Abstract of PhD thesis "At the Frontiers of Integrated Assessment of Climate Change: Distribution, Technology policy, and Land"

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Abstract

Integrated Assessment Modeling is the prevailing paradigm for the assessment of climate change impacts, mitigation policies, and transformation pathways. Model results were a decisive impulse for the international community to commit itself to stabilize global warming at well below 2°C temperature rise. However, climate policies in place or pledged as of 2015 fall short of what science finds as cost-effective transformation pathways for the 2°C target.

The recurring themes of this thesis are the distributional impacts and the distributional conflicts that are at the heart of climate change, but often hidden in Integrated Assessment Models (IAM). Along these lines, I extend and complement current IAMs, covering the topics of international technology policy, distributional implications of mitigation for developing countries, and the role of land in climate impacts.

In a first contribution, I develop a solution methodology for a global IAM with high technological detail in the energy system that allows for finer regional resolution and the inclusion of non-cooperative regional interactions. Based on this methodology, I derive optimal climate and technology policy for the 2°C target in another contribution, including spillover effects from global learning-by-doing in low-carbon technologies: While carbon pricing is by far the most important policy instrument, global learning effects in low-carbon technologies may provide an economic rationale for significant low-carbon subsidies for solar technologies and advanced vehicles under an international technology protocol.

In another contribution, I focus on the non-environmental incentives for Sub-Saharan Africa as an aggregate region to join a global climate stabilization agreement: I find that while there are significant costs from a reduction in economic growth, those may in some scenarios even be overcompensated by revenue from selling emissions permits and biomass on international markets.

I argue that climate damages on agricultural land are not fully reflected in current IAMs. Land-biased damages may have large economic impacts of due to distortionary land rents, as I demonstrate in a small IAM that considers the intergenerational distribution of wealth explicitly. In addition, I find that land-biased climate damages decrease the incentive for generations to enact climate policy – potentially aggravating the intergenerational distributional conflict that climate change is.

A final contribution on fiscal policy for wealth inequality reduction in rich countries argues that distinguishing life-cycle and bequest savings motives and different types of wealth is crucial: Taxes on capital returns, land rent, and bequests have very different redistributive power and efficiency costs, and in sum, leave room for governments to reduce wealth inequality without sacrificing economic output.

In conclusion, this thesis tries to bring the issue of distribution into the focus of Integrated Assessment Modeling, and asserts that understanding distributional conflicts will be central to further strengthening climate policy.