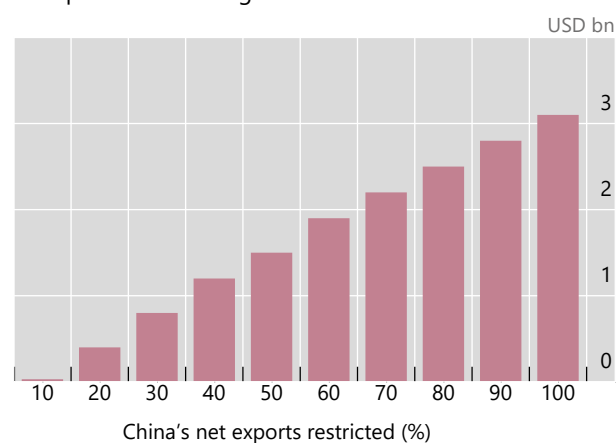
Gallium export restrictions and their estimated effects on US GDP

Graph A2

A. China's exports of unwrought gallium¹



B. Impacts of China's gallium bans on US GDP



¹ HS 81129290.

Sources: N Nassar et al (2024); Chinese Ministry of Commerce.

¹ N Nassar, E Shojaeddini, E Alonso, B Jaskula and A Tolcin, "Quantifying potential effects of China's gallium and germanium export restrictions on the US economy", *US Geological Survey Open-File Report*, no 2024-1057, 2024.