Analyzing climate change adaptation measures in Georgia

Topic: Input-Output Analyses and IO Modelling of Disasters - II
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We use a macroeconometric input-output model, e3.ge, that was specifically developed for this purpose, to analyze the socioeconomic impacts of various adaptation policies in the country of Georgia. Georgiaâ€™s geographical location and natural conditions, ranging from complex mountainous landscape to the black sea coastal zone, contribute to a substantial vulnerability to climate change. There are several observable signs of climate change in Georgia during recent decades, among others increasing mean and extreme air temperatures, increased average annual precipitation, and changing rainfall patterns, increased frequency of droughts and hailstorms. These climate change effects are increasingly impacting peopleâ€™s lives and disrupting the Georgian economy.

The e3.ge model consists of three interlinked model parts. At the core of the economic model (1) is a Georgian input-output table. As no officially published table existed at the beginning of the project, one was derived from the available supply and use tables. 38 economic sectors are differentiated inside the model. Development and linkages of final demand components, such as household and government expenditures, or gross fixed capital formation is estimated econometrically using domestic data. Labor market data is also available from Georgiaâ€™s National Statistical Office, distinguishing employment in 16 economic sectors and providing aggregated and averages wages. The energy module (2) consists of the energy balance. The energy consumption depicted in there is directly linked to individual sectors of the input-output table. The energy mix used as transformation input for the generation electricity can be found in there as well as exports and mainly imports of various energy carriers. Furthermore, energy-related emissions are calculated using national emission factors for several fossil energy carriers. The environment module (3) contains detailed economic information and data on climate change and adaptation options. Data on past damages from climate change cover extreme weather events. This damage data serves as a benchmark for the economic effects of climate change in Georgia and is projected to the future using data from extensive climate models.

Evaluation of adaptation measures is performed by conducting scenario analysis. A business-as-usual scenario is contrasted with a scenario that contains the negative impacts of climate change, and another scenario that contains both the impact from climate change and adaptation measures and their presumably positive impact, either by additional investment or by reduced damages.

Macroeconomic effects of adaptation measures in Georgia are overall positive. A higher gross domestic product (GDP), however, can result due to several factors and thus it is important to have a closer look on the underlying causes to evaluate individual measures. A positive GDP effect can be observed even in scenarios without adaptation for the years where damage occurs. Nevertheless, the so-called defensive spending on repairing, reconstruction and increased consumption behind the positive impact can be interpreted as inherently undesirable as the positive effect is due to the fact that damage has previously been caused by storms, heavy rains or heatwaves. In contrast, adaptation to climate change ensures that, e.g. additional annual construction activity will also generate a positive GDP effect and, at the same time, damages caused by extreme weather events will be lower. This can be illustrated by the example of heatwaves: Buildings heat up and people are less productive; more energy is demanded for cooling reasons; more beverages are consumed; people experience health problems. While declining

productivity has a negative impact on the economy, increased beverage consumption and increased demand for health services can have a positive economic impact. Analyzed extreme weather events also include strong wind and heavy precipitation while adaptation measures range from irrigation and windbreaks to infrastructural programs and coastline protection.

This model is the first macroeconometric model with input-output core applied in Georgia. It was developed together with the Georgian Ministry for Economy and Sustainable Development. All information and data entering the model were continuously discussed with additional stakeholders and national institutions, such as the Ministry for Environmental Protection and Agriculture, the National Bank of Georgia, and several NGOs. One objective of the project, that was fulfilled, was to rely on domestic data sources and only use international data where no other estimates are available. The model results will be now used in policy-making processes in Georgia to evaluate the economic effects under a bandwidth of climate change scenarios and adaptation options. They provide the quantitative background to decide upon effective policy instruments that lead to resilient economic develo