Excerpt #1

might conclude that whether an irreversible loss deserves real attention, sufficient to trigger the Anti-Catastrophe Principle or any special kind of precaution, turns on its magnitude, not on the mere fact of irreversibility.

MARGINS OF SAFETY

Margins of safety are hardly limited to catastrophic risks; they are reasonable in many contexts. But how should we select margins of safety?

The first step is to notice that regulators, no less than ordinary citizens, should pay attention both to the probability of harm and to its magnitude. If the magnitude of the harm is high, then regulators need not require as much evidence that it is probable. A 1/10,000 risk of 10,000 deaths must be taken very seriously. Whether or not the outcome qualifies as catastrophic, it is appropriate to weigh both probability and magnitude.

This simple point helps to distinguish cases of sensible and senseless use of the Precautionary Principle. On the senseless side: There has been no good reason for invocation of the principle in the context of cancer risks said to be associated with cellphones. For each cellphone user, the risk of harm is exceedingly low or possibly even nonexistent.[8] On the sensible side: The risks associated with low levels of arsenic in drinking water (50 parts per billion) were certainly high enough to make it reasonable for the United States to impose further regulation (a ceiling of 10 parts per billion) under the rubric of precaution.

Alternatively, suppose that science currently allows us to group the outcomes into rough, general categories of probability – with, for example, low harm being 30 percent likely, moderate harm being 40 percent likely, serious harm being 35 percent likely, and catastrophic harm being 5 percent likely. Let us suppose, too, that we will learn an increasing amount over time. If so, we might elect to take certain steps now, on the basis of a principle of "Act, then learn." The steps we now take would not be the same as those that we would take if the worst outcomes were more probable, but they should be designed so

[8] See Adam Burgess, *Cellular Phones, Public Fears, and a Culture of Precaution* (Cambridge: Cambridge University Press, 2004).

as to permit us to protect against the worst outcomes if we eventually learn that they are actually likely.[9] On this view, an understanding of what we do not know means not that regulators should do little, but that they should act in stages over time, adopting precautions that amount to a kind of insurance against the chance that the harm will be higher than we currently project in light of our current knowledge of both probability and magnitude.

But an understanding of probability and magnitude is not nearly enough. At a minimum, it is also necessary to identify the appropriate regulatory tool. A high probability of a serious harm might justify a flat ban on the product or process in question – what we might call a Prohibitory Precautionary Principle. By contrast, a low probability of a less serious harm might support further research or information disclosure. For many risks, it makes sense to follow an Information Disclosure Precautionary Principle – one that requires those who create risks to disclose that fact to the public. An understanding of the probability of the risk, its magnitude, and the menu of regulatory tools goes a long way toward the specification of good options. For every such option, a margin of safety might be selected in accordance with the existing evidence and the magnitude of the risk if it comes to fruition.

Even at this stage, however, the analysis remains badly incomplete. It is also necessary to know about the risks and costs that would be introduced by the chosen tool. If precautions would be costless, they should by all means be taken. Consider the appealing notion of "prudent avoidance," calling for avoidance of even speculative hazards when avoidance comes at a small cost. But if precautions would introduce a serious probability of a significant risk, then they are forbidden by the very idea of precaution. I have emphasized the importance of a wide viewscreen for thinking about dangers, one that asks both regulators and ordinary citizens to consider the problems produced by reducing one of a set of possible risks. But this idea is not fatal to the notion of margins of safety; it merely requires regulators to identify the particular risks that are receiving special concern, and to explain why margins of safety are appropriate for those risks.

[9] Montgomery and Smith, *supra* note 5, at 409–10. See also Scott Farrow and Hiroshi Hayakawa, Investing in Safety: An Analytical Precautionary Principle, 33 *J. Safety Research* 165 (2002).

