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Risk Perceptions in Regulation, Tort Liability, and the Market

W. Kip Viscusi

Risk regulations are generally based on a stylized view of the behavior of the individuals affected by the regulation. These behavioral assumptions establish the basis for regulation and also influence the character of the regulation that will be pursued.

The mix of behavioral assumptions that provides the basis for policy is often inconsistent. In some cases policymakers assume that irrationality prevails if that assumption will promote government intervention. If, however, individual perception of the risk and response to it is required to make a policy effective, risk regulators do not recognize individuals' cognitive limitations. These stylized views of risk-taking behavior are often sharply contradicted by empirical evidence on individual behavior. Errors in judgment and decisions do exist, but all too often these errors provide the impetus for a government policy. The net effect is that these policies often reinforce market failures rather than eliminate them.

The Risk Regulation Perspective

The long-standing assumption policymakers have

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made in the area of job safety is that workers are ignorant of the risks they face. According to this view, workers do not understand the risks created by their jobs so that the usual market mechanisms to promote safety will not be operative. In the rare situations in which workers are aware of the risk, they are portrayed as not having any choices to make since safer jobs are assumed to be unavailable. Moreover, even if there are such opportunities, workers are trapped in their current jobs by pension benefits and similar impediments to mobility.

Although this stylized view has dominated two decades of occupational health and safety regulation, reality clashes substantially with this view. There is widespread evidence of worker awareness of many job hazards, although few observers would claim that all workers understand the entire range of risks. Workers' subjective risk perceptions are strongly coupled with objective measures of the industry accident level. Moreover, in a sample of chemical workers at four major chemical plants, I found that the assessed accident risk level was equal to the published accident rate. Awareness of many health risks is also considerable, but likely to be less adequate than knowledge of imminent safety risks.

Two centuries ago, Adam Smith observed that workers will demand extra pay if they believe that

a job is particularly risky or otherwise unpleasant. Risk perceptions give rise to substantial compensating differentials for risk, on the order of over \$100 billion annually in wage compensation plus more than \$20 billion in workers' compensation benefits mandated by law. The terms of trade for accident risks appear to be quite substantial. My estimates suggest that firms must pay from \$3 million to \$6 million in extra wage compensation for each expected workplace fatality. The findings by Thomas Kniesner and John Leeth for Japan and Australia indicate that similar forces are at work there as well.

There is an additional market response that arises because workers can learn about risks once on the job, and they can quit if they do not like what they see. High rates of worker turnover on risky jobs

Although risk takers can make errors in judgment and decisions, all too often their errors provide the impetus for a government policy. The net effect is that these policies reinforce market failures rather than eliminate them.

also contradict the prevailing view that workers are trapped in hazardous jobs, as one-third of all manufacturing quit rates stem from workers' learning about job risks and quitting if the compensation provided is not sufficient.

The behavioral assumptions underlying product safety regulation are similar. Consumers are believed to be ignorant of the risks they face, and if they do understand these risks, they are unable to make sound decisions. This behavioral assumption is largely implicit. Typically, there is very little inquiry of any kind into whether consumers understand product risks or are making sound decisions. The Consumer Product Safety Commission (CPSC) and other product safety agencies do not generally assess the presence of a market failure. Typically, they do not even examine the frequency of injuries, but simply rely on injury counts that are unadjusted for intensity of the activity. The existence of a risk is often treated as being tantamount to evidence of a need for regulation.

On rare occasions there is explicit discussion of the character of risk perceptions and subsequent decisions. Consider the case of cigarette smoking. Cigarettes are by far our most stringently regulated

consumer product. Smokers are believed to be doubly handicapped. First, they are ignorant of the risks, and second, they are addicts.

Studies of product safety decisions suggest that these stylized views of consumer behavior are overly simplistic. The same kinds of risk-dollar tradeoffs observed for jobs have been found for hazardous products as well. Safer automobiles command a higher price—\$4 million per expected fatality prevented. Consumers are willing to pay a comparable premium for housing in areas with lower pollution-related mortality. What is perhaps most striking is that the implicit values of life reflected in decisions involving a broad range of risky product and job choices are of the same order of magnitude.

