RECONCILING COST-BENEFIT ANALYSIS WITH THE PRINCIPLE THAT SAFETY MATTERS MORE THAN MONEY

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Some health and safety laws emphasize safety over cost considerations by invoking the principle that safety matters more than money. Other laws rely on cost-benefit analysis (CBA) that equates safety and money. In this Article, Professor Mark Geistfeld argues that, despite their apparent inconsistency, the two regulatory approaches can be reconciled. He first explains why the safety principle most plausibly stands for a distributive claim that in the context of nonconsensual risk impositions, the safety interests of potential victims deserve greater weight than the ordinary economic interests of potential injurers. Although this claim seems to be inconsistent with CBA, Professor Geistfeld analyzes cost-benefit tort rules to demonstrate how potential victims are inadequately compensated for certain types of nonconsensual risks threatening death, an inequity that can be quantified with cost-benefit methodology. He shows that the inequity is defensibly remedied by altering the duty of care to give safety interests greater weight than economic interests (the weighting sanctioned by the safety principle), which ultimately yields a well-defined decision rule that modifies CBA for certain types of nonconsensual risks threatening serious physical injury. Subsequently, he contends that modified CBA (1) satisfies the requirements of modern welfare economics, (2) can accommodate a wide range of normative concerns, and (3) closely conforms to important tort practices, suggesting that it implements a version of the safety principle closely corresponding to the version adopted by the tort system. Finally, Professor Geistfeld concludes that the value of modified CBA is illustrated by the structure it gives to the precautionary principle, a vague regulatory approach based on the safety principle that has become increasingly important and controversial in international law.

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     After jurors announced a staggering verdict of $4.9 billion against General Motors on July 9, a juror explained the panel's fury at the company. 'We're just like numbers, I feel, to them,' he said. 'Statistics.'

     Message sent: The jurors concluded that the auto maker had risked lives to save a few dollars on each car, and they were incensed.[1]

     Tort law is supposed to encourage good behaviour. But the message of the GM award is that cost-benefit analyses, particularly on safety, should not be carried out and in any event should never be written down.[2]

INTRODUCTION

     The huge verdict against General Motors echoes the message previously sent by the notorious Ford Pinto case[3] in the 1970s: Individuals are likely to be upset by health and safety decisions that trade off dollars for lives, particularly if those whose lives are at stake have not consented to the tradeoff.[4] The idea that life is priceless underlies a widespread belief that health and safety decisions should strive to reduce nonconsensual fatal risks at all costs. What else explains the result of a 1992 poll finding that eighty percent of the respondents agreed with the statement that we should achieve a clean environment "'regardless of cost'"?[5]

     Of course, no one really wants to spend everything on safety. But the widespread resistance to tradeoffs between safety and money is plausibly linked to the principle that "safety matters more than

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    [1] William Glaberson, Looking for Attention with a Billion-Dollar Message, N.Y. Times, July 18, 1999, § 4 (Week in Review), at 3. The award was subsequently reduced to $1.2 billion. Milo Geyelin, Lasting Impact: How an Internal Memo Written 26 Years Ago Is Costing GM Dearly, Wall St. J., Sept. 29, 1999, at A1. The jury was infuriated by a 1973 internal GM memo stating that postcollision fires cost GM $2.40 per car based on forty-one million cars on the road at that time, rear-end collision fatality rates (about 500 per year), and an estimated value of human life of $200,000 based on government statistics. Id.

    [2] GM and the Law, Economist, July 17, 1999, at 16, 16. The jury did not consider a complete cost-benefit analysis (CBA). Micheal M. Weinstein, Analysis: Cost of Life Issue in GM Suit Lost on Price of a Part, J. Rec. (Okla. City), Aug. 13, 1999, 1999 WL 9848045. Nevertheless, the jury's indignation at an internal company memo acknowledging and monetizing the risk poses a problem for cost-benefit analyses of safety measures, as such analyses must identify and monetize risk.

    [3] Grimshaw v. Ford Motor Co., 174 Cal. Rptr. 348 (Ct. App. 1981).

    [4] Gary T. Schwartz, The Myth of the Ford Pinto Case, 43 Rutgers L. Rev. 1013, 1014 (1991) (observing that Ford Pinto case "shows how disturbed the public can be by corporate decisions that balance life and safety against monetary cost").

    [5] Poll Shows Four of Five Americans Support Environment, Even Over Economy, 23 Env't Rep. (BNA) 1155 (Aug. 7, 1992).

money," what I refer to as the safety principle. The principle has been embraced by many moral philosophers and is reflected in important legal practices.

Laws regulating health and safety often have distributive impacts that implicate difficult normative issues. These laws protect the interest that potential victims have in their physical security, while burdening the economic and liberty interests of those engaged in the risky activity. The appropriate mediation of these interests is a normative matter. In some contexts, the interests are mediated by the parties themselves, reducing the regulatory role to one of ensuring that the parties make well-informed choices. Absent mutual consent, the interests must be mediated or traded off in some manner by the legal rule. According to some moral theories, the interest potential victims have in their physical security is more important than the burdens imposed on risk-creating actors who must expend money on safety precautions or pay damages or fines.[6] The underlying rationale is that physical injury is more disruptive for potential victims than is the expenditure of money for potential injurers, justifying a legal rule that gives safety interests greater weight than economic interests.

The safety principle has shaped a number of legal rules governing risky behavior. According to a leading torts treatise, "the law has always placed a higher value upon human safety than upon mere rights in property."[7] Similarly, case law in the European Community recognizes that "there could be no question but that the requirements of

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[6] E.g., Charles Fried, An Anatomy of Values: Problems of Personal and Social Choice 192 (1970); Alan Gewirth, Reason and Morality 54-57 (1978) (arguing for lexical ranking of goods into three tiers in which physical integrity is ranked as first-tier "basic" good, and wealth and convenience are ranked as third-tier "additive" goods); Judith Jarvis Thomson, The Realm of Rights 176-248 (1990) (arguing that individuals have right that others not cause them harm, which permissibly can be infringed by others only if doing so would produce sufficiently large and appropriately distributed increment of good); Ernest J. Weinrib, The Idea of Private Law 147-52 (1995) (arguing that corrective justice based on Kantian right renders cost considerations irrelevant for "real" risks); Gregory C. Keating, Reasonableness and Rationality in Negligence Theory, 48 Stan. L. Rev. 311, 349-60 (1996) (arguing that Rawlsian social contract theory places higher value on security interests than ordinary economic interests); David McCarthy, Rights, Explanation, and Risks, 107 Ethics 205, 212-15 (1997) (arguing that individuals have right that others not impose risks upon them, which permissibly can be infringed only if resultant good "sufficiently outweighs" burden imposed on bearer of right and is appropriately distributed).

[7] W. Page Keeton et al., Prosser and Keeton on the Law of Torts 132 (5th ed. 1984). There is some question whether this weighting of interests applies to accidental harms. See infra note 98. The analysis here shows why the principle should apply to accidental harms. See infra Parts III, VII.B.

the protection of public health must take precedence over economic considerations."[8]

The safety principle is embodied in various statutes. Under the Occupational Safety and Health Act of 1970,[9] standards for toxic materials and harmful physical agents must be determined on the basis of technological and economic feasibility, even if the costs of regulation bear no reasonable relation to the benefits.[10] Environmental legislation also prohibits reliance on cost considerations in important contexts.[11]

The safety principle influences the procedures regulators use to evaluate risk. When a risk is unknown, most agencies rely on risk estimates likely to exceed the actual risk.[12] The Environmental Protection Agency, for example, overestimates the risk that a substance might be carcinogenic by at least a factor of seven, and quite likely more.[13] Procedures designed to overestimate risk are justified on the ground that safety concerns (the possibility that the substance might be hazardous) are more important than economic considerations (the possibility that the substance will be subject to costly regulation even though it is not hazardous).[14]

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[8] Case T-13/99 R, Pfizer Animal Health SA/NV v. E.U. Council, 3 C.M.L.R. 79, 82 (1999).

[9] 29 U.S.C. §§ 651-678 (1994).

[10] Am. Textile Mfrs. Inst. v. Donovan, 452 U.S. 490, 509 (1981).

[11] The standards for criteria pollutants under the Clean Air Act cannot rely on cost considerations. See 42 U.S.C. § 7409 (1994). Instead, the standards must ensure "an adequate margin of safety," id. § 7409(b)(1) (ambient air quality standards), or an "ample margin of safety," id. § 7412(d)(4) (hazardous air pollutants). But cf. Am. Trucking Ass'ns v. EPA, 175 F.3d 1027, 1033 (D.C. Cir.) (finding Clean Air Act's provisions for ambient air quality standards, as interpreted by EPA, to be unconstitutional delegation of legislative power), reh'g denied, 195 F.3d 4 (D.C. Cir. 1999), rev'd sub nom. Whitman v. Am. Trucking Ass'ns, Nos. 99-1257, 99-1426, 2001 WL 182549 (U.S. Feb. 27, 2001). The Act also contains the pervasive requirement that companies adopt the "best available control technology" rather than technology that passes a cost-benefit test or is cost-effective. See 42 U.S.C. §§ 7411, 7475. Similarly, water pollution standards for toxic pollutants must provide an "ample margin of safety." 33 U.S.C. § 1317 (a)(4) (1994). Another example is provided by the Endangered Species Act, which forbids tradeoffs between preservation and cost except in rare circumstances. 16 U.S.C. § 1533 (1994).

