Researchers detect illegal intercountry trade of mercury using discrepancies in mirrored trade data

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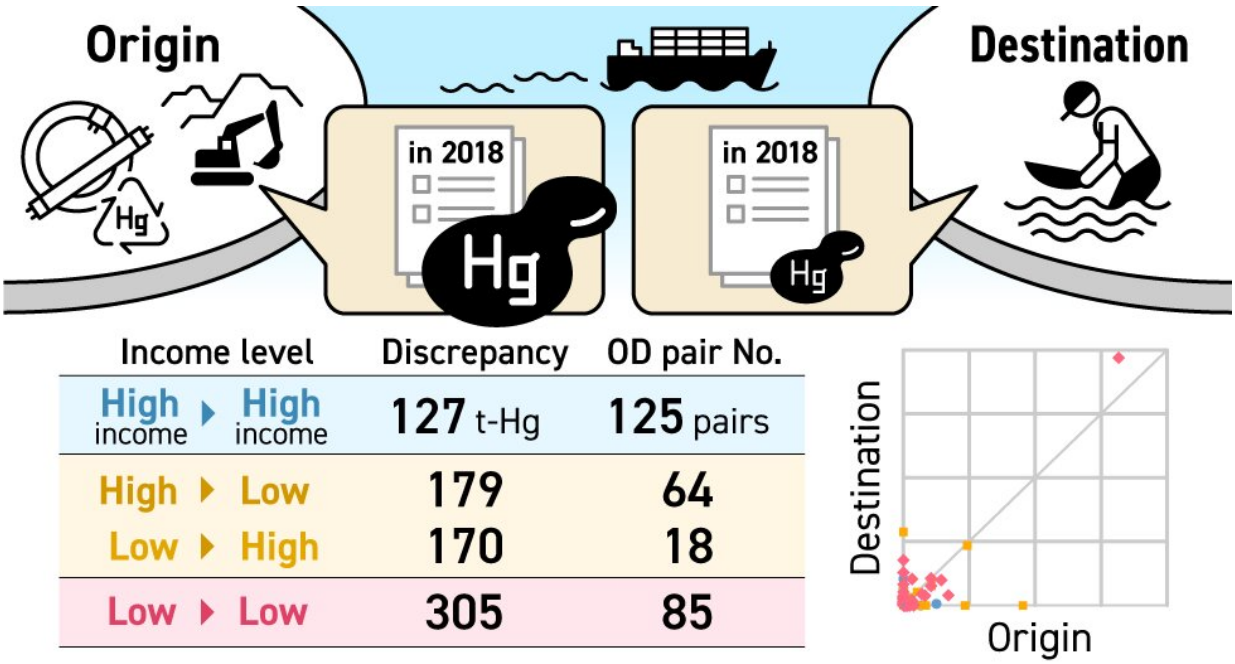

Scientists from Hiroshima University and the National Institute for Environmental Studies developed a new method to detect illegal mercury trade using discrepancies in mirrored trade data. Credit: Masaaki Fuse, Hiroshima University and Kenichi Nakajima, National Institute for Environmental Studies

The Minamata Convention on Mercury is an international treaty designed to protect humans and the environment from the harmful

effects of mercury pollution. With these treaty restrictions on the use of mercury, an increase in the illegal trade of mercury has been expected. A team of researchers undertook a study of the illegal intercountry trade of mercury by examining different countries' export and import trade statistics. They were successful in developing a data driven method for detecting the illegal international trade in mercury.

They published their work in the journal *Environmental Science & Technology* on September 23, 2022.

Named for the Minamata Bay in Japan where thousands of people were poisoned by mercury-tainted wastewater, the Minamata Convention on Mercury was adopted in 2013. The treaty came into full force in 2017 with 137 countries participating in the convention. The treaty banned the opening up of new mercury mines. It also required existing mines to be phased out and the use of mercury in products to be restricted. The Minamata Convention's advantage over other environmental conventions is that it includes a three-part design that includes legally binding regulations, an independent financial mechanism, and a compliance mechanism.

Prior to this study, no study has detected the illegal intercountry mercury trade in the context of the international movement to phase out mercury because of difficulties in monitoring illegal intercountry trade by each country's trade statistics. "Detecting the existence of illegal international trade in mercury is a key issue in assessing the effectiveness of the Minamata Convention," said Masaaki Fuse, an associate professor in the Graduate School of Advanced Science and Engineering at Hiroshima University.

Countries are phasing out mercury through international environmental regulations because of its damaging effects on human health and ecosystems. The World Health Organization lists mercury in the top 10

of chemicals of major public health concern. With the restrictions on the legal use of mercury tightening, and the increase in the illegal trade of mercury, including smuggling, the researchers sought a way to examine the issue.

The researchers approached the question of illegal trade, looking for discrepancies. In trade statistics, a discrepancy is defined as the gap between the exports reported by the exporting country's trade statistics and the mirrored imports reported by the importing country's trade statistics. In looking at these numbers, the team applied an intraclass correlation coefficient (ICC), that is a descriptive statistic, to the mirrored exports and imports from trade statistics of each country provided by the United Nations Comtrade.

The UN Comtrade is a database that provides official trade statistics as reported by countries and areas. Using the ICC, the team analyzed the trade trends by year and by country. They included both low-income and high-income countries in their study (low-income and high-income economies, as defined by the World Bank).

Using the year-based ICC analysis, the team identified a tendency to reduce the detection of discrepancies in the reported mirrored exports and imports for mercury at the intercountry level under the recent mercury phase-out movement. Through an ICC analysis focusing on exporting and importing countries, the team verified the validity of the ICC analysis as a way to detect illegal intercountry trade of mercury.

This study is the first to highlight the detection of illegal intercountry mercury trade in the mercury phase-out movement using discrepancy in mirrored trade data from UN Comtrade. "Our analyses detecting the illegal trade of related countries contribute to the effectiveness evaluation and custom capacity building required in the Minamata Convention by offering a data-driven method to enable the effective

detection of illegal mercury trade," said Fuse.

Looking ahead to future research, the team hopes to establish a method for evaluating the effectiveness of the Minamata Convention by extending the method developed in this study. "Our ICC analysis enables the identification of countries in need of increased customs capacity and intercountry cooperation among the Convention parties," said Fuse.

More information: Masaaki Fuse et al, Detecting Illegal Intercountry Trade of Mercury Using Discrepancies in Mirrored Trade Data, *Environmental Science & Technology* (2022). DOI: 10.1021/acs.est.2c04327

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