Safety at Any Price?

Walter Oi

LIVING is dangerous. We are reminded of this fact, from time to time, by stories about especially terrible accidents and diseases. An outbreak of legionnaires' disease can claim twenty-one lives, ruin a thriving hotel business, and spoil a city's bicentennial celebration. The collapse of an earthen dam, the crash of a jumbo jet, cotton dust in a textile plant, flammable pajamas, "high-rise" bicycles—all these are testimony to the hazards of living. An Upton Sinclair, Estes Kefauver, or Ralph Nader can bring about from one of these situations political actions intended to lower its human and financial costs.

The statistics are less sensational than grim news stories, but they allow us to quantify the magnitude of the problem. The most reliable data on fatalities reveal that 103,030 Americans were killed in accidents in 1975 (compared to 48,373 who were victims of homicides and suicides). The accidental death rate varies systematically with age, race, and sex, and is highest for young non-white males. Indeed, accidents are the leading cause of death for all persons under forty-five years of age. Injury statistics, though less reliable than statistics on deaths because they depend to some extent on self-assessments, reveal the pervasiveness of the accident problem. In 1972, Americans suffered 63.4 million injuries requiring either medical treatment or restricted activity for the victim or both. The injury frequency rate per 1,000 persons was 312

for all persons and 515 for young males. Accidents were responsible for nearly one-eighth of all hospital admissions (other than for maternity). According to the National Safety Council, the cost to the nation for accidents occurring in 1976 was some $52.8 billion. The toll is large whether measured by the economic costs to victims and property or by the human costs of pain and suffering.

Accident statistics are collected mainly in response to demands for information to aid in program planning and evaluation. Conceptually, the goals of accident research—to uncover the causes for disabling injuries and illnesses—should dictate the ways in which statistics are collected and analyzed, but all too often the opposite holds true: the direction of accident research is determined by the availability of data. Safety and health programs and policies have generated a substantial body of accident statistics. These give us some indication of the differences in risks associated with different activities and products. When these data are linked to the personal characteristics of the victims, we can also measure the variations in injury frequency rates as they relate to these personal characteristics.

Risks and Risk-Taking

No one—well, almost no one—voluntarily exposes himself to injury for the sheer joy of taking a risk. Given a sufficiently large and diverse population of individuals, there are, to be sure, some who contradict almost every generalization about human behavior. In the late 1950s, the Metropolitan Life Insurance Com-

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pany studied the circumstances surrounding seventy-nine cases of accidental fatalities caused by firearms. In 40 percent of these cases, the death resulted from a silly action like pointing the gun at someone and saying "Bang! you're dead." What is perhaps more startling is that in 9 percent of the cases, the deceased had participated—and lost—in a game of Russian roulette. Perhaps I am ultraconservative, but hang-gliding and hydroplane-racing seem to be activities that are undertaken for the sheer joy of risk-taking. After calculating the risk levels for general aviation, one observer has concluded that flying in private planes could only be rationalized as "pure adventure." With enough people and enough dispersion in tastes, there will always be contrary individuals. In what follows, however, I shall look at the tendencies that are exhibited by the bulk of the population.

Accidents—like the slag that is produced along with the pig iron—are the unavoidable byproducts of production processes. The benefits that derive from the principal product or activity are sufficient to warrant incurring the contingent accident costs. Although most of us dislike exposing ourselves to risks of injury or death, we consciously do so in order to derive the benefits of the related activity or good. Thus, we do not always buy the safest ladder, we drive little Fords and Datsuns instead of brontosaurus tanks, and we live in the city.

In talking about accident risks, it is helpful to distinguish two related concepts of "risk," (1) exposure risks, which are explicitly linked to specific goods or specific activities (for example, the risk of hearing loss in a foundry) and (2) injury risks, which are the cumulative risks of injury over a given time period like a month or a year. An obvious safety principle can be stated in terms of these concepts:

> Each individual can achieve any level of perceived injury risk by choosing activities and goods with different exposure risks.