[12] Dennis J. Paustenbach, Retrospective on U.S. Health Risk Assessment: How Others Can Benefit, 6 Risk 283, 287 & n.17 (1995).

[13] A leading advocate of the EPA's methodology acknowledges a sevenfold overestimation. Adam M. Finkel, Is Risk Assessment Really Too Conservative? Revising the Revisionists, 14 Colum. J. Envtl. L. 427, 431 (1989); Adam M. Finkel, A Second Opinion on an Environmental Misdiagnosis: The Risky Prescriptions of Breaking the Vicious Circle, 3 N.Y.U. Envtl. L.J. 295, 349 (1995). Others argue that the methodology overstates the risk by a factor of more than 100 or even infinity in some cases. E.g., Philip H. Abelson, Exaggerated Risks of Chemicals, 48 J. Clinical Epidemiology 173, 175 (1995).

[14] In the terminology of statistical decision theory, the issue is one of determining how to compare scientific false positives (i.e., the chance that the estimation procedure identifies a substance as being hazardous when it is not) with scientific false negatives (i.e., the

This precautionary approach to risk regulation is embodied in the "precautionary principle" in the field of international environmental law. According to the precautionary principle, any uncertainty regarding the hazardous properties of a substance or activity ought to be resolved in a manner that favors regulation (and the associated possibility of risk reduction), with cost considerations of secondary importance.[15] The precautionary principle is invoked in many recent international environmental conventions, including the Framework Convention on Climate Change[16] and the Biosafety Protocol regulating trade in genetically modified organisms.[17]

Another role played by the safety principle is revealed in the debate over health care reform. The increasing need to control the cost of health care has prompted many analysts to argue that medical devices and treatments should be subjected to cost-benefit analysis (CBA).[18] For the most part, these arguments have been rejected by policymakers because CBA requires a dollar valuation of the lives saved by different programs or treatments. This requirement is anathema for many doctors and public health officials who believe that life is priceless, making it inappropriate to discuss health outcomes in monetary terms.[19]

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chance that the substance is deemed harmless when it actually is hazardous). A decision procedure designed to overestimate risk reduces the chance of false negatives while increasing the chance of false positives. The justification for tipping the balance in this way is that false negatives cost lives, whereas false positives cost money. Talbot Page, A Generic View of Toxic Chemicals and Similar Risks, 7 Ecology L.Q. 207, 219-20 (1978).

[15] E.g., Frank B. Cross, Paradoxical Perils of the Precautionary Principle, 53 Wash. & Lee L. Rev. 851, 851-54 (1996).

[16] Framework Convention on Climate Change, May 9, 1992, art. 3(3), 31 I.L.M. 849, 854 (1992).

[17] See Comm'n of the Eur. Cmtys., Communication from the Commission on the Precautionary Principle 11, 27 (Feb. 2, 2000) [hereinafter Communication on the Precautionary Principle] (discussing definition and use of precautionary principle in European and international agreements, including Biosafety Protocol), at http://europa.eu.int/comm/dgs/health_consumer/library/pub/pub07_en.pdf. The Protocol was signed in Nairobi by sixty-five countries on May 25, 2000; the European Community and its members were signatories. Biological Diversity: Biosafety Protocol Attracts 65 Signatures, Eur. Env't, June 1, 2000, 2000 WL 20766626; see also Marcela Valente, Environment/Trade: No Simple Answer in Debate on Biotechnology, Inter Press Serv., Feb. 17, 2000, 2000 WL 4089890 (discussing Biosafety Protocol).

[18] E.g., Valuing Health for Policy: An Economic Approach (George Tolley et al. eds., 1994).

[19] E.g., Alan M. Garber, Advances in Cost-Effectiveness Analysis of Health Interventions 6 (Nat'l Bureau of Econ. Research, Working Paper No. 7198, 1999); Alice M. Rivlin, Rationalism and Redemocratization: Time for a Truce, in Worst Things First? The Debate Over Risk-Based National Environmental Priorities 25 (Adam M. Finkel & Dominic Golding eds., 1994) (describing how early efforts to compare disease control programs at U.S. Department of Health, Education, and Welfare "evoked a storm of protest, especially from the medical professionals, who objected to trying to quantify benefits" of lives saved).

As indicated by the health care debate, many believe that the safety principle requires rejection of cost-benefit methodology. CBA reduces the costs and benefits of a regulation into a common metric, typically money, and then deems the regulation to be desirable if its benefits outweigh the costs.[20] The cost-benefit decision rule gives safety interests, expressed in monetary terms, the same weight as economic interests, apparently violating the safety principle.

Any conflict between CBA and the safety principle is highly relevant to the regulation of risk. CBA is required by various federal statutes.[21] More significantly, CBA has been used routinely by federal agencies since 1981 pursuant to executive orders issued by the Reagan and Clinton Administrations.[22] Many state agencies must use CBA as a matter of state law.[23] Numerous health and safety regulations are based on CBA, whereas other regulations are based on the safety principle. If regulatory approaches based on CBA and the safety principle are inconsistent, legal decisionmakers must choose between them, presumably having to justify why one approach is preferable to the other in any given context. Such justification has yet to be proffered. We do not know whether the regulation of health and safety is proceeding on an inconsistent basis, or whether there is an unidentified consistency between CBA and the safety principle that can yield a coherent regulatory approach.

This Article argues that cost-benefit methodology is fundamentally compatible with the safety principle and provides the much needed tools for turning the safety principle into an operational decision rule. A cost-benefit decision rule that gives equal weight to economic and safety interests often inequitably favors potential injurers at the expense of potential victims, an inequity that can be identified

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[20] See generally E. J. Mishan, Cost-Benefit Analysis (3d ed. 1982).

[21] Numerous examples of federal legislation requiring CBA are provided in Am. Textile Mfrs. Inst. v. Donovan, 452 U.S. 490, 510-11 & 510 n.30 (1981). The most significant recent example is the Unfunded Mandates Reform Act, which requires CBA of all federal regulations that involve significant expenditures by state, local, or tribal governments. 2 U.S.C. §§ 1501-1571 (Supp. IV 1998). Other prominent recent examples include the Safe Drinking Water Act Amendments, 42 U.S.C. § 300g-1(b)(3)(C) (Supp IV 1998); and the Toxic Substances Control Act, 15 U.S.C. § 2605(c)(1) (1994).

[22] President Reagan's order concerning CBA is Exec. Order No. 12,291, 3 C.F.R. 127 (1981), reprinted in 5 U.S.C. § 601 (1988). President Bush did not repeal this order. President Clinton subsequently repealed the order and replaced it with another requiring CBA. See Exec. Order No. 12,866, 3 C.F.R. 638 (1993), reprinted in 5 U.S.C. § 601 (1994). The differences between the two orders are described in Richard H. Pildes & Cass R. Sunstein, Reinventing the Regulatory State, 62 U. Chi. L. Rev. 1, 6-7 (1995).

[23] Ten states currently require CBA of all proposed agency rules, and seven states require CBA of selected rules. Robert W. Hahn, State and Federal Regulatory Reform: A Comparative Analysis 3 (AEI-Brookings Joint Ctr. for Regulatory Studies, Working Paper 98-3, 1998), http://www.aei.brook.edu/publications/working/working_98_03.pdf.

and quantified with cost-benefit methodology. The inequity can be mitigated if the cost-benefit decision rule is modified to give the safety interests of potential victims greater weight than the economic interests of potential injurers, the type of weighting sanctioned by the safety principle. This regulatory approach satisfies the methodological requirements of CBA and appears to be a defensible way to implement the safety principle. Modified CBA therefore provides a unified approach to the regulation of risks threatening physical injury.

Part I begins to develop the safety principle, concluding that distributive concerns can justify the regulation of nonconsensual risks in a manner that favors the safety interests of potential victims over the economic interests of potential injurers. For prudential reasons, these regulations cannot routinely require large departures from cost-benefit outcomes across the range of nonconsensual risks, indicating the need to identify why a particular cost-benefit outcome violates the safety principle. Part II describes the aspects of cost-benefit methodology relevant to the safety principle. Part III uses the torts context to show how cost-benefit legal rules can disadvantage potential victims unfairly. The distributive inequity can be mitigated by a legal rule that gives the safety interests of potential victims greater weight than the economic interests of potential injurers.

