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“Good Policies Given Bad Decisions”

by

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Causes of the Financial Crisis: Many Responsible Parties
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In his paper, John Taylor writes, “One view is the markets did it. The other view is the government did it.” Taylor clearly inclines to the second view, and Richard Posner, though less definitive, joins him in this assessment. This is the TV detective’s take on the world: Scour the evidence and find the guilty party. I want to suggest that a third view applies, which is that both parties were highly responsible, although neither intended the outcome, not unlike the parties to many accidents. Webster’s Collegiate Dictionary defines an accident as “an unfortunate event resulting from carelessness, unawareness, ignorance, or unavoidable causes.” This financial crisis qualifies admirably. It was a mega-accident.

I urge you to think about three questions regarding accidents that are often asked in tort law, an area where Posner made one of his many reputations in law. Might this be a situation of contributory negligence? If so, which party had the last chance to avoid the meltdown? Did the government create an attractive nuisance? To support the attractive nuisance hypothesis, we would have to posit that we must protect the private sector as we must protect children, who might be tempted by a swimming pool but not capable of protecting themselves.

As an introduction to the government’s role, Posner and Taylor give us a short course on monetary policy. Such instruction is not surprising from Taylor; he has been a leading practitioner for years. But, as Posner notes, lightheartedly, “I guess if I can write on sex and literature and Benjamin Cardozo, there is no reason not to write about monetary policy.”

Posner’s brief discussion of the federal overnight fund rate and of signaling is well worth reading. I am going to use it in my class to talk about signaling. His postmortem on the Lehman collapse is equally compelling. My favorite part of Taylor’s paper is his discussion, cast as a third-party view, of the misapplication of the Taylor Rule. It reads, with an excess of modesty, as

1 I thank Laura Malick, Roger Porter, and Richard Posner for helpful comments. This research was supported by a grant from the Alfred P. Sloan Foundation.
2 These comments were prepared in response to papers by Richard Posner and John Taylor. Those papers and these comments will appear in Robert Glauber, Thomas Healey, and Roger Porter (eds.), New Directions in Financial Services Regulation, MIT Press.
though the Taylor of the Taylor Rule were a recently discovered fourth cousin. I absolutely agree with these two gentlemen. The excessive monetary ease during the 2002-2005 era – a gross violation of the Taylor Rule – was inexcusable and played a major role in creating the crisis that has followed.

But many point fingers elsewhere, as I will in this essay. There certainly exist many different explanations and culprits. I will argue that the blame falls specifically and heavily on a broad range of the private players and public regulators in our financial sector. Within those groups, prime responsibility falls on the medium-size players and on the big players, not on the young couple who took a shot on a condo with a 1% down payment and then lost it.

There is a key question that must be answered at the outset. Why was this crisis so enormous? We all know that the subprime crisis was the triggering event. The remarkable thing about this crisis in contrast to previous crises is how a relatively small loss – $1 trillion in subprime mortgages – initiated a gigantic loss amounting to $20 trillion.

Compare this with the previous American financial crisis, the NASDAQ swoon of 2001-2002. This was just as important as the subprime loss, but basically little happened. A few people, around Route 128 and in Silicon Valley, were severely discomforted. My portfolio went down along with many others, but those losses did not prove to be a serious problem. The reason is that the NASDAQ crisis stemmed from excessive enthusiasm, a traditional cause of crashes throughout history. NASDAQ investors thought we were in a brave new world where a collection of first-moving companies would dominate future markets. As a result of the first-mover illusion, investors paid exorbitant amounts for companies with only modest prospects. There is GOOGLE, of course. But for every GOOGLE, there were many dozens of companies that lost 90% or more of their heyday value.

What made the more recent crisis so much more far-reaching?

Financial Engineering, An Enduring Danger, and Regulation

The novel aspect of this recent crisis was the tremendous inter-penetration of the various sectors. This was due significantly to the unfortunate factors that Paul Volcker described to us, most notably financial engineering. Thus, B’s shortfalls became A’s losses, and similarly for the shortfalls of C and D. But due to assets both unfamiliar and opaque, A had not understood his level of exposure or risk. Losses reverberated and cascaded, and the financial world collapsed. Equally important, and a major component of innovative financial engineering, was the rise of...
the nonbank banks, or the shadow banking industry, which had become responsible for most of
the lending in our economy.

Alas, such engineering, like nuclear weapons, will now be with us forever. Pandora’s box
has been opened. Sophisticated and hard-to-track financial instruments will not go away; they are
sure to figure in future financial crises. Indeed, some of the seeds have already been planted;
worst the crisis in Greece that came to light in early 2010, with Goldman Sachs once again in a
starring role as facilitator.

Fancy financial products and nuclear weapons share features beyond their irremediable escape from Pandora’s box. Those who own them have power, respectively financial/economic power and military/political power. Though we might prefer that none had them, if our competitors have them, we certainly want them as well. With financial instruments, this interactive relationship is true of firms, as well as of nations. Further, both engineered financial products and nuclear weapons are extremely difficult to regulate, since critical elements of secrecy provide some of their value.

Surely some stiff modes of regulation will emerge to be placed on exotic financial products and on new financial institutions. But academia and Wall Street are infinitely creative, and ten years from now new products and institutions will exist that offer or appear to offer superior profit opportunities, and that weave around the newly emplaced regulations. Regulations will have a tough time keeping up with such innovations; and, unless mechanisms are created that enable private participants to understand what they are buying, unrecognized risks will once again bring major losses to financial markets and possibly to the broader society.

In the arms race between effective regulation and innovation, I am arguing, innovation will win at least some of the time. Note my term effective regulation. Blanket regulations can be thrown over anything that involves money, but that hardly guarantees that they will do a good job.

Whether one is optimistic or pessimistic about the capabilities of a traditional regulatory approach, our recent experience teaches a stern lesson on the way regulation should be conducted. Our current many-channels regulatory process, where different institutions and instruments are regulated by different parties, is simply an inadequate defense when some developments have the potential to threaten the whole system. To begin, the many-channels approach promotes regulatory shopping, where players tailor their products and presentations to get the regulator who will be most favorable to them. More importantly, risks that endanger the
whole system get insufficient attention, since no single regulator has sufficient incentive, 
capability, or authority to investigate them.

This nation needs some version of a systemic risk assessor, a form of financial 
intelligence agency, whose job it is to oversee current conditions and emerging developments to 
determine whether the system as a whole is in jeopardy. Such an entity would continually scan 
the horizon for new life forms, such as nonbank banks, that might not receive sufficient 
traditional regulatory attention. Whether the assessor should also have regulatory responsibilities 
is debatable. If granted extreme arbitrary power, it might be reluctant to exercise it.3

Information and a Modest Proposal

Regulation, I have argued, cannot be a complete answer. Private players must have 
adequate and appropriate information to take actions that protect and avoid actions that endanger 
themselves. Thus I propose that we cast a bright light that reaches into the financial shadows. A 
broad comprehension of what is happening can only be reached by illuminating information that 
may currently be inaccessible to all. Such understanding, based on much fuller information, has 
the best potential to protect us. Note that even fairly traditional instruments can bring about 
crises if not properly understood. Long Term Capital Management (LTCM), after all, was 
merely a hedge fund. But its investors hardly understood the risks they were taking, and 
probably their leaders did not either.

Sometimes the required information is inaccessible to the many because it is hidden by 
the few. Bernie Madoff showed us that an apparent garden-variety investment fund can exist as a 
house of cards, if even very sophisticated folks do not do their homework to unearth required 
information. There are few Bernie Madoffs, of course. But what is troubling about his activities 
is the moral from his story. Really savvy institutions and individuals take false reassurance from 
the knowledge that their peers are investing in the same fund. They implicitly assume that others 
understand what is going on, even if they themselves do not. Large numbers of sophisticated 
people and institutions trusted Madoff. Why did they trust him? Because everybody else trusted 
him. Madoff paraded through the financial system dressed only in the Emperor’s New Clothes.

