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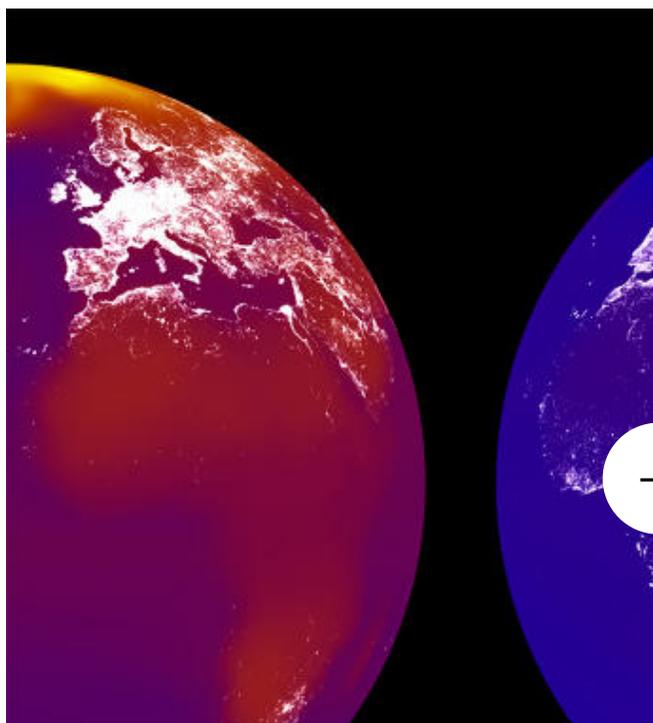
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# No One Works When It's Hot, So Climate Change Is Going To Ruin The Economy

Even rich countries won't escape the terrifying economic havoc wrought by the climate change they caused.



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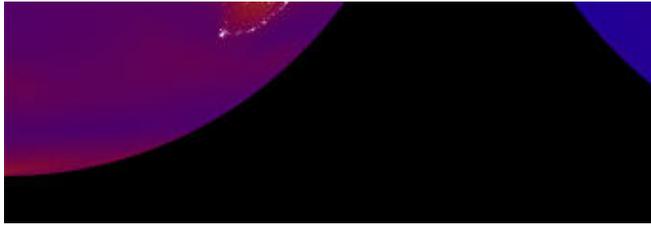
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**01 / 03** These two globes show 2100 temperatures under “business as usual” climate policy (right). The nightlights, as seen from space, show the economy

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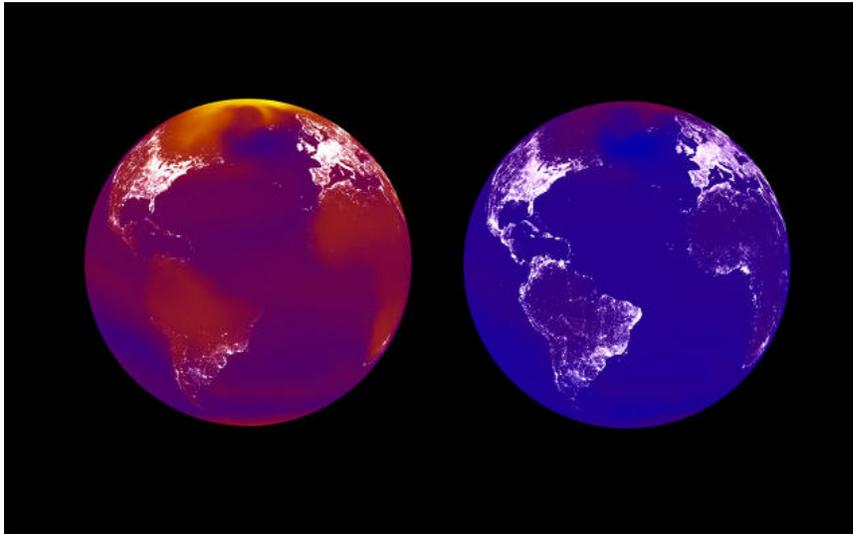
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The slowing down of life on a hot summer day isn't your imagination. Economic literature is full with examples of how productivity comes to a crawl—even in America's over-air conditioned society—when the temperatures climb above a given tipping point.

Consider that the number of cars rolling off U.S. auto assembly lines decreases during heat waves. Or that American children have scored lower on math tests that are given when the thermometer rises above 79 degrees. One study found that weekdays above 86 degrees have cost an average of \$20 a person in lost economic performance in the U.S. And if temperatures above 85 degrees are sustained over a growing season, yields for crucial crops like corn and soybean in the U.S. drop substantially—a worrisome economic and global food security outcome in a predicted future of hotter summers.

The many trillion dollar question is what happens when all of these individual effects become more frequent as the world's thermostat rises. How much will climate change cost? And how will it change the economic landscape of the places that aren't affected

by heat-related productivity losses now, but will be soon.