One is unlikely to be injured while in bed. Yet, although the evidence is shaky, it suggests that the hours spent at work are safer than the hours spent at home, at least for a majority of all employed persons. Exposure risks per hour vary widely across occupations, industries, and firms. Large firms are safer places to work than small firms. Data presented by Richard Thaler

and Sherwin Rosen indicate that the risks of a fatal accident are twice as high for a taxi driver as for a truck driver. Guards, watchmen, and doorkeepers expose themselves to an accidental death risk that is fourteen times greater than that facing fishermen. Bureau of Labor Statistics data indicate that employment in refuse collection, stevedoring, drilling and tunneling, and logging is four to five times riskier than the average for all manufacturing and thirty to fifty times riskier than clerical employment.

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The range of exposure risks is equally large for household and recreational activities of various kinds. One will be safer in a one-story house where there are no stairs, safer having someone else shovel your snow, and safer riding trains and buses than driving. By a suitable choice of activities and goods, a person can achieve any level of injury risk that he desires.

Assuming that individuals accurately assess exposure risks, how can we explain the stable and persistent differences in injury risks that are revealed by the accident statistics? If we return for a moment to the thesis that individuals engage in risky activities to get the benefits associated with these activities, we can discuss the question in terms of a hedonistic calculus of pleasures and pains. Individuals will pursue risky activities to the point where the marginal benefit of the principal activity is just equal to the marginal accident cost generated by the undesirable but possibly unavoidable byproduct—disabling accidents. The expected accident costs will depend on the chances of being injured and the cost if injured (which includes the medical bills, the losses in wages or salaries, compensation for pain and suffering or impairment, and so on). The benefits may be financial—as they are when a sandhog or an Air Force pilot gets a wage premium for engaging in high-risk activities. Or they may be in the form of the psychic utilitarian pleasures of, for

example, skiing or driving one's own car. The assumption here is that individuals choose their portfolios of activities and goods to maximize the excess of benefits over accident costs. Persons who derive greater benefits from the activities or goods or who suffer lower accident costs in the event of an injury will undertake riskier activities. As a consequence, their injury rates will be higher.

The Role of Choice

The hypothesis that a person maximizes the difference between perceived benefits and perceived costs can be extended from the individual to other economic agents such as firms and employers. Employers do not intentionally maim their workers, nor do they intentionally market unnecessarily hazardous products. Accidents in the workplace involve not only added insurance premium costs for workers' compensation but also damage to property; moreover, excessively defective products may result in lawsuits and will surely depress future sales.

The individual actions of 200 million consumers, 90 million workers, and 10 million firms are expressed in markets that somehow produce an equilibrium pattern of accident risks. This pattern reflects millions of personal valuations of accident costs, of current safety technology and legal liability arrangements, and of the constraints imposed by safety and health regulations. Injury risk levels exhibit wide differences among groups of people—being, for example, substantially higher for males than for females. Among males, increasing age is associated with a lower injury rate but a higher accidental death rate. The reckless, nimble twenty-year-old is more likely than the older man to be hurt, but his youth and resiliency somehow keep him from being killed. It is not at all surprising to find that young men experience the highest injury rates. They are, after all, the ones who volunteer for the Marine Corps, supply most of our criminals, work at risky jobs, and ride motorcycles. Increasing wealth, urbanization, the changing composition of the labor force, and improvements in safety technology can all be expected to affect the pattern of changes in disabling injury rates over time. Indeed, U.S. historical statistics reveal that

equilibrium risk levels have shifted downward over time—the accidental death rate, for example, having declined from 80 per 100,000 persons in 1930 to 56 per 100,000 in 1975.

Although we are safer today than we were a generation ago, social reformers can still point to situations which, in their view, constitute unreasonable risks and hazards. Books like Nader's *Unsafe at Any Speed* or Carson's *The Silent Spring* have identified risks that appeared to call for government intervention. The Corvair was supposed to be unreasonably risky (1) because it inflicted substantial accident costs upon unsuspecting drivers and innocent third parties, (2) because insurance and legal liability arrangements did not fully compensate accident victims, and (3) because the risk could have been avoided by better design and quality control. In such cases as these, it is argued that, without government regulation, too many individuals are exposed to socially unacceptable risk levels because of information gaps, wrong incentives, and third party effects. It is also argued that unless we adopt appropriate social insurance and compensation schemes, the burden of accident costs will be inequitably distributed, being borne almost entirely by accident victims.

