Discrepancies in Carbon Emissions Accounting: A Comparative Analysis of GTAP and OECD ICIO Databases within the Context of the CBAM

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The European Union's Carbon Border Adjustment Mechanism (CBAM) introduces a carbon cost on imports, necessitating accurate carbon emissions estimation. Previous literature on uncertainties in MRIOTs has traditionally focused on sector-aggregated cross-national discussions, often overlooking the implications of database selection at the sectoral level. This study addresses this gap by comparing discrepancies in emissions estimates from two widely used multi-regional input-output databases: the Global Trade Analysis Project (GTAP) database and the OECD's Inter-Country Input-Output Tables (OECD ICIO).

Our analysis focuses on investigating the variations in emissions embodied in trade for scopes 1, 2, and 3 as defined by the European Commission for implementation of the CBAM. We base our estimations on specific trade flows instead of focusing on emissions from specific regions and/or industries(products). Particularly, we utilize the Emissions Embedded in Bilateral Trade (EEBT) method in calculating scope 3 carbon emissions, with a focus on consumption-based EEBT estimates that account for the full carbon footprint along the entire global value chain, which encompasses all upstream emissions.

Being mindful of the potential pitfalls that may arise from ungrounded aggregation, we perform aggregations of the sectors and regions(countries) in the two databases to be able to draw meaningful conclusions on sectors and regions of interest, as well as to further simplify the computational processing of our estimations. Industry sectors in the databases are aggregated into 11 common aggregate sectors. We aggregated the world into 11 regions to reflect the EU's major trading partners in the metals sector, an industry that expects significant impacts from the CBAM.

Results show significant disparities between the two databases examined, varying considerably by region and scope. Under scope 1, the GTAP database underestimates emissions for most regions, with the most extreme differences occurring for South Korea and Japan. This suggests that major differences exist in how industrial emissions are allocated, even for the simplest direct emissions. Differences are less pronounced in general for scope 3 emissions, but an outlier is found in emissions for imports from Vietnam to the EU, where the GTAP database overestimates by 79%. Given these results, South Korea, Japan, and Vietnam may experience substantial differences tariff burdens depending on which data are used for carbon accounting, and which scope the EU ultimately applies to implement the CBAM.

By industry, the largest discrepancies in carbon accounting for trade to the EU between the GTAP and OECD-ICIO are found in the Fossil Fuel sector. The GTAP database overestimates the emissions embodied in trade of fossil fuels by up to 1708% in scope 3. This explosive increase that we see for fossil fuels in scope 3 can be attributed to the emissions caused by the final consumption of fossil fuels, such as those direct use and emissions in the household, etc. now being accounted for in the GTAP database in the fossil fuels sector instead of the respective sectors that utilize fossil fuels.

These findings highlight the significance of database selection in using carbon accounting for policymaking, emphasizing the need for harmonized methodologies to ensure fair and consistent policy implementation. Gaps in estimation by database impede the monitoring of carbon emissions towards achieving carbon neutrality, as inconsistent data can lead to misguided policy decisions and hinder effective environmental regulation. Additionally, gaps in estimation run the risk of being translated into unjustified economic burdens when implementing policy measures such as the CBAM, potentially placing undue financial stress on certain sectors or countries.