Moreover, the variations in these values follow a plausible and consistent pattern. Consider the implicit values that different groups of workers attach to each expected job injury. How does this value vary with other risk-related choices workers make? Smokers and those who forgo use of seat belts presumably place a lower value on their health status, and this should be reflected in their job choices as well. These valuations are \$26,000 per statistical injury for smokers, as compared with an average of \$48,000 for the entire working population. Those whom we would expect to be more reluctant to bear risk place an even higher value on injuries—\$78,000 for seat belt users and \$83,000 for non-smokers who use seat belts. These are not hypothetical values, but are based on actual wage-risk tradeoffs for a sample of workers in the state of Oregon. The preferences with respect to risk follow the patterns one would expect if these risks were the result of rational tradeoffs.

The Behavioral Perspective of Tort Liability

The behavioral assumptions of the tort liability system parallel those of government regulation. The principal rationale for product liability is that consumers are believed to systematically underestimate the risks they face, and that leads to inadequate levels of safety. That assumption, for which there is little empirical support, provided the impetus for the adoption of strict liability, which shifted much of the responsibility for accidents from accident victims to producers.

The richest and most contradictory set of behavioral assumptions is embodied in the courts' approach to hazard warnings. Consumers are generally assumed to be ignorant of the risks posed by products except in extreme circumstances of the



"The heck with reading all these health labels! Rehire my food taster!!!"

most prominent risks that we face, such as the dangers posed by knives. As a result, we need strong warnings to convey the safety message. If, however, the firm provides consumers with a sufficiently bold warning, it is generally assumed that consumers would have processed the information and taken the appropriate precaution. The potential for misperception and consumer error is then ignored. The irrationality assumption is replaced by a full rationality assumption, provided that the firm provides a sufficiently strong warning. If these obligations are not met, consumers will not only err, but they will do so in a manner that generates excessive risk levels.

The requirements pertaining to the strength of the warning often assume that consumers have extremely limited rationality. Self-proclaimed human factors experts testify that if the warning had been in bolder print or had been surrounded by a more prominent box, consumers would have heeded the warning.

What these court battles ignore are the real cognitive problems individuals face with warnings. Problems of information overload, warnings proliferation, and label clutter, which test the limits of consumer rationality, do not enter the courts' deliberations. Instead, the emphasis is on how the warning for the particular hazard in the case could have been designed to generate the greatest impact. The emphasis is on altering behavior and on generating dramatic responses. Efficient risk-taking is not the objective.

Courts' treatment of warnings also fails to reflect the potential efficiency of risky behavior. Consumers could quite rationally choose to forgo a recommended precaution. Our study for the EPA of the disutility of wearing rubber gloves while using drain opener indicated that consumers would be willing to pay 17 cents per bottle to avoid using rubber gloves. Unless the probability of the adverse event

is very high or consumers' valuation of the risk is very substantial (in this case the cutoff value for hand burns must be \$5,000), it may not be economically desirable to take the precaution. Our objective of efficient risk-taking will generally lead consumers to buy some risky products and to forgo some safety precautions. As a result, the policy objective of maximizing consumer precaution may be a misleading index of our actual success. We should be less concerned with creating effects such as decreased consumption of risky products and more concerned with the rationality of these choices. Do people understand the risk, and are they making sound decisions?

Greater prominence of warnings is not always tantamount to more effective warnings. The objective of warnings should be to inform consumers to foster efficient risk-taking decisions, not to generate alarmist responses. Moreover, when consumers examine the different warning messages received for a variety of products, they should be able to distinguish the relative riskiness of the products on the basis of the warnings. If every warning is boxed and highlighted to the maximum extent possible, then we shall be providing consumers with no basis to make distinctions regarding the relative riskiness of different products and activities.

Even if consumers are given sufficient information to make an informed choice, all is not lost. Plaintiffs still have another line of attack, which is that the firm must give consumers repeated reminders concerning the risks they face, since consumers are forgetful.

