

Revising the cost of climate change: Study yields projections 'six times larger than previous estimates'

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Study projects that every additional 1°C rise in temperature will lead to a 12 percent decline in global gross domestic product. Credit: Liz Zonarich/Harvard Staff

Climate scientists have warned of calamitous consequences if global temperatures continue their rise. But macroeconomists have largely told a less alarming story, predicting modest reductions in productivity and spending as the world warms.

"The disconnect was always surprising," said Adrien Bilal, an assistant professor of economics.

For [a working paper](#), Bilal partnered with fellow macroeconomist Diego R. Känzig, an assistant professor at Northwestern University, to rethink their field's approach to climate change projections.

In the end, the pair emerged with an economic forecast more worrisome than previous predictions. The world is already 1°C warmer than it was in pre-industrial times. The new analysis finds that every additional 1°C rise means a 12% hit to global GDP, with losses peaking just six years after the higher temp is recorded.

"In terms of the magnitude," Bilal noted, "that's six times larger than previous estimates."

At a conference in 2023, Bilal and Känzig began puzzling over the challenges of estimating the economic fallout of climate change. "It's really difficult, because the economy is always growing due to other factors," said Känzig, who cited technological innovation as one example. "At the same time, one of the byproducts of that growth is emissions that feed temperature change."

An [influential set of studies](#) completed over the past 15 years worked around this complexity with formulas that rely on temperature variation at the national level. "This approach lets you control for a lot of these confounding factors," Känzig explained.

But local temperature doesn't fully account for the 21st century's increase in extreme weather events, with their devastating effects on capital as well as productivity. "When it gets a little hotter in Germany, you tend to see more [heat waves](#) but not more wind or precipitation," Bilal said. "But when the world's temperature goes up, you see more of all three. Global temperature is just much more correlated with [extreme weather events](#)."

The co-authors set out to use the variable of global temperature—"an approach consistent with the geoscience," Bilal said—to predict GDP damages in 173 countries starting in 2024. To achieve this, they assembled a data set that integrates weather and economy records going back 120 years. Then they set about modeling economic outcomes under the continued warming expected by 2100.

"Another way to look at our results is, what would happen if global temperature went up an additional 2°C by the end of the century?" Bilal said. "We found that would reduce output and consumption by 50%. That's a big reduction. It's twice as big as the Great Depression but it's going on forever."

Economic growth would continue. "We might still be richer in 2100 than we are today," Bilal specified. "But we would be twice as rich in 2100 if there was no climate change."

To understand the implications of these results for decarbonization policy, the co-authors applied global temperature to "the [social cost](#) of carbon," a model developed in the 1990s by Nobel laureate William D. Nordhaus.

Globally, Bilal and Känzig arrived at a social cost of \$1,056 per ton, whereas another [recent estimate](#) (again, set to local temperature variations) put global cost at just \$185 per ton.

Using their new method to recalculate social cost for the U.S. alone, the co-authors landed on \$211 per ton. Compare that with the cost of federal decarbonization interventions covered under the 2022 Inflation Reduction Act, estimated at \$95 per ton by [one study](#).

"The silver lining of our results," Bilal offered, "is that decarbonization easily passes the [cost-benefit analysis](#) for large economies like the U.S.

and European Union."

More information: Adrien Bilal et al, The Macroeconomic Impact of Climate Change: Global vs. Local Temperature, (2024). [DOI: 10.3386/w32450](https://doi.org/10.3386/w32450)

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