Suppose, for example, that the risk of getting cancer from sunbathing is not trivial, and that the cost of risk reduction consists of using sunscreen or staying out of the sun for some part of every day. A margin of safety is hard to contest. Or suppose that the risk of a terrorist attack in airports cannot be dismissed, and that the costs of risk reduction consist of the security measures that have become standard in the United States in the aftermath of the attacks of 9/11. On plausible assumptions, those costs are well worth incurring, even though they are far from trivial. Compare the American-led war to remove Saddam Hussein from Iraq. Reasonable people could justify that war on "margin of safety" grounds. The very high costs, in terms of both human life and money, might have been worth incurring if we attend only to the risks, to the people of Iraq, that were associated with the continuation of Saddam's horrific regime. But some reasonable people feared that the war itself would contribute to risks of terrorism, above all by fueling anti-American sentiment and thus making it easier to recruit terrorists and to inspire them to murderous acts. When risks are on all sides, the idea of a "margin of safety" cannot by itself resolve the underlying disputes.

In any case the real question is not whether to have a margin of safety, but how big the margin of safety should be, and to which risks the margin should be applied. For the risks associated with terrorism, a huge margin of safety would call for a ban on air travel in the United States – a ban whose cost would obviously be too high (and one that would introduce multiple risks of its own). For the risks associated with air pollution and global warming, a ban on coal-fired power plants would be required if the margin of safety were set high enough – but at the present time, such a ban would simply be too expensive (and it would be far from risk free). For both individuals and societies, margins of safety are chosen with careful attention to the costs and risks that they produce.

THE ANALYTICS OF PRECAUTION

We should now be able to see that applications of the Precautionary Principle against particular risks can be described in terms of four important factors: (a) the level of uncertainty that triggers a regulatory response, (b) the magnitude of anticipated harm that justifies such a

response, (c) the tools that will be chosen when the principle applies (tools such as disclosure requirements, technological requirements, or prohibitions), and (d) the margin of safety that applies in the face of doubt.[10]

No sensible person believes that an activity should be banned merely because it presents "some" risk of harm; in this sense, an absolutist version of the Precautionary Principle, while having occasional influence in practice,[11] lacks theoretical appeal even to its proponents.[12] Some threshold degree of evidence should be required for costly measures of risk avoidance, in the form of scientifically supported suspicion or suggestive evidence of significant risk. But the magnitude of the anticipated harm matters a great deal. The demand for scientific evidence should be reduced if the harm would be especially large if the risk came to fruition.

We can also identify a range of regulatory tools.[13] For example, a Funding More Research Precautionary Principle would say that if there is an even minimal reason for concern, the appropriate initial step would be to subsidize further research as a precautionary step.[14] The Information Disclosure Precautionary Principle would say that in the face of doubt, those who subject people to potential risks must disclose relevant information to those so subjected. The debate over labeling genetically modified organisms involves this form of the Precautionary Principle. An Economic Incentives Precautionary Principle would insist that in the face of doubt, those who impose a possible risk should be asked to pay a tax or a fee that corresponds to the public's best assessment of the cost of that risk. For every regulatory tool, there is a corresponding Precautionary Principle. Of course the idea of "margin of safety" can be understood in multiple different ways, with a continuum from a small margin, designed to counteract

[10] Compare Per Sandin, Dimensions of the Precautionary Principle, 5 *Hum. & Ecol. Risk Assess.* 889 (1999).

[11] See J. S. Gray, Statistics and the Precautionary Principle, 21 *Marine Pollution Bulletin* 174 (1990).

[12] Per Sandin et al., Five Charges against the Precautionary Principle, 5 *J. Risk Research* 287, 290–91 (2002).

[13] Richard B. Stewart, Environmental Regulatory Decisionmaking under Uncertainty, 20 *Res. L. & Econ.* 71, 76 (2002).

[14] See John D. Graham, Decision-Analytic Refinements of the Precautionary Prnciple, 4 *J. Risk Research* 127, 135–38 (2001).

speculative and noncatastrophic risks, to a large one, designed to insure against the worst imaginable cases.

A great deal of progress might well be made through attending to the various moving parts. An Information Disclosure Precautionary Principle would make best sense when there is some probability of harm, but it does not appear to be terribly high, and when the outcome would be far from catastrophic. A Prohibitory Precautionary Principle, with a large margin of safety, would be justified if the evidence of harm is clear and if the outcome would be particularly bad.

Consider in this light the partly sensible but frequently vague and confusing communication on the Precautionary Principle from the European Commission.[15] The communication urges that the principle "should be considered within a structured approach to the analysis of risk" that includes "risk assessment, risk management, risk communication." Hence measures based on the principle should not be blindly precautionary, but should be nondiscriminatory in application and consistent with similar measures previously taken. The Commission also insists that precautionary steps should be proportional to the chosen level of protection and "based on an examination of the potential benefits and costs of action or lack of action (including, where appropriate and feasible, an economic cost/benefit analysis)."

