Carbon border adjustment, agricultural abatement technology adoptions in exporting countries, and technology spillovers

The current emission reduction targets outlined in the Paris Agreement fall short of achieving the necessary temperature goals (IPCC, 2023). An assessment of countries' progress in implementing these targets reveals an even more precarious situation (Climate Action Tracker, 2023; IPCC, 2023). In the realm of agriculture, the need to mitigate emissions coexists with the essential goals of ensuring food security and maintaining production. Consequently, the integration of technological solutions becomes a crucial element in the array of sectoral mitigation options.

As emerging economies boost their agricultural production to meet the demands of growing populations and adapt to evolving income-related demand patterns, such as higher meat consumption, the significance of mitigation efforts in developed countries diminishes. However, technology transfers and policies that incentivize broader adoption of abatement technologies can improve the climate effectiveness of trade-related climate policies such as CBAMs on imported agrifood products. The aim of this study is to analyze these dynamics.

In this paper, we build on previous work in determining agricultural mitigation targets (Jensbye and Yu, 2023), simulating agricultural CBAMs (Jensbye et al., 2023a) and implementing mitigation technologies (Jensbye et al., 2023b). Specifically, we consider two additional mechanisms that can potentially lead to the intended outcomes of using trade-related climate policy instruments such as CBAM and Climate Club to promote adoptions and diffusions of abatement technologies. First, we extend the link between the CBAM measure and the exporters' production system, connecting the cost associated with the CBAM on exporters to their uptake of abatement technologies. Second, the analysis delves into the role of technology spillovers, examining the existing technology gap between developed and developing countries and assessing the potential gains from technology diffusion.

Objectives and scenarios

We consider the country-specific agricultural emission reduction scenarios developed by Jensbye and Yu (2023), which is developed based on national mitigation targets and country characteristics. These country specific reduction targets form the basis for the design of CBAM measures by countries with more ambitions emission reduction targets, imposed on exporting countries with no or less ambitious emission reduction targets. We then explore how the CBAM measures can influence technology adoptions in the exporting countries and technological spillovers.

In a first scenario (scenario 1), we implement an agricultural CBAM measure without accounting for potential abatement technology effects. Subsequently, in scenario 2, we broaden the scope for technological uptake by establishing a connection between the CBAM price and the abatement technology adoption based on existing marginal cost estimates. Additionally, we include a second set of scenarios exploring the role of technological spillovers by increasing the availability of abatement technologies in developing countries.

In total, we simulate four alternative scenarios, each differentiated based on the CBAM effect on technological adoption and the role of technology diffusion.

Model and baseline

The scenario simulations will be implemented in an extended recursive dynamic version of the GTAP v7 model (Corong et al., 2017). This extension, among other features, includes non-CO2 emission (Chepeliev, 2020) and allows implementation of multiple carbon prices in each economy for different parts of the economy, allowing for the simultaneous solution of emission reduction targets set for different sectors (Clora et al., 2023).

The model will be calibrated on the GTAP v11 database, aggregated to reflect the focus on the agricultural sectors. The database will be updated in annual steps to recreate a baseline towards 2050. In our baseline, we target macroeconomic drivers following SSP2 drivers (Fricko et al., 2017), i.e. real GDP (Dellink et al., 2017), population and labor force projections (Kc and Lutz, 2017). Non-agricultural GHG emissions in each country follow a trajectory consistent with NDC pledges (UNFCCC, 2022), and beyond that a current policy trajectory.

Expected results:

The analysis will focus on the change in the cost of mitigating from the shift in the technology applied. Focusing specifically on the effect of positive technology spillovers. Such spillovers are likely to affect to production and international trade patterns. As the exporters faced by a CBAM measure will have another option for reducing the cost burden

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