

THE ECONOMICS OF SAFETY

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We now know more about the topography of the moon than about the earth's topography.

—Zdenek Kopal, *TIME*, Sept. 8, 1967, p. 37.

Every finite set of historical events is only a sample of what might have happened.

—LEWIS RICHARDSON, *STATISTICS OF DEADLY QUARRELS* 132 (1960).

INTRODUCTION

Kopal's textual statement, reflecting man's disposition to study the less important at the expense of the more important, is applicable to our knowledge of "safety" and "unsafety." Safety is, of course, a subject of many dimensions. One of these is the economic dimension. Consideration of this dimension has two aspects: (a) to inquire into how an optimal balance can be achieved between the value of varying degrees of safety and the cost of providing these degrees; (b) to inquire into how combinations of rewards and penalties, developed mainly within the framework of competition and bargaining, can give rise to a degree of safety that is neither excessive nor deficient but optimal in the sense that its value and cost are in balance. In what follows an attempt is made to put some of the elements of the problem in context.

I

CHOICE

Discussion of safety, however defined, involves discussion of choice. Safety is largely the product of human action consequent upon prior choices. The economics of safety consists in so pricing it, or compensating its absence, as to produce the economically optimal amount of safety at socially optimal resource cost.

Speaking very broadly, almost any human action involves choice; the external environment delimits a range of possible actions at any given moment but does not usually reduce that range to a single alternative. The formulation of a theory of human action in some sphere as a theory of choice means its presentation as a functional relation associating with each possible range of alternatives, a chosen one among them.¹

There is a set of conceivable actions which an individual [or decision-making body] could take, each of which leads to certain consequences. The individual has in mind an ordering of all possible consequences of actions, saying, for each pair of consequences, either that he prefers one or that he is indifferent between them . . .

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¹ Arrow, *Utilities, Attitudes, Choices: A Review Note*, 26 *ECONOMETRICA* 1 (1958).

In a given situation the range of actions open to an individual is limited in some way, . . . [say by resources available or the state of technology].²

As we indicate later, ordering alternatives usually is complicated by the presence of "uncertainty" in that consequences are "not uniquely related to actions."³ Alternatives among which choice must be made are not always independent; some are complementary to others. Choices made today have implications for the chooser's range of choice tomorrow in that some of tomorrow's resources are committed, or the *options* left open to the chooser tomorrow are reduced. Choices made in respect of augmenting safety often entail a freezing of tomorrow's resources or a narrowing of tomorrow's options. Heavy and (often) environment-changing outlays upon fixed capital may be made today, with the result that service and other charges are imposed tomorrow and that choices open today are no longer available tomorrow. For example, weather control in *A* can inflict great damage upon *B*. It is essential, therefore, that the costing of today's choices and consequences should include a loading for the sacrifice of tomorrow's options.

Under the head of tomorrow's costs of today's actions should be included allowance for the fact that one consequence of such action may be the creation of groups with vested interests in perpetuating obsolete results of today's action—for example, current failure to outlaw privacy-invading devices and procedures spawns a class of manufacturers and others interested in their perpetuation. Offsetting or destroying such interest groups is likely to be costly, since organized power is more effective than dispersed power. Today, for example, a powerful group, apparently with ties to the military-industrial complex of which President Eisenhower warned a heedless public and with vast subsidies at the expense of the already well-plucked American taxpayer, is in process of visiting the troubles of supersonic transport upon millions of helpless residents residing in its path. Should this project be realized, as now seems likely, the political and economic cost of doing away with it, if at all possible, would be very expensive.

This example points to a related issue, that of making the number of choices sufficiently large to make for a relatively optimal solution. Consider the problem of airport noise,⁴ one involving effects associated, as unsafety often is, with indefinite property rights. One of three extreme choices may be chosen: prohibit planes, empty the land near the airport of people, or make no provision for noise damage. A preferable solution is to allow people to buy land near the airport at a low enough price to compensate them for enduring the noise, and a yet more preferable one is for the airport to buy from affected landowners rights to "dump" jet plane noise on their land. Neither of these solutions fits supersonic transport because the swath

² Arrow, *Alternative Approaches to the Theory of Choice in Risk-Taking Situations*, 19 *ECONOMETRICA* 404 (1951).

³ *Id.* at 405. Uncertainty may cause spending on desirable activities to be suboptimal.

⁴ This example is taken from A.A. Alchian and W.R. Allen's excellent book, *UNIVERSITY ECONOMICS* 473 (1967).

of noise is too wide. The former solution, however, fits a fairly common case, that of occupancy of flood-prone land.

There may be yet another way out of the situation just described, namely, suppression of the noise. This is an unlikely outcome. It does, however, illustrate application of a principle of importance, that of the "hiding hand," which "beneficially hides difficulties from us."⁵

Creativity always comes as a surprise to us [W]e would not consciously engage upon tasks whose success clearly requires that creativity be forthcoming

. . . [S]ince we necessarily underestimate our creativity it is desirable that we underestimate to a roughly similar extent the difficulties of the tasks we face, so as to be tricked by these two offsetting underestimates into undertaking tasks which we can, but otherwise would not dare, tackle.⁶

Insistence by the state on high levels of safety may, as does the practice of courts in allowing heavy awards to injured parties, prompt a creative response that greatly diminishes the degree of unsafety, given that so doing promises the creator sizable profits. The situation is somewhat parallel to that in which the introduction of a minimum wage leads to labor-displacing invention.⁷ One may suppose that, since many persons prefer the small probability of a large gain to the large probability of a small loss, and since some of these persons are creative as well, there exists enough potential creativity to be triggered by aggressive action against unsafety, the removal of which is likely to be quite profitable to the creator.

A somewhat parallel argument supporting aggressive public action against sources of unsafety may be based upon the dangers to which man's great adaptability exposes him. For this adaptability enables man "to become adjusted to conditions and habits which will eventually destroy the values most characteristic of human life." Men tend to adjust to ever more undesirable conditions. "The lowest common denominators of existence tend to become the accepted criteria, merely for the sake of a gray and anonymous peace or tranquility."⁸ A case in point is modern man's overadaptation to noise and its dangers. Yet this noise can be prevented through the imposition of limitations upon its generation.

II

SAFETY DEFINED

Having dealt with the role of choice in general, we must define safety in order to lay a groundwork for our analysis. Safety is easily defined in general terms, but not so easily in particular terms. Defined generally, safety consists in freedom

⁵ This paragraph is based upon Hirschman, *The Principle of the Hiding Hand*, THE PUBLIC INTEREST, Winter 1967, at 10.

⁶ *Id.* at 13.

⁷ This case is not quite parallel in that the displaced persons may not be able to find employment elsewhere because wage rates have been pressed to too high a level by the state or a trade-union monopoly.

⁸ R. DUBOS, *MAN ADAPTING* 278, 279 (1965).

from the incidence of events that tend to produce harm and damage, or at least from the harm and damage that are normal sequelae to the incidence of these events. Thus safety against smallpox consists either in freedom from exposure to contact with its victims, as in a smallpox-free community, or in the freedom conferred by vaccination in the event of exposure to contact with sources of the disease.