The idea of proportional response is a useful recognition of the fact that risk "can rarely be reduced to zero." (Rarely is surely an understatement.) The reference to cost-benefit analysis sensibly recognizes the relevance of "non-economic considerations," including public acceptability. But it is not so simple to combine cost-benefit analysis with the Precautionary Principle. What should be done if the anticipated costs of regulation exceed the anticipated benefits of regulation? Does the Commission mean to suggest that even in that case, action is justified in the interest of precaution? Always? Most of the time? An affirmative answer is suggested by the Commission's unhelpful contention "that the protection of health takes precedence over economic considerations."[16] This is unhelpful for two reasons. First, everything depends on degree; a very slight improvement in

[15] Communication from the Commission on the Precautionary Principle (Brussels, Feb. 2, 2000), available at http://europa.eu.int/comm/dgs/health_consumer_library/pub/pub07_en.pdf.

[16] *Id.* at 4.

public health would not justify an enormous expenditure of money. (Would a hundred million dollar expenditure be worthwhile to avoid a handful of minor health problems?) Second, large expenditures can themselves produce adverse health effects (as we saw in chapter 1). If government requires significant amounts to be spent on risk reduction, there is at least a risk of increases in unemployment and poverty – and both of these lead to increases in illnesses and deaths.

The Commission also emphasizes the importance of a "scientific evaluation of the potential adverse effects" when considering whether to act.[17] Indeed, recourse to the Precautionary Principle is said to presuppose "identification of potentially negative effects" alongside a "scientific evaluation" that shows inconclusive or imprecise data.[18] In this way, the Commission does not argue that the principle should be invoked without evidence. The Commission's communication leaves many open questions and I have raised a number of doubts about it. But insofar as it takes the Precautionary Principle to call for attention to potentially significant risks when the costs of control are not excessive or grossly disproportionate, it provides a plausible start.

The pieces are in place for an understanding of how to go beyond that start and to reconceive the Precautionary Principle outside of the context of uncertain risks of catastrophe. Margins of safety are sensibly used for risks that justify the most concern, at least if those margins do not themselves impose serious harm or create significant risks. If a product or activity produces real risks but offers no real benefits, there is a strong argument for banning it. The tasks are to identify the full universe of relevant risks, to specify the appropriate tools, and to impose margins of safety that are closely attuned both to the "target" risk and to the risks that are associated with reducing it. Sometimes those tasks are daunting, but in many cases a little attention to the central inquiries should go a long way toward resolving heavily contested questions for both ordinary citizens and nations.

MANAGING FEAR AND DISCLOSURE REQUIREMENTS

In the last decades, many people have been enthusiastic about the idea that producers of hazards should inform people of the underlying

[17] *Id.* at 13. [18] *Id.* at 14.

risks, so as to promote knowledge rather than ignorance and so as to allow for more informed choices. In the world of regulatory policy, information disclosure often seems better than either government inaction or command-and-control regulation, simply because it is less intrusive and allows people to choose as they wish. In the context of drugs and medical procedures, patients are often informed of low-probability events, including worst-case outcomes, even if the risk of disaster is exceedingly small. In general, isn't it best to tell people about the dangers that they face, whatever the likelihood of harm?

An understanding of the nature of fear raises cautionary notes about disclosure policies. Suppose, for example, that regulators propose to label goods that contain genetically modified foods, so as to ensure that consumers know that this is what they are buying. Or suppose that regulators require water companies to disclose to their customers the level of arsenic in their drinking water – a level that, in democratic societies, generally ranges from a high of 25 parts per billion to a low of 5 parts per billion. On reasonable assumptions, both of these steps may cause far more trouble than they are worth. The problem is not simply that people may well misunderstand risk disclosures, seeing the hazard as far greater than it is in fact. The problem is also that the disclosure may greatly alarm people, causing various kinds of harms, without giving them any useful information at all. If people neglect probability, they may fix, or fixate, on the bad outcome, in a way that will cause anxiety and distress but without altering behavior or even improving understanding. It would be better to tell people not only about the risk but also about the *meaning* of the probability information – for example, by comparing a risk to others encountered in ordinary life. But if the risk is low, and of the sort that usually does not trouble sensible human beings, is it really important to force disclosure of facts that will predictably cause high levels of alarm?

