ASSESSING THE ROLE OF INTERNATIONAL TRADE IN GLOBAL CO_2 EMISSIONS: AN INDEX DECOMPOSITION ANALYSIS APPROACH

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Overview

Stabilizing the concentration of CO_2 emissions in the atmosphere has been a global goal to mitigate the climate change. Actions have been taken at regional and country levels to reduce emissions. An important issue behind climate policies is to identify pathways for emission mitigation. It is grounded largely on understanding changes in energy use and CO_2 emissions.

Trade-related CO_2 emissions have become an increasingly important component in global/national emissions as globalization with supply chains crossing national borders has intensified. The varying specialization of economies in the global production system has led to carbon leakage between advanced economies and emerging economies. If international trade continues to be promoted, economies, particularly major importers/exporters such as China, United States and EU, are likely to see a growing emissions embodied in trade (EET). The development may lead to a trade-emission dilemma which needs to be resolved in the context of global emissions reduction. Consequently capturing the impact of international trade on global/national emissions has been a widely debated and studied issue.

Methods

This study assesses the role of international trade in global/national emissions using the index decomposition analysis (IDA) technique. Specifically, based on the multi-region I-O model, we first estimate the production (consumption) by destination (source) as well as emissions embodied in product flows of global economies. The impact of exports on economies' production-based emissions and that of imports on consumption-based emissions are investigated. In addition to the entire national emission inventories, emission balance changes are issues of interest to policymakers since they help to characterize countries' role in international climate negotiation. Quantifying the drivers behind changes in countries' emission balance offers insights on the causes of the trade-emission dilemma. We therefore further study changes in countries' emission balance over time. Three IDA models to respectively study changes in production-based emissions, consumption-based emissions, and emission balance with a focus on trade are proposed.

Results

Using the World Input-Output Database, we apply the proposed models to empirically examine the impacts of international trade on global CO_2 emissions from 1995 to 2009. From the production perspective, it is found that the growing share of exports in GDP drove up the total emissions, while the exports composition became marginally greener, particularly after 2005. From the consumption perspective, it is shown that imports had larger impact on the advanced economies, e.g. the EU and the United States, that rely heavily on imports to satisfy demand. Both the intensity and composition of imports contributed to emission mitigation. The different performances of economies in production-based and consumption-based emissions led to the outsourcing of CO_2 emissions. From the viewpoint of emission balance, it is found that the expansion of carbon leakage between advanced economies and emerging economies occurred in the study period was driven by the widening trade balance and more emission-intensive trade structure.

Conclusions

The objective of this study is to assess the role of international trade in global/national emissions using an index decomposition analysis approach. Based on the emission accounting from MRIO analysis, three IDA models are proposed. The production-based IDA (P-IDA) model adopts the production-based accounting principle and examines the emissions embodied in all the products of economies, including both domestic goods and exports. Similarly, the consumption-based (C-IDA) model investigates the emissions embodied in all the demands of

economies that cover both domestic goods and imports. These two models are extensions of the conventional IDA model by distinguishing between domestic goods and imports/exports. The impact of international trade can therefore be quantified from different perspectives. Further, the EB-PDA model, which is essentially the difference between the P-IDA and the C-IDA model, reveals changes in an economy's emission balance. The proposed models can also be extended to study intensity indicators and domestic trade. Compared to structural decomposition analysis (SDA), the three IDA models are simpler and more flexible in analyzing the impacts of trade.

The proposed models are useful to energy and environmental development and assessment relating to trade. Understanding the impact of international trade in global/national emissions assists the debate on climate issues, e.g. establishing environmental responsibilities at the global level. The trade related results shed lights on the linkage between trade and climate responsibilities, which can help to resolve the trade-climate dilemma in major emission exporters such as China. Studying changes in countries' emission balance further shows the dynamics of carbon leakage among economies, which is closely related to the design of border carbon adjustments that aim to strengthen the competitiveness of domestic industries.