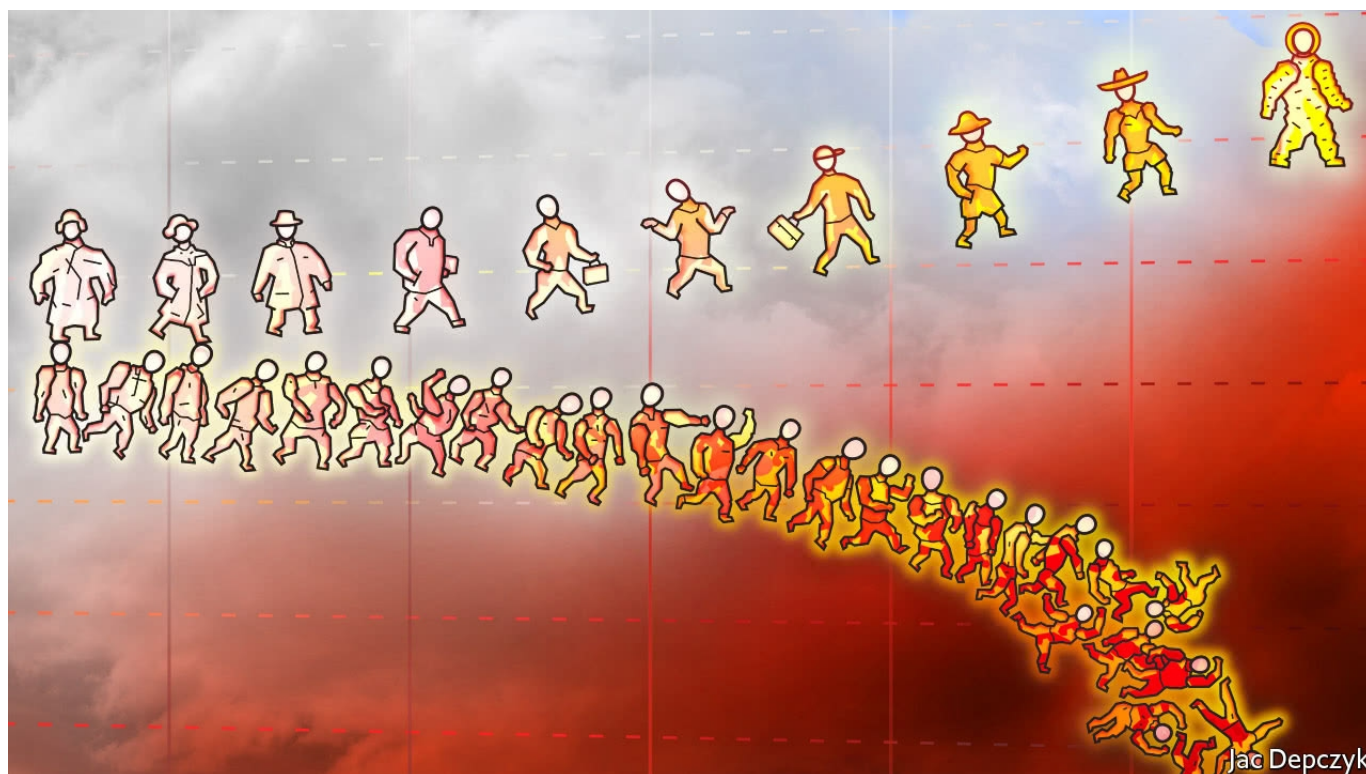


Free exchange

Climate change and inequality

The rich pollute, the poor suffer[Print edition](#) | Finance and economics

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ON JULY 12, the Larsen C ice shelf in Antarctica disgorged a chunk of ice the size of Delaware, a small state on America's east coast. America's government seems unfazed by the possibility that such shifts might one day threaten Delaware itself. Its climate defiance grows not only from the power of its fossil-fuel industry and the scepticism of the Republican party, but also from a sense of insulation from the costs of global warming. This confidence is misplaced. New research indicates not

only that climate change will impose heavy costs on the American economy, but also that it will exacerbate inequality.