While a general definition of safety may facilitate discourse, it can contribute little to analysis. One must define safety—let us call it S —more specifically, to designate freedom from specific kinds of harm and damage “caused” by a particular agency, say an arm broken by a motor car. We may, therefore, categorize safety S more or less finely. Thus, if we divide the universe of harm against which safety is sought into 500 categories, we may label the categories S_1, S_2, \dots, S_n , where n is 500. If S_1 designates a broken arm, we may further categorize it $S_{11}, S_{12}, \dots, S_{1j}$ where $1, 2, \dots, j$ designate the agencies assumed to “cause” broken arms. Should yet further subdivision be required, additional subscripts may be employed to identify the conditions isolated, say $S_{111}, S_{112}, \dots, S_{11m}$.

It is not possible to say except conjecturally what complete safety signifies in terms of the well-being of individuals. A state of complete safety is nonexistent just as is a state of zero safety. Indeed, achievement of a state of complete safety would entail waste of society's resources. We may, however, describe and perhaps measure the impact of an increase or a decrease in safety. We may imagine an individual situated at a chosen point on the highest preference function currently accessible to him. If safety is increased (decreased) he will move to a higher (lower) function at a corresponding point unless the price structure should also change. One can, therefore, put a value on the change in the degree of safety. Presumably, successive increments of safety add diminishing increments of well-being while successive decrements subtract increasing amounts of well-being from the level serving as a point of departure. Moreover, incremental costs of safety eventually rise faster than its incremental benefits; then further increase in safety is wasteful.

Safety, however broken down and specified, can seldom if ever be defined in absolute terms. For reasons touched upon later, we can seldom say that safety against some particular harm is complete where unity designates completeness. Safety may, in theory, range between 0 and 1.0 in a community. In practice, however, safety will range only between 0 and some positive value < 1.0 , say 0.8. We may then define unsafety U for a community, as $1-S$, and a particular kind of unsafety U_1 as $1-S_1$. In the individual case, of course, even though (say) $S_1 < 1.0$, the potential safety of any particular member of this community will lie between 0 and 1; for the value 0.8 is a probable value inferred from past experience and applicable to the whole community but not to any individual.

While the ruling or actual community value for (say) S_1 is 0.8, this value may be susceptible of increase. Let us call the actual community value S_1^a and the maximum attainable value S_1^m . If $S_1^a < S_1^m$ where $S_1^m = 0.9$, then the value of U_1 can be re-

duced from 0.2 to 0.1 and that of S_1 can be increased to 0.9. It does not follow, however, that it would pay to increase the value of S_1 from 0.8 to 0.9; doing this may require the absorption of scarce resources with alternative uses that are more significant than the stipulated increase in the value of S_1 . This case is but a species of a genus; it is seldom if ever *economically worthwhile* to undertake a hundred per cent realization of that which is *technologically possible*. It could never pay to make agriculture depend significantly upon desalinated water. Indeed, as Shakespeare remarked, "Striving to better, oft we mar what's well."

Normally, safety is conceived of in specific terms, of S_1 rather than of S . It is possible, however, to conceive of safety in general for a community, designating it as before by S . S is then arrived at by aggregation, but with allowance for interdependence among S_1, S_2 , etc. Then S^a would represent the aggregate of the actual values S^a_1, S^a_2 , etc., and S^m would designate the aggregate of the maximum values S^m_1, S^m_2 , etc.

Safety and unsafety may be expressed in subjective as well as in objective terms. Given enough information of the sort that exists and can be assembled, safety at the community level may be expressed in terms of probability, that is, in an objective measure of the relative frequency of S and U . This objective measure will completely determine the relevant conduct of individuals, however, only if the *belief* in safety coincides with its objective value and the significance of that value at the individual level. Moreover, even given the existence of an objective measure (the existence of which may be subject to doubt in a dynamic world), men may "entertain a *rational* preference for one belief over another" on "rational grounds other than statistical frequency."⁹ They can proceed from premises "to conclusions which are reasonable but not certain."¹⁰ If men are irrational or superstitious, the role of belief may be much more powerful. This is evident in primitive societies and in societies which harken readily to priestly promises and prospectuses devised by rhetors. Remarkable, for example, was the behavior of property-holders in eleventh-century Europe, moved by the rhetoric of Pope Urban II. Apparently counting upon material as well as spiritual gain from participation in the Crusade, they sold immobile property for a fraction of its then usual value and used the proceeds to purchase crusade-supporting mobile property at unusually high prices.¹¹ Even in modern and presumably more rational societies, untutored belief can play an important role. For example, there is a "folklore of accidents," and a widespread belief that "accidents somehow mysteriously defy any kind of systematic study beyond mere tabulation."¹² Even in the absence of folklore and in the presence of considerable information, the beliefs of men tend to differ. These differences produce

⁹ J.M. KEYNES, A TREATISE ON PROBABILITY 97 (1921). On the resemblance of some underwriting to making book, *see id.* at 22-23, 404-05.

¹⁰ *Id.* at 98.

¹¹ J. THOMPSON, AN ECONOMIC AND SOCIAL HISTORY OF THE MIDDLE AGES (300-1300) 392 (1928).

¹² W. HADDON, JR., E. SUCHMAN & D. KLEIN, ACCIDENT RESEARCH 6 (1964).

marked variation in the reactions of individuals to given safety situations. They also affect the assessments individuals make of the values to be put upon the amount of compensation C required to balance a given degree of unsafety U ; this is discussed below.

III

COMPENSATION

The well-being of any given¹³ individual is a function, *ceteris paribus*, of his personal safety, which is a function in turn of the value of his community's particular safety S_1 (or of S , if safety in general is under consideration). Suppose that the value of S_1 is 0.6 and that the maximum currently attainable value of S_1 (*i.e.*, S_1^m) is 0.8; then the well-being W associated with S_1 [*i.e.*, $W(S_1)$] is less than the well-being associated with S_1^m [*i.e.*, $W(S_1^m)$]. $W(S_1)$, when $S_1 = 0.6$, can be increased to $W(S_1^m)$ in two ways: (a) the value of S_1 can be increased (say) from 0.6 to 0.8; or (b) each individual can be compensated in such amount C_1 that the welfare associated with C_1 [*i.e.*, $W(C_1)$], when added to $W(S_1)$, is equivalent to $W(S_1^m)$. It may be possible, furthermore, to increase well-being enough so that it corresponds to what it would be if $S_1 = 1.0$. The economic choice posed is: does course (a) or course (b) cost more? The less expensive of the two courses is the preferable one.

