

Tracing CO₂ Emissions in Global Value Chains

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- The carbon leakage among developing economies via GVCs has increased rapidly.
- Reducing self-responsibility-based emissions is crucial for the design of climate change policies.
- SMEs should be one of the most important targets for CO₂ emissions reduction.

Countries have been increasingly joining in global value chains (GVCs) via various routes mainly including international trade and investment. Consequently, there has been rapid growth in greenhouse gas (GHG) emissions and pollution associated to GVCs related activities. For example, the net emission transfer via international trade from developing countries to developed countries increased from 0.4 Gt CO₂ in 1990 to 1.6 Gt CO₂ in 2008, which exceeds the Kyoto Protocol emission reductions (Peters et al., 2011); 12-24% of sulfate concentrations over the western United States on a daily basis is due to the export-related Chinese pollution (Lin et al, 2013). Given the above facts, understanding how a country's participation in GVCs affects environment in detail, and versa how environmental regulations and policies influence the country's participation, performance as well as firms' activities in GVCs is important for both economic and climate change related policy making and business practices. IDE-JETRO launched a joint research project in close collaboration with Tsinghua University in 2016, to elaborate the evolving relationship between greenhouse gas emissions and international trade using the most up-to-date GVCs based analysis tools and database. Our main findings are summarized below.

Actions must be taken to retard the increasing carbon leakage among developing countries as an important part of the international credible and competent governance for achieving the global emission reduction target.

Our empirical results based on the World Input-Output database (1995-2009) show that the difference in carbon intensity and position in GVCs between developed and developing countries causes massive "carbon leakage" through international trade. This kind of "carbon leakage" increasingly happens within developing countries in recent years after China's accession to the WTO. For example, the magnitude of "carbon leakage" between the largest two developing economies, China and the rest of other developing country group has exceeded all bilateral relations between any developed economy, or groups and China (e.g. the US-China or the EU-China). This could be a great concern since both China and other developing countries in the Non-Annex B country group (Kyoto protocol) have either relatively weaker environmental regulations or lower enforcement level of these regulations. This clearly implies that trade and investment policies should not be independent to environment policies in the so-called GVCs era.

Helping developing countries set an appropriate target for emission peak in terms of their self-responsibility based emissions is a constructive way for curbing the rapid increase of global carbon emissions.

There has been a consensus on the “Common but Differentiated Responsibilities” (CBDR) in the international community for climate change. However, about how to make effective implementation of CBDR, many challenges still remain, especially on the treatment of historical responsibility on climate change. The level of concern on the historic accumulation of CO₂ emissions generated in the era of western countries’ industrialization may decrease in terms of the rapidly increasing self-responsibility based emissions (according to our GVC based definition) in developing countries in recent two decades. It may be relative easier to achieve consensus on the control of self-responsibility-based emissions in advance than to allocate historical shared responsibilities through comprehensive international negotiation.

Micro, small and medium-sized enterprises should be one of the most important targets for CO₂ emissions reduction.

Our case study on China shows that firms in the same industry but with different ownership and size have very different market share, production technology and carbon intensity and can face very different emission regulations and financial conditions. This fact has largely been ignored in most of the existing literature on climate change. Using a newly augmented Chinese input-output table in which information about firm size and ownership are explicitly reported, we have identified the key targets for carbon emissions reduction. One target is the electricity sector which emitted 31.4% of China’s CO₂, of which 85% is from state-owned enterprises with very high carbon intensity in 2010. Another important target is that micro, small and medium-sized

enterprises (MSMEs) contributed more than half (54%) to China’s CO₂ emissions in 2010, in which the Non-metallic mineral products made by MSMEs was the largest contributor (876 Mt). We also applied a dynamic computable general equilibrium (CGE) model to analyze the impact of alternative climate policy designs with respect to regulation and financial conditions on heterogeneous firms. The simulation results indicate that introducing emission trading does not necessarily lead to higher economic efficiency for emission reductions since the trading mechanism can increase leakage from regulated to unregulated firms, which intensifies the differences in emission reduction efforts and lowers average efficiency, especially in the long run. Elimination of the preferential subsidy for green investment or expanding regulation coverage can significantly increase the economic efficiency of emission reduction. Elimination of the preferential subsidy for state-owned enterprises equalizes the financial costs for green investment across firms and mitigates the distortion in the allocation of green investment.

Summary

The rapid expansion of GVCs brought dramatic changes to the world economy. Most studies on GVCs focuses on value-added, job opportunities and income. However, serious side effects, e.g. GHG emissions and pollution, are also generated along GVCs. we will continue the above interdisciplinary study at more detailed firm and sector levels for better design of economic and environmental governance and policies.

Ref: Peters, G.P., Minx, J.C., Weber, C.L., Edenhofer, O. (2011). Growth in emission transfers via international trade from 1990 to 2008. *PNAS* 108(21): 8903-8908; Lin, J., Pan, D., Davis, S.J., Zhang, Q., He, K., Wang, C., Streets, D.G., Wuebbles, D.J., Guan, D. (2014). China’s international trade and air pollution in the United States. *PNAS* 111(5): 1736-1741.

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