The problem with buried information is not merely that institutions do not want to ‘fess

3 I am grateful to Richard Posner for the pointing out the dangers of combining the broad powers to assess with 
broad powers to regulate. If the regulatory impositions will be severe, as they sometimes have to be, there will be 
the tendency to under assess dangers.
up. Combine the extraordinary levels of cross holdings, the dearth of information, and the continuing level of financial innovation, and no one knows quite what to ‘fess up to. There are so many quasi-financial institutions today that traditional regulation will not work. I do not think the solution is to combine two regulatory agencies or to create a new regulatory agency. I think the solution is to think about regulation in a new way. The focus, I will argue, should be on information.

In his paper, Posner discusses externalities and the people imposing externalities on the rest of the system. Following his lead, and despairing of the potential for effective regulation, I think a real problem involves the externalities of information. Information is a public good, which implies that no private entity has a sufficient incentive to unearth it. We had a very unstable system, and nobody knew how unstable it was. We had a collective interest in assessing how unstable our system was. My fear is that the government, which did not have the resources then or today, will not have the resources in the future to unearth the critical information. We have to look at some form of public-private relationship that can unearth information about how unsafe the world might be.

I would like to present the bare bones of a modest proposal on one approach. When many players have the same obligations or hold the same assets, there are significant informational externalities. If investment firm A investigated deeply and discovered that a major asset was threatened, firms B and C would benefit from that information. Yet no firm has sufficient incentive to incur the entire cost of such an investigation. Conceivably, the government could identify situations where such externalities abound, as it did in assessing assets subsequently shown to be toxic in this crisis. The government could then order that one firm be selected at random, or on some logical basis such as level of exposure, to do a much more detailed investigation than the firm would choose for itself. The results could then be passed to its similarly situated brethren firms. To avoid revealing proprietary competitive information, the results of the investigation could be sanitized before being passed on to the government and to the firm’s peers. The firm, which would be the greatest beneficiary, might pay for 40% of the investigation, with its peers divvying up the remaining 60%, most likely in proportion to their levels of holdings. The government would also have the prerogative to pass appropriate information along to the investing public.

The Players and Their Contributions
In assessing blame for the meltdown, it is important to recognize the asymmetries of the two parties. The view of the government as a large, unified entity is outdated, and this is apparent in the ongoing debates about who should regulate the financial system in the future. The potential regulators, some of them as yet unchartered agencies, are battling for survival in much the same way as private entities do. Various other private entities are cheering and lobbying for these gladiators.

The private sector, despite all the discussion about “too big to fail,” is comprised of thousands of decentralized decision makers. This structure makes it harder to say, “A did it,” or, “B did it,” or, “C did it.” Once again, contributory negligence plays a major role. Surely the people who created the failed instruments bear responsibility. But their damage would have been contained if the rating agencies had identified their deficiencies. And even if the rating agencies were asleep or corrupt, those who purchased toxic securities could have prevented the collapse if they had done sufficient due diligence before buying them.

We cannot look for a single factor that caused the financial crisis. To do so is to fall prey to the myth of the autopsy: You read in the paper that a 93 year-old man died of kidney failure. However, his death was actually caused by 34 factors, and kidney failure was just the most proximate at the time. I would further argue that even though the government behaved badly, if the private sector had been more alert, or indeed not somnolent, the crisis would not have happened.

Posner excuses the borrowers in the housing crisis, and I agree. If somebody had lent me money to buy a house in an area where housing prices were going up by five to eight percent a year, and said I only needed a one- or two-percent down payment, I would have thought that sounded like a good bet. I would have been doing the right thing. By the way, 25 percent of the mortgages that were written between 2003 and 2006 were written with a down payment of two percent or less. These mortgages were not being written to people like Roger Porter, individuals who would have been so embarrassed by the prospect of defaulting on a financial obligation that they would have kept making their mortgage payments even if the mortgage was under water. Rather, the borrowers were people who would give up their houses or condos, some by necessity, some because they found it the financially prudent thing to do.

But Posner also states that he would not “blame the banks,” the folks on the other side of these transactions. By contrast, I believe the banks were surely making a mistake. They were writing many mortgages with down payments of two percent or less in a highly volatile market.
Yes, these could be packaged up and sold, but ultimately a bigger fool to buy could not be found.\(^4\)

Posner and Taylor do an excellent job of identifying government follies. To provide balance and to fulfill the discussant’s responsibility, I will tilt in the opposite direction and identify blame that falls on the other side. How about credit default swaps? They were not the creation of the federal government. We had $5 trillion worth of commercial loans outstanding. It was to be expected that a lot of those borrowers had been overly optimistic and had invested excessively. Maybe we could have expected $3 trillion worth of commercial default swaps. But in fact we had $50 trillion worth of commercial default swaps. By comparison, however I slice up the ownership of my very nice house, it is inconceivable that its future owners could get insurance written on it for $30 million. But that, in effect, is what happened with these swaps. The levels of obligation, most notably of the insurance, vastly exceeded the value of the underlying instruments being insured.

In large part, this obligation inflation was accomplished through leverage. The levels of leverage – read debt relative to assets -- in the financial industry were unprecedented. Citi was leveraged 20 to 1, well above its accustomed level in the prior 15 years in the low teens to 1.\(^5\) I thought that that was impressive before I learned that the European banks were leveraged at substantially higher ratios, indeed, at ratios never before seen in our lifetimes.

\(^4\) This was a form of Ponzi scheme where the players, the banks, surely knew that lending with 2% downpayments was unsound, yet ample profits were being tallied along the way. In such a scheme, players who will know with high probability when the end is coming can be expected winners. My speculation, however, is that virtually all were merely doing what others were doing, and thinking little about the potential for the collapse. By engaging in “standard professional practice,” despite the dangers that practice entailed, they were gaining the protection of the herd.

Many financial instruments have the property of being highly profitable for a while, thus luring in investors and vastly expanding in scale. Ultimately, much too much money comes to chase too few assets so that prices become excessive, leading to an ultimate collapse. Even such highly touted fields as venture capital may prove to have had underwhelming returns on net up through the end of the financial crisis. That is because much more money was at stake in the disappointing years at the end then in the earlier years of great success.

\(^5\) Interestingly, Bank of America and JP Morgan Chase, both of which were strong enough to pick up major assets after the meltdown, both had their leverage ratio fall over this period. For Bank of America it went from the mid teens in the early 1990s to 11.6 to 1 in December 2007. For JPMorgan Chase it went from the high teens in the early 1990s to 12.2 in December 2007.
Some big, bad players also merit special scrutiny. One of my favorite examples of a big bad player, in part because I was an investor in it, was AIG. Distinguished economist Jacob Frenkel, former Governor of the Bank of Israel and then Vice Chairman of AIG, remarked that: “We did nothing wrong.” What AIG has been blamed for most in the public press is paying out $165 million worth of bonuses. And, boy, am I indignant, because had AIG given me that money, I would have been more than made whole. That, however, is not really the reason that I should be angry. AIG got a bailout. In fact, AIG received the largest bailout – $170 billion, which makes that $165 million look like chicken feed – that our government gave to anyone. But unlike Goldman Sachs or Bank of America or many other firms that just took a loan to get them through a rocky period, AIG is not likely to pay back the loan quickly. These bailout loans had a heads-I-win-tails you-lose aspect. If any firm can, it will pay back quickly to avoid paying high charges and to win some public relations plaudits. But if it is truly insolvent, do not expect to see our money repaid in full for many years, where many years may well be a synonym for ever.