Connecting CBA and the safety principle in this manner solves the fundamental problem posed by the safety principle: How much more weight should be given to safety interests? CBA creates a distributional problem whenever potential injurers owe money to potential victims as compensation for imposing the nonconsensual risks sanctioned by CBA, but the absence of redistributive institutions makes the transfer infeasible. Part IV argues that the transfer can be effectuated by modifying the cost-benefit rule so that the potential injurer is required to spend the money on further risk reduction. The requirement reduces the welfare level of the potential injurer to the same level as would occur under conditions of actual transfer. The requirement increases safety investments above the cost-benefit amount, and the resultant risk reduction benefits potential victims. As compared to conventional cost-benefit outcomes, modified CBA yields welfare levels for potential injurers and victims that more closely approximate the welfare levels they would attain under conditions of actual consent. Modified CBA therefore yields better distributive outcomes than conventional CBA. Part IV then explains why CBA need not be modified when the risk threatens many individuals, is reciprocal, or threatens physical injury to the buyer in a contractual relationship.

Part V argues that these modifications to CBA satisfy the requirements of welfare economics. Part VI argues that modified CBA

appears to be a normatively defensible way to implement the safety principle. Part VII then assesses modified CBA in light of tort law. The tort system has adopted the safety principle, so the degree to which modified CBA conforms to tort law indicates the degree to which the safety principle under modified CBA corresponds to the tort version. Part VII shows that modified CBA is highly consistent with important tort doctrines, providing further reason for concluding that the approach defensibly implements the safety principle.

Part VIII uses the precautionary principle to illustrate both the need to develop the safety principle and the value of employing cost-benefit methodology towards that end. The vagueness of the precautionary principle, coupled with its increasingly prominent role in international law, has become a source of international tension. In response, the Commission of the European Communities published its version of the principle.[24] Part VIII shows why this version is unsatisfactory because it never addresses the appropriate relation between safety and money, and then shows how the European version of the precautionary principle, like the safety principle upon which it is based, can be operationalized by cost-benefit methodology.

I

THE SAFETY PRINCIPLE

Despite the popular appeal and widespread application of the safety principle, it is not well developed. An overly vague version of the principle is vulnerable to forceful criticism.[25] To serve as a defensible basis for risk regulation, the principle must be reducible to a set of guidelines capable of generating health and safety regulations.

A defensible version of the safety principle will specify the conditions under which the principle is invoked properly. After all, money is merely a surrogate for something else. Money could be used to purchase vaccines, for example. In that context, the claim that safety (risk reduction) matters more than money (used for risk reduction) makes little sense.[26] Similarly, the safety principle is not relevant for tradeoffs between competing sets of economic interests. Risks need not threaten only physical injury; they also can threaten economic loss. It makes little sense to claim that safety—the reduced risk of an

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[24] Communication on the Precautionary Principle, supra note 17.
[25] Cross, supra note 15, at 859 (showing how safety principle, as embodied in precautionary principle of environmental law, "can be attacked as an uncertain decision rule").
[26] For a discussion of the issues that arise when risks are traded off against one another, see John D. Graham & Jonathan Baert Wiener, Confronting Risk Tradeoffs, in Risk Versus Risk: Tradeoffs in Protecting Health and the Environment 1 (John D. Graham & Jonathan Baert Wiener eds., 1995).

injury threatening pure monetary loss—should be more important than money. Hence the safety principle applies only to tradeoffs involving (1) nonmonetary safety or security interests, such as the interest in being protected against pain and suffering or the loss of life's pleasures, and (2) "ordinary" economic interests that will not be utilized for risk reduction of this type.

Not all such tradeoffs are appropriately governed by the safety principle. For situations in which individuals make well-informed choices to face risk-threatening injury to the self, individual preferences usually are sufficient to determine how safety should be traded off against money. Workers accept risky jobs in return for higher wages. Consumers purchase subcompact cars, even when they can afford safer, more expensive vehicles. As long as these *choices* are *well informed*, individuals can determine the appropriate tradeoff between their own safety and economic interests. To reject these choices in favor of the safety principle would be paternalistic, widely disfavored, and inconsistent with important legal practices, such as assumption of risk. Due to the way in which consent promotes individual autonomy, the safety principle would be hard to defend if it routinely applied to consensual risks.[27]

The regulation of involuntary or nonconsensual risks, by contrast, is governed defensibly by the safety principle. For nonconsensual risks, potential victims (like pedestrians) typically do not benefit directly from the risky activity (driving), whereas most or all of the benefit is received by potential injurers (drivers). This separation of the

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[27] This claim is central to any reconciliation of CBA and the safety principle, because welfare economics is based on the "non-paternalistic assumption that a household has 'sovereignty' over how its welfare is to be measured." Robin Boadway & Neil Bruce, Welfare Economics 39 (1984). The claim does not appear to be morally problematic, as there seems to be widespread agreement among philosophers that well-informed consent is sufficient to justify risk exposures. E.g., McCarthy, supra note 6, at 215 ("Consent is one of the most important notions within the realm of rights, and it is clearly relevant to the permissibility of many risk-imposing activities . . . ."). To be sure, there is philosophical disagreement concerning the appropriateness of relying on individual preferences to resolve moral issues, but that debate is not relevant to the question of whether the safety principle should apply to well-informed, voluntary risk exposures. Those who reject the use of individual preferences for resolving moral issues typically do so on the ground that individual preferences are not sufficiently well informed or otherwise concern purely private matters, making them an unreliable indicator of an individual's views on public matters. See Daniel A. Farber, Eco-Pragmatism: Making Sensible Environmental Decisions in an Uncertain World 51-56 (1999) (summarizing debate). By definition, an individual's well-informed choice to face risk-threatening injury to the self is a private matter not plagued by an informational problem. (If others also would be injured by the risk exposure, for them the risk is involuntary, and so the safety principle would become relevant in that respect.) Hence the concerns that might justify rejection of individual preferences for resolving moral issues are not relevant to the question of whether the safety principle should apply to well-informed voluntary risk exposures.

benefits and burdens of the risky activity is not present for consensual risks, as the relationship between the parties enables them to share the benefits and burdens. The regulation of nonconsensual risks therefore poses a difficult distributive issue. Safety requirements benefit potential victims at the expense of potential injurers, whereas the risky behavior promotes the interests of potential injurers at the expense of potential victims. Both sets of interests directly conflict, and each matters in light of the moral concern for equality. The two sets of interests need not be given equal weight, however, as the interest that potential victims have in their physical security is fundamentally different from the competing interest of potential injurers to engage in the risky activity and avoid the cost of safety precautions. According to the safety principle, the safety interests of potential victims deserve greater weight than the ordinary economic interests of potential injurers.

The unequal weighting of interests may reflect risk aversion. Risk-averse individuals are willing to pay more than the expected cost of injury (probability of injury times severity of loss) to avoid facing the risk. Most people are risk averse.[28] For them, safety (risk elimination) seems to be more important than the associated cost of injury. The safety principle also can be defended with the distributive rationale that physical injury is more disruptive to the pursuit of one's life plan than is the loss of money.[29] This important difference can justify regulations that give safety interests greater weight than economic interests.

The safety principle can be justified on either or both grounds, although the two justifications do not necessarily weight safety and economic interests in the same way. A justification based on risk aversion implies that the cost of risk aversion should be incorporated into the weight given to safety interests. The distributive justification could require that even greater weight be given to safety interests, insofar as risk aversion does not account adequately for the way in

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[28] As an analytical matter, risk-averse individuals have a declining marginal utility of wealth, a behavioral trait that plausibly describes most people. Moreover, only risk-averse individuals would be willing to pay insurance premiums, which are based on the expected cost of the insured-against event plus administrative charges. The fact that individuals commonly purchase insurance therefore supports the claim that most individuals are risk averse.

[29] As Gregory Keating argues, "[a]ccidental injury threatens grave disruption to the pursuit of a conception of the good, and accidental death prematurely ends the pursuit of such a conception. . . . Increased monetary expenditures on precaution, by contrast, burden persons' capacity to realize their conceptions of the good in more modest and incremental ways." Keating, supra note 6, at 354-55.

which the prospect of physical injury is a more severe problem for potential victims than is the loss of money for potential injurers.

In its extreme form, the distributive rationale for the safety principle gives safety interests dominant priority over ordinary economic interests. This version of the safety principle is based on a strong claim regarding the individual right to safety. Federal legislation in the 1960s and 1970s based on the safety principle was "fueled by the notion that a safe workplace, or clean air and water, should be treated as involving a right to be vindicated rather than a risk to be managed."[30] One prominent interpretation of individual rights, developed in the context of constitutional law, is that they "trump" public values concerning the common good.[31] If there is such a right concerning personal safety, then the safety interests of potential victims could not be traded off routinely against the ordinary economic interests of potential injurers in an effort to achieve the common good.

A different reason for giving dominant weight to safety interests is based on the claim that a multidimensional concern, such as the value of life, cannot be compared with ordinary economic interests: The two are "incommensurable."[32] The incommensurability claim has influenced the debate over health care reform.[33] The claim finds support in the widely held cultural notion that life is priceless, a notion undoubtedly related to the safety principle. If no amount of money is equivalent to a human life, then safety interests apparently dominate ordinary economic interests.

