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Digest

Growth and Global Warming

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Does a rise in temperature decrease the level of GDP in affected countries or the permanent growth rate of their GDP? Recent research, depending on the model used, points to a large dispersion of projection estimates.

Nath, Ramey and Klenow (2023), in "How Much Global Warming Will Cool Global Growth", study the impacts of global warming on global economic growth. Their paper presents a range of evidence suggesting that global growth is linked together across countries by flows of technology and innovation, such that changes in temperature are not likely to lead countries to permanently diverge in their growth rates over time even if some countries are much more affected than others. The paper then empirically analyzes the impacts of temperature on GDP in historical data and finds that unanticipated increases in temperature cause substantial declines in output in hot countries and modest increases in output in cold countries. Critically, the effects of temperature shocks on GDP appear to be remarkably persistent, suggesting that future climate impacts are likely to accumulate across years in countries suffering the largest impacts and that economic projections do not account for.

Their paper builds on classic work in the literature, including related empirical research by **Dell, Jones, and Olken** (2012), and analysis and projections by **Burke, Hsiang, and Miguel** (2015). More generally, the question of measuring aggregate climate damages goes back to the Nobel-prize-winning research of the **Nordhaus** (1992) Dynamic Integrated Climate-Economy (DICE) model. The new research in **Nath et al.** (2023) finds that the global costs of warming are three to five times larger than projections derived from the classic DICE model, but two to three times smaller than projections in **Burke, Hsiang, and Miguel** (2015).

The primary difference in damage projections between the sources described above

comes down to whether model climate change as having an impact on the level of GDP that stays constant over time or as an impact on the growth rate that accumulates across periods. **Moore and Diaz** (2015) show that this modeling choice can affect estimates of the social cost of carbon by an order of magnitude, and a range of recent papers in this literature investigate the question.

Casey, Fried, and Goode (2022) use a model of economic growth to motivate an empirical approach to distinguish growth effects from level effects in the data and find that the level of temperature does not affect the growth rate when controlling for year-to-year changes in temperature, which they interpret as evidence that temperature affects the level of income, but not the growth rate. In contrast, **Burke and Tanutama** (2019) use subnational data to show the tremendous persistence of the effects of temperature on output, which they interpret as evidence in favor of projections that allow temperature to affect the growth rate. The **Nath et al.** (2023) paper argues for a combination of the two methods, in which projections allow temperature changes to affect growth in each country for some time, but not for the countries to diverge permanently in their growth rates.

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