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There is some evidence to indicate that people systematically underestimate risks, especially very small ones. Accidents happen to "the other guy." No amount of statistical evidence can ever persuade us that they can happen to ourselves. On the other end of the spectrum, loss of life or limb is of such awesome magnitude that people probably cannot gauge contingent accident costs—that is, the likelihood of an accident and the pattern of probable costs should it occur. The underestimation of the risks and of the contingent accident costs induces many individuals into working at un-

reasonably hazardous jobs and into buying dangerously shoddy products. But most of the evidence on this point is anecdotal, and our Russian roulette prototype assures us that we can always find exceptions to even the most reasonable rules. The anecdotes may concern such exceptions. More systematic studies suggest that people do have roughly accurate "guesstimates" about what are the high-risk activities. According to a Michigan Survey Research Center study of workers' attitudes, the workers' rankings of risky industries were closely correlated with rankings based on Bureau of Labor Statistics work injury rates.

An additional argument is that the accident toll is excessive because firms are provided with the wrong incentives. They allegedly will not adopt the best safety practices so long as accident costs can be shifted to unwary workers or passed along to helpless equipment manufacturers. (The present crisis in products liability illustrates the point: injured workers are circumventing workers' compensation by suing equipment manufacturers.) The counter argument holds that workers behave recklessly because they know that, in the remote chance of a truly serious injury, a benevolent society will pick up the medical bills and give them a subsistence income. Rules that provide the proper incentives to both firms and workers would surely promote greater safety. Some lessons can be learned from the trucking companies. The driver who owns his own rig is likely to take better care of it, thereby lowering maintenance costs. So most motor carriers now hire owner-operated rigs and provide plans that enable drivers to finance the purchase of their rigs.

Finally, accidents often involve what economists call externalities and what lawyers sometimes call third-party effects. The pollutants emitted by a pulp mill or the noise created by a supersonic jet are not matters that can be left entirely to the pulp mill and its workers or the airline and its customers. The risks to the health and hearing of other (third) parties must be taken into account. Residents of the Fox River Valley in Wisconsin have a legitimate interest in the output of kraft paper mills, and residents of the Borough of Queens a legitimate interest in the flight path of an SST landing at Kennedy Airport. If the Fox River is "too thin to walk on and too thick to drink" and the air above it too thick to breathe, that is important to society. If the sonic boom breaks windows and eardrums, that too is a matter of social concern.

The Valuation of Risks

Here we must pause to examine the question, what price are we willing to pay for more safety? Injury risks are not—like shoes, off-track-betting tickets, loquats, and visits to massage parlors—"goods" that can be produced, sold, and traded. Rather, they come packaged with power lawn mowers, coke bottles, and jobs in coal mines. But, as with other "mixed bags," the proportions of the components can be varied and we can impute a "price" to one component. These implicit "prices" for safety are reflected in markets. Wage premiums must be paid to attract workers to high-risk jobs, and sellers of the more hazardous types of cutting tools must accept lower prices for a package consisting of a cutting tool and a larger injury risk.

The willingness to pay for safety (higher prices for safer products or lower wages for safer jobs) depends on the probability of an accident and the cost inflicted by the accident. If an artificial limb were as good as a natural one, if there were working artificial eyes, if burned skin could be replaced, financial compensation could fully restore the "whole man." In this event, we could objectively calculate the accident costs and arrive at an optimal risk structure in which the cost of preventing accidents is equated, at the margin, with these objectively measured accident costs. The situation becomes a bit more complicated when the accidents involve truly nontraded goods like lives and limbs. Even here, market prices can be used to infer some implicit valuations of the contingent accident costs. Using data on wage differentials, Thaler and Rosen found that workers behaved as if they attached a value to life of $160,000 to $260,000. Robert S. Smith, using a slightly different body of data, came up with considerably higher implicit values of up to $1.5 million for a life. Some variation ought to be expected because human lives are not homogenous goods like bags of No. 2 wheat. The individuals who take the riskiest jobs are likely to be the ones who attach the lowest val-

ues to life and who incur the lowest accident costs if injured.