The big difficulty was that AIG had written some $440 billion dollars of credit default swaps, a figure that was not, by the way, in its annual reports. That’s real money, even for the big big players. Who knew about that astronomical level of potential liability? Did its accountants? Did its counterparties, such as Goldman Sachs? If its counterparties did know, were they really stupid to rely on an insurer that would collapse when the losses came in? Or perhaps did they have a hint as to how the game might play out if disaster struck?

As soon as the financial crisis hit, Goldman Sachs (GS) did run to Washington, or, more accurately, Lloyd Blankfein ran to Hank Paulson, the Treasury Secretary and his predecessor at Goldman Sachs. Blankfein did not say: “We need a bailout for Goldman Sachs.” Rather he said: “The world needs a bailout for AIG.” If you had had credit default swaps with AIG at the GS level, estimated to be $15-20 billion, you too would have run to Washington, and you too would have tried as best you could not to draw attention to yourself. The implicit story was that both Goldman Sachs and the government regulators did not know the magnitude of AIG’s exposure. (By the way, the U.S. regulators can deflect some blame, since these credit default swaps had been mostly written in London.) I daresay that the people who were running AIG did not realize their level of exposure. No one knew. But shouldn’t some have suspected? Shouldn’t some have investigated?

Everything was out of proportion in 2008. We had bubbles not merely in housing prices, but bubbles in the prices and implicit prices of a vast array of financial instruments. Panics are
as interesting and as important a phenomenon as bubbles, and are equally difficult and important to study. Panics and bubbles played important roles in the 2008 meltdown. The absence of information and, as Taylor said, the absence of a clear policy, clearly contributed to these panics. Markets abhor a vacuum, and we had an information vacuum.

Monetary Policy and the Macro Outlook

Allow me to switch gears and return to monetary policy and the macroeconomic picture. Beware of short-term measures that are long-term killers. Keynes said: “In the long run, we are all dead.” He was right, but maybe he should have said that those of us who worry about the short run often take measures that impair and sometimes kill us in the long run. That suggests the interesting question of what our current monetary and fiscal policies should be, given the coupled misfortunes of our high rate of unemployment and our huge deficit.

Not being a macroeconomist, I will not venture an answer. The Taylor Rule surely provides one, albeit not one that our political system, or indeed many economists, would accept. But all should recognize one great virtue of instruments like the Taylor Rule: They protect us from ourselves.

Any self-denying ordinance, like the Taylor rule, should be thought of like a diet. A key question is, how strict should it be? It does not take into account every factor that should be taken into account, so some deviations are inevitable. Sometimes we allow ourselves to stray a little, and sometimes we wander far off course. The interesting question is: How can we have policies that keep us in line, but sometimes allow us to venture out a little bit? I am not very good at controlling my diet deviations, so I try to be strict with myself. Given the experience of the last few years, it is clear that our policymakers take leave from normal prudent policy much too readily.

Posner does not like naysayers, but he used the word “depression” in the title of his first book about the crisis, and twice in this essay. I thought that was quite negative. We are not in what I would label a depression, and I do not believe one looms.6

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6 In the United States, the nonprofit National Bureau of Economic Research has taken responsibility for identifying and dating recessions, and is usually accorded such authority in the press. It explicitly avoids using the common definition of two down quarters of economic activity. Rather, it uses the ambiguous definition: “a significant decline in economic activity spread across the economy, lasting more than a few months, …”
more severe than the recessions of the postwar era, but dramatically less dire than the to-year Great Depression, where GNP fell by nearly half, unemployment reached 25%. I think the appropriate word to describe our economy, in the near future, is suppression. I think that the things that we have done to our economy over the last decade will suppress us for the next decade, in terms of the deficits, inflation, and so forth.

Confidence matters. Posner is miffed that Ben Bernanke does not run around saying mea culpa.7 Whatever my diagnosis of Ben Bernanke’s failures or successes, I do not want him to run around saying mea culpa. We only have one guy who is in charge of the Federal Reserve, and I think the worst thing he could do is say, “Although I’ve done a good job for the last year, prior to that I was really screwing up.” That would be terrible for the financial markets and the economy, not merely for Ben Bernanke.

Yet, I think our country now confronts serious problems of confidence and trust. Ten years ago, when we got a document from Lehman Brothers, we knew that it was reliable. Today, we can get a document with any name on it – Goldman Sachs, Harvard University, or even the U.S. Federal Government – and its full faith and credit do not really count as such.8 Is there any way to restore confidence in our institutions?

Thinking Probabilistically, Crises in the Future, and Illuminating Information

Not many people foresaw this crisis the way it happened, and now there are thousands of people – I must admit I am one of them – who look back and explain precisely why it happened. History in general, I believe, should be written probabilistically. I think we should study crises by asking what the probabilities of events were before they occurred. If we had changed certain variables, how would that have changed the probability estimate at the time? I have a very hard


7 Posner’s argument is that government officials should admit when they have screwed up “instead of lying continuously.” He feels strongly that Bernanke should not have been reappointed, and that to secure his position he had to make unwise promises about policy.

8 Goldman Sachs’ ploy with its Abacus investments – it allowed John Paulson to prepare a poisoned portfolio that it then sold to its clients -- will deeply undermine trust for Goldman Sachs and, through reputational externalities, for other major financial institutions.
time, for example, deciding what would have happened if the government had rescued Lehman Brothers. Would Congress have passed the bailout? If it had not passed the bailout, would that have been a good or a bad thing? Would somebody larger have been bailed out later?

I do not know, but I would like to think about such matters probabilistically. The best way to start is by looking forward. How likely is unemployment in December 2010 to fall below 9% or to rise above 11%? I am not speculating on the direction, but experience suggests that people, indeed experts, assess their probabilities much too tightly. Predicting next year’s economy is like picking next year’s World Series winner; the most likely outcome is unlikely.

We will not see this type of crisis again, but we will see other types of crises. I share Nicholas Nasim Taleb’s views of Black Swans. These are high-impact events whose occurrences lie well outside our normal expectations. Such events, though rare, are much more common than people think. Moreover, once they do happen, the reasons why they did are readily rationalized. An infinite number of crises can arise, and the critical question remains: What will happen in the future?

My analysis suggests that the current financial system has become effective at burying information that should be and can be uncovered. This unacceptable situation poses continuing dangers. Thus, I conclude, with apologies to Cole Porter:

Let’s Do It: Let’s Illuminate

We know that banks do it, geeks do it;
Even educated Greeks do it.
We do it,
We all obfuscate.

Investment firms in New York do it;
Hong Kong hedge firms seeking torque do it.
We do it.
We all obfuscate.
In London Town, AIG did it;
Moody’s, Fitch and S&P did it.
We do it.
We all obfuscate.

The Fed, feeling beyond reach, did it;
Bernie Madoff, in Palm Beach, did it.
We do it.
We all obfuscate.

But I think that we can evolve; do it.
We only have to resolve; do it.
Let’s do it;
Let’s illuminate.

Small light emitting diodes do it;
Bugs and bolts of lightning do it.
Let’s do it;
Let’s illuminate.

Enlightened leaders, they have done it;
Like Edison, we could bank on it.
Let’s do it;
Let’s illuminate.
Abstract

When risks threaten, cognitive mechanisms bias people toward action or inaction. Fearsome risks are highly available. The availability bias tells us that this leads people to overestimate their frequency. Therefore, they also overreact to curtail the likelihood or consequences of such risks.

More generally, fear can paralyze efforts to think clearly about risks.

We draw on a range of environmental risks to show the following: 1. Fear leads us to neglect probability of occurrence; 2. As fearsome environmental risks are usually imposed by others (as externalities), indignation stirs excess reaction; 3. We often misperceive or miscalculate such risks. Two experiments demonstrate probability neglect when fearsome risks arise: a. willingness-to-pay to eliminate the cancer risk from arsenic in water (described in vivid terms) did not vary despite a 10-fold variation in risk; b. the willingness-to-accept price for a painful but non dangerous electric shock did not vary between a 1% and 100% chance. Possible explanations relate to the role of the amygdala in impairing cognitive brain function.

