3 Questions: Benjamin Olken on the economic impact of climate change

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How is climate change going to affect our economic activity in the future? Many researchers have dug into this subject empirically in recent years, including economists Michael Greenstone and Benjamin Olken of MIT. Now Olken, along with economists Melissa Dell of Harvard University and Benjamin Jones of Northwestern University, has co-authored a lengthy review article for the *Journal of Economic Literature*, surveying this research and suggesting areas needing further study. Olken sat down with MIT News recently to discuss the climate-economy connection.

Q. You've just written a review essay about "the new climate-economy literature," the plethora of studies emerging in the last several years about the effects of climate change on economic activity. What is the approach being used now to study this issue?

A. Historically there has been a lot of interest in the question of how climate affects economic activity, from Ibn Khaldun [a 14th-century Tunisian scholar] to Montesquieu, but it's obviously become particularly pressing now, given the concerns about global climate change. There are many potential consequences of global climate change, and part of that calculation involves the economic damages.

Because climate is a long-run average and weather is what happens day

to day, the idea of much of this literature is to say: Can we look at the impacts of weather—a hot day or hot month or hot year—and see what the effects of those are on economic activity, and use that to help us say something about these broader questions we're interested in? We use that variation in weather to directly identify its impact on economic activity, and aim to address these longer-run questions as well.

Q. There are now many studies that look at different types of weather events, such as heat, precipitation, and huge storms. Many of these also look at the impact on agriculture, industrial output, labor productivity, or even political unrest. Are there any major trends across these studies that jump out at you?

A. One striking thing we found in doing the review, which we hadn't looked for, is that the magnitudes of some of the impacts seemed remarkably similar to us. There were a bunch of different examples that seem to be suggesting a number of around 2 percent less output per degree centigrade, over and above a certain threshold. Another point we're trying to make is that these numbers can be big. A 2 percent drop per degree centigrade is a large number. With our initial findings [in 2008], some people said, "Oh, that number is too big." But there are other studies, in other settings, coming up with similar numbers.

There has been a lot of emphasis on studying the effects of climate change on agriculture. But if it's affecting other aspects of the economy—like industrial output, investment, and innovation—the long-run [impact] could be much bigger. Realizing the breadth of effects that we see happening is important, and I think [these studies] suggest that. Our own study [published in 2012] indicates temperature changes affect

the growth rate of output in the long run. Over one year, the effect is the same, but any time you have compounding growth, as everyone knows, reducing year-on-year growth rate makes it a much bigger deal.

As far as political conflict stemming from climate change, I do think some countries are [politically] stable, and less likely to see the effects. But there is consistent evidence, in a variety of contexts, that increased temperatures lead to increased conflicts. Teasing out what exactly is the causal pathway is hard. Weather has many effects. The weather makes your crops grow badly, which in turn could lead to unemployment, which could lead to more conflict. Or if heat leads directly to aggression, then people are more likely to riot when they're hot. But we can say that this whole panoply of things is interesting: The literature tells us that weather can affect things in all of these ways.

Q. What are some of the avenues for future research about the climate-economy connection?

A. The next challenge is to bridge the distance from year-to-year to more medium-term analysis. In this paper, we lay out a number of empirical approaches to this. For example: What is the impact when it is 97 degrees in New York City? That a pretty unusual event. But in Phoenix, they get 97-degree days all the time, and should be better adapted for those days. So if you see the effects of a 97-degree day in New York are bigger than in Phoenix, you would think there can be a lot of adaptation to ameliorate the impact of those days. On the other hand, if it looks like the impact of those 97-degree days is the same in New York and in Phoenix, you might say, there are limits to how much we can adapt to climate change. Another thing you can do is look at differences over longer time periods—a decade or two decades. It might provide less data, but you can do that to get to medium-term results.

For the Integrated Assessment Models that project the impact of global climate change in, say, the year 2100, all of this can help us think about the qualitative channels a model should have—if it just includes the effects on agriculture, or if it includes industrial output or the long-run growth rate. And quantitatively, I think it adds really important data points, hopefully helping people to make well-educated decisions about reasonable magnitudes of climate effects.

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