Since the indifference map fixing the trade-offs between more (less) safety (*i.e.*, ΔS_1) and less (more) compensation (*i.e.*, ΔC_1) varies with each individual, no arrangement for compensation to offset U_1 will satisfy every member of a community in the same measure. Consider a community in which $S_1 = 0.8$ and $U_1 = 0.2$ and in which, therefore, U_1 is distributed over a small fraction of the community's population. Provision might then be made (say) for enough C_1 to counter-balance U_1 sufficiently to prevent U_1 from reducing welfare W at all, or more than a small amount below what $W(S_1)$ would be if $S_1 = 1.0$. The funds making C_1 possible will normally be provided under a risk-pooling and sharing arrangement, a joint voluntary insurance arrangement whereunder the actual or recognized loss in welfare associated with U_1 is shared. Most individuals prefer to bear the certain cost of a small insurance premium to the small chance of a large loss associated with the actual incidence of nonsafety, even though receipt of C_1 may be subject to the possibility of default on the part of the payer contractually responsible for C_1 .¹⁴

¹³ One is always tempted to say "representative" individual. Yet such an expression ignores the variation from individual to individual in reaction to a particular state of communal unsafety, even given similar information. See, e.g., Morgan, *Who Uses Seat Belts?*, 19 BEHAVIORAL SCIENCE 463 (1967). Of course, if a certain distribution of individual attitudes exists and the curve representing this distribution is stable, changes in the response of any one individual to changes in S may be used to indicate the nature of the response of a community to changes in its S .

¹⁴ While this pooling arrangement may or may not affect the degree of unsafety, U_1 , it probably reduces the financial reserves required to meet the money outlay made necessary by U_1 . It also reduces the real cost of "untoward contingencies," by diffusing their "consequences." It is "better for two men

IV

CAUSATION

Increasing the value of safety S_1 , S_2 , etc., calls for more specificity than does making provision for compensation required to offset unsafety $U_1 = (1-S_1)$. In the latter case, it is necessary only to know the probability of incidence of U_1 , together with the degree of compensation to be provided and the cost of administering the loss-sharing, risk-pooling arrangement. Increase of S_1 , on the contrary, calls for careful analysis of the circumstances with which S_1 and U_1 , respectively, are associated, that is, of the "causation" of S_1 and U_1 .

Application of the concept of causality in the field of behavioral science is very difficult, causal explanation itself being the product of nineteenth-century mechanics. It is most applicable in a very limited spatio-temporal context in which "as more and more intermediates are identified the causal connection is more and more fully specified." In relatively unlimited contexts, on the contrary, "causal explanation is correspondingly irrelevant."¹⁵ What is required is explanation, intelligibility.¹⁶ What is needed in respect of the study of safety and unsafety with the object of reducing U and increasing S is inquiry into the pattern of immediate antecedents and concomitants of S and U ; these will yield explanation.

The concepts of causation employed in law are of little use in the explanation of unsafety. For that matter, as economists have shown, the application of "causal" analysis to the effects of particular economic legislation upon economic behavior may reveal these effects to be negligible or even detrimental.¹⁷ Concepts of legal causation may, however, contribute to the devising of means to reduce unsafety U . These concepts focus attention upon the roles of human agents in chains of "causation" and help to impute responsibility or irresponsibility for U to these agents.¹⁸ These concepts may, therefore, contribute to the erection of safety-increasing arrangements, for they direct attention to purpose, to purposive behavior, the manipulation of which by economic and other means can, within limits, reduce the magnitude of U (*i.e.*, $1-S$).¹⁹

to lose one eye than for one to lose two," for many to be wounded than a few to be killed. See F. KNIGHT, *RISK, UNCERTAINTY, AND PROFIT* (1921). On the impact of diversity of tastes upon the demand for insurance, see Pauly, *The Economics of Moral Hazard: Comment*, 58 AM. ECON. REV. 531 (1958).

¹⁵ Kaplan, *Noncausal Explanation*, in CAUSE AND EFFECT 145, 146 (D. Lerner ed. 1965).

¹⁶ *Id.* at 147-48.

¹⁷ *E.g.*, Stigler & Friedland, *What Can Regulators Regulate? The Case of Electricity*, 5 J. LAW & ECON. 1 (1962).

¹⁸ Golding, *Causation in the Law*, 59 J. PHILOSOPHY 85 (1967); H.L.A. HART & A. HONORÉ, *CAUSATION IN THE LAW* (1959); H.M. Hart, Jr. & J. McNaughton, *Some Aspects of Evidence and Inference in the Law*, in EVIDENCE AND INFERENCE 48 (D. Lerner ed. 1959). Legal changes may promote allocative efficiency. Mishan, *Pareto Optimality and the Law*, 19 OXFORD ECON. PAPERS 276 (1967). See also Fuller, *Freedom as a Problem of Allocating Choice*, 112 AM. PHIL. SOC'Y PROCEEDINGS 101 (1968).

M.S. Schulzinger concludes that while a satisfactory theory of accident causation has not yet been evolved, "nearly all the causative factors of accidents ultimately relate to the human factor." M. SCHULZINGER, *THE ACCIDENT SYNDROME* 15 (1956).

¹⁹ On purpose, see Kaplan, *supra* note 15, at 152-53; see also Feuer's discussion of interventionism in

It is seldom easy and cheap to reduce unsafety U and increase safety S ($= 1-U$). Unsafety is of diverse origin, human (e.g., riot), nonhuman (e.g., earthquake), or both. The genesis is more likely to be complex than simple. Thus, unsafety may be the product of chance intersection of causal chains.²⁰ Often it is the result of a tendency for small circumstances to become conjoined in time and space. Auto accidents are illustrative. It is often alleged that high-speed driving is a major "cause" of serious accidents. In fact, however, according to one inquiry, fatal accidents are largely the result of a teaming up of small things. "A list of the causes of any hundred fatal accidents would run over two hundred items."²¹ "Safety campaigns" based on false assumptions can, therefore, be "a menace," serving only to "add another disturbing" ingredient to the complex of elements generating highway problems. There is even "evidence that lowering speed limits tends to *induce* accidents, whilst raising the limits prevents them."²² Only detailed study of a particular kind of unsafety can disclose its genesis and reveal whether it is the product of easily isolated agents, of conjunctions of small factors, or of sets of occurrences that are not reducible to terms of simple "causation" and individual responsibility. Irresponsible behavior is, of course, a frequently contributing element even as the doctrine of "contributory negligence" holds. What is important for the present discussion, however, is not the complexity of the explanations of a great deal of unsafety but their bearing upon the cost of increasing safety and upon modes of dealing with the issues involved.²³

Any discussion of "causation" must take into account the negative and the positive contributions of the state and its agencies to safety and unsafety. These contributions help to shape the environment within which safety-affecting behavior takes place. The state may fail to act, it may stress the unimportant at the expense of the important, and it may generate unsafety as such. Typical of failure by the state to augment safety when it could is illustrated by its action in respect of X-ray exposure, of inadequate supervision of clinical laboratories as well as of the use of DDT, of radioactive fallout, and of failure to provide adequate air-traffic control. Thus, dispersed radioactive fallout may eventually become concentrated again in milk and afflict the thyroid glands of children. Again, it is said that 3,500 to 30,000 deaths occur yearly because of the cumulative effects of radiation associated with

Causality in the Social Sciences, in CAUSE AND EFFECT, *supra* note 15, at 191. See also E. NAGEL, *THE STRUCTURE OF SCIENCE* 24-25, 402-03, 554-55 (1961).