Government and the law, both made by mortals and both responding to public pressures, similarly neglect probabilities for fearsome risks. Examples relating to shark attacks, Love Canal, alar and terrorism are discussed.

Keywords: action bias, availability bias, biased assessment, risk regulation, risk perception

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Respectively, Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, and Felix Frankfurter Professor of Law, Harvard Law School, on leave 2009-10; Frank P. Ramsey Professor of Political Economy, Harvard University, John F. Kennedy School of Government. Peter Zhang provided helpful research assistance. Corresponding author: Richard Zeckhauser, John F. Kennedy School of Government, Harvard University, 79 John F. Kennedy St., Mailbox 41, Cambridge, MA 02138; Phone: 617-495-1174; Fax: 617-384-9340; Email: richard_zeckhauser@harvard.edu.
1. The Problem and the Thesis

When risks threaten, some cognitive mechanisms push people toward action; others push them toward inaction. The availability heuristic (Tversky and Kahneman 1973 and 1974) is a mechanism that can push in either direction. It leads people to predict the frequency of an event, or a proportion within a population, based on how easily they can bring an example can to mind. When relevant adverse risk events are cognitively available, people will be inclined to act to reduce their likelihood or consequences; this phenomenon, which is labeled the availability bias, might lead them to overvalue the threat from the risk, and thereby take excessive precautions. But if relevant events are not available, the unavailability bias will predominate. The risk will be slighted, and action will be inhibited.

Most of the literature on individual and social responses to risks stresses the inaction case, and focuses on the need to develop mechanisms to ensure that serious dangers receive sufficient response. President Roosevelt’s concerns about fear, expressed in his very next words, were: “nameless, unreasoning, unjustified terror which paralyzes needed efforts to convert retreat into advance.” Roosevelt was right to see that this “paralysis” phenomenon is important. But because cognitive biases also push in the opposite direction, producing overreactions or what we might think of as panic, mechanisms are also needed to dampen public demands and policy responses. Panic and passivity are the opposite ends of a spectrum. Each is unwelcome.

This essay focuses on fearsome risks -- those that stimulate strong emotional responses, such as fear and anxiety. Such risks, which usually involve high consequences, tend to have extremely low probabilities, since life today is no longer nasty, brutish and short. We aim to show here that in the face of a fearsome risk, people often exaggerate the benefits of preventive, risk-reducing, or ameliorative measures. In both personal life and politics, the result is damaging overreactions to risks. In this essay, we focus on a form of decision bias that goes by the name of probability neglect.
A broad array of environmental risks fall into this category, involving both probabilities and stirring strong emotions. These include the risk of getting cancer from contaminants in drinking water, having a highly valued species – such as the bald eagle – go extinct, or significant life loss due to the meltdown of a nuclear plant. In each case the probabilities are difficult to calibrate, even for experts, and the ordinary citizen would worry about such risks much more in terms of consequences than in their likelihood of occurrence.

Probabilities perplex people. Puny probabilities prove particularly perplexing. When risk probabilities are extremely low, as they are for most high-consequence negative events, those who fall victim to probability neglect will give up too much to avoid the risk. Frequently, they will take excessive preventive action. This will be true of governments and corporations as well as individuals, in part because they respond to individuals, in part because of their own tendencies.

One salient manifestation of probability neglect is that in two situations involving the same fearsome risk, one much more likely than the other, individuals may value risk elimination little differently even though probabilities may differ by a factor of 20 or more. The reason is that they focus on the bad outcome itself, and they are inattentive to the question of how likely it is to occur – hence their overreaction when the risk is low. Such overreactions in general can be categorized as “action bias.” That bias is especially likely if the relevant actors will be able to obtain credit for responding to the risk. That credit may come from themselves or from the public more generally (Patt and Zeckhauser 2000).

An understanding of action bias in the context of low-probability risks, and its common ingredient probability neglect, has important implications for both law and policy. It is predictable that in the aftermath of a terrorist attack, the public will both alter its behavior and demand a substantial governmental response. That will be true even if the magnitude of the risk does not warrant such a response, and even if the danger is far less than that presented by other
hazards that do not greatly concern people, perhaps because they do not get much public
attention. Consider, for example, the possibility that extensive security precautions at airports will
lead people to drive rather than to fly; because flying is much safer than driving, such precautions
might sacrifice many lives on balance. The monies spent in recent years on airplane security
might be out of scale with the level of risk reduction produced, particularly since numerous tests
have found that the screening routinely fails to find weapons.

Perhaps such screening, however low the risk or ineffective the preventive, does fulfill the
function of reassuring the public. If so, it serves a positive function, not unlike the nighttime hoof
clops of mounted police. Squad cars may be better at deterring or catching criminals, but do
much less to reduce public anxiety. Hoof clops are splendid for fear reduction. The same points
apply of course to many other purported forms of risk reduction, including measures to prevent
financial crises, local steps to reduce greenhouse gas emissions, and regulation of abandoned
hazardous waste dumps. Financial crises have a distinctive element: fear-related emotions
themselves may stimulate the crisis, as in 2008, making reassurance that much more critical.

In the personal as opposed to social domain, we can find many analogues, as when people
alter their travel plans to avoid slight risks of crime, restructure their portfolios to avoid small
risks of big financial losses, or change their diet to avoid minimal health risks. In all of these
cases, a form of action bias, fueled by probability neglect, may lead to overreactions. The costs of
overreaction may be financial (restructuring the portfolio), increased risk (driving rather than
flying), or sacrificed pleasure (children foregoing Halloween due to extremely rare razor-blade
incidents).

2. Overreaction to Environmental Risks

Overreaction to risk is frequently found in the environmental realm. A dramatic example is
provided by the Three Mile Island accident in 1979. Significant amounts of reactor coolant were
leaked to the environment, including releases of cancer-inducing agents. The Kemeny
Commission Report, created under Presidential order, concluded that in expectation less than one
case of cancer would be created. Yet the accident affected public and political opinion
sufficiently to terminate the construction of any new nuclear plants in the United States for 30
years. The coal- and oil-fueled plants built in their stead surely caused many more health
problems, looking only at the air pollution they produced. (Today, nuclear power is poised to
make a comeback given concerns about global warming due significantly to CO₂ emissions from
conventional power plants.) The impact of Three Mile Island was reinforced due to the release of
the movie *The China Syndrome* the same month as the accident. The movie made a catastrophic
accident – narrowly avoided due to courageous action of the movie’s heroes – “available” in the
public mind. As remarked earlier, when an example of an event can readily be brought to mind,
it is judged to be much more likely.

Probabilities are often hard to calculate in environmental contexts. Risks can emanate from
thousands of sources and affect millions of people. Ideal policy, say in setting a standard, would
look at the consequences from a slight change in a risk-producing activity. However,
epidemiological evidence will rarely be conclusive in establishing such consequences, for
multiple reasons: (1) most risks have their impacts over long time periods, (2) if large numbers
of people are affected, all very slightly, changes in risk are hard to perceive, (3) other factors are
likely changing at the same time when the risk under study changes, (4) controlled experiments
imposing risks are unethical, and (5) the risks that we are concerned about have very low
probabilities, requiring extremely large samples to detect changes in their levels.

Given the virtual impossibility of deciphering risks levels from mere observation, we often
extrapolate risks to exposed human populations from quite different contexts. Thus, to judge the
danger of a carcinogen, we are likely to expose an animal population – mice being a favorite
subject pool – to extremely high concentrations. Such concentrations make it likely that effects,
if there are such, will show up in a small pool of subjects, say 500 mice. The challenge to this
approach is that we then must extrapolate from high to low doses and from animals to man. Such
extrapolations require heroic assumptions, and are subject to fierce debate. A risk that is judged
to be 1/1,000,000 by one researcher might be judged 100 times as high by another.