Let me come back to the idea of socially acceptable risks. In the Corvair case, three considerations entered into determining these:

(1) the size of the accident costs, which depends both on the probability that the untoward events will occur and the cost of these events;

(2) whether the accident costs are covered by existing insurance and liability arrangements; and

(3) the possibility of avoiding part of the risks by spending more on accident prevention.

If society can be persuaded that the accident costs which can be avoided by efforts at prevention exceed the accident prevention costs, then the risks are socially unacceptable. This is another way of stating the Calabresi rule—which says that accident risks are optimal when they minimize the sum of accident costs and accident prevention costs. (The restatement ignores distribution effects, or what Calabresi calls secondary accident avoidance costs. These include the compensation of victims and the legal and transaction costs of making these re-

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distributions.) Determining which risks are socially acceptable thus turns on estimates of the accident costs and of accident prevention costs. If their sum can be reduced by public intervention, then the risks are socially unacceptable.

In situations involving "individual risks," I believe that personal valuations of accident costs should be used to judge whether risk levels are socially acceptable. With a given assessment of the risks and his personal estimate of the value of his life, my erstwhile colleague decides to go sailing. His friends hold a very different assessment of the risk and of the value of his life and argue that society would be better off by not letting him go. Should we invoke

sanctions in this case? Indeed, most of the cases involving consumer product safety revolve about one of two alleged facts—(1) that consumers underestimate expected accident costs and buy unreasonably hazardous goods and (2) that manufacturers either do not know how to produce safer products or have no incentive to do so. As long as there are consumers and manufacturers who, because of ignorance, systematically underestimate the expected accident costs, the social reformer may conclude that many individual risks are unacceptably high even though consumers voluntarily choose to incur them.

Acceptable risk levels in situations involving "communal risks" tend to be far lower than for individual risks. Commercial jets must be considerably safer than executive jets. Richard Zeckhauser has argued that society will pay more for safety in a situation where there is one chance in 10,000 that ten lives will be lost than in a situation where there is one chance in 1,000 of losing one life. These arguments seem to appeal to the "public goods" nature of communal risks and to economies of scale in accident prevention. When the lives of 200 passengers are at stake, the aggregate sum that these passengers are prepared to pay to reduce their risk is large—indeed, it may be over 200 times larger than the sum the lone executive will pay. Further, the cost of lowering risk levels by enough to save one life is less in the case of the jumbo jets than in the case of executive jets.

My distinction between individual and communal risks differs from the distinction between voluntary and involuntary risks. I can voluntarily choose to live in a city with a nuclear power plant or to fly in a jumbo jet. But when I live in the nuclear city or fly in the giant plane, the risks that I confront are the same as the risks facing my neighbor or my fellow passenger. Insurance companies can assemble a portfolio of risks, so that premiums and claims balance out. But society's portfolio of accident risks is not diversified, and theory tells us that when we put all our eggs in one basket, we need the promise of a high return to justify carrying that basket to market. If society is to be persuaded to invest in nondiversified portfolios of accident risks—as when a substantial part of the city could be destroyed by a nuclear explosion—it will demand a higher expected return, that is, a better chance of getting the eggs to

market or, in this case, a lower possibility of a nuclear explosion.

