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TRANSPORTATION AND EMISSION TRADING A CGE ANALYSIS FOR EUROPE

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Overview

The European Emission Trading System (ETS) covers the main contributors of CO2 emissions: energy and energy intensive industries, thus leaving out the second main contributor of emissions: the transport sector. Environmental regulation of the transport sector takes mainly place at member state level. However, there exists a voluntary agreement of automobile producers to reduce average emissions of new cars to 140 g/km until 2008 at the European level. This coexistence of regulation induces welfare losses due to differences in marginal abatement costs of the sectors regulated under the ETS and transportation. Thus the European Commission proposed to include aviation into the ETS at the end of 2006, and there is also a debate about including the road transport sector into the ETS, either in a midstream or upstream manner. In midstream emission trading, automobile producers have to hold emission allowances for the average emissions of sold cars, whereas in upstream emission trading, the producers and importers of gasoline have to acquire permits for the emission induced by the sold units of gasoline.

This paper uses a top-down CGE model to analyze the welfare effects of widening the scope of the ETS to include both, aviation and road transport. Aviation is implemented in a downstream way where airlines have to hold the allowances; road transportation is addressed in the upstream fashion.

Böhringer et al. (2006) and Babiker et al. (2000, 2003) analyze the impacts of separated carbon markets. Böhringer et al. (2006) implement the European Burden Sharing Agreement1 (BSA) in a partial equilibrium model of Germany and the rest of the EU. Marginal abatement cost functions are derived from the PACE model (Böhringer, 2001). The results show that deviation from the optimal allocation of emission allowances to the sectors regulated under the ETS causes excess compliance costs. The deviation from the optimal allocation is generated either by lobbying of influential ETS sectors or by information problems since governments need to know future allowances price to determine the optimal carbon tax rate for the non-ETS sectors. Babiker et al (2003) model the BSA in the European version of the MIT EPPA model (Viguier et al., 2003) which includes private transportation. They compare the welfare losses of implementing the emission reduction requirements on member state level and nonexistence of European wide emission trading. The results show that domestic emission trading causes less welfare losses in all member states than a scenario where each sector is faced with the BSA reduction requirement. Babiker et al. (2000) use the EPPA model to show that the exemption of different sectors from emission trading for the United States economy causes welfare losses.

Method

The analysis is based on a static multi-region CGE model of the EU15 including aviation and private transportation supplied by households. The model contains four industries,

[1] The EU has taken to opportunity to fulfill the obligation of the Kyoto protocol as a *bubble*. The EU bubble has to reduce emission by 8% compared to 1990. Internally the allocation of the EU emission budget is regulated under the EU Burden Sharing Agreement.

three transport and five energy sectors. Industries are energy intensive industries, agriculture, and other industries and services. Transportation sectors are divided into air, water and road transport. Crude oil, natural gas, coal, electricity and refined oil products are the modeled energy sectors. Additionally, the model takes household's own supplied transport into account. The model is implemented in GAMS (Brooke et al., 1987) with MPSGE as subsystem (Rutherford, 1999). Calibration is based on the GTAP-6 database (Hertel 1997) which is consists of input-output tables of 2001. Since the GTAP-6 database provides only an aggregated account for refined oil products disaggregation of the refined oil account is required to derive gasoline consumption. For the representative household, data of the European household budget survey (Eurostat 1999) are used for disaggregation. Gasoline consumption of production sectors is derived from the Eurostat annual energy statistics of the year 2001 which provide detailed information on refined oil consumption split by sector and refined oil products.

Expected Results

In the reference scenario, effective BSA reduction requirements in the year 2001 are implemented. Electricity, energy intensive and refined oil production are part of the ETS while remaining sectors face a percentage cut of the baseline emission equal to the BSA requirement. Revenues from the carbon constraints are allocated as lump-sum transfer to the household. Thus, there is no elimination of pre-existing distortionary taxes. In subsequent scenarios, aviation and road transport will be included into the ETS and their emission budgets are added to the budget of the ETS.

I expected the model to show welfare gains in every scenario. The welfare gains of the inclusion of road transport sectors should be greater than the gains resulting from the incorporation of aviation since the benchmark emissions of road transport are larger than these of the aviation sector. The largest gains should occur in the scenario where both, road transport and aviation, are part of the ETS.

Tentative conclusion

This work should add on the ongoing discussion about the inclusion of aviation and road transport into the ETS. My hypothesis is that proposal of the European Commission to incorporate aviation into the ETS is a right step towards the cost efficient compliance of the EU Kyoto target. However, there are still opportunities to improve the cost effectiveness of compliance: the inclusion of road transportation provides additional welfare gains.

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