ALTERNATIVES TO COST-BENEFIT ANALYSIS IN REGULATORY DECISIONS

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Cost-benefit analysis can be a useful tool, but some regulatory reformers would have us apply it as an indiscriminate, decision-making *rule*. I would like to offer some words of caution—on methodological flaws and on possible political misuse of the results—that may be summarized as follows:

- There are important differences between economic regulation and environmental, health, or safety regulation that must not be overlooked.
- Costs are easier to express than benefits, but their quantifiability makes them no more certain or reliable.
- Benefits include improved quality of life and good health as well as positive economic side-effects, but they defy accurate estimation and their recipients are not a well-organized lobbying group.
- The comparison of costs and benefits is beset by serious methodological difficulties and requires the analyst to make value-laden assumptions; yet cost-benefit analysis appears, deceptively, to be a neutral technique.
- Insistence on cost-benefit decision rules and other regulatory "reform" efforts may be undemocratic attempts to reorient legislative mandates.

Differences Between Economic Regulation and Regulation of Health, Safety, and the Environment

Economic regulation seeks to improve the working of the market for goods and services by encouraging competition, economic efficiency, and the diversity of available goods and services. Regulation addresses itself to this goal by attempting to ensure that the price mechanism operates efficiently to allocate goods and services properly among economic sectors and between producers and consumers. Economic regulation, properly carried out, is thereby expected to reduce the price of goods and services it seeks to regulate.

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Health, safety, and environmental regulation, on the other hand, attempts to ameliorate the adverse consequences of market activities, and technology in general, by reducing the attendant social costs. This regulation attempts to internalize the social costs of production by ensuring that the prices of goods and services reflect the true costs to the society. This means that prices in many cases can be expected to go up. Charles Schultze, in his now famous work with Alan Kneese entitled *Pollution, Prices, and Public Policy*, has cautioned us not to regard price rises that internalize social costs as inflationary.

The assumption that all price increases are inflationary (indeed, inflation was so defined by an early executive order of Gerald Ford) ignores the crucial distinction between economic and environmental regulation. With economic regulation, associated price increases may well be inflationary and an indication that government efforts need to be reexamined. But with environmental regulation, price increases may be a measure of success. Environmental regulation is not really an instrument of economic policy; it is an instrument of *social* policy concerned with the nature and distribution of the effects of industrial activity. Therefore, environmental regulation cannot be judged by economic criteria alone.

Even if such criteria are (inappropriately) used, inflation is still a phony issue in the national debate over environmental, health, and safety regulation. Actual estimates of the effects of such regulation on the Consumer Price Index—by several groups, including the President's Council on Wage and Price Stability and the Council on Environmental Quality—place the effect at well below 1% in a time of double-digit inflation.

Problems with Estimating the Costs of Regulation

It is often assumed that, because the costs of complying with regulation can be easily monetized, they are reliable estimates of true costs. Unfortunately, there are many instances in which the costs are not only uncertain, but unreliable. Agencies depend to a large extent on industry data to derive estimates of compliance costs. I do not believe I am being too unkind in questioning the bias of those estimates. The regulatory agencies themselves do not have access to the information concerning alternative products and processes, and resultant costs, which will enable them to come up with the best estimates of the costs of compliance. In addition, compliance cost estimates often fail to take three crucial issues into account: (1) economies of scale which inevitably arise in the demand-induced increase in the production of compliance technology; (2) the ability of a regulated industrial segment to learn over time to comply more cost-effectively— what the management scientists call the learning curve; and (3) compliance costs based on present technological capabilities ignore the crucial role played by technological

innovation, which yields benefits to both the regulated firm and to the public intended to be protected. Indeed, environmental regulation has been called "technology-forcing" by the courts and by analysts. The costs of compliance should not be based on static assumptions about the firm and its technology. Otherwise, a large overestimation will result.

An examination of the minimal effects of the OSHA vinyl chloride standard on the private sector is a striking example of how different the actual economic impacts can be, compared to ominous pre-regulation predictions, on the part of some analysts, of the economic demise of the industry.

Problems with Estimating the Health, Safety, and Environmental Benefits of Regulation

The state-of-the-art in estimating the number of cancers or cases of chronic disease prevented—or even injuries—is in its infancy. Many health professionals believe, because of the accepted view of the mechanisms of cancer causation, that there is no safe exposure to a carcinogen. Safe levels for chronic toxins which are not carcinogens are often derived from either acute human exposures or high-dose animal experiments. The extrapolation techniques to lower doses for chronic human exposure are imperfect. Therefore, benefit calculations for a particular maximum exposure level allowed under regulation are often not very meaningful. Theories of accident prediction do not serve us much better. We scarcely need to be reminded of the unanticipated risk that attended the incident at Three Mile Island, or the failure to predict design defects in the DC-10. Both costs and benefits of regulation are beset by uncertainty; however, the uncertainty attending the benefit calculations is usually very much larger.