A new study proposes some terrifying answers, at least for people who live in wealthy nations. Because if you're a resident of say Africa or India, you may have known already that you were screwed—for years, economists have said that climate change will hit poor nations the hardest. While developing nations have the fewest resources to adapt to hotter temperatures, rising seas, and droughts, wealthy economies have believed they were much more resilient. Just pump up the AC and build a few seawalls, right? Nothing a few billion can't fix.

The paper, published in the journal *Nature* in October, has poked holes in this conventional wisdom.

While scientific climate models are well developed, the economic effects of global warming have always been harder to pin down. Economists analyze the

impacts of climate change in two ways. Some look at how individual, "micro" parts of the economy—such as worker productivity or crop yields—would be affected by unabated global warming. (Examples of this include some of the studies listed at the beginning of this article.) Others look at the "macro," economy-wide scale, i.e. how the GDP of a country or the whole world would respond to long-term temperature changes.

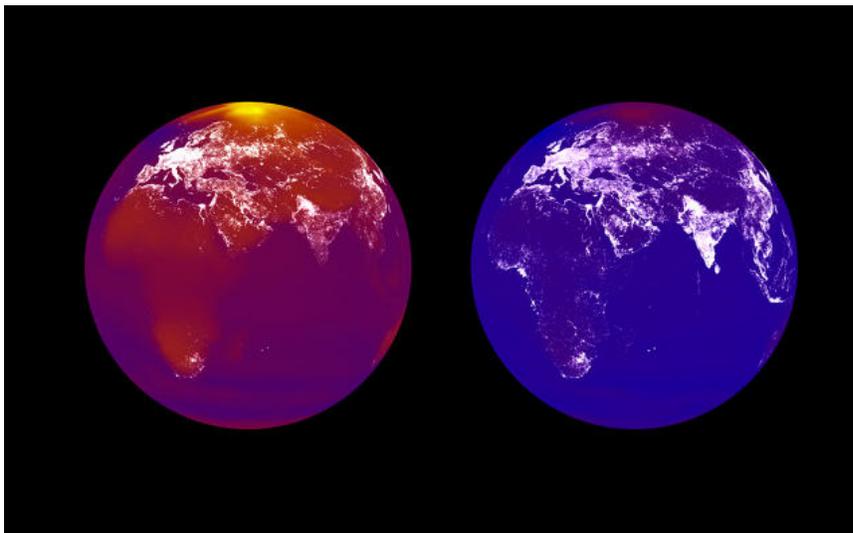
But there has been a problematic discrepancy in these two lines of thinking. The "micro" researchers have found that all modern economies have temperature thresholds, above (or below) which key elements of the economy start to go south—say farm laborers who slow down at their jobs and then eventually just go inside and stop working. But researchers looking at historical data at the "macro" level showed that, unlike poor countries, wealthy economies tend not to respond to temperature—they just keep chugging along.

Stanford University assistant professor Marshall Burke, the lead author of the new paper, was troubled by the mismatch: "I think it was beginning to be recognized, but to us, it seemed like people were less worked up about it than they should have been. Why would we see strong results that we really trust on a micro level, but not on a macro level? It didn't make sense."

The problem, he and his co-authors suspected, was that most of the world's poor countries are also located in hot climates. Because it's hard to separate the economic effect of a nation's climate from its pre-existing poverty, many economists end up trying to

compare very different countries—say the temperate U.S. and tropical India. Burke, along with the University of California, Berkeley's Sol Hsiang and Ted Miguel, did something different. They carefully looked at the economies of 166 countries year by year between 1960 and 2010, and how they performed given the weather the country experienced that year. That allowed them to statistically tease out the effect of temperature on a national economy more accurately—they were comparing one nation to itself.

Globally, this data showed, the "optimal" temperature for economic productivity peaked at an average yearly temperature of 55 degrees Fahrenheit. At hotter or colder temperatures, productivity rapidly declined. The result held true from 1960 to current times and in both farming economies and industrial ones.



Here's where it gets scary: It also held true for both rich countries and poor ones. After all, the problems that come from it being very hot don't all go away

with access to AC—things like energy costs, asthma rates, and violence also all increase with temperature. What's more, the further a nation is from the optimal 55 degree temperature, the stronger the effect of small, one degree temperature increase can be. In other words, poor countries won't only feel the effects of climate warming strongly because they are poor—but because they are unlucky to already be in a tropical zone. And it means that richer, temperate countries don't have the same wiggle room as previously thought. Each degree of increase brings greater and greater damage.

"The fact that rich countries are equally affected [by temperature]—that's a really surprising result. That's not what people believed for a long time," says Peter Howard, a climate economics expert at the New York University School of Law's Institute for Policy Integrity.

The authors then attempted to create a new estimate of the bill of damages for global warming based on their new findings. If warming continues unchecked and global temperatures rise an average of 4.3 degrees Celsius by 2100, climate change will "reshape the global economy," they report. Average global incomes will decrease about 23% compared to what would happen with no climate change. This is staggering—Burke says that previously, economists thought the impact would be far lower, more like 2 to 3% of the GDP.

