TRADE IN CARBON AND THE EFFECTIVENESS OF TARIFFS

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Overview

In the absence of a global agreement to reduce CO_2 emissions, single countries or regions have introduced subglobal climate policies. One major risk associated with unilateral action, however, is carbon leakage, i.e., the relocation of emissions from regulated to unregulated regions. Given the global nature of the CO_2 externality, carbon leakage worsens the cost-effectiveness of unilateral policies. A principal measure to combat carbon leakage is carbon tariffs, where embodied emissions in imports are taxed at the domestic CO_2 price when crossing the border. Several recent studies have investigated carbon tariffs and concordantly find that they effectively increase the cost-efficiency as a complementary measure to unilateral emissions pricing (see e.g. Böhringer et al. 2012, Schenker et al. 2012).

OECD countries that potentially introduce emission regulations are large net importers of embodied carbon while developing countries are large net exporters. Recent studies have shown that trade in carbon has increased substantially over recent years (Peters and Hertwich 2008, Peters et al. 2011).

Our research question is how this development influences the effectiveness of an introduction of carbon tariffs. In other words: are the potential relative global cost-savings through carbon tariffs increasing due to increasing carbon in trade? We address this question by combined multi-region input-output and computable general equilibrium analysis for the years 1995 to 2007 based on data provided by WIOD.

Methods

We base our analysis on the WIOD database. In a first step, we employ a multi-region input-output model to calculate emissions embodied in trade and the composition of embodied carbon in goods from 1995 to 2007.

In a second step, we use a large-scale computable general equilibrium (CGE) model to simulate the impacts of carbon tariffs on the global cost-effectiveness of unilateral climate policies as well as on production in energy-intensive and trade-exposed industries for the years 1995 to 2007.

Results

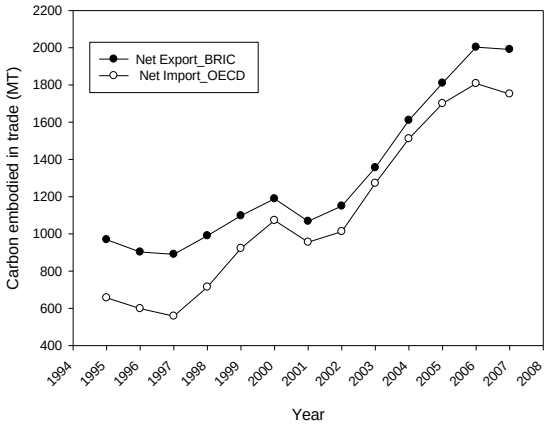
MRIO Calculations

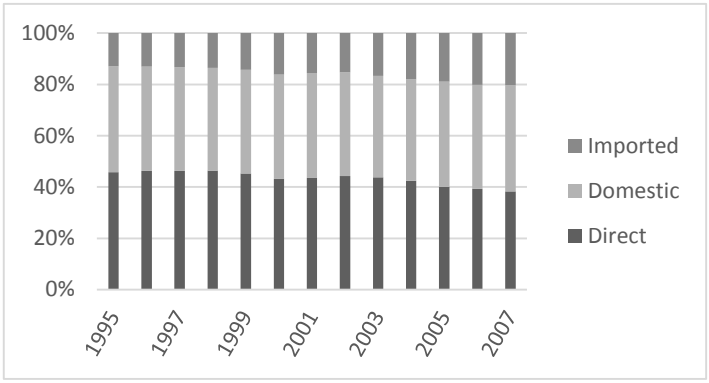
While industrialized countries are large net importers of embodied carbon, developing countries are large net exporters. In general, trade in embodied carbon has increased substantially over recent years. Figure 1 shows that net imports of embodied carbon in OECD countries roughly tripled and net exports of BRIC countries doubled from 1995 to 2007.

Figure 2 shows a decomposition of the embodied carbon in an average good that was produced in an energy-intensive and trade-exposed sector in the OECD. "Direct" refers to emissions from fossil fuel inputs, "Domestic" to carbon embodied in domestic intermediate inputs and "Imported" to carbon embodied in imported intermediates. The share of embodied carbon stemming from imported sources has increased from about 12 percent in 1995 to approximately 20 percent in 2007.

Figure 1:
Net imports of embodied carbon in OECD and net exports of embodied carbon in BRIC (1995-2007).

Figure 2:
Percentage decomposition of the carbon content of an average EITE good in the OECD.





Computable general equilibrium analysis

We begin our analysis by looking at the leakage rates in our policy scenarios. If we first consider uniform CO2 pricing, we find that leakage is of increasing relevance. Between 1995 and 2007 we see a steady increase in the leakage rate, which roughly doubled from 4.6% to 9.4%. Higher leakage rates go along with higher CO2 prices within the OECD, in particular in the time period of 2002 to 2007. With a tariff in place, the leakage rate is lower throughout. From 1995 to 2000 the carbon tariff reduces leakage to below 2%. From 2001 to 2007 the carbon tariff reduces leakage by 3-4 percentage points in each year, thus became less effective in reducing leakage in relative terms. While in 2001 more than half of the leakage rate under the REF scenario is attenuated through carbon tariffs, in 2007 the tariff reduces the leakage rate by less than one third.

In terms of global cost-efficiency, carbon tariffs only show very moderate effects in our analysis. While from 1995 to 2001 the introduction of tariffs even slightly increases global costs compared to domestic emission pricing only, it slightly decreases costs for the years 2002 to 2007.

Conclusions

In our calculations we found substantial increases in carbon trade, particularly net imports of carbon into OECD countries and net exports from developing countries. Based on these results we expected a significant and increasing effectiveness – and thus increasing relevance – of carbon tariffs in unilateral climate policy of OECD countries. In terms of leakage and global cost-efficiency, however, our CGE policy simulations suggest that the effectiveness of carbon tariffs does not increase over time. On the other hand, the burden shifting potential increased from 1995 to 2007. This is due to increasing gains in terms-of-trade for OECD countries.

These results are preliminary. A more detailed analysis is still ongoing.

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