It is fair to say that the state-of-the-art in benefit estimation is much less developed than the methodologies for calculating compliance costs.* In addition, there is no organized interest group that systematically pursues the benefit estimations in the same way in which the costs of compliance are researched. The tendency by analysts to rely on hard numbers places the estimation of benefits on insecure ground. Softer numbers are harder to believe.

Finally, it must be realized that the benefits derived from direct regulation are only a part of the benefits that can be derived from the regulatory process. Indirect, or *leveraged*, benefits are derived from the pressure of regulation to induce industry to deal preventively with unregulated hazards, to innovate, and to find ways to meet the public's

*The reader is referred to a recent review of the state-of-the-art of benefit estimation: "The Benefits of Environmental, Health, and Safety Regulations," Nicholas A. Ashford *et al.*, prepared for the Committee on Governmental Affairs, United States Senate, March 25, 1980.

need for a cleaner, healthier environment while maintaining industrial capacity. To put it another way, the positive side-effects accompanying regulation need to be included in a complete assessment of the effectiveness of the regulatory agency's strategies. An example of leveraging is apparent in the observation that chemical companies are now routinely conducting short-term tests on new chemicals for possible carcinogenic activity, even though no general regulatory requirement exists.

Problems in Comparing Costs and Benefits Within a Cost-Benefit Framework

Even if we could accurately estimate the amount of disease or injury prevented by regulation and the compliance costs of doing so, the tasks of (1) monetizing health benefits that may accrue far into the future (or even monetizing current safety benefits from reducing accidents) and (2) comparing those benefits to current compliance costs are fraught with difficulty. A human life or a lost limb does not have an established unique market value. Payments to workers to assume risky occupations prior to their being injured (an *ex ante* valuation) are different than the values placed on the injured workers by their families after the injuries have occurred (an *ex post* valuation). Which valuation is correct? The work of Fischhoff, Kasperson, Kunreuther, and others amply demonstrates the inability of people and firms to consistently value and assume long-term, low probability risks. These characteristics of risk assumption leave a market valuation of the benefits of regulation in great doubt.

There is another crucial problem with regard to valuation. The person who values or is willing to assume a risk assumes that risk in a way which reflects the bundle of economic goods he/she comes into the marketplace with. It is naive to talk about workers who sell their labor for their health. A worker sells his labor for his/her health cheaply if he/she does not have a large bundle of economic goods. On the supply side, the selling price is determined by the entire set of economic goods the worker has. If you think it is unfair for poor people to sell their labor more cheaply than wealthy people do, then you do not like the functioning of the market. If you do not care, then you are willing to allow the operation of that market mechanism. It comes down to the fundamental issue of the distribution of wealth. Economic efficiency reflects the maintenance of the current economic arrangements, and decisions made by the market are themselves value-laden. You cannot be indifferent to the distribution of wealth, and the fact is that the distribution of wealth determines at what price risk is assumed. To ignore equity is to consider equity irrelevant. Deciding what a life is worth by market criteria is value-laden itself.

Although this is changing, some analysts still insist on expressing health, safety, and environmental benefits in monetary terms. The successor index to evaluating a change of net social welfare in dollars is the benefit-to-cost ratio, e.g., the number of fatalities prevented per

dollar expended. The problem with this index is that it can never really be applied. The benefits of regulation include deaths prevented, diseases and injuries prevented, pain and suffering prevented, hospital costs prevented, etc. The benefit side of the equation is itself composed of many elements of different character. How do we decide how many serious injuries are equivalent to one death?

Other problems exist in comparing costs and benefits and they raise doubts about the usefulness of using traditional cost-benefit analysis as a decision-making tool in the regulatory area. Already discussed were the problem of correctly estimating compliance costs, the problem of monetizing benefits, and the problem of dealing with these kinds of valuations in the face of great uncertainty. An additional problem is discounting, over time, both the benefits and the costs. There are three different approaches to the discounting of non-monetizable benefits, such as the reduction of adverse health effects:

- discount the health benefits at the same discount rate used in the monetary benefit or cost calculations;
- discount the health benefits but at a lower discount rate than that used in the monetary benefit or cost calculations; or
- do not discount health benefits at all.

