Abstract

Climate, Weather, and Damages

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This paper builds a highly-disaggregated global economy-climate model featuring variations in both weather (temperature) and climate (the probability distribution over weather). The model consists of approximately 19,000 $1^\circ \times 1^\circ$ regions containing land. Carbon emissions from the use of energy in production increase the Earth's temperature and regional climates (average temperature) respond more or less sensitively to this increase. Regional temperatures, in turn, vary stochastically according to an empirical statistical downscaling model estimated using high-resolution panel data on temperature. Each region makes optimal consumption-savings and energy-use decisions as its productivity varies in response to changes in both weather and climate. Regions interact through global energy and financial markets and through the global carbon cycle and climate system. The relationship between climate and regional productivity has an inverse U-shape, calibrated so that the many-region model replicates estimates of aggregate global damages from global warming. Changes in productivity stemming from stochastic variations in regional temperature are calibrated to replicate relationships between temperature and regional GDP in the G-Econ database. The calibrated model serves as a laboratory in which to assess the ability of non-structural (reduced-form) methods to extract economic damages caused by variations in weather and climate from panel data on weather, climate, and GDP. The paper documents quantitatively their performance and investigates possible sources of bias.