Overreaction to fearsome risks in the environment can come about for many reasons: (1)
Environmental risks are usually imposed unwillingly on external parties. Indignation over such
an imposition stirs excess reaction. This proclivity is reinforced in the policy realm, where the
party demanding action (the externality recipient) is not the party paying for it. Hence, paying
much more to avoid a risk than the benefits secured is not troubling. (2) We misperceive the
risk, as happened after Three Mile Island. (3) Though we calculate the risk, as opposed to
merely grasping it through some gut process, through a series of conservative assumptions we
end up with a probability estimate that is far above what an expected value calculation would
yield. Scientific practice, say when proving a theory, is to employ conservative assumptions.
However, rational decision theory requires that one act on the expected value of a probability. (4)
Though we may have an accurate estimate of the risk, the emotions stirred by its fearsome aspect
lead us to neglect probability values. This essay is devoted to the fourth reason. It focuses on
low-probability risks. Therefore, not considering their magnitude leads to overreaction.

In general, we overreact to some risks and virtually ignore others. “Often too much weight
is placed on risks of low-probability risks but high salience (such as trace carcinogens)... Too
little effort is spent ameliorating voluntary risks, such as those involving automobiles and diet.”
(Zeckhauser and Viscusi 1990, p 559) Many environmental risks would seem to fall in the
overweighted category.
3. Demonstrating probability neglect

Prospect theory (Kahneman and Tversky 1979) tells us that the perceived benefits of risk elimination will be much less than proportional to the risk avoided, since the probability weighting function takes a downward leap at 0. However, prospect theory alone gives no indication that the ratio of valuations would change dramatically with the nature of a risk, or with the way it was described.\(^4\)

Experiments on probability neglect seek to assess whether attention to probability could be overshadowed by attention to the affective goodness or badness of the outcome, quite contrary to what leading theories of decision making posit. To make the same point in broader and more metaphorical terms, emotional activity dampens cognitive activity. Loewenstein and Lerner (2003) observe that: “As the intensity of immediate emotions intensifies, they progressively take control of decision making and override rational decision making.” We would expand this assertion to include overriding well-documented behavioral patterns in decision making, such as those described by prospect theory. If such overshadowing or “taking control” is found, then an alarming risk could swamp or at least temper the importance of dramatic probability differences.

Some of the relevant experiments explore whether varying the probability of harm would matter less in settings that trigger strong emotions than in those that are relatively emotion-free. One such study explored people’s willingness to pay to avoid electric shocks, in an effort to test the relevance of variations in probability to “affect rich” decisions (Rottenstreich and Hsee 2001). In the “strong emotion” setting, participants were asked to imagine that they would participate in an experiment involving some chance of a “short, painful, but not dangerous electric shock.” In the relatively emotion-free setting, they were told that the experiment entailed some chance of a $20 penalty. Participants were asked to say how much they would be willing to pay to avoid participating in the relevant experiment. Some participants were told that there was a 1% chance
of receiving the bad outcome (either the $20 loss or the electric shock); others were told that the chance was 99%.

The central result was that variations in probability affected those facing the relatively emotion-free injury, the $20 penalty, far more than they affected people facing the more emotionally evocative outcome of an electric shock. For the cash penalty, the difference between the median payment for a 1% chance and the median payment for a 99% chance was predictably large. The median subject paid $1 to avoid a 1% chance, and $18 to avoid a 99% chance. For the electric shock, by contrast, the difference in probability made little difference to median willingness to pay: $7 to avoid a 1% chance, and $10 to avoid a 99% chance – only 1½ as much in the affect-rich setting as opposed to 18 times as much when little emotion was involved. (Of course, a fully rational response would produce a ratio much greater than 18, since income effects are likely trivial for such small gambles.)

The conclusion is that when a hazard stirs strong emotions, most people will pay an amount to avoid it that varies little even with extreme differences in the starting probability. What we are stressing here is that when the probability of loss is very low, people will show action bias. They will favor precautionary steps even if those steps are not justified by any plausible analysis of expected utility.

For either social or personal risks, the implication is clear. When the potential loss is likely to trigger strong emotions, action bias threatens, as it does when the loss is an economic meltdown, environmental catastrophe, terrorist attack, contracting cancer, or getting killed in a plane crash. Even if the likelihood of a terrible outcome were extremely low, people would be willing to pay a great deal to avoid it, whether through public or private action. Once a risk is in people’s minds, their willingness to pay to avoid it will often be relatively impervious to significant changes in probability. The significant and often expensive precautions taken against a possible sniper attack by citizens of the Washington, DC area in October 2002 provide a
dramatic example; they attest to the phenomenon of probability neglect in the face of a vivid threat. Indeed, some of these precautions, such as driving great distances to a gas station in Virginia, almost certainly increased mortality risks on balance. ⁵

Probability neglect and hence action bias can be found for willingness to reduce, and not merely to eliminate, a risk. To be sure, prospect theory shows that people will pay a special premium to eliminate a risk, but where the risk is emotionally gripping, risk reduction will not be sensitive to the question of probability. To investigate the possibility of value inflation in response to risks, we asked a large number of law students to state their maximum willingness to pay to reduce levels of arsenic in drinking water.

The appropriate standard for arsenic in drinking water drew substantial public attention a few years back. Three days before the end of the Clinton Administration, it proposed tightening the standard from 50 parts per billion to 10 parts per billion. The new Bush Administration immediately suspended the standard. However, in response to a public outcry it reversed its decision, and the 10 parts per billion standard is now the law. In the academic community, there is considerable controversy on two issues relating to the standard. First, what does this tighter standard cost per life saved? The amount could be high since the risk is low. Second, the costs of meeting the standard per capita vary dramatically from one jurisdiction to another. One estimate was that the cost per household would be $0.86/year in districts with more than one million households, but $163/year for districts with between 101 and 500 households. ⁶ Cost-benefit analysis would suggest the standard should be much stricter in large as opposed to small districts.

Our goal is not to determine the appropriate standard, but to illustrate the real-life relevance of our questions. They were based on the actual choice confronting the Environmental Protection Agency, and employ risk numbers within the ballpark of actual figures used by the agency itself.
The subjects were students in Cass Sunstein’s class in Administrative Law – for 2nd and 3rd year students – at Harvard Law School. All students were required to participate. The participants were randomly sorted into four groups, representing the four conditions in a 2x2 experiment, where both the probability and the description of the risk varied. In the first condition, people were asked to state their maximum willingness to pay to eliminate a cancer risk of one in 1,000,000. In the second condition, people were asked to state their maximum willingness to pay to eliminate a cancer risk of one in 100,000. In the third condition, people were asked the first question, but the cancer was described in vivid terms, as “very gruesome and intensely painful, as the cancer eats away at the internal organs of the body.” In the fourth condition, people were asked the second question, but the cancer was described in the same vivid terms as in the third condition. In each condition, participants were asked to check off their willingness to pay among the following options: $0, $25, $50, $100, $200, $400, and $800 or more. Notice that the description of the cancer in the “highly emotional” conditions added little information, simply describing many cancer deaths, though admittedly some participants might well have learned that these were especially horrific deaths.7

The first hypothesis, consistent with the probability weighting function of prospect theory, was that the ten-fold difference in probabilities – between 1/100,000 and 1/1,000,000 – would generate a much less than a ten-fold difference in willingness to pay. The second hypothesis was that the probability variations would matter less in the highly emotional conditions than in the less emotional conditions. More specifically, it was predicted that the highly emotional conditions would overshadow differences in probability, whereas such differences would have greater importance in the less emotional condition.

