Border Carbon Adjustments Revisited

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(1) Overview

In the absence of a global agreement, several industrialized countries have imposed national and regional climate policies, e.g. CO_2 taxes or emission trading systems respectively. A major problem, however, is that emission pricing potentially decreases the international competitiveness of domestic energy-intensive and trade-exposed (EITE) industries. This also stimulates production in EITE sectors of unregulated regions and can lead to a relocation of domestically abated emissions, i.e. to carbon leakage through the so-called competitiveness-channel. This of course decreases the cost effectiveness of unilateral climate policies. In order to combat leakage and, politically more important, excessive structural change to the disadvantage of domestic EITE industries, several additional unilateral policy options are imposed or being considered, see, e.g., Böhringer et al. (2012). A lively discussed proposal is border carbon adjustment (BCA), i.e. the taxation of the emissions embodied in imported goods and rebating of emissions embodied in exported goods. Common findings in numerical studies so far are that full BCA moderately increases global cost-effectiveness of unilateral action through leakage reduction, and protects the domestic EITE industry in the sense that it dampens their loss of international competitiveness or even fully restores it. Our research question is whether these results are stable with respect to the abating region. We use a computable general equilibrium (CGE) model to address these questions and compare results for the EU27+ (meaning countries participating in the EU ETS) and for Switzerland. Our finding for the Swiss case is that the implementation of BCA in addition to uniform emission pricing can be rather detrimental for at least parts the domestic EITE industry. This is due to the composition of production inputs, more precisely, to what extent embodied emissions in inputs stem from domestic or imported sources.

(2) Methods

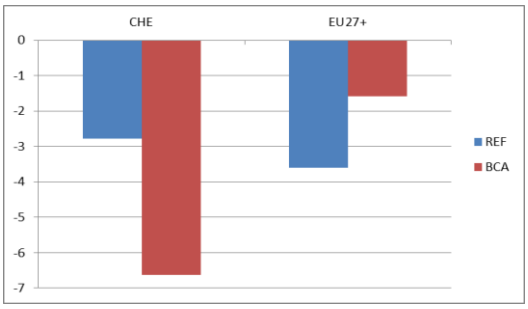
We use a multi-region, multi-sector computable general equilibrium (CGE) model of global trade and energy. We use the GTAP 8 dataset, which includes detailed national input-output tables as well as bilateral trade flows and CO_2 emission data for 129 regions and 57 sectors for the year 2007, see Narayanan et al (2012). We aggregate the dataset to 7 regions and 15 sectors that are important for our research question. We separate the most energy-intensive and trade-exposed sectors in order to apply BCA: refined oil products, non-ferrous metals, mineral products, iron and steel, chemical, rubber and plastic products as well as paper products. The model features a representative agent in each region, who receives income from the primary factors labor, capital and natural resources and maximizes welfare subject to his budget constraint. We hold investment and government provision of public goods and services as well as the base-year trade balance fixed for each region throughout the simulations. Final consumption in each region as well as region- and sector-specific production is represented through nested CES functions. International trade is modeled following Armington's differentiated goods approach, where goods are distinguished by origin (Armington (1969)). CO_2 emissions are linked in fixed proportions to the use of fossil fuels, with CO_2 coefficients differentiated by the specific fuels carbon content. We use a multi-region input-output (MRIO) calculation within the model to determine the carbon content of all commodities and trade flows and create decompositions of the emissions used in production (see, e.g., fig.1).

We compare the impacts of border carbon adjustments on the output of EITE industries for the EU27+ and for Switzerland under different emission reduction targets and alternative BCA designs. Alternative designs for BCA include, e.g., the distinction, whether only an import tariff is implemented or additionally EITE exports are rebated for their carbon content in order to better compete in foreign markets.

(3) Results

We find that while for the EU27+ BCA works as many former studies suggest, i.e. in particular as a measure to protect the competitiveness of their EITE industries, it is detrimental for some sectors in the Swiss EITE industry. Figure 1 shows exemplarily the percentage output change of the non-ferrous metals (NFM) sector in the EU27+ and Switzerland if the respective country introduces a policy to reduce domestic emissions by 20% either through a uniform CO_2 price only (REF) or through a uniform CO_2 price complemented by BCA. While in the EU27+ the NFM sector recovers from an output reduction of 3.5% (REF) to 1.5% if BCA are imposed, the same policy in Switzerland increases the output reduction from under 3% to over 6.5%.

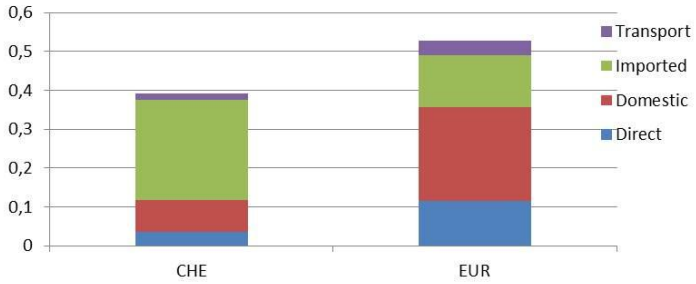
Fig. 1: Output change (%) from benchmark in non-ferrous metals industry



The impact of BCA on the different economies and the EITE sectors in particular hinges critically on emissions embodied in traded goods. Switzerland imports more than twice as much emissions as they produce domestically while the EU27+ only imports the amount of a little bit over one third of domestically produced emissions. The CO_2 trade balance (imports – exports of CO_2 embodied in traded goods) is 100% of domestically produced emissions for Switzerland compared to 20% in the EU27+.

Figure 2 shows a decomposition of the CO_2 intensity (Mt CO_2 /Billion USD) respective EITE industries in Switzerland and the EU27+ according to the origin of emissions. We see that a much larger share is imported in Switzerland, thus potentially priced through BCA.

Fig. 2: Decomposed emission intensity for EITE industries



(4) Conclusions

We show that the impact of border carbon adjustment measures can vary to a large extent. Depending on which country or region imposes them, they can either increase or decrease the competitiveness of domestic energy-intensive and trade-exposed (EITE) industries substantially. We show these two cases for the EU27+ and Switzerland exemplarily. Of most importance for the impact of BCA is the composition of emissions in the production inputs of EITE industries, i.e. whether they stem from domestic sources, or are embodied in imports.

References

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