²⁰ E. NAGEL, *supra* note 19, at 326-29. Some of the chains described in T. WILDER, *THE BRIDGE OF SAN LUIS REY* (1927), are illustrative.

²¹ Schwartz, *The Case for Fast Drivers*, HARPER'S MAGAZINE, Sept. 1963, at 65, 68. The courts may, however, be on the verge of holding automobile manufacturers liable for accidents associated with speeding. TIME, Aug. 25, 1967, at 48. Bartenders may incur liability for accidents if they permit drinking to excess by drivers of cars.

²² Schwartz, *supra* note 21, at 65-66, 67.

²³ Aspects of accident causation are dealt with in W. HADDON *et al.*, *supra* note 12, and M. SCHULZINGER, *supra* note 18.

therapeutic diagnosis in which the radiation hazard commonly runs from several to one hundred times what it need be. This unnecessary multiplication of hazard could be prevented through appropriate regulation of personnel and equipment.²⁴ Also representative, though more difficult to cope with, is unsafety connected with air travel. This unsafety is associated in part with traffic density, itself a consequence both of urban conglomeration financed in part by government and of the failure of Congress, together with its agencies, to take sufficient corrective action or force the responsible airlines to take action.²⁵ It is even possible that the state, by enacting employment-limiting minimum-wage laws and related measures, has worsened the health of many denied both work and therapeutic substitutes for work. It is possible also that the state, by enforcing unduly restrictive licensure provisions within the area of medical service, has sufficiently reduced the number of medical personnel to offset the effect of increase in quality and has thereby argumented the number of days of illness per person above the attainable level.

What appear to be instances of stressing the less important at the expense of the more important may also be noted. Illustrative is the prolongation of the lives of the physically helpless, or the heavy emphasis put upon the association of relatively high mortality with the use of cigarettes. Comparison of the costs and results of this campaign, initiated largely by the Public Health Service, with what the same outlay could do if spent in other health areas, might reveal the latter use to be preferable. Concentration of scientists on \$50 billion post-Apollo space programs as well as on weaponry in the name of man's safety reduces emphasis upon biomedical science and man's biological health²⁶ even as heavy expenditure upon delusory civil defense and admittedly ineffective defenses against long-range missiles diverts resources from safety-increasing areas of investment. Concentration on time-consuming and minority-affecting organ transplants or on the reduction of unsafety associated with less important diseases, usually in response to the ballyhoo of television "personalities" and the misdirected gifts of governments and the gullible,

²⁴ See, e.g., Nader, *X-Ray Exposures*, NEW REPUBLIC, Sept. 2, 1967, at 11; see also TIME, Sept. 8, 1967, at 69. Various destructive chain reactions are described by Barry Commoner in *SCIENCE AND SURVIVAL* (1966).

²⁵ Years must pass before the fancy solutions put forward by so-called experts can ease the impact of density in some metropolitan areas, should that prove possible at all. Indeed, the introduction of giant planes will probably increase density and the annual air death toll. See U.S. NEWS & WORLD REPORT, Jan. 1, 1968, at 54; TIME, Sept. 8, 1967, at 56; Ridgeway, *Air Accidents*, NEW REPUBLIC, Aug. 5, 1967, at 12. "Congress was horrified when three astronauts were asphyxiated and died in a fire on the launch pad"; its pressure promptly brought about corrective action. This same Congress has remained insensitive to hundreds of deaths (perhaps because they may not be "in the line of duty") caused by essentially preventable air accidents, among them those caused by private planes. *Id.* at 13. An unstatistically minded federal government "seems intent on supporting the expansion and maintenance of 200,000 private planes in this 'rich man's' private fleet at the expense, both in terms of money and lives, of the millions of people who ride on the 2,000 commercial airliners." Near Miss, NEW REPUBLIC, Aug. 19, 1967, at 8. See generally Fromm, *Aviation Safety*, in this symposium, p. 590; NATIONAL ACADEMY OF ENGINEERING, *CIVIL AVIATION RESEARCH AND DEVELOPMENT: AN ASSESSMENT OF FEDERAL INVOLVEMENT* (1968).

²⁶ See, e.g., A. WEINBERG, *REFLECTIONS ON BIG SCIENCE* (1967).

may augment the unsafety associated with important diseases.²⁷ Asymmetrical expenditure such as that upon death control unaccompanied by compensating expenditure upon birth control may tend to generate more illfare than welfare.

Government subsidization of supersonic transport illustrates how the state can produce situations unfavorable to safety. The federal government is contributing several billions to this project and, should it finally materialize, will be under pressure to contribute many more billions to the accommodation of airport facilities for use by this dinosaurian craft. This aircraft will dump a thunderous sonic boom upon people in a fifty to sixty mile path below the plane, causing extensive damage to health and property. This prospect, together with the failure of the plane's architects to do anything effective to meet it, apparently is receiving little attention from the very governmental agencies that are promoting the project.²⁸ These, along with congressional spokesmen for aviation interests, appear to be more concerned for the profits of a few than for the comfort and safety of millions of citizens. One might also point to a somewhat similar relationship between the interests of a few and the safety of the many, manifest in the pursuit of foreign policies by a sequestered few in the executive branch of governments, in greater or less disregard of the probable impact of these policies upon the health and safety of the underlying population. Some, though not all, of the situations in which a state has become on balance a source of unsafety is largely a joint product of two sets of conditions: (a) uncertainties associated with the impact of the twentieth-century technological revolution upon man's physical and social environment; and (b) continuation of the political control of this environment in the hands of special interests and of public personages whose training, legal and otherwise, is unsuited to coping with this impact.

IV

DYNAMIC VERSUS STATIC SOCIETIES

Reconciling the search after safety with the search for progress is conditioned by how dynamic a society is, and by how long it takes a chain reaction to eventuate in injury of the innocent. When a society is dynamic, the rule of legal precedent, however important,²⁹ tends to become less binding in respect to matters of safety as well as to other matters, particularly if the rule in question relates in some measure to substance instead of to the mode of dealing with substance. In Blackstone's still

²⁷ See, e.g., Rottenberg, *The Allocation of Biomedical Research*, 57 AM. ECON. REV. (PAPERS AND PROCEEDINGS) 109 (1967), and Klarman's comments, *id.* at 151.

²⁸ Samuelson, *The SST and the Government: Critics Shout into a Vacuum*, 157 SCIENCE 1146-51 (1967); Enke, *Government-Industry Development of a Commercial Supersonic Transport*, 57 AM. ECON. REV. (PAPERS AND PROCEEDINGS) 71 (1967), and Moore's comments, *id.* at 102. On an uncirculated secret report critical of the SST, see Evans & Novak, *The SST Coverup*, Washington Post, Aug. 10, 1967, at A17, col. 1. See also Lardner, *Supersonic Scandal*, NEW REPUBLIC, March 16, 1968, at 13; NATIONAL ACADEMY OF ENGINEERING, *supra* note 25.

