Structural Emission Attribution in the Global Supply Chain and Climate Policy Making

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Author: Fumiya NAGASHIMA
Co-Authors: Shohei TOKITO, Tesshu Hanaka

Previous studies have demonstrated that it is crucial to establish complementary supply chains from both an economic and environmental perspective, as well as implement environmental policies that focus on international coordination and global supply chain management. To develop effective policies to mitigate climate change, it is important to understand the emission accounting of the sectors comprising the global supply chain network and implement the appropriate policies. Focusing on the relationship between sectorsâ€™ position in the global supply chain and its policy implications, this study develops a structural position analysis framework based on input-output analysis. We calculated the gross emissions from all supply chain paths passing through a specific sector and transaction using the HEM and decomposed them into three types: production-oriented emissions (POEs), consumption-oriented emissions (COEs), and betweenness-oriented emissions (BOEs). Our framework reveals high-priority sectors and transactions, and the best strategies for CO2 emission reduction in the global supply chain. We also expand the discussion on emission reduction policies to inter-sectoral and international collaboration based on a multi-regional input-output table, focusing on cross-border transactions. The results indicate that Chinese industries with large HEM impacts are the production- and betweenness-oriented, while the U.S. has industries with large HEM impacts in the betweenness- and consumption-oriented, similar to Europe. In terms of budget allocation for climate mitigation, the main focus in China is on reducing emission intensity and the use of intermediate goods with high emissions for the manufacturing sectors, while, in the U.S. and Europe, policies to promote the reduction of direct emissions from production of goods for exports through carbon taxes are important. Policy makers in those countries joint emission reduction policies should be coordinated to take advantage of each countryâ€™s emission reduction potential. Our findings suggest that, in Asian countries, carbon emissions originate mainly from intermediate goods trades, suggesting the need for mandatory life cycle assessment reporting and emissions disclosure. Moreover, the Asian region has many large betweenness-oriented trades in terms of its overall industry and is a hub connecting upstream industries with high emission intensity and extensive final consumption in each region. Taking advantage of the vast trading blocs (e.g., the Trans-Pacific Partnership and the Regional Comprehensive Economic Partnership), thorough supply chain emission control and the establishment of a green supply chain in Asia will greatly contribute to global emission reduction. Further, we identify that the structural position of basic iron sector in China, Latin America, and Europe are similar. If our framework is to be carried out within global network, it could be coordinated with these countries with a similar industrial structural position to promote a common â€œtransitionâ€• strategy. Furthermore, by providing new incentives to reduce HEM impact in addition to the assigned amount and credits of carbon emissions under the Paris Agreement, further emission reduction can be achieved through clean development mechanism (CDM) and Joint Implementation (JI) if countries involved in emissions (intermediate inducers) that have been previously overlooked can be identified. To reduce GHG emissions, including those in developing countries, it is necessary to create new rules to keep the benefits of CDM for emitting countries. In this context, it is imperative to add value to the reduction potential of the entire supply chain by providing new incentives for consumption policies and the establishment of green supply chains.