Global Supply Chain Vulnerability to Crime-Related Risk: An Economic Impact Analysis of Cargo Theft

Topic: Trade Disruptions along Global Supply Chains
Author: Haruka Mitoma
Co-Authors: Norihiko Yamano, Shohei TOKITO

As global production fragmentation has amplified supply chainsâ€™ exposure to diverse risks, managing them has become critical for supply chain resilience. While supply chain risk is typically discussed in the context of natural disasters and geopolitical disruptions, crime-related risks have received far less attention. In particular, cargo theft represents a crime-related risk that involves the loss of goods during transportation and distribution. Unlike large-scale shocks such as natural disasters, it is typically smaller in magnitude but far more frequent. However, its economic impact remains underexamined in quantitative research.

This paper is the first attempt to quantify how cargo theft risk in global supply chains affects prices of final products influencing international competitiveness and living standards across countries. We also compare two time periods to examine how the global production fragmentation has altered supply chainsâ€™ vulnerability to cargo theft.

To address these research questions, we develop a novel MRIO framework to quantify embodied trade and transport margin rate, drawing on the concept of embodied tariff rate developed by previous studies. Trade and transport margins are component of purchasersâ€™ prices and reflect the costs required for goods to reach final users safely. Embodied margin rate indicates the ratio of the cumulative margins incurred throughout intermediate transactions along global supply chains to the basic price of a final product.

When cargo theft risk increases, preventive and responsive measuresâ€”such as higher insurance premiums, rerouting of transport, increased security expenditures, and precautionary production buffersâ€”raise trade and transport margins. As the increased margins are passed along the supply chain, they generate upward cost pressure on the prices of final goods. Our framework captures how elevated cargo theft risk propagates across countries and industries and increases final goods prices.

We construct a country-level cargo theft risk index using several indicators, including the Logistics Performance Index (World Bank), the intentional homicide rate (UNODC), and the criminal networks score (GOCI). We use OECD Inter-Country Input-Output (ICIO) Tables for 2005 and 2019. We also use harmonized supply tables consistent with the ICIO to calculate margin rates at the country-sector level. We construct two scenarios: a preâ€“cargo theft scenario without cargo theft risk effects and a postâ€“cargo theft scenario incorporating risk-induced margin increases based on each countryâ€™s cargo theft risk index. The economic impact of cargo theft is measured as the difference in embodied margin rates and final goods prices between the two scenarios.

At the global level, cargo theft risk increased embodied margin rates by 2.65% in 2005 and 2.97% in 2019, resulting in price increases of 0.2% and 0.24%, respectively. Decomposition shows that approximately half of the upward cost pressure arises from indirect transactions from the perspective of final producers, and the share of impacts originating from indirect tiers increased in many countries. Further, we found that the contribution of foreign cargo theft risk to domestic prices has generally increased. Overall, the global economy has become increasingly exposed to cargo theftâ€“induced cost pressures. These pressures originate from more distant upstream tiers and from risks occurring outside national borders, making them more difficult for final producers and policymakers to trace and manage.

Interdependency analysis shows that global cost pressures are driven primarily by advanced economies with dense and highly interconnected supply chain networks rather than by regions with higher cargo theft risk indices. Based on the 2019 structure, the largest forward cost pressures are generated by Russia, China, and the United States. Russiaâ€™s large influence reflects its central role in supplying energy mining products and basic metals. The result suggests that strengthening security measures in advanced economies can yield substantial benefits for the global economy.

Meanwhile, Brazil and Nigeriaâ€”both characterized by relatively high cargo theft risk indicesâ€”have become more influential within global supply chains over time. Cargo theft risk indices in many emerging and developing economies have shown only limited improvement. At the same time, global production fragmentation has intensified, increasing exposure to foreign cargo theft risk. If the pace of participation to the global value chains in these economies outpaces security improvements, the global economy may become increasingly vulnerable to the economic consequences of cargo theft risk. Therefore, in the long run, sustained efforts to reduce cargo theft risk in emerging and developing economies will be essential to mitigate such systemic vulnerabilities.