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Exploring potential impacts of carbon border adjustment mechanisms and climate clubs in agriculture

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Introduction and objectives

Current projections[1] suggest that greenhouse gas (GHG) reductions expected from implementing all National Determined Contribution's (NDCs) targets will not be enough to limit the temperature increase specified in the Paris Agreement. This has prompted intensified discussions on the need of agricultural emissions reductions (Hönle et al., 2019; IPCC, 2022; Richards et al., 2018; Wollenberg et al., 2016), which under current policies are expected to increase slightly by 2050 (IPCC, 2022). However, agriculture is generally recognized as a hard-to-abate sector (Edelenbosch et al., 2022; Matthews, 2021), with marginal abatement costs differing across countries (US EPA, 2019). It is also a highly protected/supported sector due to concerns such as food security (Beckman, 2021). As of December 2022, only 10 countries have set clear emission reductions in agriculture towards 2030 (Jensbye et al., 2022; OECD, 2022),[2] although it is possible that more countries may take similar action (Jensbye et al., 2022). Moreover, concerns regarding carbon leakage and net exports have often been cited as an argument for opposing agricultural emission reductions, mirroring the discussions in the emission intensive and trade exposed (EITE) manufacturing sectors such as steel, cement, electricity, hydrogen, aluminum and fertilizers.

To incentivize more countries to abate agricultural emissions for achieving effective global reductions, preventing agricultural carbon leakages and net export losses are important considerations. The so-called carbon border adjustment mechanism (CBAM) has been frequently mentioned as a policy tool to address these concerns. For example, starting in 2023 the European Union (EU) will implement a unilateral CBAM, imposing a carbon price on EITE imports (European Commission, 2021; European Commission et al., 2022). The effectiveness of the CBAM, however, is contingent on a number of considerations, not the least the possible adverse reactions from other countries. To avoid retaliatory outcomes, countries may seek to form climate clubs (Nordhaus, 2015), with blocs of countries imposing CBAMs on imports of specific goods. For the agricultural sectors, no similar CBAMs have been planned by the EU and individual EU member states are not in a position to implement border measures on their own. Nevertheless, such discussions have emerged and are likely to intensify if and when a sufficiently large set of countries starts to implement agricultural carbon pricing. In fact, the European Parliament's Committee on Agriculture and Rural Development has already suggested that the scope of the CBAM should be extended to agricultural products after the phasing-in period, due to its high trade exposure (European Parliament, 2022). Therefore, there is an analytical need to explore the potential implications on the agrifood markets of the implementation of agricultural CBAMs from alternative groups of countries/regions.

[1] https://climateactiontracker.org/global/temperatures/
[2] Denmark, Germany, Ireland, Belgium, Netherlands, France, Portugal, Korea, Brazil, UK.

In this study, we use a recursive dynamic CGE model to quantify the potential implications of alternative climate clubs implementing agricultural CBAM, with the focus naturally placed on the emission-intensive livestock sectors and animal food products.

Methods and illustrative scenarios

To simulate our scenarios, we adopt a modified version of the recursive dynamic CGE model GTAP-E-RD, an energy-oriented version of the GTAP-RD model (Aguiar et al., 2019). This modified version includes two carbon pricing systems that allow to implement economy-wide and agriculture-specific climate policies, a set of equations accounting for non-CO2 and GHG emissions, and an array of potential border carbon adjustment instruments (Clora et al., 2021). The model is enhanced by including modal substitution in international shipping (Clora and Yu, 2022), and by updating household demand's income and substitution elasticities following developments in GDP per capita.

The model is calibrated on the GTAP Power v10 (Chepeliev, 2020a) and the GTAP non-CO2 datasets (Chepeliev, 2020b). The databases are updated to recreate a baseline from 2014 (base year) towards 2040 in annualized steps. In our baseline, yearly GDP changes are exogenously targeted, consistently with historical data between 2014 and 2021, with recent forecasts between 2022 and 2027 (IMF, 2022), and with business-as-usual projections between 2028 and 2040 (Dellink et al., 2017). We assume labor force and population growth to be consistent with the 'middle of the road' Shared Socioeconomic Pathway SSP2 (Kc and Lutz, 2017). Additional ingredients, such as changes in tariff rates following recently signed free trade agreements (Mimouni et al., 2020), in domestic savings rates (Fontagné et al., 2022), sector-specific productivities (Bekkers et al., 2021), and energy efficiency improvements, are also targeted. GHG emissions are targeted by endogenizing economy-wide and agriculture-specific carbon prices. GHG emissions are assumed to follow the updated economy-wide NDCs targets for the non-agricultural sectors, and reductions consistent with projections by Jensbye et al. (2022) in the agricultural sectors. Furthermore, the EU CBAM on EITE imports is implemented in the baseline.

We build our scenarios based on potential alternative groups of countries that could cooperate in implementing agricultural CBAMs on the rest of the world. All CBAMs implemented in this study are based on exporters' emission intensities, including direct and indirect emissions. For example, a CBAM on processed cattle meat will include emissions from processing plants and (more importantly) emissions from the underlying livestock production. In the first scenario, the EU is assumed to be the only region implementing a CBAM on agricultural imports. The EU, in fact, is the only region currently planning to implement an international CBAM, and plans to update the sectoral coverage in 2026 and periodically after that (European Commission, 2021). In the second scenario, we simulate a climate club formed by countries with high abatement ambitions, which implements a CBAM on imports from the rest of the world. These countries are selected according to the cluster analysis in Jensbye et al. (2022). Finally, in a third scenario, we assume a larger climate club consisting of all major exporters of agricultural and animal food products (i.e. EU, Oceania, North America, and South America).

Expected findings and implications

Using a recursive dynamic CGE model to simulate alternative regional patterns of carbon border adjustments in agriculture, we will shed light on potential impacts on regional and global production, trade and emissions. Additionally, this paper adds to the literature on the growing nationalistic tendencies in international trade, by quantifying a set of potential future trade environments designed in relation to national climate efforts.

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