The extreme version of the safety principle yields a lexicographic decision rule for evaluating health and safety regulations. This terminology refers to the procedure for ordering words in the dictionary. Whether one word precedes another depends on a comparison of their initial letters. If they coincide, then the second letters are compared, and so on. Similarly, if safety matters more than money, then any two health or safety regulations should first be compared on the basis of the overall risk levels that each are likely to attain. The regulation that would attain the lowest risk level is the most desirable according to the lexicographic criterion that safety matters more than

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[30] Cass R. Sunstein, Paradoxes of the Regulatory State, 57 U. Chi. L. Rev. 407, 413-14 (1990); see also Weyerhaeuser Co. v. Costle, 590 F.2d 1011, 1043 (D.C. Cir. 1978) (stating that best practicable technology standard under Clean Water Act is based on notion that public has right to clean environment, limited only by extent to which cleanup is impractical or unachievable).

[31] Ronald Dworkin, Taking Rights Seriously 184-205 (1978).

[32] For an explication of three related uses of the term "incommensurability," see Matthew Adler, Introduction to Symposium, Law and Incommensurability, 146 U. Pa. L. Rev. 1169, 1170-81 (1998).

[33] See supra notes 18-19 and accompanying text.

money. It is only if each regulation would reduce risk by the same amount that monetary considerations become relevant for choosing between them.

The extreme version of the safety principle cannot be defended. Suppose a regulation is expected to save one more life in the United States than an alternative regulation, but costs a billion dollars more to implement. The simple lexicographic ordering of safety over money would choose the safer regulation, justifying the billion dollars of additional cost on the ground that the saved life is infinitely valuable. Once this decision criterion is employed across the range of risky activities, enormous sums of money would be required, exhausting the resources that could be used to address other pressing social problems, including those involving risks to life or health.[34] This version of the safety principle would not be limited to tradeoffs between risks threatening noneconomic loss and ordinary economic interests. As any defensible version of the safety principle must be limited to tradeoffs of that type, the extreme version of the principle cannot be defended.

At minimum, any defensible version of the safety principle must recognize that monetary considerations necessarily constrain the amount of attainable safety. But even if it were desirable to expend all discretionary resources ("ordinary" economic interests) on safety, a regulatory approach based on this premise would still face a significant practical problem. How could any given regulatory agency determine the amount that should be spent to reduce those risks falling within its jurisdiction? Any decision rule requiring that total safety investments must equal some economy-wide constraint like total discretionary wealth would need to coordinate the actions of all governmental bodies capable of regulating health and safety risks. Absent such coordination, a few agencies could promulgate regulations consuming a disproportionate share of available resources, leaving other agencies with insufficient resources for reducing the risks within their jurisdiction, risks that often will be more important.[35] The coordina-

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[34] "[I]f the entire U.S. gross domestic product were devoted to avoiding fatal accidents, we would have only $55 million to spend per life at risk. That expenditure would leave us no available resources to combat cancer and AIDS or to provide for other health-related needs, such as food and housing." W. Kip Viscusi, The Dangers of Unbounded Commitments to Regulate Risks, in Risks, Costs, and Lives Saved: Getting Better Results from Regulation 135, 135 (Robert W. Hahn ed., 1996).

[35] This lack of coordination explains the irrational outcomes created by the federal legislation that does not allow agencies to set regulatory standards on the basis of cost considerations. One of these statutes involves workplace standards for toxic materials and harmful physical agents. See supra note 9 and accompanying text. A regulation promulgated under this statute concerning potentially carcinogenic benzene emissions during

tion required to avoid irrational outcomes would be extraordinarily difficult, if not impossible to achieve.

The difficulty of coordinating regulatory action, coupled with the need to limit the safety principle to tradeoffs between safety interests and ordinary economic interests, suggest that any operational version of the safety principle will involve a departure from cost-benefit outcomes rather than the outright rejection of CBA. Costs and benefits expressed in market prices reflect the highest value of the numerous alternative uses to which the money could have been put. By engaging in the cost-benefit exercise, regulators can rely on the informational role of prices to identify the social cost of the safety investments required by the regulation. The regulators then can decide whether the safety principle justifies a departure from the cost-benefit outcome.

Although this more limited version of the safety principle considers tradeoffs between safety and money, it is not necessarily inconsistent with rationales for the safety principle based on the claim that safety and money are incommensurable. Two things can be incommensurable but still subject to rational choice.[36] For example, regulators rationally can trade off safety and money by relying on expressive considerations—what the choice expresses about social attitudes, and so on—while still acknowledging that safety is fundamentally different from money.[37] The expressive component of choice depends on context, implying that the appropriateness of any given tradeoff between safety and money must be context dependent.[38] As long as regulators adequately account for expressive concerns in the evaluative process, they can trade off safety and money while acknowledging their incommensurability.[39]

Recognizing the relevance of expressive concerns and cost considerations does not turn the safety principle into an operational deci-

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waste operations costs $19 million per year of life saved, whereas it would cost about $17,000 per year of life saved if all women over age fifty were to receive regular mammograms. See Tammy O. Tengs & John D. Graham, The Opportunity Costs of Haphazard Social Investments in Life-Saving, in Risks, Costs and Lives Saved, supra note 34, at 167, 167. A more coordinated regulatory approach would enable us to save about twice as many lives for the same amount of money currently expended on life-saving regulatory interventions. See id. at 172-74.

[36] The claim that money and lives are truly noncomparable is controversial for those who believe that the two are incommensurable. See Ruth Chang, Introduction to Incommensurability, Incomparability, and Practical Reason 1, 13-24 (Ruth Chang ed., 1997).

[37] See Elizabeth Anderson, Value in Ethics and Economics 59-64 (1993).

[38] See generally Cass R. Sunstein, Incommensurability and Valuation in Law, 92 Mich. L. Rev. 779 (1994).

[39] The rudiments of such a process are described in Pildes & Sunstein, supra note 22, at 89-95.

sion rule, however. The distributive version of the safety principle still faces a severe problem of being indeterminate over a significant range of regulatory alternatives. As a prudential matter, the safety principle cannot justify routine, large departures from cost-benefit outcomes, for otherwise the aggregate amount of safety investments required by the regulations likely would exceed the economic resources properly governed by the safety principle. But how much of a departure is warranted? And in what circumstances are departures warranted? Absent a defensible resolution of these issues, the distributive version of the safety principle may not be feasible.

Framing the problem in this manner suggests the need to evaluate CBA in light of the safety principle. The ostensible purpose of the safety principle is to ensure that health and safety regulations do not unfairly disadvantage potential victims. The safety principle therefore would seem to require departures only from those cost-benefit outcomes that unfairly disadvantage potential victims. By identifying the nature of these distributive inequities, it may become apparent how they can be remedied by the safety principle.

II
Cost-Benefit Analysis of Health and Safety Regulations

To analyze CBA in terms of the safety principle, we can ignore those aspects of risk regulation not relevant to the safety principle. The principle is unlikely to be relevant for determining the amount of risk to which individuals voluntarily expose themselves, so the analysis will focus on nonconsensual risks and ignore issues pertaining to the amount of care that individuals should take for their own protection.[40] Similarly, the safety principle has no apparent relevance for the measurement or quantification of economic interests, so the analysis will assume the costs of safety investments are well defined.

The safety principle addresses tradeoffs between money and safety. Two tradeoffs of this type occur in CBA. To quantify a safety benefit, cost-benefit methodology translates the associated risk of physical injury into a monetary equivalent, a step that involves a tradeoff between money and safety. Once the safety benefit has been

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[40] Even if the safety principle should account for the care taken by potential victims, the way in which the safety principle alters CBA is unlikely significantly to reduce the incentive of potential victims to take care. As shown in infra Part IV, the safety principle modifies CBA whenever potential victims cannot be compensated fully for facing the risk. The modification does not compensate potential victims fully for the risk, giving them an incentive to avoid the injury.

monetized, CBA compares and trades off the safety benefit with the economic cost of eliminating the risk.