In practice, hazard warnings of this type have met with very limited success. The "buckle up for safety, buckle up" campaign did not greatly alter

The policy approach of trying to persuade people to change their risk-taking behavior in effect questions the validity of individual preferences, which are the foundation of all economics.

seat belt use. The CPSC's Project Burn Prevention educated consumers about fire safety but had negligible effects because the policy did not add to consumer knowledge. Safety training programs for high school students and nutrition education programs also have had little effect. Browbeating

consumers has not succeeded because these efforts have not provided new knowledge. One would expect that the most recent alcohol warnings that proclaim that “consumption of alcoholic beverages impairs your ability to drive a car” would have little effect on drunken driving. This is information consumers already have. The policy approach of trying to persuade people to change their behavior in effect questions the validity of individual preferences, which are the foundation of all economics. Not surprisingly, these efforts have not met with success.

What is apparent is that programs that provide new information can have dramatic effects. In a

Individuals tend to underestimate the magnitude of the larger risks we face and to overestimate the lower probability causes of death.

study of workers at four chemical plants, we found that hazard warnings can influence risk perceptions and willingness to work at the job. The critical ingredient for efficiency was not the risk level conveyed by the warning but the strength of the warning in terms of its new informational content. The scientific studies of hazard warnings provide a quite different perspective on the ingredients for effective warnings from that often provided by the self-proclaimed human factors experts. Warnings can be effective if they provide new information in a clear and convincing manner. We must design our warnings programs to meet the legitimate information needs of otherwise rational individuals.

The underlying assumptions about consumer rationality that pertain to the various aspects of the courts' hazard warnings policy do not reflect a coherent view of consumer behavior. The only organizing principle consistent with these diverse warnings requirements is an attempt to maximize the demands placed on the firm and to give plaintiffs the greatest opportunity for success.

Determinants of Risk Perceptions

The evidence on the accuracy of risk perceptions is somewhat mixed. The reality of individual risk perceptions lies between the extreme views of full rationality and complete ignorance of the risks. There are numerous errors in risk perceptions, but these are not random. Most important, the deficien-

cies that have been observed with respect to risk perceptions are systematic in nature.

Consider first the size of the risk. Psychologists such as Baruch Fischhoff have shown that individuals tend to overestimate small probability events and underestimate the larger risks they face. The tampering with Tylenol capsules in the 1980s that led to the cyanide poisonings also temporarily wiped out the sales of Tylenol, although the national risks involved were small in magnitude. Thousands of tourists routinely cancel their European vacation plans after a highly publicized terrorist attack. These and similar reactions to small risks reflect a general pattern of behavior. Individuals tend to underestimate the magnitude of the larger risks we face, such as the chance of dying from heart disease and stroke, and they overestimate the lower probability causes of death, such as the chances of being killed by lightning.

There is also another class of risks—those that are not called to an individual's attention at all. In situations of ignorance, we not only do not know the magnitude of the risk but do not even know of the existence of this class of hazards. Individuals generally set their perceived probability of such events equal to zero.

The nature of the trend in the risk level is also of consequence. If there is an increase in the risk from its accustomed risk level, consumers tend to overreact to the change by more than is warranted, given the magnitude of the risk change that may be involved. The fanfare that greets newly discovered carcinogens exemplifies this behavior.

Consumers' valuation of risk increases dwarfs their valuation of risk decreases. In one consumer product safety study we found that the amount consumers would be willing to pay for an injury risk decrease in their products of fifteen in 10,000 was comparable to or was exceeded by the price cut they needed to incur a risk increase of one in 10,000. Moreover, about two-thirds of all consumers would be unwilling to buy the products at all at any discount or even be willing to be paid to use the product if its risk level increased by one in 10,000. These are the same consumers who indicated an often modest willingness to pay for much more substantial risk reduction. Respondents were completely unwilling to consider a risk increase from fifteen in 10,000 to twenty in 10,000, even though they expressed only modest interest in decreasing the risk from fifteen in 10,000 to ten in 10,000.