The valuation of lives and disabling conditions may vary with the nature of the risk (whether voluntary or involuntary, individual or communal) or with the lives and injuries at stake. I recently read an analysis of OSHA's coke-oven standard where the estimated cost of complying with the standard was divided by the projected number of lives saved to arrive at a figure of over $50 million in compliance costs to save each life. The author concluded that the standard was contrary to the public interest, given this high implicit value of a life saved. The funds required to comply with the standard would save many more lives if they were spent on highway safety, school crossings, and so on. In a study done at the University of Sussex in England, the authors pointed out that if they had applied to nuclear power plants the implicit life values revealed by safety programs in coal mining (an individual and quasi-voluntary risk), nuclear plants that had one explosion every three years would match the safety record of the coal mines. The "price" of safety may differ from one risk situation to another, but examination of the "implicit prices" helps to reveal just what more safety will cost.

Regulatory Approaches

Congress has identified various situations which, in its opinion, involve socially unacceptable risks calling for government regulation. Clean air, wholesome meat, unadulterated drugs, licensed doctors exemplify some of these. The agency that is charged with the responsibility for reducing risks and accident costs can follow any of several regulatory paths.

(1) The agency can produce and disseminate information. Products that might be unsafe or unhealthy could be certified and labeled (as cigarettes now are) rather than being banned from the market. Plants could be inspected and their compliance with specified safety standards publicized. Governments have almost universally rejected this informational path to safety. The National Commission on Product Safety asserted that consumer education has little if any impact on the accident toll. A very different story is told by A. P. Iskrant and P. V. Joliet in a study on crib deaths. When

the dangers of putting plastic laundry bags in cribs were publicized by the Department of Health, Education, and Welfare, the reported number of suffocations in cribs fell sharply. More evidence is needed before we can judge the efficacy of the public production and distribution of safety and health information.

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(2) The agency can impose penalties and fines to deter the creation of unsafe conditions and the manufacture of unsafe products. Robert S. Smith has proposed this path, which is usually associated with environmental protection, for occupational safety. According to his estimates, a tax of $2,000 per injury could be expected to reduce injury frequency rates by 8 to 12 percent. (To be sure, if the proceeds of this tax were paid to accident victims, counterproductive behavior might be encouraged—with workers feigning injuries to get compensation.) Smith's plan combines elements of "no-fault" insurance and self-insurance; its main weakness is that the injury taxes could be a source of great financial uncertainty for small firms.

(3) The agency can promulgate mandatory standards. The Occupational Safety and Health Administration (OSHA) and the Consumer Product Safety Commission (CPSC) were directed to follow this path to greater safety and health.

When OSHA was first established, it adopted some 1,700 standards that had been generated by industry self-regulation or mandated by state safety commissions. (When state standards varied, OSHA usually accepted the most stringent version.) Responsibility for creating new standards for the workplace was assigned to a separate organization, the National Institute for Occupational Safety and Health, which has devoted almost all its resources to the study of health hazards. The CPSC's task of producing safety standards has been considerably harder because there are fewer studies and fewer data on accidents associated with con-

sumer products than on industrial accidents. The commission underwrote several projects intended to produce products standards—including projects on heavy soft-drink bottles and safe power lawn mowers. On the latter, the Cornell Aeronautical Laboratory recommended a model in which contact with the blade would not mangle one's hand, but very little was said about the way in which the blade cut grass. The standard that was proposed for lawn mowers in 1975 would have increased their price by more than $40—a fact that was highly publicized by the Council on Wage and Price Stability. (See page 10, this issue, for a discussion of the CPSC's current proposal.)

Standards, like laws, constrain individual behavior. If we insist that people obey the law, we must back up our insistence with enforcement, so it is not surprising that the largest part of OSHA's budget is allocated to "compliance." Inspectors must be trained and sent to examine work sites. If violations are found, citations must be issued. If the violation is serious and willful or deemed to present an imminent danger, plants can be closed or fines levied. But the fines are pitifully small. When compliance entails an added accident prevention cost of, say, $100,000 and the fine is only $100, a firm can afford up to 1,000 citations before the costs of noncompliance exceed the costs of compliance. But it must be remembered that there are over 1,700 standards and compliance with many of them requires far less than $100,000. In 1973, around 7 percent of all manufacturing establishments were inspected, and only 15 percent of that small number were found to be in compliance.