²⁹ On the importance of relative constancy of law through time, see L. FULLER, *THE MORALITY OF LAW* 79-81 (1964).

static England, "the duty of the judge" was "to abide by former precedents,"³⁰ and even in America *stare decisis* long remained both a "moral" and a "legal obligation."³¹ Yet in this century the grip of *stare decisis* has been relaxed through the multiplication of cases and situations in which the principle is difficult to apply.³² The opportunity for flexible policy thus exists.

Turning from legal to economic aspects of dynamics, we may say, perhaps with some exaggeration, that if an economy is static, cumulating experience may finally render nearly all change foreseeable, or at least expressible in terms of probability. Ignorance diminishes and with it uncertainty in the sense of that which is non-predictable, actuarially or otherwise.³³ In such a static or nondynamic society, it is reasoned, the future, together with expectations warranted thereby, would be sufficiently foreseeable or assessible in actuarial terms to permit entrepreneurs to estimate costs and returns and hence to hire and pay inputs in keeping with their productivity. A principal result would be that no residual "profits" or "losses" would emerge.³⁴ Moreover, even should this society become subject to change that was *foreseeable*, uncertainty would still be absent and the outcome would be the same.³⁵ In a nonstatic society subject to change that is neither foreseeable nor susceptible of reduction to actuarial terms, ignorance of the future is great, and uncertainty is present everywhere and incident in some degree upon each and all except insofar as it has been shifted to specialists in uncertainty-bearing³⁶ who experience either "profit" or "loss."³⁷

While searchers after explanations of the emergence of profit were the first to distinguish analytically between dynamic and static societies and between societies relatively free of uncertainty and those ridden with it, the distinction is quite important for the analysis of safety, unsafety, and policies pertinent thereto. It is true, of course, that Knight's analysis, including his distinction between "risk" and

³⁰ T. HOLLAND, *THE ELEMENTS OF JURISPRUDENCE* 69 (12th ed. 1917), citing 1 BLACKSTONE, *COMMENTS* 69 (2d Am. ed. 1799). But even Blackstone recognized that "this rule admits of exception, where the former determination is most evidently contrary to reason. . . ." *Id.* at 70.

³¹ Larremore, *Stare Decisis and Contractual Rights*, 22 HARV. L. REV. 182, 189 (1908).

³² Hamilton, *Judicial Process*, 7 ENCYC. SOC. SCI. 452 (1932).

³³ The presence of "runs" makes very long periods essential to the correct determination of any "normal" actuarial values. 1 W. FELLER, *AN INTRODUCTION TO PROBABILITY THEORY AND ITS APPLICATIONS* 67-69, 83-85 (2d ed. 1960). When "chance fluctuations" involve "cumulative effects," the results of stochastic processes "should serve as a warning to those who are prone to discern secular trends and deviations from average norms." *Id.* at 68.

³⁴ See F. KNIGHT, *supra* note 14, pts. 1 and 2.

³⁵ *Id.*, ch. 5. As noted, even in an essentially static society, a priori and a posteriori probabilities may not coincide, with the result that what appear to be trends but are not trends may be suggested by the data. 1 W. FELLER, *supra* note 33, at 67-68, 83-85.

³⁶ F. KNIGHT, *supra* note 14, pt. 3. Uncertainty seldom can be entirely shifted; whence nearly every income includes an element of profit. *Id.* at 366-67.

³⁷ "Change according to a known law does not give rise to profit, nor does risk if measurable, since it can be eliminated by insurance or some equivalent device." *Id.* at xi. When uncertainty rules, and "risks," being "chiefly of the nature of chances of errors in judgment," are "not measurable, because too unique to form into classes," "profit" or "loss" emerges. *Id.* at xiii.

"uncertainty," is considered defective.³⁸ It is also true, however, that, since man's world is ridden with uncertainty, he must carefully consider the consequences likely to ensue if he responds to uncertainty in one way rather than another. Alternatives need to be ordered in terms of their relative desirability,³⁹ and societies need to be equipped with institutions capable of coping with uncertainty, though not at the expense of salutary change and progress.⁴⁰ Modern worlds as well as the homosphere are shot through not only with "chance" conjunctures and stochastic processes but also with organized and deliberate efforts to produce change and bring into being new genera as well as new species of goods and services. The outcomes are predictable only in part, since novelty and serendipity are always present.

The dynamic character of modern society makes it much more difficult to deal with safety and unsafety in terms of controlling *U* optimally and establishing legal precedents well adapted to continuing optimality. When uncertainty reigns, it is often difficult to foresee the consequences of measures, among them those designed to increase safety, and this difficulty tends to be accentuated when externalities are present. The sources of unsafety may be inconspicuous if, after the manner of the slowly grinding mills of the gods, they generate unsafety at a low rate and with accumulating but delayed impact; yet in time they can give rise to much harm and damage. Illustrative are possible effects of upsetting ecological balance by destroying certain types or strains of life, but without making provision for counterbalancing the adverse effects of this destruction. Potentially illustrative is the fact that man is almost on the verge of being able to "program his own cells with synthetic information," though lacking in capacity to put this knowledge to optimal use.⁴¹ Man's very attempts at eradicating disease may backfire by giving rise to adverse effects that balance or outweigh the beneficial effects of the eradication program.⁴² Similarly, his efforts at riverine flood control may increase unsafety along seacoasts. Even in the realm of crime control, outcomes may differ from intentions. Thus, augmenting the security of criminals may diminish that of productive members of society—impose new costs of self-protection on citizens, and reduce the return on investment in law enforcement. Similarly, coddling rioters clearly jeopardizes the life and property of the law-abiding in the short run,⁴³ but the alternative of escalating or failing to de-escalate violence in our cities may in the long run generate new hostilities and new insecurity for all citizens; optimality of long- and short-run costs and benefits

³⁸ Arrow, *supra* note 2, at 404, 417-18, 426-28.

³⁹ See discussion in *id.* at 405-06, 434-35; see also Arrow, *supra* note 1, at 1, 4-6.

⁴⁰ See F. KNIGHT, *supra* note 14, ch. 12. Today much thought is being given to the future, but the findings have not yet become specified enough to permit much evasion of uncertainty, even by large enterprises. See, e.g., THE FUTURIST, a journal started in 1967; the Summer 1967 issue of DAEDALUS devoted to the year 2000; H. KAHN & A. WIENER, THE YEAR 2000 (1967).

⁴¹ See editorial entitled *Will Society be Prepared*, 157 SCIENCE 633 (1967).

⁴² Barlow, *The Economic Effects of Malaria Eradication*, 57 AM. ECON. REV. (PAPERS AND PROCEEDINGS) 130 (1967), and Newman's comments, *id.* at 155.