Regulations derived in this manner can be justified with individual consent. CBA translates a risk of injury into the monetary equivalent chosen by the individual exposed to the risk. Individuals exposed to regulated risks therefore would accept cost-benefit regulations if they could contract over the matter. Individuals ordinarily cannot contract for nonconsensual risks, however. Consequently, cost-benefit regulations are justified normatively by reference to the hypothetical contract between potential injurers and victims. The normative significance of the hypothetical contract is undermined by the absence of the monetary transfer that would occur under conditions of actual consent. Cost-benefit methodology assumes, though, that any distributive inequities created by hypothetical consent can be redressed by the income tax system or other redistributive institutions. Due to the appeal of hypothetical consent coupled with the appropriate transfer payments to potential victims, economists have not been troubled by the claim that CBA unfairly disadvantages potential victims. Instead, economists have focused on other methodological problems with CBA.[41]

A. Cost-Benefit Analysis of Risks Threatening Physical Injury

Suppose a safety investment reduces the risk of physical injury by ten percent. The risk reduction is the benefit of the safety investment. To compare this benefit to the cost of the safety investment, the risk of physical injury must be translated into money: The risk must be monetized. Often the risk of physical injury includes the possibility of

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[41] CBA does not yield consistent answers to the question of whether one project involving fatal risks is better than another. Charles Blackorby & David Donaldson, Can Risk-Benefit Analysis Provide Consistent Policy Evaluations of Projects Involving Loss of Life?, 96 Econ. J. 758 (1986). The problem of consistency does not imply that CBA ought to be rejected by legal decisionmakers, however, since CBA still might be the most defensible decision procedure for courts or agencies. Matthew D. Adler & Eric A. Posner, Rethinking Cost-Benefit Analysis, 109 Yale L.J. 165 (1999). Another problem with CBA pertains to the difficulty of getting good estimates for the price of risks in nonmarket settings. The problem is not that the risk measures are methodologically inappropriate. Rather, the problem is one of figuring out how to get reasonably accurate estimates by relying on surveys or other methods. E.g., Peter A. Diamond & Jerry A. Hausman, Contingent Valuation: Is Some Number Better than No Number?, 8 J. Econ. Persp. 45 (1994). Finally, some scholars question whether it is appropriate for CBA to define benefits and costs in terms of individual preferences. See, e.g., Adler & Posner, supra; Allan Gibbard, Risk and Value, in Values at Risk 94 (Douglas MacLean ed., 1986). The argument here does not question whether CBA inappropriately relies on preferences, because it seems implausible that the safety principle routinely would reject the safety choices made by well-informed individuals. See supra note 27 and accompanying text.

death. How could a fatal risk be translated into a finite amount of money, if no amount of money can substitute for life?

The economic approach to monetizing fatal risks is no different from its approach to monetizing or pricing anything else. Economic analysis posits that individuals make rational choices based on their preferences for scarce resources. Individual choices are constrained by cost considerations, including the prices of desired goods, wealth, and time. What someone chooses reveals her valuation of the activities or goods in question *relative* to cost considerations. The choice does not reveal the individual's valuation independent of cost considerations, so it corresponds to a "price" rather than intrinsic "value." For example, we might all agree as an abstract matter that water is intrinsically more valuable than diamonds, even though each of us ordinarily would pay more for a diamond than for a liter of water (the former is more scarce than the latter). The qualification "ordinarily" is needed because the price someone would pay for water, or diamonds, depends on the context in which the choice must be made. Context determines the relevant cost considerations, which in turn influence the choices someone makes in light of her preferences. The fact of scarcity, and the resultant need to make tradeoffs, accordingly defines the economic decision facing individuals.

Safety is like most other goods in the sense that it is costly and forces individuals to make tradeoffs. Safety, like water, is also essential to life, but it does not follow that individuals should spend everything on safety for the same basic reason that they do not spend everything on water. Exactly how much someone should spend on safety, according to standard economic methodology, depends on how she values safety in light of the relevant cost considerations in the context under consideration.

Suppose the individual faces a given probability of suffering a fatal injury. Suppose also that the individual is not concerned about leaving money for others in the event of her death. Even though no amount of money could compensate the individual for losing her life, she ordinarily would not be willing to spend everything on safety. Of course, if the individual were certain to die, she would spend all of her wealth to eliminate the risk.[42] But the individual would not make herself destitute to avoid a very small fatal risk. Instead, the maximum amount the individual would be willing to pay (WTP) to eliminate a fatal risk is the amount that makes her indifferent between (1) the state in which she does not face the risk and has a lower level of

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[42] A point worthy of biblical recognition. See Job 2:4 (New Jerusalem) ("Someone will give away all he has to save his life.").

wealth due to the payment of the WTP amount, and (2) the state in which she faces the probability of dying and pays no money to avoid the risk. For example, suppose an airbag raises the total price of a new car by $500 and would reduce the risk of fatal injury by 1 in 10,000. If the individual were indifferent between the car without the airbag and the car costing $500 more with the airbag, then her WTP measure for this particular risk is $500.

The WTP measure, like prices in general, will vary with context.[43] As the chance of continued life becomes more uncertain (as the probability of dying increases), the need to maintain wealth becomes less important, so the WTP measure increases with increases in the probability of death. In the extreme case of certain death, the WTP measure equals the individual's wealth. As implied by this case, the WTP measure also depends on the individual's wealth, connecting the measure to the problem of resource scarcity described earlier.

In other contexts, CBA measures the safety benefit in terms of the minimum amount of money the individual would be willing to accept (WTA) in order to face the risk. Again, this measure depends on the magnitude of the risk (the probability and severity of injury) and the individual's wealth.[44] If the risk were certain to kill the individual, then she would not be willing to accept any amount of money in exchange for facing the risk: The WTA measure equals infinity. For smaller fatal risks, the individual would be willing to accept some positive payment that makes her indifferent between (1′) the state in which she does not face the risk and receives no money for facing the risk, and (2′) the state in which she faces the risk and has a higher level of wealth due to receipt of the WTA risk proceeds. In effect, the WTA measure is the monetary equivalent of the benefit a potential victim must receive before she would assume the risk. The individual's determination of the WTA measure is very similar to the determination of the WTP measure, as revealed by a comparison of the choice between (1) and (2) and the choice between (1′) and (2′). Not surprisingly, then, the WTA measure, like the WTP measure, gives the individual's monetary valuation of the safety benefit of eliminating a defined risk in a defined context.

Although the WTA and WTP measures are conceptually similar, they have important differences. The WTA scenario defines the baseline or status quo in terms of the potential victim's welfare level without the risk: Either the individual does not face the risk, or she

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[43] For a more formal statement of the properties of the willing to pay (WTP) measure, see infra app. § 2.

[44] See infra app. § 1.

chooses to face it and receives the WTA risk proceeds. In both in-
stances, the individual is not worse off than she would be in a world
without the risk. The WTP scenario, by contrast, defines the baseline
in terms of the potential victim's welfare level with the risk: Either
the individual faces the risk or pays the WTP amount to eliminate the
risk. In both instances, the individual is worse off than she would be
in a world without the risk, all else being equal.

    Due to their different baselines, the WTA and WTP measures
significantly differ for substantial risks threatening serious physical in-
jury. Money is a poor substitute for health or life, so all else being
equal, the individual requires more money to accept a risk that threat-
ens physical injury. The individual also is willing to pay larger sums to
avoid facing such risks, but the WTP measure is limited by the individ-
ual's wealth, whereas the WTA measure depends on wealth but is not
limited by it. Consequently, the WTA measure always exceeds the
WTP measure, and the difference can be substantial.[45] In the case of
certain death, for example, the WTA measure equals infinity, whereas
the WTP measure equals the individual's total wealth.

    The WTA and WTP measures are approximately equal for small
risks, but that equality should not mask a fundamental difference be-
tween the two: Each corresponds to different welfare levels for po-
tential injurers and victims. The WTA measure applies whenever the
potential victim is compensated by the potential injurer for facing the
risk, whereas the WTP measure applies whenever the potential victim
must pay the potential injurer to reduce risk.

    The differences in the WTA and WTP measures make the choice
of measure important for CBA. Nevertheless, the methodology of
CBA cannot determine fully which measure should be used. The ap-
propriate measure often is determined by context. For the context
most clearly governed by the safety principle, though, the appropriate
measure must be determined by normative argument.

    Consider the employment context, a contractual setting in which
potential victims (workers) do not have to pay for safety measures or
the right to injury compensation from the potential injurer (em-
ployer). In addition to the base wage, workers in a perfectly competi-

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[45] See W. Michael Hanemann, Willingness to Pay and Willingness to Accept: How
Much Can They Differ?, 81 Am. Econ. Rev. 635 (1991) (showing that willing to accept
(WTA) and WTP increasingly will diverge as there are fewer substitutes for good being
risked). A related empirical reason for the difference is that individuals are significantly
more averse with respect to losses relative to a reference point than they are favorably
disposed to gains, and that individuals tend to value goods they possess more highly than
those they do not possess. Daniel Kahneman, Jack L. Knetsch & Richard H. Thaler, Ex-
perimental Tests of the Endowment Effect and the Coase Theorem, 98 J. Pol. Econ. 1325
(1990).

tive market receive a risk premium for any work-related risks. The employer has a choice to eliminate the risk by making safety investments, thereby eliminating the need to pay a risk premium to workers. The employer also could eliminate the risk premium by giving the worker a guarantee to fully compensatory damages. Whether or not the employer makes such expenditures, the worker's expected utility is unaffected. The risk premium or right to fully compensatory damages merely ensures that the risk does not reduce the expected utility of workers relative to comparable jobs without the risk. Instead, the cost of the risk or related safety investments and guarantees affect the employer's expected profits. The risk therefore conforms to the WTA measure: The potential victim is not made worse off by the risk, whereas the potential injurer is made worse off by either the risk or the associated safety investments and compensatory guarantees.