Calculating the economic effects of climate change is no simple matter. It means working out how a given increase in global temperature affects local weather conditions; how local weather affects things like mortality and crop yields; how those changes add to or subtract from regional GDP; and how thousands of local-level changes in GDP add up nationally or globally. No sweat.

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The sheer number of moving parts means that the “damage function” used in many papers, which links changes in global temperature to economic costs, is not well characterised. The authors of a new study published in *Science* aim to firm things up. Solomon Hsiang of the University of California, Berkeley, Robert Kopp of Rutgers University and their co-authors run their climate models repeatedly, for

three different temperature scenarios, to see how 15 different economic variables behave in 29,000 possible future states of the world, for each of 3,143 American counties.

Using that information, they assemble probability distributions showing the costs America is likely to sustain by the end of the century. Their findings are stark. Even a modest rise in temperature impairs American economic performance. An increase in global temperature of 1.5°C is very likely to reduce annual output by the end of the century by between zero and 1.7%; a rise of 4°C would probably generate losses between 1.5% and 5.6% of GDP. These figures mask considerable variation across America. In some counties the models forecast a rise in local GDP of 10%; others face a staggering expected decline in annual output of 20%.

It is not surprising that the nationwide costs of climate change should conceal losses in some places and gains in others; that is how averages work. But the

distribution of losses matters. The study shows that the pain of climate change will fall more heavily on America's poorest bits than on its richest areas. Falling crop yields and labour productivity, and rising mortality and crime, are expected to be especially pronounced in America's hot southern counties, where incomes are below the national average. In richer New England and the Pacific north-west, in contrast, winters will be milder and less deadly, and agricultural yields may rise. The aggregate economic cost of climate change is reduced because the burden disproportionately falls on those with low incomes, hardly the ideal way to slash the cost of warming.

Climate change is costly in part because its effects are uncertain, impairing investments and other actions which might mitigate its harms. Thus people would be willing to pay some money to know with greater certainty what higher temperatures will mean in future. Uncertainty around economic projections is highest in the poorest counties. For some of these places the worst outcomes could mean GDP losses of 40% or more. The authors reckon that after adjusting for the uncertainty of climate change, and for its unequal effects, the economic damage caused by a global temperature rise of 3°C could be 1.5-3 times bigger than the unadjusted aggregate figures suggest.

Though focused on America, the analysis also describes the world's climate problem. The costs of global climate change will again be unevenly (and uncertainly) distributed, but harm will often be smaller for richer, temperate countries. As a result the estimated economic loss from warming is almost certainly understated, because the nastiest effects are concentrated in places where incomes are lowest: and, correspondingly, where tumbling incomes have the smallest effect on global GDP.

Yet just because a county in Mississippi faces a harsher future as a result of climate change than a county in Washington does not mean Mississippians must fare worse than Washingtonians. The authors hold the distribution of America's population constant in conducting their analysis, but point out that harm could be

reduced by large-scale migration. Is that a realistic possibility?

People do move as it grows hotter—but not in a uniform way. Research by Cristina Cattaneo and Giovanni Peri, for instance, shows that migration is an important element of the response to warming in middle-income countries, but that in poorer places the cost of moving locks people in place, amplifying the regressive impact of climate change. What is more, climate change might well require broad migrations from the middle latitudes to countries farther north or south, yet rich-country borders are far less porous (with respect to migrants from poorer countries, at least) than those in the developing world. Even within the large domestic territory of a country like America, mobility cannot be taken for granted; it has been falling in recent decades, even as economic fortunes have diverged and an opioid epidemic has ravaged some parts of the country while sparing others.

Ice in their veins

The rich are disproportionate contributors to the carbon emissions that power climate change. It is cruel and perverse, therefore, that the costs of warming should be disproportionately borne by the poor. And it is both insult and injury that the wealthy are more mobile in the face of climate-induced hardship, and more effective at limiting the mobility of others. The strains this injustice places on the social fabric might well lead to woes more damaging than rising temperatures themselves.

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