The U.S. government has devoted a lot of time and effort to estimating the social cost of carbon. This is basically a standard exercise in cost-benefit analysis, following a familiar three-step process:

1. **Impacts.** Figure out the physical impacts of the emissions. This involves setting up some emissions scenarios and then running computer simulations to see how much they would change global temperatures. Scientists are fairly confident about the floor for the expected temperature change but less so about the ceiling.

2. **Valuation.** Determine the cost in dollars associated with those physical impacts — for example, what is the value of the land that would be lost to sea level rise at various points in the future? There are substantial uncertainties here too, especially at higher temperature changes that fall well outside the range of past weather variability. A key issue is how successful people would be in adapting to climate change and how much the adaptation would cost.

3. **Discounting.** Because the costs are incurred over a long period of time, they need to be converted into present value, which is done with a technique called discounting. The key parameter here is the discount rate. There is no economic consensus about the right one to use.

There is a lot of controversy about cost-benefit analysis in general, but there are special issues in applying the technique to climate change because of these uncertainties. Even some people who normally support cost-benefit analysis question how meaningful the results are in the context of climate change. (You can find a detailed discussion of the issues here.)

One of the things that we've learned from the modeling efforts is that the most important costs associated with climate change involve the downside risks that the impacts will turn out to be much worse than expected due to tipping points. Some scholars, like MIT economist Robert Pindyck, suggest that we take those risks into account more directly. (here) We could begin by deciding how much we should try to reduce those risks, then figure out the emissions reductions required to do so, and finally set the price of carbon as the marginal cost of the emissions reductions. This is something of the reverse of the normal way of doing cost-benefit analysis, where we start with the marginal harm of the pollution and use that to figure out the right level of pollution control.

That leaves open, however, how much of a risk of climate catastrophe we're willing to tolerate. Ideally, it would be zero, but that may not be feasible. We can't use a cost-benefit

analysis to decide that issue — the whole reason for taking this approach is the difficulty of doing a cost-benefit analysis. What we *can* do, however, is to consider what level of risk we would consider significant and then move as far as feasible toward that goal — that is, setting the emissions reductions and therefore the cost of emissions reduction at the highest level we consider tolerable. (here again). In environmental policy circles, this is known as feasibility analysis. Outside the United States, it might be called the precautionary principle

Like the government's "social cost of carbon" effort, the upshot would be a dollar amount associated with emission of a ton of carbon, which could then be plugged into cost-benefit analysis of specific regulatory decisions. It's not clear whether we should cause the resulting figure the social cost of carbon. Unlike the government's approach, it's not based on a direct estimate of how much harm is done by the added carbon pollution. On the other hand, suppose we are considering whether to allow a project to emit additional carbon. If we allow the extra emissions, we will have to compensate reducing emissions somewhere else, in order to stay on the emissions pathway that we've already selected to minimize the risk of carbon catastrophe. So one of the costs of the project to society s the need to make additional carbon reductions elsewhere, and this could be appropriately consider the social cost of carbon *vis a vis* that project. Calling it the shadow price of carbon might be less confusing, however.