GVCs and Embedded Carbon Emission Dynamics: Implications of CBAM for EU Downstream Sectors

Topic: YSI and Development Programme (4) (Discussants: Satoshi INOMATA and Kailan Tian)
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Research Question:
Global Value Chains (GVCs) have transformed international trade by distributing production stages across multiple countries, complicating the attribution of greenhouse gas (GHG) emissions to specific nations. While GVC participation has contributed to economic growth, it has also increased emissions embodied in trade. To prevent carbon leakage and mitigate emissions, the European Union (EU) has implemented the Carbon Border Adjustment Mechanism (CBAM), which imposes a levy on certain carbon-intensive imports. However, its potential consequences for EU manufacturers, particularly downstream sectors reliant on emissions-intensive imports, remain underexplored. This study addresses the following research questions: (1) How have emissions embedded in GVCs evolved across regions and sectors? (2) How have domestic and foreign emissions associated with EU production shifted over time, and what are the possible implications of CBAM for EU manufacturers? (3) How are emissions embedded in EU imports from key developing economies, such as China and India, absorbed within GVCs, particularly in downstream value chains? Are they primarily used for final consumption within the EU or as intermediate inputs for further value addition?

Methodology:
This study employs a Multi-Regional Input-Output (MRIO) model, a widely used framework for tracing emissions through GVCs. The MRIO model allows for a detailed assessment of how carbon emissions are generated, transferred, and absorbed along GVCs. Using this model, we assess the potential impact of CBAM on production costs and competitiveness of EU downstream industries.

Data:
The analysis utilises World Input-Output Tables (WIOT) from the World Input-Output Database (WIOD). These MRIO tables provide detailed inter-industry and inter-country trade relationships, allowing for an in-depth examination of emissions embedded within GVCs. Carbon emissions accounts are sourced from the Joint Research Centre of the European Commission.

Findings:
The results reveal that the growing integration of developing economies, particularly China and India, into GVCs has led to increased emissions generation in these countries, with increased carbon footprint in developed economies such as the USA and the EU. Consequently, the EUâ€™s net imports of embedded carbon emissions have risen, making it more reliant on emissions-intensive imports.
Within CBAM-covered sectors, a significant share of imported emissions is further absorbed in downstream value chains, such as manufacturing industries that process raw materials into higher-value goods. This suggests that CBAM, while addressing carbon leakage, may also increase input costs for EU manufacturers, potentially reducing their global competitiveness. The findings further indicate that as CBAM expands to cover more sectors and free allowances under the EU ETS are phased out, these effects could become more pronounced, requiring policy interventions to mitigate competitiveness risks. The findings suggest that coordinated international climate policies may be required to balance environmental goals with trade and competitiveness concerns.

Novelty of the Research:

This study contributes to the literature by offering a novel analysis of GVCs and environmental policy. It provides insights into the dynamics of emissions embedded in international trade. Unlike prior studies that focus on impacts of CBAM on the EUâ€™s trade partners, this research assesses broader implications of CBAM on EU manufacturers within GVCs and offers new insights into the evolving structure of emissions-intensive trade and its policy implications.