⁴³ See, *Who Pays for Riots*, TIME, Aug. 4, 1967, at 68. Riot insurance is becoming more costly and/or unavailable.

is again the goal to be sought, and one must count *all* the costs including those attributable to lost respect for the effectiveness of law and law enforcement and to the reactions of law-abiding citizens to apparent toleration of threats to their safety. As another dismal byproduct of a constitutionally derived luxury that may cost us more in unsafety than we realize we may note the irresponsible news and entertainment media, ever wrapped in the white robes of "freedom of the press" as they generate mass violence.⁴⁴

Man lives in a world not only dominated by uncertainty but also bound together by economic, ecological, and various other ties of interdependence. As a result, changes in any one sector are likely to produce changes, good or bad, in other sectors. Some of these changes are quite unpredictable; one cannot always foretell whether an increase in short-run safety is being purchased at the expense of long-run safety. Yet risks must be undertaken in the hope that the aggregate of well-being will be increased. A ship captain cannot, Thomas Aquinas long ago remarked, avoid navigation merely in order to preserve his ship.⁴⁵

V

EXTERNALITIES

The matter of externalities was raised in 1859 by John Stuart Mill when he distinguished between self-regarding and other-regarding actions and declared only the latter to be subject to the jurisdiction of society.⁴⁶ On Mill's principle, should an individual allegedly endanger his life-expectancy by smoking cigarettes, the decision to smoke or not to smoke is his own, not that of any external agency.⁴⁷ It is questionable, therefore, except from the point of view of a contingent-fee lawyer, to hold a cigarette company liable for a smoker's death from a cancer not certainly traceable to any one cause, among them smoking, which an individual does voluntarily even after a link between smoking and cancer has been alleged. More generally, when an individual's actions affect only his own safety, the actions in question are entirely within his own jurisdiction. This is not so when others are affected; then the actor may be required to suspend his actions or negotiate with the affected persons regarding just compensation for their actual or possible injury. Mill would hardly have endorsed the doctrine that drunkenness, glue sniffing, or use of marijuana or

⁴⁴ See Methwin, *Mass Media and Mass Violence*, NEW LEADER, Jan. 15, 1968, at 6.

⁴⁵ SUMMA THEOLOGICA, pt. I-II, q. 2, art. 5. See L. FULLER, *supra* note 29, at 185.

⁴⁶ "As soon as any part of a person's conduct affects prejudicially the interests of others, society has jurisdiction over it, and the question whether the general welfare will or will not be promoted by interfering with it, becomes open to discussion. But there is no room for entertaining any such question when a person's conduct affects the interests of no persons besides himself, or needs not affect them In all such cases, there should be perfect freedom, legal and social, to do the action and stand the consequences."

J.S. MILL, ON LIBERTY 372 (P. Wheelwright ed. 1935). There is not involved here limitation upon the range of choice to which the individual often is subject. See FULLER, *supra* note 18.

⁴⁷ To those who would point to the security of the smoker's family, Mill would probably have noted that exposure to higher mortality can be offset by carrying more insurance.

LSD somehow frees individuals of *full* responsibility for their actions while under the influence of these intoxicants or drugs. He would have noted that which the courts and juries often overlook, namely that an individual is fully responsible when he begins to drink to excess and thus sets in motion a stream of actions which eventuate in harm to others.

Policies respecting safety and unsafety must, as Mill implied, take into account externalities when these exist. They are present when either costs, including unsafety U , or benefits, including safety $S(= 1-U)$, or both, are incident in part upon individuals who are not parties to the transactions or contractual or other arrangements that give rise to these costs and benefits. If unsafety (safety) were an entirely random product, the result of many small actions, or the product of the specifically imputable behavior of one or more individuals, and if its disadvantages (advantages) were widely dispersed in very small quantities, or were incident entirely upon the responsible source, the subject of externalities might be ignored. But they are present in all societies, and above all in dynamic modern societies in which many ties bind men together and many channels carry afar both slowly-maturing and rapidly-developing consequences of what superficially appear to be relatively localized actions. Quite illustrative are the actions which have polluted man's environment until now (*e.g.*, spread of DDT; effects of seawater pollution). It is said that it will take thirty years and \$300 billion to make air and water clean in the United States. Who foresaw in 1932 that opening a deep Welland Ship Canal would eventually pollute the beaches and damage the fishing industry of Lake Michigan? And, had it been foreseen, would corrective measures have been taken, since at the time neither the principle of private property nor an alternative set of rules was operative? Today, actions reducing salinity and deepening channels are making the Suez Canal a channel for marine life that could produce catastrophic results among the fauna of the Mediterranean by 1970.⁴⁸ As of now, adverse effects of the sort just described tend to be viewed as fortuitous byproducts of action rather than as foreseeable risks susceptible to rational calculation and hence subject to remedy under the law of torts or under an appropriate set of arrangements designed to parallel the law of torts. Some sort of protection against excessive use of herbicides and unnecessary food irradiation may also be indicated.

When externalities exist, those with whom unsafety or safety originates bear only some of the costs or reap only some of the rewards of their safety-affecting activity. In consequence, too much unsafety and too little safety tends to be generated. Illustrative in a variety of ways is the pollution inflicted on innocent parties by manufacturers, public agencies, private households, and others.⁴⁹

⁴⁸ Gunnar Thorson's forecast in an address given before a conference on marine biology at Duke University, reported in the *Durham Morning Herald*, Sept. 17, 1967, at 6A, col. 1. See also Rubinoff, *Central American Sea-Level Canal: Possible Biological Effects*, 161 *SCIENCE* 857 (1968).

⁴⁹ On the nature of the externalities problem see Copeland, *Communities of Economic Interest and the Price System*, in *THE TREND OF ECONOMICS* 105 (R. Tugwell ed. 1925). On pollution viewed as an externality see *CONTROLLING POLLUTION* (M. Goldman ed. 1967).

Turning now to the externality component of safety-affecting actions, we may order them over a range running from cases in which externalities are negligible, through a stretch of cases in which externalities are of significant magnitude, to cases in which safety is or approximates a public good and unsafety is or approximates a *negative public good*. Negligible cases may be ignored on economic grounds alone. The intermediate stretch of cases is subject to corrective intervention if such action is possible and the cost of intervention falls sufficiently short of the rectificatory benefits produced. When, however, the benefits of safety or the disadvantages of unsafety are *collective* in nature, governmental supplementation of market forces may no longer prove adequate. For then safety cannot be marketed to individuals at prices which equal or fall short of the marginal valuation the beneficiaries set upon particular quantities of "safety" or of "avoidance of unsafety." The amount of "safety" consumed by A does not limit the quantity available for consumption by B; each consumes the same amount even though A may place a higher marginal valuation upon this amount than does B. Under the circumstances, therefore, safety is a product available to all persons subject to its incidence. Illustrative is the safety supplied through flood-control measures, or the unsafety generated by the state or by large-scale enterprises.⁵⁰

Unsafety assumes the form of a *negative public good* when it is generated or fostered by the state, by one of its agencies, by a city, or by a large corporation deriving support from the state. Mention has already been made of supersonic transport and of large-volume pollution of air and water. Underlying such welfare-reducing actions by the state is the shortage of technical personnel capable of estimating the consequences of technological change and informing the Congress and its agencies accordingly. This shortage leads to imperfect analysis of safety-affecting problems by governmental agencies⁵¹ and makes members of Congress, few of whom are technologically competent, more amenable to the Circean whispers of special interests.⁵²

VI

SAFETY AND THE MARKET

Safety may be treated as a resource-absorbing commodity or service. Its production therefore involves the allocation of resources to the production of safety and the allocation of the resulting safety to those in need of it and entitled to it because they

⁵⁰ On externalities see W. BAUMOL, *Economic Theory and Operations Analysis* 368 (2d ed. 1965); Bator, *The Anatomy of Market Failure*, 72 Q. J. ECON. 351 (1958); R. MUSGRAVE, *The Theory of Public Finance*, pts. I-II (1959); Samuelson, *Aspects of Public Expenditure Theories*, 40 REV. ECON. & STATISTICS 332 (1958). See also, *New Thrill for Motorists*, NEW REPUBLIC, Oct. 5, 1968, at 6, discussing the threat to safety posed by the "truck-train" bill pending before Congress.

