Decomposing Carbon Leakage: An Analysis of the Kyoto Protocol

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The focus of this paper is carbon leakage under the Kyoto protocol. Carbon leakage is the endogenous increase in carbon emissions as a result of emission reductions elsewhere. It reduces the effectiveness of policies to reduce greenhouse gas emissions as agreed upon by the so-called Annex-B countries: the industrial and transition countries. Leakage occurs mainly within the developing countries. However, we show that carbon leakage can also occur in the former Soviet Union, which is part of the Annex-B group, because their agreed emission limits are above their emissions in a business-as-usual scenario. Typical values for the leakage rate turn out to be around 20 percent, if one analyses the impact of the Kyoto protocol with a time horizon of 20 years. The leakage rate depends above all on the relative size of the developing countries and on the openness of the regions to international trade. In this paper we mainly focus on the role of trade patterns. Leakages occur as a result of trade in energy carriers and trade in energy-intensive products. This paper investigates the importance of these different channels. Trade in energy leads to lower energy prices in developing countries, making production there more energy-intensive. Energy-intensive industries may reallocate from Annex-B countries to developing countries, making imports in Annex-B countries more energy-intensive. We separate these two channels numerically and we compare the relocation effect with the standard trade diversion in custom unions. This decomposition of leakage is made under different assumptions concerning the reference scenario used and the mitigation policy pursued. A sensitivity analysis is carried out to assess the importance of different model parameters concerning trade, energy substitution and energy supply. In the final part of the paper we address the impact of technology spillovers. Especially we analyse technology transfers related to the relocation of energy-intensive industries. It is shown that these transfers mitigate the leakage and increase the efficiency in global energy use. In all analyses we use the dynamic, multi-sector, multi-region AGE model WorldScan. The model is benchmarked to the GTAP-E dataset.

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