In other perfectly competitive contractual settings, such as those involving product transactions, potential victims (consumers) must pay for safety investments or the right to injury compensation from the potential injurer (manufacturer). Relative to an identical situation without the risk, the potential victim is made worse off by either the risk or the need to pay for safety investments and compensatory guarantees. The risk accordingly conforms to the WTP measure, as illustrated earlier by the individual decision regarding automobile airbags.

In contractual settings, then, the choices made by potential victims determine context (work, product use) which in turn determines the appropriate risk measure. In these contexts, the cost of safety investments and guarantees of injury compensation is borne by either the potential victim (the WTP measure) or the potential injurer (the WTA measure). Nonconsensual risks, by contrast, do not dictate a particular measure for monetizing risk. Consider interactions between automobile drivers and pedestrians. The circumstances do not dictate that potential victims (pedestrians) must pay for the right to injury compensation. Nor do the circumstances dictate that potential injurers (drivers) must bear these costs. This context therefore involves a fundamental indeterminacy. Should potential victims be required to pay for the risks of others, making the WTP measure appropriate? Or should potential injurers be required to pay for the risks they impose on others, making the WTA measure appropriate?

Resolution of these questions depends on the specification of initial entitlements or property rights.[46] Until the questions are resolved,

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[46] See, e.g., Robert Cameron Mitchell & Richard T. Carson, Using Surveys to Value Public Goods: The Contingent Valuation Method 30 (1989) ("The choice between the WTP or WTA formulation is a question of property rights: does the agent have the right to sell the good in question or, if he wants to enjoy it, does he have to buy it?").

the safety benefit is undefined. CBA therefore depends on well-defined entitlements, so it cannot determine who should hold those entitlements in the first instance, contrary to Richard Posner's controversial argument that all legal questions should be resolved by this methodology.[47] Instead, normative justification determines initial entitlements which then determine whether the WTA or WTP measure monetizes the safety benefit of reducing nonconsensual risks. The dependence of CBA on normative justification in this context is potentially significant, as this context is the one most clearly governed by the safety principle.

Once the benefits of risk reduction are well defined (and we have been assuming safety costs are well defined), regulations or liability rules can be formulated in cost-benefit terms. Although the measurement process can be complex, the decision rule is simple. CBA requires only those safety investments or precautions costing less than the resultant benefit of risk reduction (expressed in terms of either the WTA or WTP measure). A safety investment of $2 is required if it would eliminate a risk monetized at $3. Similarly, a different risk monetized at $4 is permitted if it could be eliminated only by safety investments costing $4.25. This decision rule minimizes the total cost of the risky behavior ($2 of safety investments and $4 of monetized risk), yielding allocatively efficient outcomes.

The cost-benefit decision rule gives equal weight to safety interests and ordinary economic interests, in apparent violation of the safety principle. The equal weights, however, are consistent with the version of the safety principle based on risk aversion. CBA defines the relevant safety interests—the WTA and WTP measures—in a manner that includes the cost of risk aversion.[48] These safety interests need not be given greater weight to account for risk aversion, so CBA

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[47] See generally Richard A. Posner, The Economics of Justice (1983). The analytical problems created by Posner's attempt to answer all legal questions by reference to CBA, in the guise of wealth maximization, are described in Lewis A. Kornhauser, Wealth Maximization, in 3 The New Palgrave Dictionary of Economics and the Law 679 (Peter Newman ed., 1998). Posner now acknowledges this problem. Richard A. Posner, Wealth Maximization and Tort Law: A Philosophical Inquiry, in Philosophical Foundations of Tort Law 99, 99-100 (David G. Owen ed., 1995) (acknowledging that wealth maximization is incomplete criterion for assessing legal policy because wealth depends on assignment of property rights). Note that the indeterminacy disappears for perfectly reciprocal, nonconsensual risks. See infra Part IV.B.2.

[48] For risks threatening injuries fungible with money, a risk-averse individual is willing to pay more than the expected value of the risk (probability of loss times value of loss) in order to avoid facing it. Risk aversion cannot be defined in this way for injuries not fungible with money, because the individual's valuation of the loss (the WTA or WTP measure) includes all costs posed by the risk, including the cost of risk aversion. See infra app. §§ 1, 2.

can give these interests the same weight as economic interests while being fully consistent with any rationale for the safety principle based on the preference that most individuals have for avoiding risk.

Any conflict between CBA and the safety principle therefore must stem from the distributive rationale for the safety principle, which maintains that money matters less than safety because money is replaceable whereas health or life cannot be restored.[49] In important respects, the difference between money and safety—or, more formally, the degree of substitutability between money and safety—is accounted for by CBA, particularly when it relies upon the WTA measure for monetizing risk. The WTA measure gives the potential victim's assessment of the amount of money that would compensate her adequately for the risk imposition, so the measure might address any concerns about the difference between money and safety that underlie the safety principle. Nevertheless, CBA could conflict with the safety principle because CBA does not require that potential injurers actually give potential victims their WTA risk proceeds. The absence of such a transfer could mean that CBA yields distributive outcomes deemed to be unacceptable by the safety principle.

However, the methodology of CBA relies on good reasons for not requiring actual transfers. But do those reasons satisfy the distributional demands of the safety principle?

B. Justifications for Disregarding Distributional Issues in Cost-Benefit Analysis

CBA is a form of welfare or normative economics, the branch of economics that studies the criteria for determining whether alternative economic situations are better or worse than one another.[50] Traditional welfare economics of the late nineteenth and early twentieth centuries compared alternative situations by relying on the assumption that individual utilities can be measured (cardinal utility) and then compared across individuals. This decision rule selects utility-maximizing outcomes, making its normative justification dependant on utilitarianism.[51]

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[49] See supra Part I.

[50] See, e.g., Allan M. Feldman, Welfare Economics, in 4 The New Palgrave: A Dictionary of Economics 889, 889-90 (John Eatwell ed., 1987) (tracing origins of welfare economics to nineteenth century debates concerning question of whether laissez-faire is "better" or "superior" to regulated economy).

[51] See, e.g., Amartya Sen, The Possibility of Social Choice, 89 Am. Econ. Rev. 349, 351-52 (1999) (tracing origins of traditional welfare economics to influence of utilitarianism of Jeremy Bentham). The ensuing discussion of the new welfare economics draws on this source and on Mishan, supra note 20, at 301-14.

The need to make interpersonal utility comparisons troubled welfare economists. In the late 1930s, prominent economists rejected the utilitarian decision rule in favor of the new welfare economics, which posits that interpersonal utility comparisons are impossible or otherwise outside the scope of economic analysis. The new welfare economics compares alternative economic situations by relying on the Pareto principle, which holds that one economic situation is better than another if it makes at least one person better off and no one worse off.

The new welfare economics recognizes that few policies satisfy the Pareto principle, so it relies on *potential* Pareto improvements to compare alternative economic situations. This decision rule, widely known as the compensation or Kaldor-Hicks criterion, holds that one economic situation is better than another if those who would gain from the change could compensate the losers for their losses and still be no worse off than in the original state. The compensation criterion selects policies with benefits (the gains of the winners) in excess of costs (the losses of the losers) and therefore forms the basis of CBA.

The normative justification for the compensation criterion and CBA typically is based on the hypothetical contract. If the parties were able to contract over the matter, those who gain from the policy change would be able to get the losers to agree to the change in exchange for compensation for the resultant losses. After the exchange, the winners still would be better off (as their gains exceed the losses of others), and no one else would be worse off as each loser has been compensated fully, so the policy change would be mutually acceptable to all affected parties.

Hypothetical contracts differ from actual contracts for various reasons, including the absence of any monetary transfer between the parties. Potential victims would agree to face a risk in exchange for receiving the WTA risk proceeds, but that transfer is not accomplished by a hypothetical contract. Without the transfer, why would a potential victim consent to the risk?

Any normative justification for CBA based exclusively on hypothetical compensation is troubling.[52] Consequently, welfare economists maintain that CBA defensibly can ignore distributive questions only if the government can redistribute income via lump-sum transfers between households.[53] A lump-sum transfer does not involve administrative or other costs and does not affect the behavior of anyone who

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[52] See, e.g., I.M.D. Little, A Critique of Welfare Economics (2d ed. 1957).

[53] E.g., Richard W. Tresch, Public Finance: A Normative Theory 39 (1981); Hal R. Varian, Microeconomic Analysis 405 (3d ed. 1992).

pays or receives benefits. By relying on such transfers, the government can convert hypothetical compensation into real compensation, turning the potential Pareto improvement identified by CBA into an actual Pareto improvement. No one loses under a cost-benefit regulation, and some people gain. Everyone presumably would consent to the regulation (as reflected in the hypothetical contract), giving CBA a broader normative appeal than the "old" welfare economics with its exclusive reliance on utilitarian forms of justification.