Another feature of risk perceptions is that individuals tend to overreact to highly publicized risks. It

has long been noted, for example, that risks of major natural disasters such as tornadoes and earthquakes tend to be overestimated. Tourists in the Middle East incorrectly believe that they are more likely to be killed in a terrorist attack than in an automobile accident. Risks featured prominently in the news assume greater relative importance than they deserve. Media coverage does not convey probabilities, but simply highlights the number of adverse events in a risk calculation.

A prominent example of highly publicized risks is that of cigarettes. The government has mounted a three-decade informational campaign against

Because it is difficult to communicate risk information reliably and because individuals have cognitive limitations in processing this information, we must continually verify that we are providing accurate information and are not leading consumers to be unduly complacent or excessively alarmist.

smoking. This effort has included mandatory hazard warnings, advertising bans, annual reports by the surgeon general, and a persistent barrage of media stories highlighting the dangers of smoking. How could people continue to smoke? Smoking critics claim that they must not know what they are doing. The policy assumption has been that smokers remain ignorant of the risks, and if only the smoking message could be conveyed with sufficient forcefulness, they would terminate their smoking behavior.

Evidence on smokers' risk perceptions accords more closely with the patterns one would expect given the substantial publicity devoted to these risks. Overall, consumers assess the lung cancer risks from smoking as being forty-two out of 100, a risk level that exceeds the actual lung cancer risk by four to eight times. Consumers likewise estimate the overall mortality risk from smoking as being fifty-nine out of 100—or better than a fifty-fifty proposition—which likewise overestimates the risk levels scientists have assessed. The risk perceptions of smokers are somewhat lower, but even for this group there is evidence of overestimation of the risk. Moreover, these risk perceptions have a dramatic effect on smoking behavior; as smoking rates in the United States would rise by roughly 8 percent if consumers based their lung cancer risk perceptions on the

scientifically estimated risks of lung cancer as opposed to the perceived risks.

Consumers should not be faulted for this apparent overestimation of the risks. The information that they have been given indicates that the product is risky, but does not indicate a specific probability. Higher risk perceptions in the face of substantial adverse publicity for a product are to be expected and are not so much a sign of irrationality as a reflection of the informational environment in which we live.

The smoking example illustrates the potential import of the government's providing risk information. As risk perceptions have risen over time, smoking rates have plummeted. Whereas smoking was once the norm, now fewer than one-third of all adults smoke.

More generally, if we provide new information in a convincing manner, it can potentially assist individuals in making rational risk-taking decisions. But because it is difficult to communicate risk information reliably and because individuals have cognitive limitations in processing this risk information, we must continually verify that we are providing accurate risk information and are not leading consumers to be unduly complacent or excessively alarmist.

One aspect of risk perceptions that has influenced the impact of risk regulations is that the perceived probabilities tend to flatten out probability differences. Thus, a risk difference between four out of ten and five out of ten appears to be less than one out of ten. Individuals consequently will underestimate the risk change achieved through precautionary behavior. This flattening process may account for the disappointing reactions that individuals have displayed with respect to various precautionary behaviors that have been urged. Until seat belt use became mandatory, for example, few individuals buckled up. This failure does not appear to be due to a lack of information or due to the onerousness of using seat belts. Rather, it is consistent with a more general pattern in which consumers fail to recognize the extent of the risk differences that are present and that can be achieved through precautionary behavior.

Another type of perceptual bias is that individuals have an aversion to situations of ambiguous beliefs—a phenomenon that Howard Kunreuther has documented in several contexts. Consider the following two situations based on a study Wesley Magat and I performed for the EPA. In the first the individual faces a cancer risk of 175 out of 10 million. In the second situation two equally valid studies

indicate that the risk is either 150 out of 10 million or 200 out of 10 million, with a midpoint of 175 out of 10 million. Fear of the worst-case scenario leads individuals to prefer the less ambiguous risk although they should be indifferent to the two situations. This distrust of uncertain chances of an adverse outcome may motivate many public responses to risk that often reflect a strong reaction to dimly understood health risks called to the public's attention.