The first approach would apply the traditional present-discounted-value criterion to non-market items. This approach has the advantage of allowing parallel treatment of all costs and benefits. Any positive discount rate would value one year of health impairment saved in an early year higher than one year of impairment saved in later years. For example, if the discount rate is 7%, then one year of health impairment prevented today would be equivalent to 1.4 person-years of health impairment prevented in 5 years, or 2 person-years of health impairment prevented in 10 years, or 7.7 person-years of health impairment prevented in 30 years.

The second approach would allow for discounting of non-monetizable benefits, but at a lower discount rate. This approach can be defended in terms of a belief that certain amenities, such as health, become more valuable relative to other goods in this society as time passes and the standard of living improves. The following relationship would separate the factors affecting the present value of health impairment prevented in year n:

$$\frac{x(1+\epsilon)^n}{(1+r)^n}$$

where: x = metric, expressed in person-years of health impairment prevented in any one year

where: ϵ = fractional annual increase in value of health impairment prevented

r = annual discount rate

For small values of r and ϵ, this is equivalent to:

$$\frac{x}{(1 + r - \epsilon)^n}$$

Thus, the "effective" discount rate $(r - \epsilon)$ will be less than the discount rate used for monetary benefit or cost calculations. (Note that, in principle, if the society's valuation of health benefits increases rapidly, the effective discount rate for benefits could even be negative!)

The third approach would not discount non-monetizable benefits but simply leave them expressed in natural units with a note as to the time-distribution of their realization. The desirability of this approach can be seen from two considerations.

First, there is a question of the appropriateness of applying a discount rate to consequences of an action that has significant beneficial effects on future generations.† Clearly, any positive rate of discount will discriminate in favor of choices that involve adverse impacts on earlier generations but not on later ones. The benefits of environmental, health, and safety regulation often extend beyond the current generation who bear the monetary prevention costs. If the decision-maker is concerned with intergenerational equity then an argument could be made that the appropriate social rate of discount is zero (not including inflation).

Secondly, the "benefit" of removing a person now from risk of future damage, which is irreversible, inevitable, and non-arrestable once the risk exposure occurs, can be considered to be a present benefit—and quantified, for example, as the benefit of removing those presently at risk from future harm.

The manner in which the discounting problem is handled can alter the comparison of benefits and costs and render the use of a benefit-to-cost ratio as a decision rule highly suspect, even when used to decide between alternative regulatory strategies on health investments.

The present value of the net effects of any given regulation, or the *rank ordering* of the effects of alternative regulatory regimes, can change markedly depending upon the discount rate used in the cost-benefit calculation. For example, using a discount rate of zero for future health benefits (i.e., not discounting future health benefits) may make a regulatory choice tenable while using a discount rate for health benefits comparable to the discount rate for capital expenditures may show a proposal to be undesirable.‡ Further, since the consequences of many

†A complete adoption of this argument might not allow for discounting of costs where the benefits are received currently and the costs are incurred in later generations.

‡The problem is exacerbated when a market/institutionalized "price" exists for the health benefit. For example, an asbestos-using firm may either install a ventilation system today to get rid of asbestos or instead pay compensation costs 30 years from now when a worker develops cancer. What should the rational owner of a firm do? The owner can have the use of his money for 30 years, send a worker's children to school, bury him in a gold coffin, and still be ahead financially. Will traditional economic analysis provide a correct answer?

regulatory actions may be to impose compliance costs today in order to bring about health benefits far into the future, the choice of a discount rate can make one regulatory option look better or worse than an alternative, depending on the magnitude of the discount rate. Since there is no consensus on what that rate should be, the policymaker's preferences for a particular regulatory option can, but should not, be hidden in the choice of a discount rate.

An even more serious limitation of a simple comparison of costs and benefits is that it ignores the equity implications of the fact that the costs and benefits are often borne by different groups of people and firms. It should be noted that the aggregation of costs and benefits without consideration of equity is value-laden itself. It is a decision to ignore equity.

Finally, the comparisons of costs and benefits of a regulation must in turn be compared against what might have happened in the absence of that regulation. For example, if we were to estimate the benefits and costs of adopting a safety standard for a consumer product, we must ask whether the producer industry might not have made the product somewhat safer in the absence of regulation in response to increasing products liability suits in the courts. In this example, it would not be correct to attribute to regulation either all of the costs expended or all of the benefits conferred. What alternative scenario the evaluator chooses can, of course, make the actual regulation look better or worse. Unless we have an alternative universe that we can even begin to define for analytical purposes, evaluations of the effects of a regulation are on very shaky ground. These inherent limitations of cost-benefit analysis render these techniques highly suspect for social decision-making.