⁵¹ See, e.g., *Report Whitewashes Blackout*, INDUSTRIAL RESEARCH, Sept. 1967, at 18, on the lack of technical sophistication in the Federal Power Commission's report on the 1965 northeast blackout. See also, *Why the Power Failures and Why More May Come*, U.S. NEWS & WORLD REPORT, June 19, 1967, at 76.

⁵² On Congress's lack of technical counsel, see Costi, *Who Tells Congress About Technology*, INDUSTRIAL RESEARCH, Sept. 1967, at 78.

have paid for it in some fashion. These two allocative functions can be performed, at least suppositiously, by the market, through other institutional arrangements, or through a combination of these two means. The object of allocation is to produce safety in the right amount, supply this amount as cheaply as possible, and allocate it appropriately.

Provision of compensation against the incidence of unsafety is much more suited to regulation by the market than the allocation of safety. Compensation is sold in units, at a price per unit, and in keeping roughly with the actuarial cost of the prospectively incident unsafety. The purchaser of compensation can, within limits, purchase as much potential compensation as he desires, given his estimate both of his financial needs if harmed and of his vulnerability to the incidence of unsafety. Exchange of premium for protection can, therefore, generate reciprocity.⁵³

The market accessible to suppliers and demanders of safety cannot establish reciprocity between them, both because of externalities and because of discontinuities in the supply of safety and the demand for it. The market can, however, supply much information relevant both to the optimum provision of safety and to the institutionalization of rules insuring the equitable and the economic administration of compensation. Indeed, given the costs of safety and the demand for it, an efficient market would determine what amount of safety is optimal, compatibly with the terms on which compensation for harm is to be had.⁵⁴ These terms may, however, prove inordinately costly as is the U.S. auto-insurance system, best described as a model of expensive inefficiency. Under this system only \$1 in compensation is paid victims for each \$2.20 in premiums and taxes; contingent-fee and other lawyers, together with overhead, eat up the rest.⁵⁵

Safety is not costless. Providing it absorbs scarce resources which have alternative uses; these constitute the *visible* costs of safety. The visible cost of producing any particular kind of safety is likely to rise as $S_1 (= 1 - U_1)$ increases, sometimes with the result that S_1 cannot be increased beyond some value less than unity. The provision of safety may also entail hidden costs, especially in a dynamic society when the "safety" in question is the result of the imposition of excessive controls upon man's inventive and innovative activities.

⁵³ See L. FULLER, *supra* note 29, ch. 1, on reciprocity and exchange, and the moralities of "aspiration" and "duty."

⁵⁴ Within limits such compensation is a substitute for safety. Its availability, together with the terms of availability, conditions the extent and the shape of the demand curve for a particular kind of safety. The degree of safety present, compatible with optimal resource use, will be affected by the price of a given amount of compensation which may affect the behavior of potential victims and by the amount for which agents responsible for experienced unsafety are liable. As S. Rottenberg shows, the economic conception of liability is more conducive to bringing about optimal safety than is the applicable rule of law. Rottenberg, *Liability in Law and Economics*, 55 AM. ECON. REV. 107 (1965). The economic rule equates liability with correctly computed loss.

⁵⁵ *The Business with 103 Million Unsatisfied Customers*, TIME, Jan. 26, 1968, at 20. "Contingent fees . . . now provide roughly one-third of the U.S. bar's total income." *Id.*; Graham, *To Speed Up Car Suits*, N.Y. Times, Feb. 18, 1968, § 4, p. 7, col. 1. See A. CONARD *et al.*, *AUTOMOBILE ACCIDENT COSTS AND PAYMENTS* (1964).

The visible costs of increments in safety may be approximated when it is the product of a single decision maker in, say, a plant in which the variability and hence the average quality of the human factor is roughly constant. Then both the costs of rendering equipment and physical environment more safe and of improving the performance of workers can be approximated.

It is more difficult to estimate the costs of safety when it is the joint product of two or more distinct decision makers. Consider the automobile or, for that matter, any comparable instrument. A car manufacturer can estimate the cost of adding safety-producing features to a car, but he cannot estimate how much the safety of his cars will be increased. For how safe a car is depends also, presumably in a major degree, upon the quality of the driver of this car and the nature of the environment in which it is driven. The cost of improving this combination is not easy to get at. It is possible, of course, to increase safety greatly and at little or no resource cost: (a) by denying the right to drive to any small fraction of drivers responsible for a relatively large fraction of the harm occasioned by cars and of the compensation paid victims by insurers; and (b) by adjusting premiums systematically to the degree of risk which a driver imposes on his insurer and hence thereby providing him with incentive to reduce this risk. These courses of action have not been taken; neither a rational system of driver-license denial nor an orderly set of safety-encouraging differential premiums has been introduced.⁵⁶ In fact, so unsatisfactory is the insurance system that some believe the federal government may take it over if it is not improved.

When safety is a public good, its aggregate cost is relatively easy to estimate, unless the good in question is a multipurpose one yielding other products as well as safety. Even so, the contribution to safety, together with its cost, can be estimated with reasonable accuracy.

Sometimes safety may be produced in several ways. Then the cheaper means is the one to be chosen. For example, relief for forms of urban pollution may be provided through the creation of a public instrumentality. Or the pollution may be prevented through use of a system of economic penalties and rewards under which the originators of the pollution are held responsible. The latter method is likely to be the preferable one.⁵⁷ Of course, if the pollution is the product of many small suppliers, the public instrumentality may be the only satisfactory means unless, as

⁵⁶ See TIME, *supra* note 54, at 21-22. The concept of accident proneness has been criticized by W. HADDON *et al.*, *supra* note 12, at 387-444, and by M. SCHULZINGER, *supra* note 18, at 13-14. But the TIME article herein cited reports a study which concluded that "if 20% of the country's drivers lost their licenses . . . the accident rate would go down 80%."

⁵⁷ See Krutilla, *Is Public Intervention in Water Resources Development Conducive to Economic Efficiency?*, 6 NATURAL RESOURCES J. 60 (1966); Krutilla, *An Economic Approach to Coping with Flood Damage*, 2 WATER RESOURCES RESEARCH 183 (1966); CONTROLLING POLLUTION (M. Goldman ed. 1967). On air pollution, much more difficult to cope with economically and legally, see generally Symposium, *Air Pollution Control*, 33 LAW & CONTEMP. PROB. 195 (1968); THE ECONOMICS OF AIR POLLUTION (H. Wolozin ed. 1966).

with automobiles, pollution-suppressing devices may be attached to the sources of the pollution.