In a similar vein the government's risk assessment procedures greatly exaggerate the small and ambiguous risks that we face. Rather than focusing on the mean level of the risk, the principal guide for policy is often the upper end of the 95 percent confidence limit. Even this upper bound on the risk is often not sufficient, as the government often adds a "margin of safety" beyond the no-risk level. In some instances, such as determining the reproductive risk levels for compliance with California's risk communication program under Proposition 65, these biased risk values are distorted even further by multiplying the upper bound of the risk by a factor of 1,000 for the purpose of "conservatism." This distortion is particularly great since the standard is linked to observable reproductive effects, not adverse impacts. Vitamin A and caffeine are two substances that would merit warnings under this risk standard.

Because scientific evidence regarding low-probability events tends to be the least reliable, our knowledge concerning these risks is usually the least precise. Routine accident risks, such as the chance of being injured on the job, occur with sufficient frequency that our judgments are quite refined. Events that might befall us once every 7 million years, which is the annual cancer risk threshold for California's Proposition 65, can be evaluated less readily because we have fewer observations relative to the risk level on which to base judgments regarding what may be a negligible risk. We also have very little experience in dealing with infrequent events so that it is difficult to put the relative risk magnitude in perspective. Moreover, extrapolation based on animal studies becomes particularly fraught with error in situations in which the level of the risks is so low.

The result is that when we are addressing small risks, the degree of our uncertainty is particularly great. From the standpoint of government action, however, these risks command significant attention—an undue amount given the expected lives that will be saved. We are not guided by the level of the risks

but rather by an inflated estimate of what the upper bounds of the risk might conceivably be.

The emphasis of government policy consequently mirrors the biases reflected in consumer behavior. The small risks, the newly discovered risks, and the risks that are increasing from our accustomed risk level receive the greatest attention. The truly substantial risks that we face, such as the risks posed by being overweight or from ingesting animal fats, go largely unattended.

Implications for Government Action

The biases exhibited in individual responses to risk are systematic and predictable. Individuals do a great deal that is sensible. They learn, but do not have perfect information. Moreover, they can process the information they receive and make rational risk-taking decisions, but people are imperfect. There are cognitive limitations that affect the amount and character of the information that they can act upon in a reliable manner.

A principal ramification of these results for government policy is that these shortcomings do not always imply that there is insufficient safety. Indeed, the preponderance of the inappropriate responses to risks that have been identified involves excessive and alarmist reactions rather than inadequate responses. We may often have excessive rather than insufficient safety.

These results are also optimistic with respect to the degree of government intervention that is needed. In particular, the market often can work on a decentralized basis provided that individuals are given adequate risk information. This information

Small risks, newly discovered risks, and risks that are increasing from their customary level receive the greatest attention. Truly substantial risks go largely unattended.

should be designed to inform consumers, not to alarm them or to try to persuade them to alter the risk-taking decisions that they would consciously make, given their preferences.

The main factor that must be taken into account is that consumers do have limited capabilities to process the information they receive. If we offer consumers labels that are cluttered in terms of having a great deal of extraneous and repetitive

information, then we shall not convey the risk information clearly. The format and structure of the warning label often are of substantial consequence in that we want the warning to communicate the risk information in a clear manner that can be easily processed.

Once a reasonable degree of clarity has been attained, however, refinements in the warning label have little impact. Adding more boxes around the warning, increasing the print size, and other nuances that are the focal point of court battles over hazard warnings are of little consequence once we have a warning that communicates the risk information in a clear and convincing manner. Stronger warnings with bolder warning messages or more prominent warning messages from the hazard warnings vocabulary (using the word *warning* rather than *caution*) are not always desirable. The purpose of warnings is not to alarm but to inform. To preserve our credibility across other warnings efforts and to ensure that our vocabulary is not diluted, we want the warnings message to be commensurate with the risk that the product poses. The results pertaining to consumer responses to warnings indicate that hazard warnings have a constructive role to play, but they should recognize that our objective is to produce efficient risk-taking behavior, not to eliminate potentially risky choices. If that were our objective, we should be pursuing more stringent regulations, such as product bans.

