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Does Risk Aversion Make a Case for Conservatism

Ralph M. Perhac Jr.

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Introduction

Conservatism is widely advocated and employed in risk assessment, and because risk assessment plays an ever-increasing role in environmental policy, it stands to have a profound effect on environmental policy and on the allocation of scarce resources. Despite its prevalence, the use of conservatism in risk assessment is controversial. It has been variously argued that conservatism is at odds with rational (i.e., expected-value) decision-making, distorts resource allocation and the pattern of regulation, and conflates risk assessment and risk management — and that the cumulative effect of conservative assumptions (even if individually acceptable) is an unacceptable level of conservatism.[1]

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1 *See, e.g.,* Daniel L. Maxim, *Problems Associated with the Use of Conservative Assumptions in Exposure and Risk Analysis,* in The Risk Assessment of Environmental and Human Health Hazards: A Text Book of Case Studies 526 (Dennis J. Paustenbach, ed. 1989); Bernard Goldstein, *The Problem with the Margin of Safety: Toward the Concept of Protection,* 10 Risk Anal. 7 (1990); Albert Nichols & Richard Zeckhauser, *The Perils of Prudence,* Regulation, Dec. 1986, at 13; Albert Nichols & Richard Zeckhauser, *The Dangers of Caution: Conservatism in Assessment and the Mismanagement of Risk,* in Advances in Applied Micro-Economics (V. Kerry Smith, ed. 1986); W. Kip Viscusi, Fatal Tradeoffs: Public and Private Responsibilities for Risk 157 (1992); Vincent T. Covello & Miley Merkhofer, Risk Assessment Methods: Approaches for Assessing Health and Environmental Risks 263 (1993); Chris Whipple, *Nonpessimistic Risk Assessment and de Minimis Risk as Risk Management Tools,* in The Risk Assessment of Environmental and Human Health Hazards..., *supra,* 1105.

A variety of arguments for conservatism exists.[2] Arguably the most important one proceeds from the premise that it is better to be safe with regard to human health and life than sorry. My concern does not lie with the wisdom of the premise itself but rather with the chain of reasoning that ostensibly leads from there to the conclusion that conservatism is advisable. Rarely, if ever, has this chain been subject to careful analysis.[3] If it should involve invalid inferences or conceptual flaws, a very powerful argument confronts advocates of conservatism — one that depends, not upon juxtaposing one set of value judgments against another, but upon logical and conceptual analysis. Further, any flaws which turn up affect very modest as well as extreme conservatism.

My aim is not, however, just to identify logical and conceptual flaws. It is to determine precisely what the case must be for this argument to go through. In fact, under restrictive conditions, a valid argument for conservatism can be made on the basis that it is better to be safe than sorry (validity concerns the chain of reasoning, but not the truth of the premises). A focus on logical structure means that I will not question any value judgments that might figure into the premises of the argument for conservatism, other than insisting on conceptual clarity. As important as these value judgments may be, a great deal can be gained simply from a clear understanding of the logical structure of an argument, the meaning of premises, and an understanding of what can and cannot be inferred from what. Too often debates about conservatism miss the mark precisely because of the lack of a clear understanding of these matters. Hence, I try to lay the logical and conceptual groundwork for more fruitful discussions of the merits of conservatism in risk assessment.

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2   Adam M. Finkel, *Has Risk Assessment Become Too "Conservative"?* in Resources, Summer 1989, at 11 Adam M. Finkel, *Is Risk Assessment Really Too Conservative? Revising the Revisionists,* 14 Colum. J. Env'l L. 427 (1989); Adam M. Finkel, *The Case for "Plausible Conservatism" in Choosing and Altering Defaults,* in National Research Council, Science and Judgment in Risk Assessment N-1-3 (1994).

