Economics of climate change adaptation in a small country in transition
– The case of Georgia –

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February 2021

Abstract

Since the collapse of the Soviet Union, Georgia's economy has been in a profound transformation process. After the Rose Revolution in 2004, a dynamic economic development can be observed, with double-digit growth rates in some years. This growth was slowed down by the Georgian-Russian war in 2008 and the global economic and financial crisis in 2009. There have been large efforts of the Georgian government to liberalize the economy (resulting in a 7th place in the World Bank's Doing Business Report 2020, which assesses the business climate in 190 countries). Since large parts of the population are employed in agriculture and are self-supplying, the government intends to strengthen agriculture and to expand subsequent processing industry (BMZ 2021). The projected increasing number and intensity of different climate change effects in Georgia hits an economy on the move. To enable climate resilient economic development, it is essential to understand, plan for and manage climate risk for key economic processes. The macro-econometric model e3.ge is used to evaluate the economic effects under a bandwidth of climate change scenarios and adaptation options for Georgia.

Keywords: Economy-Energy-Environment Model, Macroeconomic effects, Climate change adaptation, Evidence-based Policy Advice, Economic sector analysis

JEL: C54, C67, O11, Q51, Q58

* Financial support by the Gesellschaft für Internationale Zusammenarbeit (GIZ) in the context of the research project Climate Resilient Economic Development (CRED) is acknowledged.

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Long Abstract

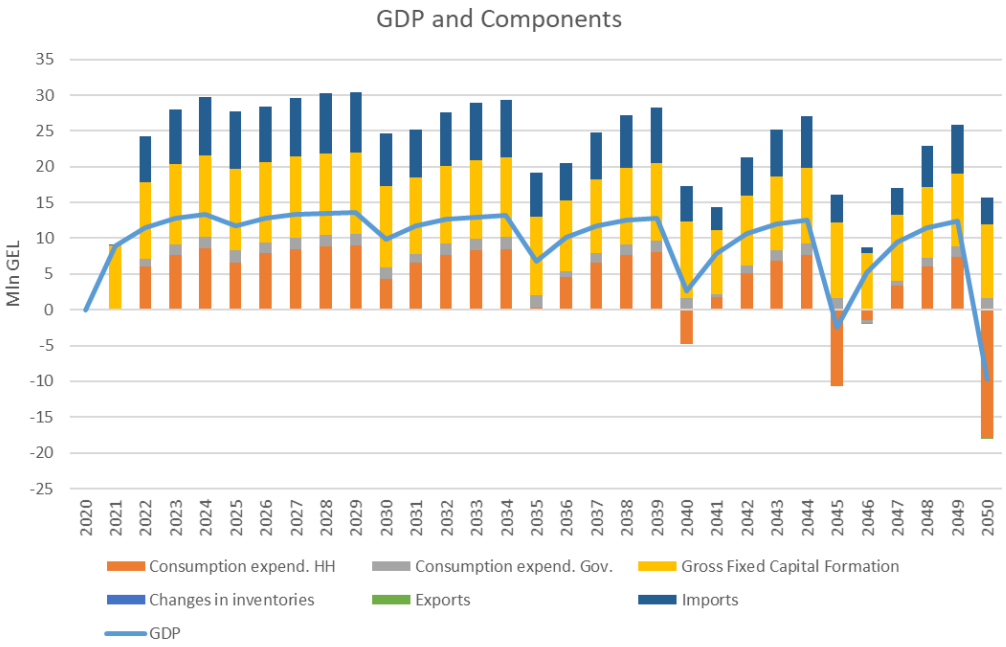
Georgia's geographical location and natural conditions (e.g. complex mountainous landscape, black sea coastal zone) contribute to a substantial vulnerability to climate change. There are several observable signs of climate change in Georgia during recent decades, among others increasing mean, and extreme air temperatures, increased average annual precipitation and changing rainfall patterns, increased frequency of droughts and hailstorms (see USAID 2016). These climate change effects are increasingly impacting on people's lives and disrupting the Georgian economy. The macro-econometric model e3.ge has been developed to evaluate the economic impacts of climate change and adaptation options on the Georgian economy.

The e3.ge model contains three interlinked model parts, the (1) economy model, the (2) energy module and the (3) environment module (Lehr et al. 2016, 2018, 2020, Aaheim et al. 2015). The individual parameters of the equations in e3.ge are estimated econometrically using time series data. The economy model contains input-output tables, which consistently describe the annual inter-industry flows and relationships between the economic sectors in Georgia. The model also considers the dependences between private consumption, government spending, equipment investment, fixed capital formation, exports and imports, and their interactions with the economy. The energy module calculates the energy demand depending on the economic activity. The environment module 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 (joint work with the University of the Balearic Islands). Appropriate adaptation measures and instruments are selected, which are then mapped into the model e3.ge. A scenario analysis is performed to examine the macroeconomic effects of implementing adaptation measures to climate change. The observable effects can be clearly assigned to the respective adaptation measures since the socio-demographic parameters (for example population development) in the scenarios are identical in each case (so-called ceteris paribus comparison).

Overall, the macroeconomic effects of adaptation measures in Georgia are positive. In particular, a transformation in the effects on gross domestic product (GDP) can be observed: In fact, a positive GDP effect in the years of damage (without adaptation) can be measured due to so called defensive spending on repairing, reconstruction and increased consumption; however, this positive effect is due to the fact that damage has previously been caused by storms, heavy rains or heatwaves ("bad" GDP effect). Adaptation to climate change ensures that, e.g. additional annual construction activity will also generate a positive GDP effect and, at the same time, damage in extreme weather events will be lower ("good" GDP effect).

The following figure illustrates these effects for the example of efficient building cooling and facade design as one adaptation option to heatwaves. Among others, the economic effects of a heatwave are the following: 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.

Figure 1: Economic effects of the adaptation measure "Efficient building cooling and facade design"; Differences between the scenario with climate change and adaptation and a scenario with only climate change



Source: own graph.

To evaluate the adaptation measure, we compare the scenario with climate change and adaptation to a scenario with only climate change. The differences between these two scenarios describe the economic effects of the respective adaptation measure. Through additional annual investments in the building stock amounting to 10 Mln. GEL/a, the aforementioned economic effects in years with a heatwave can be reduced in each case: The building stock improves and buildings remain cooler, which in turn is associated with lower health complaints and lower beverage and energy consumption. The overall effect on the GDP is positive. In the years without a heatwave, we see increasing consumption expenditures by households and government due to the positive GDP effect in the year before, resulting from the additional investment. In the years with a heatwave, the positive effect of the additional investments on the GDP is decreasing, since less and less defensive spending is made.

The model results will be 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 development.

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