Two classes of risks for which government regulation is particularly warranted are the following. First, in situations in which individuals are ignorant of the risks, such as hidden health hazards, the

To ensure that the policy emphasis will be correct, government should undertake comprehensive cost-benefit tests for all new regulations and should determine that these regulations are in society's best interests.

risks provided by the market will be overly high. Second, for the truly substantial risks we face, there may be a tendency to underestimate the magnitude of the risks and to fail to take appropriate action. Risks to our well-being posed by diet, lack of exercise, and our lifestyle contribute to the risks of stroke, heart disease, and other substantial hazards. It is these classes of major risks that are most likely to be

ignored and that will lead to excessive risk levels.

Unfortunately, these are not the risks that are usually targeted by government action. Rather than focusing on the fundamental health risks, the government often addresses the microscopic contingencies, such as the trace carcinogens posed by chemical residues. It is the new and unfamiliar risks that receive the greatest attention. In much the same way that consumers react to changes in the risk in an alarmist way, the government often focuses on the more novel and newly discovered hazards as well as the increases in risk from accustomed risk levels.

This emphasis is predictable. The same alarmist responses by consumers will generate political pressures for government action in a democratic society. The Chilean fruit incident is a dramatic case in point. After residues of cyanide were found on two Chilean grapes in Philadelphia, the U.S. government banned the consumption of hundreds of millions of dollars of fruit imported from Chile. This action was taken despite the fact that subsequent scientific studies suggested that the contamination may have occurred in the United States and may even have been part of a naturally occurring process rather than a tampering. The task for government policy is to overcome these market failures rather than to intensify them.

Toward Balanced Risk Policies

These imbalances suggest that substantial improvements could be made in government policy if it were set on a more appropriate basis. Although the size of the risk is often an important concern in terms of redirecting our efforts, it is not the only issue. Not all risks of consequence must be eliminated. Some reflect hazards that we should reasonably incur in the normal course of our lives. The key consideration that should guide government policy is an attention to legitimate market failures.

There are three ingredients for bias. Risks that are small, risks that are increasing, and risks that are highly publicized are most likely to lead to irrational action. The problems are most severe when all three of these elements are present.

One mechanism for ensuring that the policy emphasis will be correct is to undertake comprehensive benefit-cost tests for all new regulations and to determine that these regulations are in society's best interests. The Office of Management and Budget's regulatory oversight efforts promote this objective, but since agencies are exempted from this requirement whenever their legislative mandates prohibit

them from undertaking such balancing, as a practical consequence the benefit-cost requirement is of little import for risk regulation agencies. Indeed, an examination of the performance of the OMB regulatory oversight process suggests that unless the costs per life extended by regulation exceed \$120 million, OMB seldom is successful in blocking

The major task for risk regulation policy is to reorient efforts so that they will assist in overcoming the limitations of individual choice rather than reinforce them.

a regulatory policy. The oversight effort is capable of eliminating the wildest excesses in controlling risk, but cannot ensure an appropriate balance.

Underlying all these efforts is a curious mix of contradictory behavioral assumptions. In some cases rampant consumer ignorance and inattentiveness to risk are the basis for policy. In other contexts regulators and the courts assume hyperrationality on the part of individuals facing risks. Individuals are assumed to always be willing to take precautions such as wearing seatbelts once they are apprised of

the risks. The actual performance has turned out to be far more disappointing. The only theme emerging from these approaches is that the assumptions have been manipulated to maximize the degree of government intervention rather than to maximize individual welfare. We need a consistent behavioral reference point for assessing policies, not a reference point that is manipulated to justify particular policy actions.

Risk regulation policies are in part a reflection of the biases of the citizenry at large and do not necessarily represent a deliberate effort to distort society's approach to risk. The major task for policy is to reorient these efforts so that they will assist in overcoming the limitations of individual choice rather than reinforce them.

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