A Critique of Mandatory Standards

The main difficulty with the standards approach is that it fails to come to grips with the ways in which accidents and goods are jointly produced. In the accident research literature, accident "causes" are typically classified under three headings: the host, the accident agent, and the environment. Injuries on the ski slopes are "caused" by (1) the reckless actions and physical condition of the skier, (2) the design and condition of his ski equipment, and (3) the characteristics of the slope and the snow. One cannot prevent skiers from being reckless any

more than one can enforce a standard that drivers keep their eyes on the road or that employees exercise "due care." In this context, we may note that the Occupational Safety and Health Act prescribes an employee's duties with respect to unsafe acts (Section 5b), but contains no provision for enforcing employee compliance. Contributory negligence used to be available as a defense for the employer, but this is no longer so. The courts appear to have embraced the position that workers are not responsible for wearing protective equipment. A boilermaker can receive compensation for loss of hearing, even if he was supplied with earmuffs and it is demonstrated that he refused to put them on.

The standards that are easiest to enforce are those pertaining to permanent fixtures—cabs on farm tractors, tensile strengths of cables, and irremovable safety guards. Housekeeping standards that call for clean floors are harder to enforce, unless inspectors are permanently stationed in the plant (as they are in the larger meatpacking plants—though under the United States Department of Agriculture, not the Occupational Safety and Health Administration).

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Regardless of the difficulties of enforcement, the hardest problem comes in measuring the benefits of mandatory standards. It has generally been found that the actual reductions in injury rates or in lives lost from these standards tend to be far less than the reductions predicted. This is to be expected if people adjust their behavior to the greater built-in safety. Lester Lave and Warren Weber—and, more recently, Sam Peltzman—have argued this point. Seat belts, dual brakes, and collapsible steering columns make a car safer. But safer cars may tempt some people to drive faster, so that there is no change in the number of accidents. Peltzman's data show precisely this result. My examination of the before and after injury ex-

perience of the heavily inspected New York foundries indicated that safety codes had very little long-run impact on injury rates. Studies differ in their estimates of the effectiveness of mandatory standards. Most indicate reductions in injury frequency rates of 10 percent or less, and one or two studies find reductions of up to 25 percent. Unsafe acts by workers, temporary departures from safe work practices, the introduction of new employees to the assembly lines —all contribute to the firm's accident toll.

The heavy reliance on mandatory standards for safety in the workplace and for consumer products is not in the public interest, if that public interest is to minimize the sum of expected accident costs and accident prevention costs. The costs of administering the standards are high, when one properly counts the costs incurred by both the agency and the regulated firms. Moreover, the approach tends to be myopic in its view of the nature and causes of accidents. It fails to recognize the connection between built-in safety and risky actions, and it often neglects links between different risks. OSHA's performance over its first six years has not been impressive. The agency has made no systematic attempt to evaluate the effectiveness of its standards. The allocation of inspectors to plants seems to follow no rational pattern. One might contend that this is nothing more than growing pains, but it may be the approach that is wrong.

Safety and health are important economic issues. Some contend that the accident toll is an inevitable aspect of a modern industrial state in which goods and accidents are jointly produced. Jeffrey O'Connell, the leading advocate of elective no-fault insurance for almost

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everything (medical malpractice, defective power presses, workplace accidents, and so on) seems to embrace this position when he argues that the carnage will continue, that the frequency and severity of accidents cannot be significantly affected by government intervention.

In his opinion, the important policy issue is how to compensate the victims. This is an extreme position. The other extreme is to hold that regulation can eliminate virtually all serious injuries and illnesses.

We can be safer and healthier if we are prepared to pay the price. Sometimes the price is apparent, as when we are told that it will be $300 more for the air bag in our 1979 Olds. At other times, the "price" may take the form of a foregone opportunity—the inability, for example, to buy a cheaper but possibly flammable pair of pajamas. Whether it is direct or indirect, stated or implicit, there is always a "price" for reducing illness and accidents. When we or our elected representatives make decisions that are intended to improve our safety or health, it is important to recognize these "prices," so that we can weigh them against the benefits of lower expected illness or accident costs.

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