Here are the results in tabular form:
Table 1. Willingness to Pay in Dollars for Elimination of Arsenic Risks

Harvard Law School Results, 2008
Mean (Median)
[Number of Subjects]

<table>
<thead>
<tr>
<th>Probability</th>
<th>Unemotional description</th>
<th>Emotional description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/100,000</td>
<td>241.25 (100)</td>
<td>250 (100)</td>
</tr>
<tr>
<td></td>
<td>[20]</td>
<td>[13]</td>
</tr>
<tr>
<td>1/1,000,000</td>
<td>59.21 (25)</td>
<td>211.67 (200)</td>
</tr>
<tr>
<td></td>
<td>[19]</td>
<td>[15]</td>
</tr>
</tbody>
</table>

The study was conducted in two law school venues, University of Chicago (Sunstein 2002) and at Harvard Law School. At Chicago, the medians were 25 and 100 for the unemotional description, and 100 and 100 for the emotional description. While the sample size was too small to permit firm conclusions, the qualitative results pointed in the hypothesized direction. The emotional description drove out responses to the quantitative difference in the risk.

At Harvard, as shown and hypothesized, the valuations for the emotional description hardly differed even though risks differed by a factor of 10. There was substantial difference in willingness to pay (WTP) for the unemotional description. A Mann-Whitney Wilcoxon Rank Sum test showed that the WTP was actually higher for the 1/1,000,000 risk given the emotional description, though far from significant. By contrast, and as expected, the difference for the unemotional description was highly significant, with the 1/100,000 payment higher (z = 3.398, p < 0.001). Comparing the two results showed that the unemotional description gave a greater differential that was highly statistically significant.

It is important to note that the difference in WTP, even for the unemotional description, was far below the 10 to 1 odds ratio; for means it was roughly 4 to 1. Both hypotheses – that the
unemotional description would show a difference and the emotional description would not – were therefore supported. First, varying the probability had an effect on WTP that was much less than rational decision theory would predict. (Future research should assess whether even mentioning the word “cancer” induced sufficient emotion to reduce a 10 to 1 ratio to 4 to 1.) Second, the effect of increasing the probability by a factor of ten had an effect that was highly significant in the unemotional condition – but was completely insignificant in the emotional condition. When the cancer was described in affectively gripping terms, people were insensitive to probability variations.

These findings have two implications for overreactions. They suggest, first, that when extremely low probability risks give rise to intense fear, they are likely to trigger a larger behavioral response than do statistically identical comparisons involving less fearsome risks. Here, as in the experiment, there will be a kind of “emotion premium.” The findings suggest, second, that probability neglect will play a role in the private and public reaction to emotionally gripping risks, and that many people will focus, much of the time, on the emotionally perceived severity of the outcome, rather than on its likelihood. In this light, it should not be surprising that our public figures and our cause advocates often describe tragic outcomes. Rarely do we here them quote probabilities. The latter, even if reasonably large, would have little salience in the public debate.

Think of an anti-drunk driving campaign that said: “When you drink don’t drive; you have one chance in 1,000,000 of getting into a fatal car crash, a much higher probability than most people believe.” The alternative campaign, catering to probability neglect, would skip probabilities altogether. It might show a car wrapped around a tree, and a grieving family standing nearby, with the simple statement: “When you drink don’t drive.” The tree-wrap, we predict, would be more effective.
Emotions not connected to fear may also drive probability neglect. Consider outrage, an emotion sometimes stirred when low probability risks are created from the outside, as they are with nuclear waste radiation. A similar risk from radon exposure comes from one’s own basement, hence no outrage. Outrage can overshadow probabilities in much the same way as a vivid risk can, reinforcing our metaphor about emotional activity dampening cognitive activity. A central finding of relevant empirical work is consistent with that stressed here: a large difference in probability had no effect on people’s judgments in a “high outrage” condition, involving nuclear waste, but a significant effect in a “low outrage” condition, involving radon. For nuclear waste, people responded the same way to a risk of 1 in 100,000 as to a risk of 1 in 1,000,000 (Sandman et al. 1998). Even when both the statistical risk and ultimate consequences were identical in the high outrage (nuclear waste) and low outrage (radon) cases, people in the nuclear waste case reported a much greater perceived threat and a much higher intention to act to reduce that threat (id.). Indeed, “the effect of outrage was practically as large as the effect of a 4000-fold difference in risk between the high-risk and low-risk conditions” (id.).

In this light, it is not surprising that visualization or imagery matters a great deal to people’s reactions to risks. Vivid images can produce palpable overreactions (Slovic et al. 2000). When an image of a bad outcome is easily accessible, people will become greatly concerned about a risk, holding probability constant (Loewenstein et al. 2001). An interesting anomaly emerges when people are asked how much they will pay for flight insurance for losses resulting from “terrorism.” They will pay more than if they are asked how much they will pay for flight insurance from all causes (Johnson et al. 1993). The likely explanation for this peculiar result is that the word “terrorism” evokes vivid images of disaster, outrage, or both, thus inhibiting judgments involving probabilities. Note also that when people discuss a low-probability risk, their concern rises even if the discussion consists mostly of apparently trustworthy assurances that the likelihood of harm really is infinitesimal (Alkahami and Slovic 1994).
helps people to visualize the risk, thus making it more frightening. The most sensible conclusion is that with respect to risks of injury or harm, vivid images and concrete pictures of disaster can “crowd out” the cognitive activity require to conclude and consider the fact that the probability of disaster is really small.

3. Probability neglect and anxiety

We also sought to test the relationship between probability neglect and the emotion of anxiety. In order to do so, we followed Rottenstreich and Hsee (2001), who used a painful but not dangerous electric shock to produce emotion and presumably anxiety. In a subsequent class, the authors asked the same class of Harvard Law School students how much they would demand to accept a shock. If their demand price was below the experimenter’s payment price, the experiment would go ahead at the experimenter’s price, thus assuring incentive compatibility. This too was a 2x2 setup, with the probability and the timing of the shock each taking two values. The shock was either received for certain (100% probability) or with 1% probability. The shock was to be delivered immediately after class, or immediately after a class one year from the experiment. Unlike the arsenic study, the categories of payment were not predefined. Not surprisingly, the mean values substantially exceeded the medians due to a few severe outliers.

It was conjectured that contemplating receiving the shock in a year would raise anxiety beyond that of waiting to receive a potential shock at the end of class. Such anxiety, it was thought, might enhance probability neglect. It could also raise the demand price.

There were three hypotheses to be tested. They would be tested using rank order, non-parametric methods.

1. Subjects would show probability neglect. The differences in demand prices in the certainty condition and 1% chance condition would be far less than 100 to 1.
2. The contemplation period for receiving a shock in a year would increase the total costs of anxiety. Because people would want to reduce their own anxiety, the demand price would be higher for the shock to be delivered a year from today.

If hypothesis 2 was confirmed, a third hypothesis would be relevant.

3. Given that probability neglect is greater in emotionally gripping cases, the disparity between the certainty price and the 1% price would be more compressed for the shock to be received in a year (thus multiplying anxiety) than from the shock to be received today.

