

by recommending a carbon tax that is “no lower, and perhaps well above, a reasonable estimate of the present value of expected future damages.” That is clearly preferable to the current default option in the United States: regulation under the Clean Air Act. Even a low carbon tax, on the order of \$10 or \$15 per ton of carbon dioxide, should be acceptable to some fraction of the risk-taking individuals that view climate change policy as a hedge. Litterman tells us that even for the risk-takers, “emissions should be priced immediately, of course, but the appropriate price would be at a relatively low level today.” Three of Mitt Romney’s top economic advisers during his presidential campaign—Kevin Hassett (American Enterprise Institute), Glenn Hubbard (dean of the Columbia Business School), and Gregory Mankiw, (Harvard professor and former chief economic adviser to President George W. Bush)—have called for at least a modest carbon tax. For the risk-averse, a low carbon tax would be better than nothing, and even for them probably better than regulation under the Clean Air Act as well.

The approach of “trying out” a carbon tax because it seems to match the risk preferences of the greatest number of people may still seem unsatisfying to some. It is still moored in uncertain climate science and is orthogonal to the question of how we deal with our ignorance about climate change. An idea that I have advanced in the past is to create a prediction market for future climate outcomes. My proposal starts with a carbon tax that is initially set at a low level, but in every future year is indexed to a basket of climate outcomes in that year:

- global mean temperature
- days of unusually high or low temperatures
- extreme rainfall events
- duration of drought events
- global mean sea level
- ocean acidity
- hurricanes of a category 3, 4, or 5 level

If these seven climate outcomes prove to be severe, as climate scientists predict, then the indexed carbon tax will rise; if not, then it will remain at a low level. Moving averages can be used to smooth out fluctuations.

The point of this indexed carbon tax is not to incentivize emissions reductions; as discussed above, damages from climate change lag emissions by too much for this tax to “bite” at the right time. Rather, the point is to establish a liability backdrop for the prediction market. What I have proposed is, nested inside this indexed carbon tax, a cap-and-trade program for a small number of permits that can be redeemed in the future in lieu of paying the indexed carbon tax. The permits would be unitary exemptions from the tax, auctioned far in advance of their redemption date. What we would expect is that the prices for the future permits would reflect market expectations of future climate outcomes. That cap-and-trade program, exempting a small number of emitters from the indexed tax, is the prediction market. This “tax-and-cap-and-trade” program would produce market opinions on the science of climate change, scrubbed free of taint or ideology.

My proposal is aimed at trying to remove emotion from perceptions of climate science. Unsurprisingly, the problem of pricing greenhouse gas emissions raises a number of non-economic issues. It seems as though no matter how objective and data-driven you try to be, climate change inexorably pulls you back into a morass of unresolvable value judgments and moral arguments. Granted, climate science has sometimes given the world cause for skepticism, but shrillness has crowded out reasoned discourse.

Litterman is not the only person to have discussed the economics of climate change in this original way, but this short essay is the most rewarding and insight-rich piece that I have read in a long time. R

READINGS

■ “A Prediction Market for Climate Outcomes,” by Shi-Ling Hsu. *University of Colorado Law Review*, Vol. 83 (2011).

■ “Global Warming’s Six Americas in March 2012 and November 2011,” by Anthony Lieserowitz et al. Yale University and George Mason University. 2011.

Uncertainty Can Go Both Ways

BY DAVID R. HENDERSON

Bob Litterman (p. 38) makes some excellent points about the roles of uncertainty, size of damage, and economic growth in his discussion of how the government should “price” carbon emissions. However, he does not go far enough in considering the role of uncertainty. A deeper appreciation of uncertainty over the effect of carbon emissions on people’s lives leads to a wider range of reasonable policies than Litterman considers.

Technology | I first note the major issue on which he and I agree: the importance of economic growth. Litterman notes that even if, pessimistically, per capita incomes grow by only 1 percent per year, then “without factoring in climate damages, people will have 64 percent higher income in 50 years.” He reasons that climate risk “will reduce the dispersion of potential future growth scenarios” and that, therefore, it is “a potential hedge against other random factors affecting future economic well-being.” That’s an important, sophisticated point, and it is one that you would expect from a person who thinks about risk and hedges.

He also makes another, less-sophisticated point that could be just as—or more—important: the role of technology. He writes that in the distant future, when the effects of climate are expected by many to be more extreme than they are today, technology,

DAVID R. HENDERSON is a research fellow with the Hoover Institution and an associate professor of economics in the Graduate School of Business and Public Policy at the Naval Postgraduate School in Monterey, Calif. From 1983 to 1984, he was the senior economist for energy policy with President Reagan’s Council of Economic Advisers. He blogs at www.econlog.econlib.org.

which tends to move in the same direction as wealth and income, will be better. This better technology will help us cope with or even reverse the negative effects of global warming.

