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Dealing with Low Probability but High Impact Risks

In most discussions of global warming, climate scientists and economists interpreting scientists' climate change projections have tended to focus on the most likely outcomes, steering clear of unlikely, low probability, outcomes, especially low probability catastrophic outcomes. "Fear mongering" and "doom saying" based on very unlikely outcomes are seen as exaggerations of what scientists have to say, exaggerations that undermine their scientific credibility.

There appears to be a clear logic to this. People and policy-makers are interested in what is *likely* to happen, not in the whole range of things that *might* happen. As a result, the focus tends to be on a probability-weighted average *expected* impact. Outcomes of extremely low probability, whether they have very low or very high impacts, are simply ignored.

This focus on only that which is likely to happen while ignoring "outliers," can , however, involve ignoring important scientific information that may have profound implications for our and our planet's future.

In our every day lives, we do not always ignore low probability but possible outcomes, especially if the impacts to us could be catastrophic. In fact we tend to pay careful attention to them and take relatively expensive steps to guard against them. Consider our expenditures on insurance. Almost all homeowners have fire insurance even though the probability of a home fire, including those causing very minor damage, in any given year is incredibly tiny, one in three hundred. But home fire insurance is just

the beginning of our insurance expenditures. \$332 billion or 2.4 percent of the total value created by the American economy originates in the insurance industry. We insure ourselves against all manner of unlikely events: someone hurting themselves while visiting our homes, an accident in which we get killed or lose a limb, catastrophic illness, a flood, a hurricane or tornado, wildfire, hail storms, etc. Almost none of us bemoan our expenditures on fire and other catastrophic insurance. For our family's security, those insurance expenditures that protect us against low probability but high impact events make sense.

In other day-to-day activities, such as the jobs we take and the pay to which we agree, there is also significant evidence that we pay attention to quite low level on-the-job risks to ourselves and take steps to reduce them. Economists have long documented the sacrifices in pay that people make in order to avoid jobs with higher risks of injury or death. Of course, even the most dangerous of common-place jobs have relatively low likelihoods of death. Averaged across all industries and occupations, the risk of death on the job in any given year is about 4 in one hundred thousand. The common jobs with the highest risks (mining jobs) involve risks ten times higher but still only 40 deaths in 100,000 workers.

These risks might seem minute, miniscule fractions of one percent. In studying global warming, possible impacts with such low likelihoods of occurring would tend to be systematically ignored as simply remote, not likely.

However, workers do not ignore these differences in the risk of death on the job. Workers tend to shy away from relatively high risk jobs, taking lower-paying jobs while firms with more dangerous jobs have to pay their workers more to get them to accept

those higher risks, even what might appear to be very small additional risks. Economists statistically analyze this variation in pay among jobs with differing risks of death, trying to hold all other things about the workers and the jobs equal, to estimate how workers in the aggregate evaluate these low probability threats to their lives. The result is an estimate of the amount of pay workers sacrifice by taking jobs with a lower probability of death on the job. That provides an estimate of the value of a “statistical life” saved as a result of workers choosing safer jobs with lower pay. Such estimates regularly run to \$5 to \$10 million per death avoided. Workers do not put a low value on threats to their lives nor do they ignore low probability risks to those lives.

The point is that low probability events are not necessarily unimportant events that can be safely ignored. That is not how any of us live our lives and it is not a sound basis for public policy either. The size of the consequences of that event has to be considered along with its probability.

This is important when it comes to the economic evaluation of measures to control global warming. Some of the potential consequences might be classified as simply inconveniences, like less comfortable summer temperature. Other changes represent serious challenges that may require very costly changes in where we live: for instance, ocean levels rising many feet.

But some consequences can reasonably be called catastrophic: For instance, average temperatures not rising just a few degrees but temperature increases in the double digits as run-away releases of methane into the atmosphere make much of the planet uninhabitable for humans.

If we simply reject consideration of these low probability but catastrophic outcomes as “unlikely,” we may get comforting results from any benefit-cost analysis that we carry out on measures to control global warming. That analysis may tell us that it is best to do nothing that is costly right now and just wait until the future when we will be richer and have more knowledge and technology to cope with the most likely outcomes. Of course, by then, the inertia of irreversible climate change may make the catastrophic outcomes unavoidable no matter what we do.

With global warming, we should be applying the same cautious, risk adverse standards that we apply to our daily lives where we take systematic but costly steps to protect our families from catastrophic risks. To suggest that our nation as a whole should gamble with our grandchildren’s future in a way that we personally never would is simply outrageous as well as unethical.