The results were as follows:

**Table 2. Demand Price to Accept a Painful But Non Dangerous Electric Shock**

Harvard Law School Results, 2008

<table>
<thead>
<tr>
<th>Probability</th>
<th>Shock Today</th>
<th>Shock in a Year (Anxiety)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>1283.33 (50)</td>
<td>1966.43 (100)</td>
</tr>
<tr>
<td></td>
<td>[12]</td>
<td>[14]</td>
</tr>
<tr>
<td>1%</td>
<td>661.41 (50)</td>
<td>824.05 (50)</td>
</tr>
<tr>
<td></td>
<td>[23]</td>
<td>[21]</td>
</tr>
</tbody>
</table>

The first hypothesis, most important to our central claim here, was confirmed. There was nothing even close to a statistically significant difference between the certainty price and 1% conditions in both the Shock Today and Shock in a Year cases. Despite a 100 times greater chance of getting a shock, people demanded to be paid no more to receive it.13

The second hypothesis was rejected. Moreover, there was not close to statistical significance in the difference between the price in a year and the price today for either probability. This rendered the third hypothesis moot; moreover, no statistically significant difference was found in either direction.
What explains the rejection of the second hypothesis? It is conceivable that the mere thought of a shock is sufficient to induce an emotional state, and that in light of that thought, subjects were not influenced by either time lapses or by probability. Note that standard theory might predict that people would discount the future and hence be more willing to pay to avoid an imminent shock than a future one; though we hypothesized the opposite, it is noteworthy that there was no discounting of an adverse event in the future. It is also possible that although anxiety induces emotion directly, anxiety about anxiety is much less powerful. That is, individuals may have a difficult time thinking about their loss from being anxious. Future experiments might examine the role of anxiety as an emotion-inducing experience in the period before an unfavorable lottery is resolved.

4. Brain Function and Probability Neglect

It is natural to inquire why individuals might neglect the probabilities of fearsome risks. One prominent mode of explanation for such nonrational behaviors invokes evolution: “Behaving this way would have been beneficial in prehistoric times, or at least not very harmful.” A second strand of explanation relies on the natural and justifiable tendency to use heuristics: “This approach works well the vast majority of the time; this situation is either of low consequence or extremely unusual.” Neither approach explains the neglect we observe. Hence, we confine our discussion to what goes on in the brain when an individual is confronted with a threat and the fear and anxiety that go with it.

The amygdalae are two nuclei in the brain that are activated during emotional experiences, and particularly so by fearsome ones, as opposed to say happy ones. In particular, the amygdala – both the right and left amygdala – is critical to the “flight or fight” response that humans have to immediate threats and the anxiety associated with such threats (Afifi and Bergman 2005). The amygdala projects to the ventral and medial aspects of the prefrontal cortex,
the brain region “dedicated to the memory, planning, or execution of actions….” (Fuster 2001). Moreover, “impairment in decision–making [is] linked to a dysfunctional VM [ventromedial] prefrontal cortex,” the region of the prefrontal cortex to which the amygdala makes most of its neural connections (Bechara et al. 2001). If negative feelings such as anxiety are not well managed, amygdala activity will be high, and prefrontal cortex activity will be low. This could impair the critical components of decision making and logical thinking and thus lead to probability neglect.

An alternate explanation is that “the architecture of the brain gives the amygdala a privileged position as the emotional sentinel, able to hijack the brain… [an external stimulus] goes right to the amygdala before a signal reaches the neocortex…this survival mechanism lets us react to things before the rational brain has time to mull things over” (Nadler 2009). Thus, when decisions are taken quickly, we rely on a response that is emotional, not rational. The image of the threat may well outweigh its likelihood, implying probability neglect.

5. The Demand For and Supply of Law

If probability neglect characterizes individual judgment under certain circumstances, government and law are likely to be neglecting probability under those same circumstances. If people show unusually strong reactions to low-probability catastrophes, a democratic government is likely to act accordingly, either because it is responding to the public, or because its officials suffer the same proclivities. Our discussions of Three Mile Island and the arsenic standard above are salient examples of such responsiveness.

Recall that if government actors are able to claim credit for acting, or if they would be blamed for not acting (as was the Bush Administration on arsenic), the likelihood of action bias increases (Patt and Zeckhauser 2000). We suspect that in many domains, government responses to emotionally gripping problems with low probability of occurrence can be explained in this
way. (See Hamilton and Viscusi 1999, for examples.) We also suspect that ill-considered, future, or counterproductive reactions to past, present, or imminent risks derive in part from this phenomenon.

In the environmental area, there has been an intense debate about whether the National Environmental Policy Act requires agencies to discuss the worst-case scenario in environmental impact statements. Environmental groups sought to ensure discussion of that scenario. They did so in part to stimulate public concern, with the knowledge that the worst case might well have a great deal of salience, however unlikely it might be, that it would be “available” in the public mind. For its part, the government originally required discussion of the worst case, but changed in its mind, with the apparent understanding that people are too likely to overreact. Hence the current approach, upheld by the Supreme Court, requires consideration of low-probability events, but only if they are not entirely remote and speculative. Only time, and future cases will tell how these terms are to be interpreted.

At least at first glance, the current approach, and the Supreme Court’s decision, seem entirely reasonable. (On some of the complexities here, see Sunstein 2007.) If the chance that the worst case will come to fruition is truly miniscule, it is plausible to say that it need not be discussed in environmental impact statements, for the principal effect of the discussion would be to activate fear, which is by hypothesis unwarranted by the facts. Worst-case analysis should not apply when accumulated evidence shows that risks are quite low, as say with a major asteroid hitting the Earth in the next year. Yet in the context of terrorism and other emotionally laden hazards, people neglect the role of probability even when the evidence suggests that the probability is quite small (Rothschild 2001).

A good deal of legislation and regulation can be explained partly by reference to the neglect of low probabilities when emotions are running high. Consider a few additional examples:
In the aftermath of news report about emotionally gripping adverse health effects allegedly caused by abandoned hazardous waste in Love Canal, the government responded with an aggressive program for cleaning up abandoned hazardous waste cites, without closely examining the probability that illness and other harm would actually occur. In fact little was accomplished by early efforts to assure people of the low probability of harm (Kuran and Sunstein 1999). When the local health department publicized controlled studies showing little evidence of adverse effects, the publicity did not dampen concern, because the numbers “had no meaning” (Gibbs 1998). In fact the numbers seemed to aggravate fear: “One woman, divorced and with three sick children, looked at the piece of paper with numbers and started crying hysterically: ‘No wonder my children are sick. Am I going to die? What’s going to happen to my children?’” (id.). Questions of this sort contributed to the enactment of new legislation to control abandoned hazardous waste sites, legislation that did not embody careful consideration of the probability of significant health or environmental benefits (Kuran and Sunstein 1999). Even now, law and policy are affected by interest group pressures and public alarm; the government has sometimes neglected the probability of significant harm in making clean-up decisions (Hamilton and Viscusi 1998).

During a highly publicized campaign designed to show a connection between Alar, a pesticide, and cancer in children, the public demand for action was not much affected by the EPA’s cautionary notes about the low probability of getting that disease (Wildavsky 1995). The mere idea that children might die, as a result of apple consumption, had a significant effect on behavior, with probabilistic information seeming not to reduce people’s fears.

In the fall of 2001, vivid images of summer shark attacks created a public outcry about new risks for ocean swimmers. This was so notwithstanding the exceedingly low
probability of a shark attack, and the absence of any reliable evidence of an increase in shark attacks in the summer of 2001. Predictably, there was considerable discussion of new legislation to control the problem, and eventually such legislation was enacted in Florida. Public fears and anxieties were not impervious to the fact that the underlying risk was miniscule; but the emotional response greatly exceeded the statistical risk.

With respect to terrorism, the anthrax scare of October, 2001, which grew out of exceedingly few incidents, provides dramatic evidence. Only four people died of the infection; only about a dozen others fell ill. The probability of being infected was exceedingly low. Nonetheless, anxiety proliferated; people focused their attention on the outcome rather than the extremely low probability of the harm. The government responded accordingly, investing significant resources in ensuring against anthrax infections. Private institutions reacted the same way, asking people to take extraordinary care in opening the mail even though the statistical risks were tiny.

