China's contribution to emission reduction in countries along the Belt and Road: a study based on trade-embodied carbon

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The rapid growth of international trade has significantly increased the transfer of carbon embodied in trade, which has substantial implications for the allocation of emission reduction responsibilities and the achievement of global emission reduction targets. In 2023, the Belt and Road Initiative (BRI) marked its tenth anniversary, a period during which trade between China and BRI countries has flourished. China has increasingly produced export goods to meet the consumption demands of these countries, simultaneously assuming responsibility for the carbon emissions that would otherwise be borne by the importing nations. Understanding the embedded carbon in these exports is crucial for China to assert its climate contributions and carbon entitlements in international negotiations.

We employ the input-output methodology and utilize the global multi-regional input-output table (EMERGING) for the years 2010 and 2015â€“2019, applying the embodied carbon emissions method to calculate carbon emissions in global trade. The analysis focuses on the carbon embodied in trade between China and 63 countries along the Belt and Road, categorizing the trade into seven representative regions. The study analyzes sectoral contributions to embodied carbon in bilateral trade between China and key countries within these regions and conducts a structural decomposition analysis to identify the driving factors behind the observed patterns of embedded carbon.

We explored China's contribution to emission reduction in international trade from an innovative research perspective and found that the embodied carbon in China's exports to the Belt and Road countries has increased significantly, and the embodied carbon in exports has continued to exceed the embodied carbon in imports, showing a state of embodied carbon surplus. As China continues to export more goods to meet the consumption needs of BRI countries, it simultaneously assumes responsibility for the carbon emissions generated during the production of these goods. Among the seven regions, ASEAN and West Asia emerge as the primary destinations for Chinaâ€™s embodied carbon exports, while the five Central Asian countries are the principal importers of embodied carbon.

Sectoral analysis indicates that the metal product manufacturing and machinery manufacturing sectors are the largest contributors to the embodied carbon in Chinaâ€™s exports, while the energy extraction sector is the major source of embodied carbon imports. Carbon intensity is identified as the key decelerating factor: by producing and exporting goods with lower carbon intensity, China reduces the additional carbon emissions associated with domestic production in importing countries. This has contributed positively to international emission reduction efforts. Trade volume is identified as the primary driver of the growth in embodied carbon exports, with trade structure also playing a crucial role. The study provides critical insights into the regions, sectors, and underlying drivers of Chinaâ€™s embodied carbon in trade with BRI countries. These findings offer valuable guidance for advancing the BRI, optimizing Chinaâ€™s trade structure, clarifying international trade emission reduction responsibilities, and fostering regional cooperation on climate action.