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ENVIRONMENTAL POLICY IN A FEDERAL STATE

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Overview

This paper develops and applies a regional computable general equilibrium (CGE) model for environmental and energy policy in a federal state. This regional CGE model differs from the national CGE models by taking into account the interregional mobility of labor, the common product market across the regions and the explicit modeling of two government levels within one nation. We illustrate our regional CGE model with an analysis of the NEC Directive in Belgium. The NEC Directive sets upper limits for each EU member state in 2010 for the total emissions of four pollutants, responsible for acidification, eutrophication and ground-level ozone pollution. These pollutants are sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOC), and ammonia (NH_3).

Regional CGE models dealing with energy or environmental issues are relatively rare. Conrad and Schröder (1991, 1993) analyze the choice between emission taxes or abatement subsidies for climate change policy in Baden-Wurttemberg, Germany. Li and Rose (1995) measure the impact of emission controls in Pennsylvania. André et al. (2005) analyze an environmental tax reform and the double dividend hypothesis for CO_2-and SO_2-policy in Andalusia, Spain. The double dividend literature argues that substituting environmental taxes for pre-existing distorting taxes may yield not only a cleaner environment but also a more efficient way of raising revenue.

Methods

While the aforementioned regional CGE models mostly follow the framework of the national CGE models, we capture more specific characteristics of regional modeling. First, in our model, each region has its own labor market but interregional commuting limits the wage differential between regions. This approach takes into account the significant interregional commuting in small federations (e.g. Belgium) or metropolitan areas. Second, most national and regional CGE models use the Armington assumption, where goods produced in different regions and countries are assumed to be imperfect substitutes (Armington, 1969). Our model has only one goods market per country, and the goods produced in the regions of one country are perfect substitutes. The Armington assumption, however, is still used for goods imported from other countries. Finally, we explicitly model the fiscal responsibilities of the various government levels. We allocate the tax revenues to the appropriate government level and model the monetary transfer mechanisms between the government levels.

The aim of this paper is developing a regional CGE model which can be used for the analysis of environmental and energy policy in a multi-region and multi-government setting. We start from the multi-national GEM-E3 model and subdivide one country in three regions. This country has two government levels but a common labor and goods market for the regions. The GEM-E3 model is a CGE model for the European and World Economy, modeling the economy, the energy system and the environment. It has been used to evaluate the welfare impacts of various environmental policies.

Results

We illustrate the use of this model with an analysis of the climate policy and NEC directive in Belgium subdivided in three regions. The simulations show that this model is suitable for analyzing the effect of environmental and energy policies on the regional emissions and the regional marginal abatement costs, the regional output of the sectors, the regional employment, interregional commuting, and the budgets and transfers of the governments.

Conclusions

Overall, our results show that there are important ancillary benefits between the NEC policy and climate policy. These ancillary benefits work in both directions and also on pollutants, which are not explicitly included in either policy. We conclude that combining both environmental policies generates environmental benefits. Moreover, the reduction in marginal abatement costs if the climate policy and NEC policy are simultaneously combined shows that the costs of these policies are lower when both policies are simultaneously analyzed and implemented, than when both policies are separately analyzed and implemented.

The output of the energy and energy-intensive sectors is most affected by the climate policy. The output seems to be reduced more with the NEC directive than with the climate policy, reflecting the fact that the NEC directive is relatively more expensive compared to climate policy for 2010. The employment follows the same sectoral evolution as the output, although alleviated. The various environmental scenarios do not change the inter-regional commuting significantly. We find modest vertical externalities. Finally, we find that the effect of the environmental policies on the constitutional transfers between the government levels is very limited if all regions introduce a similar environmental policy.