The conventional normative justification for CBA—the hypothetical contract and the related notion of potential Pareto improvements—accordingly depends on the existence of other redistributive institutions. If there is a perfect redistributive mechanism capable of remedying any distributive inequities created by CBA, then there is no obvious reason why CBA is distributively unjust. And since CBA fully accounts for risk aversion, economists have not been troubled by the claim that CBA unfairly disadvantages potential victims.

III
COST-BENEFIT ANALYSIS AND THE SAFETY PRINCIPLE IN THE CONTEXT OF TORT LAW

We now can determine whether CBA yields distributive outcomes deemed to be unacceptable by the safety principle. An instructive institutional context is provided by the tort system. Tort law determines the degree of risk that permissibly can be imposed on individuals who have not consented to the risk and provides compensation for those injured by tortious risks. The confluence of risk regulation and compensation provides a particularly good institutional setting for determining whether distributive concerns might justify the rejection of cost-benefit regulations in favor of regulations based on the safety principle.

The distributive analysis finds that for nonconsensual risks threatening fatal injuries, cost-benefit tort rules inequitably benefit potential injurers at the expense of potential victims. A defensible remedy is to alter the cost-benefit negligence standard so that safety interests receive greater weight than ordinary economic interests, the same weighting sanctioned by the safety principle. Hence a distributive inequity created by cost-benefit risk regulations can justify regulations based on the safety principle.

A. Entitlements and Cost-Benefit Tort Rules

The formulation of cost-benefit tort rules must begin by specifying the underlying entitlements. An entitlement determines the ex-

tent and type of legal force given to an individual interest in any particular context.[54] In the context of nonconsensual risky interactions, entitlements embody the legal resolution of how conflicting liberty and security interests should be mediated. Potential injurers have liberty interests in pursuing risky behavior that imposes risks on others, whereas potential victims have interests in their bodily security. The interests of the two parties conflict. Which set of interests will be given legal force is determined by the specification of the entitlement holder, an issue that cannot be resolved by cost-benefit methodology. The entitlement also determines the type of legal force applied to a protected interest, an issue that can be resolved with CBA.

Recall that CBA cannot proceed until the entitlement holder is first specified, because the identity of the entitlement holder often determines whether the WTA or the WTP measure is the appropriate way to monetize nonconsensual risks.[55] Resolution of this issue implicates distributive concerns.

Giving the entitlement to potential victims gives their interest in bodily security legal priority over the competing liberty and economic interests of potential injurers. For this type of entitlement, the legal rule can protect the superior security interests of potential victims by burdening the subordinate liberty interests of potential injurers with safety or compensatory requirements. Such an entitlement corresponds to the WTA measure, which applies to contexts in which the potential victim is compensated for facing the risk and the potential injurer bears the cost of the risk.

Alternatively, the initial entitlement could be given to potential injurers, making their liberty interests superior to the security interests of potential victims. The superior liberty interests of potential injurers cannot be burdened to protect the subordinate security interests of potential victims, so this type of entitlement requires that potential injurers be compensated for any safety expenditures or guarantees of injury compensation. Such an entitlement corresponds to the WTP measure, which applies to contexts in which the potential victim must bear the cost of the risk.

Framed in this manner, the determination of the entitlement holder involves a distributive issue that implicates the safety principle. One way in which safety can be given priority over money is to give the initial entitlement to potential victims, as this entitlement gives

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[54] See generally Madeline Morris, The Structure of Entitlements, 78 Cornell L. Rev. 822 (1993) (identifying components of entitlements giving force to individual interests).

[55] See supra notes 45-47 and accompanying text.

legal priority to their security interests over the competing economic interests of potential injurers. This particular requirement of the safety principle is uncontroversial. Potential victims have not consented to the risk, do not directly benefit from it, and suffer the physical harm. In light of these factors and the compelling premise that individuals own their bodies, most agree that potential victims should hold the entitlement.[56] Moreover, this specification of the entitlement conforms to tort principles, as reflected in the numerous obligations that tort law imposes on potential injurers for the protection of potential victims.[57]

Thus, the safety principle imposes a distributive requirement that potential victims hold the initial entitlement, and that requirement corresponds to cost-benefit tort rules based on the WTA measure for monetizing nonconsensual risks. At this point, there is no obvious inconsistency between CBA and the safety principle. However, CBA determines the amount of legal protection given to the security interests of potential victims, and that protection may be inadequate for purposes of the safety principle. To evaluate this aspect of CBA, we must develop the cost-benefit negligence standard, which is analytically prior to the cost-benefit choice between negligence and strict liability.

B. The Cost-Benefit Negligence Standard

As discussed earlier, the requirements of CBA can be replicated by a hypothetical contract between potential injurers and victims. Potential injurers can take various safety precautions that would reduce

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[56] E.g., Thomson, supra note 6, at 205-48 (arguing that individuals have right that others not cause them harm); McCarthy, supra note 6, at 212-15 (arguing that individuals have right that others not impose risks upon them). This specification of the entitlement is commonly employed in economic analyses. Jennifer H. Arlen, Reconsidering Efficient Tort Rules for Personal Injury: The Case of Single Activity Accidents, 32 Wm. & Mary L. Rev. 41, 43 n.9 (1990).

[57] The individual right to bodily security underlies the intentional tort of battery and is the same type of interest protected by the rules of negligence and strict liability. Restatement (Second) of Torts § 1 cmt. d (1965) ("[T]he interest in bodily security is protected against not only intentional invasion but against negligent invasion or invasion by the mischances inseparable from an abnormally dangerous activity."); id. ch. 2 introductory note (stating that interest in "freedom from bodily harm" is "given the greatest protection" by various intentional torts and also by tort rules concerning negligence and strict liability); id. § 281 cmt. b (stating that one element of negligence is "that the interest which is invaded must be one which is protected, not only against acts intended to invade it, but also against unintentional invasions"); see also infra Part VII (showing how entitlement held by potential victims conforms to important tort doctrines).

the risk faced by potential victims.[58] For each precaution, there is a cost or burden B that would be incurred by the potential injurer. If the potential injurer does not take the precaution and instead creates the risk, she owes the associated WTA amount to the potential victim. The potential injurer would not incur the burden B if it would be less expensive to pay the WTA amount to the potential victim. By definition, the potential victim would agree to face the risk in exchange for the WTA risk proceeds. Hence the two parties would agree that the potential injurer can impose risks whenever the cost of eliminating the risk B exceeds the safety benefit expressed by the WTA measure: $B > WTA$. The parties also would agree that the potential injurer must take precautions satisfying the cost-benefit test (precautions for which $B < WTA$), as it would be cheaper for the potential injurer to take the precaution than to pay the potential victim to face the risk. The potential injurer's failure to take such precautions would breach the hypothetical contract, subjecting her to tort liability for any injuries caused by the breach.

The hypothetical contract conforms to the Learned Hand negligence standard, which compares the burden or cost of a precaution (B) with the benefit of risk reduction that would occur if the precaution were taken (the probability of injury P multiplied by the dollar equivalent of the threatened loss L).[59] Under this standard, an injurer is negligent if the cost of a precaution that would have prevented the injury is less than its safety benefit: $B < PL$. Notice that the Hand formula expresses the safety benefit in terms of the expected cost of injury PL, whereas CBA defines the safety benefit in terms of the WTA measure. As long as the two approaches define the safety benefit in the same way—if the WTA measure equals PL—they yield the same results.

The WTA measure provides the basis for the damages award a potential victim should receive in the event she is injured by a breach of the hypothetical contract—that is, when the potential injurer is negligent. By failing to take a required precaution, the potential injurer unjustifiably exposes the potential victim to a tortious risk and therefore owes the potential victim her WTA risk proceeds for facing that risk. This debt can be paid off if the potential injurer pays tort damages equal to the victim's WTA measure divided by the underlying probability of injury P.

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[58] The risk reduction available from any given precaution typically depends on whether other precautions also are being taken. Strictly speaking, then, for each precaution there is an associated risk of injury conditional on other precautions being taken.

[59] United States v. Carroll Towing Co., 159 F.2d 169, 173 (2d Cir. 1947) (Hand, J.).

It may seem puzzling that tort damages can transfer the WTA risk proceeds to potential victims. Tort damages, after all, compensate the individual after she has been injured by the risk, whereas the WTA risk proceeds compensate the individual for facing the risk. Despite this difference in the timing of payment, the concept of full compensation connects the appropriate tort award to the WTA measure. Suppose the individual were exposed repeatedly to a risk of 1 in 10,000 and has a WTA measure of $5. For each risk exposure, she is entitled to her WTA risk proceeds of $5 as full compensation. Over the course of 10,000 risk exposures, the individual is entitled to WTA payments totaling $50,000. Over the course of 10,000 risk exposures, the individual is likely to be injured once. Rather than receiving a $5 payment prior to each of the 10,000 risk exposures, the individual could collect her entire WTA risk proceeds of $50,000 in a tort suit. Tort damages equal to the WTA risk measure of $5 divided by the risk of injury (or multiplied by 10,000) yields tort damages of $50,000. Tort damages therefore provide a method for giving individuals the WTA risk proceeds to which they are entitled.