Of course there are difficult issues here about the relationship between respect for people's autonomy and concern for their welfare. On one view, people have a right to know the risks that they face. Perhaps disclosure of low-probability risks is justified on grounds of autonomy even if that disclosure would increase fear and distress. But if people are prone to neglect probabilities, and if we really are

speaking of exceedingly improbable risks, it is by no means clear that the interest in autonomy justifies disclosure of information that will not be processed properly. At a minimum, any disclosure, if it is worthwhile, should be accompanied by efforts to enable people to put the risk in context.

This point very much bears on the civic responsibilities of those who disseminate information about risk, including public officials, the media, and those interested in moving regulatory law in one or another direction. In view of probability neglect and the operation of the availability heuristic, it is not difficult to produce large changes in public judgments, by dramatically increasing fear. A statement of worst-case scenarios can greatly alter both behavior and thought. Sometimes these changes are entirely justified as a way of reducing a kind of complacency, or fatalism, about real risks. But it is, to say the least, undesirable to take advantage of the psychological mechanisms to provoke public concern when the risks are statistically minuscule.

HEIGHTENING FEAR?

Suppose that government wants to encourage people to focus on risks that they are now ignoring. If so, it would do well to attempt not to provide information about probabilities, but to appeal to people's emotions and to attend to the worst case, above all by providing vivid narrative and clear images of alarming scenarios. For cigarette smoking, abuse of alcohol, reckless driving, and abuse of drugs, this is exactly what governments occasionally attempt to do. It should be no surprise that some of the most effective efforts to control cigarette smoking appeal to people's emotions, by making them feel that if they smoke, they will be dupes of the tobacco companies or imposing harms on innocent third parties;[19] some such efforts provide vivid images of illness or even death. Strategies of this kind can overcome unrealistic optimism – a common basis for inattention to risks that ought to justify serious concern.

Because of probability neglect, it should not be terribly difficult for government to trigger public fear. Terrorism is effective in part

[19] See Lisa K. Goldman and Stanton A. Glantz, Evaluation of Antismoking Advertising Campaigns, 279 *J.A.M.A.* 772 (1998).

for exactly that reason. But there are serious ethical issues here. Government ought to treat its citizens with respect; it should not treat them as objects to be channeled in government's preferred directions. It is plausible to insist that government ought not to manipulate or to trick people by taking advantage of their limitations in thinking about risk. A skeptic might think that the use of worst-case scenarios, or dramatic images of harm, consists of unacceptable manipulation. But so long as the government is democratically accountable and attempting to discourage people from running genuinely serious risks, there should be no objection in principle. Tobacco companies and others who want people to run risks, for economic or other purposes, try to engage people's emotions. So long as free speech is respected, government should be permitted to meet fire with fire. Of course the issue is not always simple. In the context of state lotteries, state governments use dramatic images of "easy street" in order to encourage people to spend money for tickets whose economic value is effectively zero. This strategy, exploiting probability neglect in the domain of hope, does raise ethical issues. My suggestion is only that if government seeks to trigger concerns about real risks, it is likely to do well if it appeals to people's emotions.

There is also a striking asymmetry between increasing fear and decreasing it: A vivid incident or a worst-case scenario can produce high levels of fear, but efforts at reassurance are far less likely to work. If people are now alarmed about a low-probability hazard, is there anything that government can do to dampen their concern? Government is unlikely to be successful if it simply emphasizes the low probability that the risk will come to fruition. The best approach may well be this: *Change the subject.* I have noted that discussions of low-probability risks tend to heighten public concern, even if those discussions consist largely of reassurance. Perhaps the most effective way of reducing fear of a low-probability risk is simply to discuss something else and to let time do the rest. Recall in this regard President Bush's effort, in the aftermath of the terrorist attacks of 9/11, not to emphasize that the statistical risks were low, but to treat flying as a kind of patriotic act, one that would prevent terrorists from obtaining victory. This effort probably did not reduce people's perception of the risk, but by focusing on the "meaning" of flying, it very likely altered their behavior.