Turning now to the *hidden* costs of safety. This category does not include costs described as externalities even though these may be hidden in the present or lurk in the future as developing sequelae to current safety-intending actions. I have in mind rather the fruits of scientific and technical progress which are prevented from being initiated and/or matured for fear that attempts at initiation or maturation will produce injury in the present. A case in point is the heavy penalizing or the actual prohibition of experimentation with, or therapeutic use of, drugs which may inflict injury in the present, even though in time they are very likely to be developed into widely effective therapeutic agents. A probable effect of such penalties and prohibitions is the prevention of scientific undertakings which, while they may bring injury or death to a few persons today, could in the end bring relief to tens of thousands. Here a statistical approach is indicated, coupled with a system of insurance that will adequately remunerate those injured today (or their survivors). It is absurd to deny an improved therapy to thousands for fear that a small number of persons seeking an untested form of such therapy today may suffer. Another case in point would be the rigid control of the use of contraception pills or devices on the ground that these allegedly had produced adverse effects in a few instances. Actions of the sort described are on a par with current judicial fetishism which seems to prefer liberty for a criminal few at the expense of the safety of the law-abiding multitude.

Estimating the demand for safety presents even more difficulties than estimating its cost. In a sense, something like an estimate is most easily had when safety is a public good supplied by an agency of the state or a large private collectivity. Then careful estimates need to be made of the supposed benefits as well as of the probable costs (*e.g.*, flood control, road improvement, health programs, and so forth).⁵⁸ When the aggregate value of the benefits sufficiently exceeds that of the costs, it may be inferred that the implicit rational demand is great enough to warrant the safety-producing undertaking. Of course, there is also a redistributive problem in that often many beneficiaries may escape bearing costs while nonbeneficiaries do bear them.

The demand for various kinds of safety is often widely dispersed, with the result that a collective demand for it does not become manifest unless mobilized by trade unions or other organized groups. Even then it is likely to be difficult to convert this sort of "demand" into a function connecting prices and quantities. A better notion of what persons are willing to pay for antidotes to unsafety may be derivable, as suggested earlier, from the degree to which they provide themselves with insurance to supply compensation in the event of harm flowing from unsafety. Given any kind of inferred demand curve for safety, it is likely to be inelastic in its lower reaches though subject to upward shifts as the incomes of potential buyers rise.

⁵⁸ See Prest & Turvey, *Cost-Benefit Analysis: A Survey*, 3 SURVEYS OF ECONOMIC THEORY 155 (1966).

It is probable that the demand for safety is overestimated, in part because in an uncertain world the possible adverse consequences of unsafety are underestimated. It is probable also that the cost of providing a high degree of safety is underestimated. Accordingly, had we explicit curves for particular kinds of safety, the point of equilibrium between supply and demand would probably fall quite short of the level one might infer from public discussion of safety and its promotion. Presumably much more attention needs to be given to the provision of compensation in the event of the incidence of unsafety.

Despite the difficulties that beset attempts to estimate the demand for particular kinds of safety, together with the costs of supplying this demand, it is desirable that these attempts be made. The economic motive usually is the most powerful of motives. It stimulates men to hold down unsafety and to increase safety compatibly with the cost of doing so and the willingness of safety-seekers to pay for safety.

CONCLUSION

This essay has been concerned with the role played by resource scarcity, the resulting costliness of safety, and the supposed demand for safety. It has been inferred that the demand for safety tends to be exaggerated while its cost tends to be underestimated, especially in a dynamic, scarcity-ridden world. It has been argued that too much is invested in less important forms of safety (*e.g.*, cigarettes, motor cars, control of less important diseases) and too little in more important forms. Greater dependence on economic motivation, it is inferred, would provide a more nearly optimal amount of safety. Greater recourse to the purchase of rights to compensation against harm from unsafety is also indicated, together with improved rules regarding the determination of eligibility to claims of various sorts. Recourse to economic motivation, it is suggested, reduces the dependence of the community upon ponderous, expensive, and sometimes ineffective public agencies.

Finally, three additional points were stressed. First, it was shown that in a dynamic world there is much uncertainty and the adverse effects of technological change are far flung. Commensurate preventive as well as compensatory measures are indicated. Second, the state itself is apt to be a major source of unsafety both because of what it does and because of the support it may give vast corporations and powerful pressures groups which are thus enabled to become sources of unsafety. Witness the failure of highway bureaucracies to adopt what appear to be economically justifiable and superior means to safety; or the actions of national leaders in unnecessarily exposing tens of millions to extermination in this age of potential megadeath; or the subjection of communities to experimentation at the hands of nonpragmatic "experts."⁵⁹ Third, it has been reasoned that a cost-benefit approach,

⁵⁹ See Posin, *Bureaucracy and Highway Safety*, NEW REPUBLIC, March 23, 1968, at 15; H. SACKMAN, COMPUTERS, SYSTEMS SCIENCE, AND EVOLVING SOCIETY (1967); see also R. LAPP, THE WEAPONS CULTURE (1968).

in keeping with economically correct marginal costs and benefits is the one most likely to result in the *right* amount of safety.

From what has been said it is evident that even the administration of criminal and/or civil justice can be made prohibitively and self-defeatingly costly. For example, when the conduct of criminal justice is made subject to more and more constraint, the cost of administering it and thereby guarding the safety of citizens rises commensurately, finally beyond the point at which resources are forthcoming to sustain this increase in costs. Up to this point a given degree of safety against criminal undertakings is maintained, albeit at rising cost, but beyond this point the degree of safety declines. At issue ultimately is how much "safety" is to be provided and how it is to be distributed among the groups composing society.

It is evident also that, with the steady growth of state intervention and the consequent exercise of the "power of eminent domain," a re-examination of what constitutes "just compensation" is very much in order. For, when the compensation provided by the state fails to counterbalance roughly the disabilities inflicted by the state upon the individual subjected to the power of eminent domain, he suffers the equivalent of an increase in unsafety. He is dislodged from a higher preference function and made to locate on a lower one. He suffers injury, and the injury may prove to be physical as well as mental. Yet there usually exists some amount of compensation that will offset his injury and restore him to the preference function on which he was originally lodged. Undoubtedly, if the state is made to pay full or nearly full compensation, pressure will be brought upon the agencies immediately responsible for the exercise of eminent domain to proceed in such fashion as to minimize the initial injury and hence the amount of compensation ultimately required. The final outcome would then probably be roughly equivalent to that which a free market might have produced. There are, of course, many considerations, including ethical principles, to be taken into account when resolving diverse problems of compensation. Even so, their resolution is bound to be greatly facilitated through as much recourse as possible to a free market or its analogue.⁶⁰

⁶⁰ For a splendid review of the issues and modes of resolution, see Michelman, *Property, Utility, and Fairness: Comments on the Ethical Foundations of "Just Compensation" Law*, 80 HARV. L. REV. 1165 (1967). See also *Dennison v. State*, 37 U.S.L.W. 2053 (N.Y. Ct. App., July 1, 1968).