ICYESS2013-18-1
Interdisciplinary Conference of Young Earth System Scientists
Hamburg, Germany, 22 – 25 September 2013

Climate Policy Decisions under Uncertainty

I. Staub-Kaminski
Potsdam Institute for Climate Impact Research, Potsdam, Germany (staub@pik-potsdam.de)

Climate economics aims to bridge the gap between science and policy and provide policy makers with valuable insights into policy issues. For this purpose, integrated assessment models (IAM) of climate change inform policy makers about the optimum level of global atmosphere warming and of the associated optimal transition-path to a low-carbon economy. However, instead of announcing a climate stabilization target, the instruments available to policy makers to implement a given target, are various policy instruments such as taxes, subsidies, quotas, emission allowances or feed-in-tariffs.

The model of Policy and Regulatory Instruments in a Decentralized Economy (PRIDE) complements standard IAM by allowing for computation of optimal portfolios of policy instruments and determines which policy instruments implement a given target at lowest cost*. The effect of uncertainty on the optimal choice of policy instruments has, however, not been as much studied as the effect uncertainty has on the stringency of climate policy. The main reason is that IAM typically employ a social planner optimization that maximizes inter-temporal social welfare resulting in an optimal response to an emissions constraint.

The PRIDE model allows for multiple actors such as households, production, fossil and renewable energy firms, fossil resource owners and a Government which imposes policy instruments. The aim of the policy instruments within this model is to reduce GHG emissions and promote adaption of technologies that are constrained by imperfect innovation markets due to knowledge spill-overs (when companies can learn from and copy other companies' innovations and therefore reduce innovator's profits). In an economy of perfect information the optimal policy mix is a carbon tax, aimed at reducing GHG emissions, in combination with a subsidy, to support greater investments into technologies where inventors cannot appropriate returns from innovation due to knowledge spill-overs.

Kalkuhl et al. (2012) conducted a sensitivity analysis within the PRIDE model and concluded that the performance of a subsidy was very sensitive to small deviations from the optimal subsidy level. A key input for the optimal balance of the policy instrument mix is the degree of knowledge spill-overs. By adding uncertainty endogenously in the PRIDE model, the aim of this study is to provide valuable insights for policy making under uncertainty by analyzing the effect uncertain knowledge spill-overs have on the choice of policy instruments. We plan to model parametric uncertainty by allowing the spill-over rate to take different values with assigned probabilities of occurrence. The Government does not have perfect information anymore, but instead anticipates uncertainty in the spill-over rate, knowing the possible values and the associated probabilities. Under uncertain spill-overs it is not clear whether the Government will choose a higher level of subsidy (compared to the case of perfect information) or apply another more robust policy instrument.

(*)See Kalkuhl, M., O. Edenhofer and K. Lessmann (2012): Learning or Lock-in: Optimal Technology Policies to Support Mitigation. Resource and Energy Economics, 34(1), 1–23 for model details on the PRIDE model