3   An analysis of this sort is only hinted at in Nichols & Zeckhauser, *supra* note 2, *Perils of Prudence,* at 22.

Conservatism Defined

Conservatism involves a preference for erring on the side of overstating as opposed to understating risk under conditions of uncertainty. This preference is manifested in the use of risk estimates that exceed the mean (average) value of the probability distribution of the risk in question. The mean value, of course, is a measure of central tendency which (over repeated outcomes) tends neither to overstate or understate risk. Where a probability distribution is known, conservatism might involve selecting a risk estimate at the, say, 95th percentile — meaning there is a 95% chance that the actual risk[4] is overestimated and only a 5% chance that it is underestimated.[5]

It should be noted that I speak here of conservatism in the selection of risk estimates as shorthand for conservatism that can, and often does, enter the estimation of risk at numerous points by way of a variety of assumptions and parameters, not simply in the final selection of an estimate. Conservatism may enter the process in the selection of:[6]

1. Initial contaminant concentrations.
2. Physicochemical constants to describe the kinetics of contaminant transport.
3. Exposure frequency of humans to contaminants...
4. Human contact (uptake) rates...for alternative exposure pathways.
5. Bioavailability fractions (e.g., absorption rates through the skin).
6. Dose-response parameters and models.

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[4] Adam Finkel has suggested that the notion of "actual risk" is a pervasive misconception that contributes to misguided attacks on conservatism. Risk, he argues, is a fundamentally probabilistic notion, whereby the demand for actual risk estimates makes no sense; Colum. J. Env'l L., *supra* note 2, at 432.

But no one attacks conservatism because of the stochastic nature of the estimates it produces. Actual risk simply refers to the best possible characterization of a stochastic phenomena. Even advocates of conservatism are implicitly committed to the notion of actual risk, as their preference for erring on the side of overstating risk implies a point of reference, namely actual risk.

[5] It is possible that in a very skewed distribution the 95th percentile is also the mean, in which case the 95th percentile would not count as a conservative estimate as I am using the term. Of course, when proponents of conservatism advocate the use of the 95th percentile estimate, it is not in the belief or hope that it is the mean. They are fully prepared to overstate the mean estimate of risk.

[6] Maxim, *supra* note 1, at 532.

Risk Aversion and Empirical Asymmetries

The premise that it is better to be safe than sorry implies risk aversion, which involves a willingness to accept benefits that are lower on average (or incur costs that are higher on average) in order to avoid a gamble involving a potential loss. Conservatism is seen as a way to protect against losses that could result from "gambling" about the true level of risk; it might turn out to be higher than expected.

Despite the assumption of guarding against losses, a preference for overstating risk (conservatism) does not protect against losses more than does a preference for understating risk. Overstating (mean) risk only protects against losses (in human life) that would occur if risk is greater than the mean. It does not protect against losses (from unnecessary risk reduction expenditures) that would occur if risk is less than the mean. In order to protect against the latter, a case for understating risk exists. Which is to say, risk aversion, in and of itself, could just as well support understating risk as overstating it. Hence, one cannot logically infer a case for conservatism simply from an aversion to risk.

If one is going to make a case for conservatism on the basis of risk aversion, one must establish the existence of an asymmetry between the cases for overstating and understating risk. This might be attempted in either of two ways. One involves an appeal to empirical considerations. The other involves an appeal to value judgments.

On the empirical side, a case for overstating (mean) risk would exist, granting the wisdom of risk aversion, if risk parameters and risk are distributed asymmetrically about the mean — more specifically, if they are skewed to the high side of the mean. Under these conditions, risk aversion is better served by overstating, as opposed to understating, mean risk, because a greater potential for losses exists if risk is underestimated.

Of course, if risk is skewed the other way, a case for understating mean risk exists. The fact that advocates of conservatism never advocate understating mean risk in deference to risk aversion suggests that either (1) they believe that environmental risks and risk parameters are always skewed to the high side of the mean (which is highly unlikely), or (2) they do not rest their case on these empirical considerations, despite the fact that, as we shall see, they provide the only viable case for conservatism. It is incumbent, then, upon advocates of conservatism to

provide empirical evidence of the skewed distribution of risk and risk parameters about the mean in support of their advocacy — something which they have largely failed to do and may be unable to do in the case of many risks and risk parameters.

Risk Aversion and Asymmetries in Values

The second approach to establishing an asymmetry lies in arguing for a qualitative difference between the losses that one protects against by overstating risk versus those that one protects against by understating it (even if risk is symmetrically distributed). Then we might have reason to protect against one as opposed to the other. To this end, one might maintain that protecting against loss of life is more important than protecting against pecuniary losses. Certainly, this idea has an intuitive appeal. Yet, this surely does not mean that saving lives is categorically more important than saving money, i.e., that saving a (statistical) life is worth *any* cost. No one believes that.