Far more countries, too—77% of them—would be poorer per capita than without climate change. For instance, The United States today is right in the global productivity sweet zone, with an average

annual temperature of 53.8 F in 2010. But by 2100 the temperature could increase by as much as 12 degrees, depending on future emissions. That increase would cause per capita GDP would be lowered by 36%.

Who is going to benefit? A few cold (and already rich) countries, including Canada, parts of Europe, and Russia. These countries are often on the *other* side of the productivity temperature sweet spot, but as they warm, their economic output will increase. Want to know where the global economic powerhouses will be in 2100? Look North.

The study isn't the end all, of course. It shows us one dark future: One in which society does not act to slow greenhouse gas emissions and climate adaptation proceeds as it has in the past. But on the more depressing side, it may be an underestimate. It only accounts for the effect of temperature (and some related climate impacts like drought) on the economy—it doesn't even consider the damaging impacts like sea level rise and ocean acidification.

Writing a commentary on the study, University of Gothenburg economist Thomas Sterner said: "Should these conclusions stand up or even be strengthened, they will have far reaching implications." His "feeling is that we are only beginning to understand just how much damaged a changed climate can wreak."

Howard, of NYU, says that many economists already believe that the so-called "social cost of carbon"—the high long-term cost of emitting a ton of carbon (as opposed to the low short-term cost of buying cheap

fossil fuels)—is too cheap to begin with. With this study, he says it likely should be priced even higher.

Rich countries might not seem the same immediate damage from climate change that we're already starting to see in the developing world. But these countries can't count on emerging relative unscathed from the economic toll of climate change. In the measured tone of an academic researcher, Burke says that this attitude is "inconsistent with the historical evidence." A less measured person might simply call it hubris.

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# Why Are California's Gas Prices So Much

# Higher Than Every Other State's?

It's not only the state's stringent environmental rules that account for the difference.

*[Photo: Flickr user m01229]*



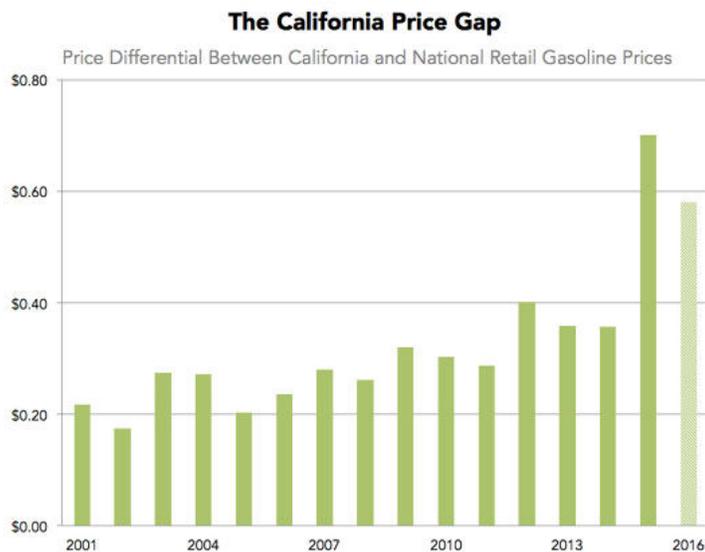
[CHARLIE SORREL](#) | 08.23.16 | 11:55 AM



Why are California's gas prices so high compared to those in the rest of the country? Is it the tough environmental regulation? High taxes? Is it because one of the state's biggest refineries blew up last year? Yes to all of those, but only partly. To find out the

real reason California's gas prices are, and have been for a long time, the highest in the U.S., one needs to do a little digging.

California's gas currently costs around \$0.50 per gallon more than the national average, at \$2.64 for regular. California's laws account for 30 of those cents, says Priceonomics' Ben Christopher, but even that doesn't account for the \$170-per-year extra that every Californian pays.



The state-added costs are made up of taxes (54 cents on the gallon, ten cents higher than the national average), and California's cap-and-trade emissions program. California also requires a different gasoline formulation that results in a cleaner-burning fuel but requires special refineries.

But that still only brings us to 32 cents on the gallon extra. The rest of the half-dollar markup comes from plain old import costs. AAA PR director Michael

Green told Christopher that, when there's a problem with one of California's 17 refineries, gas has to be brought in from the Gulf Coast, because no pipelines run over the Rocky Mountains.

But even California's gas is cheap compared to Europe's, where a gallon will cost you up to \$6.79. That's the highest current price in Europe, from Norway. But even in Germany, the U.K., and Switzerland, which are in the middle of the European gas price table, you'll pay around \$5.60 per gallon. Think about that next time you fill up in order to drive a half mile to the nearest liquor store and leave your engine running while you run inside for supplies.

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