This point about growth and technology goes beyond where Litterman takes his argument. It is possible that just a few years from now we will have the technology for “geo-engineering”—the ability to deliberately manipulate Earth’s climate. Geo-engineering, as economist Robert Murphy has noted, could be a low-cost way of preventing global warming if and when we decide that global warming is a serious threat. The longer we wait before adopting some costly environmental policy, the more we save and the better the options for geo-engineering become.

An economist’s concern | On two other issues, I disagree with Litterman.

The first is the issue of the economists’ consensus. He writes, “There is no disagreement among economists on the benefits of pricing carbon emissions.” That is simply false; there is disagreement. I’m an economist and I am not sure of the benefits of pricing carbon emissions; in what follows, I say why. Perhaps he accidentally overstated his case because in the same paragraph, he writes, “Relying on prices to allocate scarce resources is vastly superior to the command-and-control approaches of current policies, which rely on public subsidies and mandates to use particular alternatives to fossil fuels.” That *is* true, but to say that *A* is better than *B* is not to say that there is no disagreement on the desirability of *A*.

The second issue on which I part company with Litterman is the role of uncertainty, which is the main focus of his article. He admits that his reasoning about uncertainty does not lead to any firm conclusions about carbon policy. He writes, “The fundamental problem, of course, with the insights provided by the economics of risk management is that the answer depends, at its core, on something unknowable.” And yet, in his last paragraph, he reaches a strong policy conclusion. He writes:

I believe that given that uncertainty, a cautious approach that weighs the cost of catastrophic outcomes above the potential benefits of hedging future economic growth is justified. It would be best to get started immediately by pricing carbon emissions no lower, and perhaps well above, a reasonable estimate of the present value of expected future damages, and allow the price to respond appropriately to new information as it becomes known.

I think that Litterman would be hard pressed to justify that conclusion. It seems to be more of a hunch than to be something he has established in his article.

But there is a more fundamental problem. For Litterman, the uncertainty is all in one direction. Go through his article and, in every case where he discusses uncertainty, it’s about how *bad* the consequences of global warming will be. Will they be just mod-

erately bad or will we have a catastrophe? Notice what’s missing: He doesn’t entertain the possibility that global warming could be good. Nor does he entertain the possibility that not only could it be good, but it could also offset the potentially catastrophic damage that could result from global cooling. I am not a climate scientist, so I don’t know how likely global cooling is. But I am

.....

If we don’t know much about what will happen in the future—and I agree with Litterman that we don’t—then we should be cautious.

enough of an analyst to know that if we are uncertain, as Litterman admits we are, then we need to entertain that possibility.

What could cause the earth to cool? How about a change in cloud cover? In an interview with *Discover*, Henrik Svensmark, director of the Center for Sun-Climate Research at the Danish National Space Center in Copenhagen, stated:

All we know about the effect of [carbon dioxide] is really based on climate models that predict how climate should be in 50 to 100 years, and these climate models cannot actually model clouds at all, so they are really poor. When you look at them, the models are off by many hundreds percent. It’s a well-known fact that clouds are the major uncertainty in any climate model. So the tools that we are using to make these predictions are not actually very good.

Again, I emphasize that I am unable, as a layman, to evaluate evidence and claims about clouds and global warming. But I do know that uncertainty can go both ways. If we don’t know much about what will happen in the future—and I agree with Litterman that we don’t—then we should be cautious. His caution leads him to advocate a higher carbon tax than otherwise. My caution leads me to conclude that we should keep studying the issue, leave ourselves open to learning more about it, not implement a solution prematurely, and learn more about technological solutions, whether adaptation solutions or geo-engineering solutions.

I am cautious not only about the science of global warming, but also about the political system. If the government imposes a tax, that tax will be difficult to end if our later information tells us that it should end. Some interest groups will lobby to keep the tax in place. Which groups? Perhaps the producers of alternative, non-carbon-based energies, a group that has shown particular power in recent years. Economists who pay any attention to the way laws are made and to the contents of those laws should be among the first to be cautious about advocating new programs and/or new taxes. **R**

.....

READINGS

■ “Sun’s Shifts May Cause Global Warming,” by Marion Long. *Discover*, June 25, 2007.

■ “The Benefits of Procrastination: The Economics of Geo-Engineering,” by Robert P. Murphy. Library of Economics and Liberty, December 7, 2009.