In any particular case, such as anthrax, it is hard to say that precautions were excessive. This could be hindsight bias. Maybe we just got lucky that there was not some large anthrax conspiracy. But if we look across dozens of cases, we can observe a pattern in which salient but extremely low probability risks are sometimes met with excessive responses. We should reiterate our horse-clop point made earlier. If the preventive measures significantly assuage public fears, perhaps they are worthwhile even if they reduce risk little if at all. But in some cases, we suspect that to the contrary, some such measures stir rather than reduce fears by making the threat salient. Think of posting a police officer at the doors of college buildings to protect against campus shootings.

Arguably, the most severe recent example of overreaction to a risk threat is the follow-on to the terrorist attacks of September 11, 2001. Public fears and anxieties helped to produce the
Iraq War, and to private and public costs that were orders of magnitude higher than the costs of the attacks themselves. A full explanation of the Iraq War would of course have to include a number of factors, but any such explanation would point, in part, to action bias and probability neglect.

What might be done, recognizing the widespread tendency toward overreaction to emotional risks? We do not have the space to answer fully, but with respect to regulatory policy, institutional safeguards are the best way of ensuring against the harmful consequences of probability neglect. The Office of Information and Regulatory Affairs, within the Office of Management and Budget, monitors agency action to ensure that it is directed against genuinely significant problems. A general requirement of cost-benefit balancing, with careful attention to the best estimates of relevant probabilities, should provide a check on regulations that deviate substantially from objective evidence, providing far too little risk reduction for the resources required. (Such requirements should also provide an impetus to preventive measures that the public might not seek.) Reduction in public fears should count, but they are not a trump card. If government wants to protect against hysterical precautions, analytic requirements and institutional checks will provide a start.

We have said nothing in this paper about self-imposed risks, such as smoking, or drinking, or driving at excessive speed. Though assuredly some of the same forces would be at play, evidence makes it quite clear that individuals take a far different attitude toward risks that are predominantly within their control, both in assessing the level of risk, and in demanding or accepting government actions to deal with them. Probability neglect and self imposed risks is an excellent area for future study.
6. Conclusion

Our central goal here has been to understand overreactions to fearsome risks. We have suggested that when risks are vivid, people are likely to be insensitive to the probability of harm, particularly when their emotions are activated.\textsuperscript{18} If terrible outcomes are easy to visualize, large-scale changes in thought and behavior are to be expected, even if the statistical risks are dramatically lower than those associated with many activities where the stakes are equivalent but do not raise public concern. This claim about action bias helps explain public overreaction to certain highly publicized, low-probability risks, including those posed by sniper attacks, nuclear power, abandoned hazardous waste dumps, anthrax, and perhaps terrorism more generally. With financial crises, as late 2008 made tragically clear, fears and anxieties, and the action bias they induce, may dramatically magnify both the likelihood and size of a severe adverse outcome.

It follows that government regulation, affected as it is by the public demand for law, is likely to stumble on the challenge of low probability harms as well. The government should not swiftly capitulate if the public is demonstrating action bias and showing an excessive response to a risk whose expected value is quite modest. A critical component of government response should be information and education.\textsuperscript{19} But if public fear remains high, the government should determine which measures can reduce it most cost effectively, almost in the spirit of looking for a placebo that may do little for risk but do a lot to reduce fear. Valued attributes for such measures will be high visibility, low cost, and perceived effectiveness. Reducing fear offers two major benefits: (1) Fear itself imposes significant costs. (2) Both private and public responses in the face of fearsome risks are likely to be far from rational. These observations lead to the difficult questions of how to monetize and reduce public fear. The answers lie well beyond the current topic.
Acknowledgements

Notes

1 The “risk as feelings” hypothesis highlights the “role of affect experienced at the moment of decision making,” (Loewenstein et al. 2001, p 267), as opposed to a cognitive assessment of a risk.

2 The converse is surely true. If emotions lead to the neglect of probabilities, there will be insufficient response to high probability risks.

3 Johansson-Stenman (2008) analyzes the appropriate bases for public policy when people have biased risk perceptions. He demonstrates how public policies – such as risk-reducing investments – should be structured given the real costs of fear, which depends on perceived not objective probabilities. He also discusses the use of corrective taxation and information provision to reduce risk-perception biases. An important conclusion is that optimal investments should exceed what conventional cost-benefit would prescribe when individuals underestimate a risk.

4 The Russian roulette example (Kahneman and Tversky 1979, p 283) described to illustrate the probability weighting function that plays a central role in the theory does inject emotion into a decision. The subject is told she is compelled to play Russian roulette, but can pay to remove one bullet from the loaded gun. She is asked whether she would pay more to reduce the number of bullets from 4 to 3 than from 1 to 0. Most people pay substantially more for the reduction in the probability of death from 1/6 to 0 than for a reduction from 4/6 to 3/6. This reverses rationality if money is worth less if one is dead. – Surely the probability weighting function plays a significant role in explaining the payment disparity, but the emotion of the life-and-death decision may magnify it.

5 When the risk is imposed by malicious people, there is often a negative externality from the precautions taken by any individual. Those who went to Virginia to fill made it more dangerous
for D.C. fillers. When few citizens walk in an urban area at night, those who still walk find such activity more dangerous.


7 Paul Slovic stressed to us that individuals cannot experience fear over a sustained period of time. However, we believe that our questions spotlight a risk, and do have the potential to stir severe emotions as individuals respond.

8 This number was roughly calculated assuming that there are 100 million drivers, each driving after drinking 15 days a year, and accounting for half the annual fatalities in the United States.

9 An alternative explanation is that individuals demand substantial compensation for their outrage, and that such compensation is both fairly independent of the probability and large relative to the compensation for risk. Note that efforts to communicate the meaning of differences in risk levels, by showing comparisons to normal risk levels, reduced the effect of outrage; but only modestly so. Outrage had nearly the same effect as a 2000-fold increase in risk (id.). Did this information provision improve cognitive uptake directly, or indirectly because it dampened the outrage? Further experiments will be required to tell.

10 This should bring to mind a component of the embeddedness phenomenon known for contingent valuation. If seals are appealing and easily visualized, it is not surprising that we might pay more to save them in an oil spill than to save all wildlife.

11 An editor raised the possibility that the subjects did not take the experiment seriously, always a danger with experiments. We have repeated this experiment with many different types of audiences, and found consistent results, which suggests subjects do take the experiment seriously.
12 The subjects may have also concluded that we would actually inflict the shock – whether for
certain or probabilistically – in a year. If they would be paid now, that would lower their demand
price.

13 The contrast with the Rottenstreich and Hsee (2001) results is instructive. Their study differed
in two significant ways: (1) They asked willingness-to-pay rather than willingness-to-accept.
They got much lower median values, namely $7 and $19.86. (They also tried a median of $10 for
a 99% chance of a shock.) (2) They did not use an incentive-compatible procedure. Hence, their
values may be low for strategic reasons.


15 Jon Elster has explored the possibility that the worst-case analysis still should be employed as a
maximin approach when the probabilities of the various outcomes cannot be assessed (Elster
1983). Dyed-in-the-wool Bayesians, by contrast, would say that subjective probabilities should
still be assessed and employed to compute an expected probability, which would serve as the
basis for decision.

16 In pointing to the role of probability neglect in these cases, we do not mean to reach any final
conclusion on what the government ought to have done in any of them.

17 As this paper was being completed, Cass Sunstein was appointed to head the Office of
Information and Regulatory Affairs in the Obama Administration.

18 In future work, we expect to examine the complementary concept of payoff neglect: when
emotions run high the size of potential losses will tend to be slighted. The emotion may be
stimulated by anger due to the source of the risk, or merely a vivid description of the risk itself,
apart from its magnitude.
An editor suggested that education and information may not be adequate government responses, and may even be greeted by public skepticism as efforts to hide the truth. It is with such thoughts in mind we recommended cost effectiveness studies of government efforts, of whatever kind. See Johansson-Stenman (2008) for a discussion of the welfare consequences of various information-provision policies.
References