Obviously there are asymmetries and qualitative differences of various sorts between lives and dollars (after all, one is a biological phenomenon and the other is not).[7] The real question is whether these differences preclude establishing terms for the trade-off between the two. Despite qualitative differences, people must and do make trade-offs between lives and dollars. This fact is sufficient for the purposes of the present argument, which seeks only to establish that at whatever level people (society) make these trade-offs, as they must, we can assume they are neutral between the two; otherwise they would not seek trade-offs at that level. Furthermore, any attempt to alter the terms of the trade-off by way of conservatism is simply to acknowledge that we did not have the terms of the trade-off right to begin with, which is easily enough (and more directly and transparently) remedied without invoking conservatism.

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7   An example of the sort of qualitative difference that might be invoked in an effort to establish an asymmetry is provided by an anonymous reviewer who questioned the symmetry between lives lost and dollars lost on the basis that the former, unlike the latter, are irreversible. However, any such irreversibility does not stand in the way of placing a dollar value on life-saving measures; it is taken account of in the dollar value placed on the (irreversible) loss of a life. Further, dollars spent unwisely in risk remediation measures are themselves irretrievable.

Once one recognizes the untenability of the premise that human health and life are simply more important than monetary considerations, and thereby accepts the commensurability of lives and dollars in the context of resource allocations, a symmetry between the costs of overstating and understating risk is established (assuming a symmetric distribution of risks). And given this symmetry, the risk averse individual (or society) has no reason to favor errors of overstating as opposed to understating risk. Hence, the argument from risk ·aversion to the advocacy of conservatism fails to go through.

Consider the cost of overstating and understating risk by a given amount, say, ten lives. The cost of underestimating risk by ten deaths could range from zero up to the value of the ten lives which might be lost for failure to eliminate the risk in question. If the value of a statistical life is $1 million, then the cost of underestimation could range from zero to $10 million. By comparison, the cost of overestimating risk by ten deaths could range from zero up to the costs incurred in order to avert those ten, erroneously suspected, deaths. Given that ten lives are worth $10 million, we might reasonably spend up to $10 million to eliminate the suspected risk. Hence, the cost of overestimating risk could range from zero to $10 million dollars, precisely the same range associated with underestimating risk. While this symmetry involves a range rather than a specific value, there is no reason to think that the costs of understating risk would be systematically higher within this range. It is also important to note that this symmetry remains no matter high one sets the value of a (statistical) life.

Despite this analysis, one still may be tempted by the claim that it is better at the margin (where one dollar either way makes or breaks the case for an incremental life-saving expenditure) to err in spending one dollar too much to save a life than to err in losing a life for failure to spend that extra dollar. Yet, the previous analysis simply belies this claim. In either case, the error results in a loss that is equivalent to one dollar. In the first instance, we spend one dollar more than the incremental life saved is worth, which results in a net loss of one dollar. In the second, the expenditure we fail to make would have bought an incremental life, which, at the margin, would have been worth one

dollar more than the required expenditure, implying — once again — a net loss of one dollar. A refusal to accept the implications of this analysis can only be construed as a refusal to accept the commensurability of lives and dollars, but given that no one denies that a limit must be placed on life-saving measures, this refusal smacks of logical inconsistency.

The symmetry between the costs of understating and overstating mean risk does not, in and of itself, argue for the use of mean estimates of risk. Any argument to that end must grapple with the wisdom (or lack thereof) of risk aversion, an issue that I do not address here. The above considerations simply imply that from risk aversion one cannot infer the preferability of overstating, as opposed to understating, mean risk (given a symmetrical distribution of risk about the mean).

Conclusion

A preference for erring on the side of overstating as opposed to understating risk under conditions of uncertainty can be logically inferred from an aversion to risk only on condition that the distribution of risk (and risk parameters) is skewed to the high side of the mean. Perhaps for failure to recognize this fact, advocates of conservatism have made little effort to produce empirical evidence for this. Rather, they seem to rely upon the intuitive appeal of risk aversion in conjunction with a stated preference for saving lives over money at the margin. Yet, one cannot logically infer the advisability of conservatism from these premises. From an aversion to risk alone, one cannot infer the advisability of conservatism, because there are risks associated with both overstating and understating risk. The addition of the premise that saving lives is more important than saving money is still inadequate to establish the desired conclusion. An absolute preference for the former is untenable (all would agree) and any preference short of this means that the two are commensurable, which in turn means that there is no reason to favor one as opposed to the other, given appropriate terms for the trade-off between the two.

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