P 4.2 CVR
Climate Vulnerability, Risk assessment and management in a Post-Kyoto World

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1. Three research questions of the project

- What is the role of governments as well as of insurance companies in combating global climate change?
- How do climate change, discounting and population growth interact?
- What are the interrelationships between mitigation, adaptation and aiding technological change?

2. Research Summary

Task1: Insurance and financial mitigation of climate risk and disruption

An important issue in analyzing the implications of climate risks and disruptions is to answer the question on how societies politically and economically have reacted and might react in the future to severe climate disasters. In particular, it is intended to analyse: (1) how governments react, if their budgets are existentially threatened by recurring disasters, and (2) how insurance companies act in order to cope with the risk of climate change. Based upon research of Phase 2, we aim (1) to assess, how governmental authorities, insurance companies and other private actors have mitigated in the past, and in following up, and (2) to use these insights for establishing a framework which allows to forecast, how these actors might interact in the future for reducing losses caused by natural disasters.

Thereby it is by no means clear, how much we can learn from history, in particular since the global climate is expected to change more rapidly even in the near distant future than it has changed in the past. However, one answer of the society to potential natural disasters was the invention of insurance. Therefore, a closely related issue is the analysis of why some insurance companies set incentives for greenhouse gas reductions and for investments into adaptation by private. Is this pure marketing or can these incentives be effective tools for combating climate change?

Task 2: Global climate change, endogenous discounting and population growth.

Two great issues in climate economics are the interplay between population size and atmospheric greenhouse gas concentration as well as the question of an appropriate social discount rate. Regarding the first issue the literature exhibits a polar view. Some argue that population growth raises emissions, causes common pool externalities and therefore is an externality itself. Others take the view that increased population has had, and may continue to have predominantly beneficial effects. The debate is confusing in particular because of the lack of an appropriate and explicit model for evaluating the impacts of various decisions. Recently, Golosov et al. (2007) offered a formal model that incorporates both a public bad or a good externality stemming from pollution and related endogenous child-bearing decisions. Based on the seminal work of Becker and Barro (1986) and the Integrated Assessment approach of Stephan and Müller-Fürstenberger (1999) this task aims to develop an integrated assessment model of climate change with endogenous population growth. Using a dynastic overlapping generation structure the choice of the discount rate is examined, since it depends on the degree of altruism as well as on the number of children.

Task 3: Interaction between strategies to combat global climate change.

It has become apparent that climate policies must include mitigation as well as adaptation. Furthermore, investments into R&D and the transfer of clean (low-carbon and energy-efficient) technologies from the industrialized to the developing countries are viewed as key elements in combating climate change, since technological innovation can enhance and foster cheap climate protection. In discussing optimal climate policies in a post Kyoto World,

it is therefore important to understand: (1) how these instruments interact, and (2) under which conditions aiding technological change is incentive compatible in the sense that it stipulates greenhouse gas abatement. In particular, based on our work on the strategic interaction between mitigation and adaptation as well as on technological change in Phase 2, we aim at: (1) Extending the analyses on the strategic interactions between climate policies by incorporating technological change, (2) analyzing the effects of technology spill-overs and technological aid, and (3) building a basis for the design of mechanisms such that global climate targets can be met.

Task 4: Mitigation and sustainable energy strategies under global uncertainty.

Strategies for climate change mitigation and the achievement of a sustainable energy system in Switzerland are affected by a range of external factors, such as the availability and diffusion of new technologies, global/regional climate change mitigation policies (such as those identified in P4.3), and energy market and trade developments such as leakage, embodied carbon, and broader issues identified elsewhere in P4.2 (e.g. Task 2) and P4.1. At the same time, significant long-term uncertainty exists over the direction of technological change, availability of energy resources, and patterns of economic development. Therefore, this research seeks to understand how optimal energy policy and technology choices for sustainable climate change mitigation in Switzerland are affected by some of these external factors and uncertainties. The results will identify robust domestic energy and mitigation policy options, in addition to providing some guidance in terms of industry, trade and international climate policy.

3. Data and methods

Task1: Insurance and financial mitigation of natural disaster losses in a historical and economic dimension.

Task 1 is based on the examination of past and future financial adaptation to floods in Switzerland in Phase 2 (Gülden and Poliwoda, 2008). With a stylized model, where government and insurance companies are players, the incentive compatibility of insurance instruments in reducing the risk of climate change will be analyzed. With a literature survey and data from insurance companies Task 1 will be accomplished.

Task 2: Global climate change, endogenous discounting and population growth.

Based on the seminal work of Becker and Barro (1986) and Stephan and Müller-Fürstenberger (1998) an integrated assessment model with endogenous population growth will be developed. While incorporating an overlapping generation structure the interaction between population growth, the discount rate and global climate change.

Task 3: Interaction between strategies to combat global climate change.

Starting point are the game-theoretic models to analyse the strategic interactions of mitigation and adaptation developed in Phase 2 (Buob and Stephan, 2007; Buob and Stephan, 2008). We will then assess the key characteristics of technological change and incorporate these in a game-theoretical model such that the interaction between the main climate policies and technological change with special emphasis on technological aid can be investigated.

Task 4: Mitigation and sustainable energy strategies under global uncertainty.

This research will be realized by extending the global MERGE model, which already incorporates energy technology and technology dynamics (Kypreos 2007), to include a disaggregated representation of the Swiss energy system (based on Schulz 2007). Scenarios of the global factors described above and representing a range of uncertainties will be developed and analyzed using this modeling framework to identify robust domestic energy and mitigation policy options.

4. Milestones and deliverables

After 18 months:

Milestones: Identification of past reaction to climate risks and disruption on a national basis; development and analysis of an Integrated Assessment model with endogenous population growth; extension of existing models for analyzing the strategic interactions

between adaptation, mitigation and technological change in addition; development of the MERGE model with a disaggregated representation of Switzerland.

Deliverables: An assessment of climate risks management as a basis for decision making of firms and government (Task 1); a game theoretical model of the strategic interactions between adaptation, mitigation and technological change (Task 3); a report describing the Swiss MERGE model including some preliminary findings.

After 36 months:

Milestones and deliverables: Analysis of mechanisms for optimal climate policies, where the knowledge gained from Tasks 1, 2, and 3 are incorporated as well as the design of mechanisms such that global climate targets can be met; A PhD dissertation describing: improvements to analytical tools and framework; policy, technology and scenario analysis; and policy recommendations and options. These reports will provide inputs to domestic energy policy development, guidance for the negotiation of future international abatement targets, and identification of technology support needs.

5. Contribution to the WP4 and collaboration with other NCCR projects and 3rd parties

The proposal envisages collaboration activities within WP4 including alternative post-Kyoto regimes (P4.3) and international trade and global climate policy from P4.1. Further, it is expected that the climate change scenarios developed in WP2 (P2.1, P2.3 specifically) will provide broad guidance as to what constitutes dangerous climate change, providing a basis for defining mitigation targets to be analyzed in Task 4. The proposal also contributes substantially to the overall aims of the NCCR Climate, particularly those related to understanding climate change mitigation, the economy and society as well as exploring post-Kyoto perspectives in climate policy.

References

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