Understanding the potential impacts of border carbon adjustment (BCA) on the Global economy

This study incorporates border carbon adjustment (BCA) in GTAP-E. One way to implement BCA is to levy carbon content of imports equal to a country's carbon price minus the carbon price at the origin country. This adjustment would reduce carbon leakage by discouraging import substitution for carbon-intensive goods and could provide incentive for carbon-intensive countries to reduce carbon content of exports. However, Chen et al. (2020) points out that implementing BCA poses practical, political and implementation challenges. Politically, BCA could be seen by countries as a protectionist, instead of an environmental, measure that could lead to retaliatory measures and eventual disputes at the World Trade Organization (WTO).

Following Chen et al. (2020), we implement the BCA by setting a levy on the carbon content of imports (based on the carbon intensity of the country or origin) equal to the carbon price applied to a country's (e.g., EU) production. This requires estimating the embodied carbon emissions of imports in the GTAP Data base to be used as a basis for implementing BCA in model simulations. In the first step, country-specific carbon emissions per unit of output by industries are used to estimate carbon emissions associated with bilateral trade flows. This step also allows us to decompose carbon emissions from domestic output into its sales disposition, i.e., exports or domestic sales. For every commodity, the total CO_2 emissions associated with fossil-fuels combustion and embodied in trade flows from region r to region s (f_{rs}) are estimated as:

$$f_{rs} = F_r (I - A_r)^{-1} e_{rs} \qquad\qquad (1)$$

where: F_r is a vector of country-specific carbon emissions per unit of output by industries, I is the identity matrix, A_r is the technological matrix, which represents the industry requirements of domestically produced products in region r and e_{rs} corresponds to the bilateral trade flow from region r to region s.

In the second step, we use these embodied carbon emissions in trade to calculate the required BCA for each EU trading partner. The BCA is then be imposed as a tariff surcharge imposed by the EU to its trading partners in GTAP-E static model simulations.