

Short- and Long-Term Impacts of Climate Extremes (SLICE) - identifying key impact channels and effective strategies for long-term economic development under climate change

Despite significant progress in recent years, since the publication of the last report of the Intergovernmental Panel on Climate Change (IPCC), the long-term impacts that climatic extreme events such as floods, storms, and droughts have on the economy are still poorly understood. However, since extreme events are projected to intensify under global warming (IPCC AR5; Herring et al., 2014), gaining a sound understanding on the main impact channels of extreme events on economy and society is essential to assess the overall costs of climate change, to inform policy makers and stakeholders on the most efficient adaptation options, and to estimate which growth losses can be avoided by ambitious climate change mitigation. Further, recent studies suggest that developing and industrialized economies respond very different to climate impacts with the general tendency that developing economies are more vulnerable than industrialized ones (Dell et al., 2014; Hallegatte et al., 2016). While developing economies often experience a steep increase in the poverty headcount at the household level (Rozenberg and Hallegatte, 2015) and decrease in their GDP growth (Dell et al. 2012), there is some evidence that moderate extreme events could have a stimulating effect on the growth dynamics of industrialized economies (Loyaza et al. 2012).

This project has received high funding priority from the first reviewer's round within the BMBF (German Ministry for Education and Research) funded project line "Ökonomie des Klimawandels" (economics of climate change) and will be submitted for final evaluation in January 2018. The project aims at (i) gaining a deeper understanding of the disaster induced economic dynamics from the household to the macroeconomic level and (ii) identifying the main reasons for the relatively higher economic resilience of industrialized countries. Particularly, we will quantify the beneficial effects of insurance schemes for the public and private sector and study spending shocks induced by international or national aid. In addition, our analysis will account for the impact of extreme events on national debt levels. The latter can be increased by national recovery programs. High debt levels can reduce the economic efficiency of the affected countries by deteriorating their creditworthiness (Mrsnik et al., 2015). On the household level, our analyses will be based on survey data of the World Bank for selected case study regions in Africa. On the macroeconomic level, a country level analysis based on the NatCat database will be performed comparing Germany and other European countries with developing and emerging economies. On both, the microeconomic as well as the macroeconomic level, the empirical analyses will be complemented by dynamical modeling approaches, which will incorporate the findings of the empirical analyses. This will enable us to model potentially counteracting economic response mechanisms across different sectors. In addition, we will link our micro- and macro level analysis by assessing the effectiveness of

different adaptation options ranging from physical measures (e.g. dikes) to financial instruments (e.g. insurance schemes).

The physical impacts of extreme events such as flooded area or the regional extends of droughts will be derived from historical simulation data of the inter-sectoral inter-comparison (ISIMIP) project (Frieler et al., 2017). Driven by observational meteorological data, the ISIMIP project provides a novel integrated framework enabling us to assess the long-term economic impacts of the different categories of extreme events consistently across sectors. Moreover, the ISIMIP project provides consistent impact projections for different global warming and socio-economic development scenarios.

This novel approach will permit us to systematically identify hot-spot regions, where the largest environmental forcings impact on the most vulnerable economies. A focus will be put on estimating long-term economic impacts at 1.5°C at 2°C global warming above pre-industrial level, in order to estimate which growth impacts can be avoided by more ambitious mitigation policies. Further, our work aims at providing support for decision-makers involved in the international climate negotiations following the Paris agreement within the UNFCCC process.

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