Alternatives to Cost-Benefit Analysis as a Decision Rule

There are a number of different benchmarks that the regulatory decision-maker might use to arrive at a particular strategy and hence be called on to defend. They include economic efficiency, cost-effectiveness, health-effectiveness, distributional consequences (equity), and specific mandates embodied in various pieces of legislation. In some legislation, the discretion on how to "balance" various considerations is broad; in others, it is more narrowly defined. In many instances, criticism of a particular decision to regulate is really a criticism of the balance struck by Congress in empowering an agency to act. Attacks on the FDA's ban of saccharin or on OSHA's standard for occupational exposure to benzene, for example, are really attacks on the legislative mandates. By asserting that a standard is not cost-effective or that it is too expensive, critics are attempting to force an evaluation of the proposed regulation against different benchmarks.

What emerges from an examination of Federal health, safety, and environmental regulations is that a rational decision-making process does, in fact, exist. The regulatory mandates require application of

considerably more sophisticated and appropriate decision rules than those which have been naively suggested as regulatory reforms by some critics. The factors which enter in are: (1) how serious the hazard is, (2) who the recipients of the costs and benefits are, (3) what costs of regulation are imposed on the *beneficiaries* of the regulation, and (4) how informed and voluntary the risk assumption is.

In general, it appears that agencies do consider the distributional and social cost consequences of regulation. For example, when given the choice between increasing the life expectancy of 10,000 workers/consumers by one year or increasing the longevity of 1,000 workers/consumers by eight years, an agency may choose to *avoid the more tragic event.* It may opt for the latter alternative although the number of man-years saved is not maximized. When given the choice between protecting 10,000 workers/consumers from a .1% chance of death or of protecting 100 workers/consumers from an 8% chance of death, an agency may similarly choose the second course even though health benefits are not maximized. In making these choices, the decision-maker considers the concern and loss that society feels when the more tragic events occur. Because health benefits are not maximized or because no unique decision rule exists does not mean these decisions are irrational.

Similarly, there is a requirement on the part of an agency concerned with health and safety for *minimizing equity regret.* Whenever a person is not fully compensated for a loss, a question of equity arises. Also, when a person is forced to incur losses that others are not selected to incur, this too is unfair. An agency may seek to *avoid unfairness.* For example, it is conceivable that asbestos might be banned from use as a brake lining with the result that more lives are lost on the highway (due to less braking effectiveness) than are saved in asbestos-manufacturing operations. The asbestos workers are, however, a non-voluntary, select group exposed to harm that others in society are not forced to incur. Community ties and family relations may restrict the worker's job mobility for generations and prevent them from leaving the group. Further, if asbestos workers are already a disadvantaged group in society, an additional equity consideration is brought to bear. A consideration of equity along all these lines might justify the increase in the loss of lives on the highway in fairness to the asbestos worker.

The fact that both costs and benefits may be characterized by different degrees of uncertainty has already been mentioned. Clearly, comparing point (single) estimates of costs and benefits is incorrect. Cost and benefit streams must be expressed as distributions, which is not usually possible with the data—especially the data for benefits. If the distribution of risks (health benefits that might be achieved by regulation) contains an especially sensitive subgroup of potential beneficiaries—e.g., children—the equity considerations may lead an agency or society to place a higher value on the regulation even though children represent a small subset of those at risk—a subset at the tails of the risk distribution.

The decision *rule* which environmental, health, and safety agencies try to follow represents a concern with equity for workers, consumers,

and society—and a desire to *minimize the regret* of not regulating a particular activity. This is accomplished by choosing among different hazards to regulate and by choosing a level of protection for a specific hazard which avoids small probabilities of large harm. While not necessarily maximizing the number of lives saved, these decisions are clearly not irrational—unless rationality is defined tautologically as a maximizing rule.

Assets of an agency's economic impact by groups such as the Council of Economic Advisors or the Council on Wage and Price Stability may really be strategies to reorient various legislative mandates to their own point of view. It is certainly undemocratic, if not dangerous, for our society to let any one group of people—whether scientists, lawyers, or economists—set national priorities, and we must try to avoid such a "tyranny of experts."

There are no facile rules of thumb, no quick fixes, no simple indices of correctness in environmental regulation. A search for a facile decision rule—imposing upon the regulatory decision makers a requirement to undertake analyses that are overly quantitative and restrictive—would in reality *absolve* regulators from accountability rather than force them to articulate the hard choices. What can be expressed in a cost-benefit equation is only a small part of the picture. Efforts to improve regulatory decision-making might best be focused on ensuring that government, workers, consumers, and industry have better access to information on the nature and extent of health hazards, and on the technological capabilities of industries to respond to regulatory controls.