

# To Mitigate or To Adapt: Strategies for Combating with Global Climate Change

Seraina Buob\*

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## Abstract

Today, it has become more and more apparent that the Kyoto Protocol will be relatively ineffective in insuring against the risks of global climate change. One reason is that the reduction targets set in the Protocol are too low. A second one is that a majority of the developing countries and the fast growing regions of Asia and Latin America, in particular, are exempted from the duty of reducing their carbon dioxide emissions. However, even if the reduction targets are significantly raised, because of the inertia of the climate system, this would not imply a significant slow down of global warming. Consequently, mitigation, which refers to all kinds of limits on greenhouse gas emissions, cannot be the sole policy response to the threat of global climate change. Alternatively, there exists the possibility to reduce a region's vulnerability by adapting to the undesired impacts of global warming. Thereby, adaptation can cover a wide range of measures, including for example early storm warning on the one end and investments into infrastructures such as dams for preventing against flooding on the other.<sup>1</sup>

Despite of that, adaptation has not received much attention, neither by policy makers nor by the public. One reason could be that political correctness has prevented a discussion of adaptation to climate change, "because it presumably implies defeat in the battle against evil emissions." Tol (2005). A second and closely related reason might be that the majority of the developing countries cannot undertake significant adaptation measures, whereas industrialized nations might use adaptation as a substitute for greenhouse gas mitigation, and hence might reduce their engagement in carbon dioxide abatement (Berkhout (2005)).

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\*Department of Economics, Schanzeneckstrasse 1, CH-3001 Bern. Email: seraina.buob@vwi.unibe.ch. The author gratefully acknowledges the support of the Swiss National Center of Competence in Research on Climate (NCCR Climate), funded by the Swiss National Science Foundation (SNF).

<sup>1</sup>According to the Intergovernmental Panel of Climate Change (IPCC) mitigation is intervention to reduce anthropogenic greenhouse gases emissions or to enhance sinks. Adaptation refers to investment into processes, practices, or structures to moderate or offset the potential damages of global climate change, as well as to reduce the vulnerability of communities, regions, or countries to climatic change and variability. (For details, see (Intergovernmental Panel of Climate Change, Working Group 2 (2001)), (Intergovernmental Panel of Climate Change, Working Group 3 (2001))).

Conventional economic wisdom supports this argument. Adaptation is significantly different from mitigation. It generates benefits, which are private to the regional societies, whereas benefits from mitigation are public. And benefits from adaptation are likely to be experienced over the short term, whereas benefits from greenhouse gas abatement will be experienced over the long term. Consequently, economic rationality suggests investing into adaptation rather than into mitigation, whenever this is feasible. And there is a further argument in favor of adaptation. While each country can provide adaptation independently, sufficient benefits from greenhouse gas abatement will be realized only through collective actions. That means in particular that without some binding international arrangement for abatement and burden-sharing greenhouse gas mitigation will be more or less ineffective cosmetics (Heal (1990)).

Our analysis investigates the strategic interaction between mitigation and adaptation within the framework of non-cooperative player game. We suppose that adaptation and mitigation can be substitutes in protecting a region against impacts of global climate change. Furthermore, we assume that there exists no international enforceable contract for abatement and burden sharing, i.e. countries can choose what is best for their own. Wouldn't it be rational then from the perspective of a single country to primarily invest into adaptation instead of engaging in greenhouse gas mitigation?

In our analysis we allow for a step by step decision making where mitigation is chosen first and adaptation second and where the benefits of mitigation accrue only in the future. We observe: (1) If the marginal costs of mitigation and adaptation are independent of each other there exist equilibria with either zero mitigation or zero adaptation. This reflects the fact that there are two almost equally effective ways to improve a region's environmental quality, and if one is, in terms of present values, more expensive, then it is efficient to make use of the other only. However, if (2) the marginal costs of adaptation can be reduced through mitigation, then in equilibrium it is optimal for the countries to combine mitigation and adaptation. This implies that mitigation and adaptation are complements.

## References

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