This method of computing tort damages, which is particularly useful for pain-and-suffering injuries, satisfies the requirements of the case law.[60] Such tort damages enforce the hypothetical contract, because giving potential victims a guarantee of such tort damages is functionally equivalent to the exchange in which potential victims receive their WTA risk proceeds from potential injurers prior to the risk exposure.

C. Distributional Properties of Cost-Benefit Tort Rules

A negligence rule compensates accident victims only for unreasonable (negligent) risks. Giving potential victims a guarantee of compensatory tort damages for *unreasonable* risks is not functionally equivalent to giving them their WTA risk proceeds for *reasonable* risks. The cost-benefit negligence rule therefore may be distributionally problematic.

The cost-benefit negligence rule is inequitable only if potential victims are entitled to their WTA risk proceeds. Potential victims, however, are not necessarily entitled to those proceeds. Instead, they only may be entitled to have permissible or reasonable risk levels set by reference to the WTA measure. The entitlement need not require that potential victims be compensated for facing reasonable risks, those for which the cost of precaution exceeds the WTA measure. In-

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[60] Mark Geistfeld, Placing a Price on Pain and Suffering: A Method for Helping Juries Determine Tort Damages for Nonmonetary Injuries, 83 Cal. L. Rev. 773, 804-05 (1995).

deed, an entitlement to be compensated for *any* risk, whether reasonable or not, would seem to correspond to the rule of strict liability and not negligence.

The distributional properties of negligence and strict liability require further development, however. Someone killed by a tortious risk typically does not get tort damages for the lost value of life, popularly known as "hedonic damages."[61] Instead, damages in wrongful death actions traditionally are measured by the pecuniary loss rule, which limits damages to the monetary value of the benefits the decedent could have been expected to contribute to her survivors (or estate in some jurisdictions) had she lived.[62] This rule, which has been adopted by the vast majority of states, means that individuals who are killed by tortious risks receive no compensation for the loss of life's pleasures. The lack of compensation occurs under strict liability as well as the cost-benefit negligence standard.

This damages rule makes sense insofar as money cannot compensate a dead person for the lost pleasures of life. Giving damages to a dead person is not functionally equivalent to giving her the WTA risk proceeds prior to the risk exposure. But if potential victims do not receive tort damages for the loss of life's pleasures, then they do not receive their full WTA risk proceeds for unreasonable, nonconsensual fatal risks. These risks pose the greatest threat to the security interests of potential victims, yet they are undercompensated for such risks. The cost-benefit negligence rule and strict liability accordingly yield the distributively inequitable outcome in which potential victims are not compensated adequately for facing nonconsensual fatal risks.

This distributive inequity may explain why cost-benefit tort rules violate the safety principle, the ostensible purpose of which is to ensure that potential victims are not disadvantaged unfairly by nonconsensual risks. Alternatively, the distributive inequity may inhere in the nature of fatal injuries rather than the type of liability rule. Death, after all, poses a unique compensatory problem, so fatal risks may pose an inherently intractable distributive problem. To sort this matter out, we must determine whether the distributive inequity is addressed by the safety principle. If the inequity is not remedied by the

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61 Andrew J. McClurg, It's a Wonderful Life: The Case for Hedonic Damages in Wrongful Death Cases, 66 Notre Dame L. Rev. 57, 66-67 (1990).

62 Id. at 62-64; see also Restatement (Second) of Torts § 925 cmt. b (1977) (noting that, in most states, damages in wrongful death actions "are determined by the present worth of the contributions and aid that the deceased probably would have made to the survivors had he lived"). Note that the available damages in wrongful death actions are directly connected to the bequest motive of potential victims. Therefore, the distributive properties of cost-benefit tort rules can be analyzed in terms of someone who has no bequest motive and receives no compensation upon death.

safety principle, there is no apparent reason why the inequity requires the rejection of cost-benefit tort rules. But if the inequity would be remedied by the safety principle, we will have identified an important cost-benefit distributive outcome deemed to be unacceptable by the safety principle.

D.   The Safety Principle as a Defensible Solution to the Distributive Problem Posed by Nonconsensual Risks Threatening Serious Physical Injury

As an analytic matter, the safety principle can be conceptualized as remedying a distributive problem that occurs whenever potential victims are not compensated adequately for facing nonconsensual risks. Suppose that CBA appropriately balances economic and safety interests for risks threatening physical injuries fully compensable by a damages award. Why should the same weighting be appropriate for risks threatening injuries, such as death, not fully compensable by a damages award? The unavailability of fully compensatory damages disfavors potential victims relative to the situation in which such damages are available. Absolving potential injurers of the responsibility to pay damages obviously favors their interests relative to the situation in which they must pay damages. For uncompensated risks, then, the interests of the two parties would not be balanced appropriately if the interests are given the same weight as in contexts involving fully compensated risks. To restore the appropriate balance of interests for uncompensated risks, the standard of care could be altered to give the safety interests of potential victims greater weight than the economic interests of potential injurers, the type of weighting sanctioned by the safety principle.

For example, suppose that the safety interests threatened by monetarily uncompensated risks receive twice the weight as the economic interests of potential injurers. Whereas the cost-benefit negligence standard requires potential injurers to make safety expenditures any time the burden or cost B is less than the safety benefit expressed by the WTA measure, the altered negligence standard for uncompensated risks would require safety expenditures for which $B < 2WTA$. By requiring more safety expenditures, a negligence standard based on the safety principle places a greater burden on the economic interests of potential injurers. The increased safety expenditures would reduce risk relative to the level that occurs under the cost-benefit negligence standard, and in most circumstances it would reduce risk

below the level attained by strict liability.[63] The risk reduction en-
hances the security interests of potential victims relative to the cost-
benefit outcome. Hence a negligence standard based on the safety
principle helps to restore the appropriate balance of economic and
safety interests that is lost whenever fully compensatory damages are
unavailable for nonconsensual risks.

Alternatively, the distributive inequity created by cost-benefit
tort rules could be remedied if damages were made available for the
loss of life's pleasures. Although some scholars have proposed that

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[63] Under the cost-benefit negligence standard and the rule of strict liability, potential
injurers give equal weight to their own interests and the security interests of potential vic-
tims, causing them to forego any safety precaution costing more than the benefit of risk
reduction. (Such a precaution would not be required by the cost-benefit negligence stan-
dard, and strictly liable potential injurers would not take the precaution because it would
be cheaper to face the prospect of liability rather than to pay for the precaution.) A negli-
gence standard based on the safety principle would require greater precautions on the part
of potential injurers, and there are persuasive reasons for concluding that potential injurers
would take these additional precautions, thereby reducing risk below the levels that attain
under the cost-benefit negligence standard and strict liability.

Insofar as potential injurers seek to conform their behavior to the requirements of the
law, they will adhere to a more exacting negligence standard, even if in some cases it would
be cheaper for them to forego a required precaution and risk liability. These individuals
would not be similarly motivated by a rule of strict liability, which does not impose any
standard of care on potential injurers. Instead, potential injurers in a regime of strict liabil-
ity compare their precaution costs with their expected liability costs, leading them to take
the same precautions as would be required by a perfectly enforced cost-benefit negligence
standard.

Even if potential injurers do not care about conforming their behavior to the legal
standard of reasonable care and instead make safety decisions entirely on a cost-benefit
calculus, they will adhere to a higher standard of care when courts faced by evidentiary
problems impose liability on defendants whose negligence was not a but-for cause of the
injury, which is likely to be a general phenomenon. See Stephen Marks, Discontinuities,
Causation, and Grady's Uncertainty Theorem, 23 J. Legal Stud. 287 (1994); see also
Zuchowicz v. United States, 140 F.3d 381, 390 (2d Cir. 1998) (holding that causation can be
established if "(a) a negligent act was deemed wrongful *because* that act increased the
chances that a particular type of accident would occur, and (b) a mishap of that very sort
did happen"). Cases in which liability is imposed improperly on defendants due to the
absence of cause-in-fact are much rarer under strict liability. Instead, the cause-in-fact
requirement more plausibly enables some strictly liable injurers to escape liability due to
the plaintiff's inability to establish this requirement, thereby reducing the incentive of po-
tential injurers to take precautions satisfying the cost-benefit test. For formal demonstra-
tion of these incentives under different rules, see Robert Cooter & Thomas Ulen, Law and
Economics 270-75 (2d ed. 1997); Marcel Kahan, Causation and Incentives to Take Care
Under the Negligence Rule, 18 J. Legal Stud. 427 (1989).

Notice that a negligence standard will not necessarily reduce risk relative to the level
that would attain under strict liability if negligent defendants escape liability due to the
plaintiff's inability to prove the absence of reasonable care. These situations provide a
risk-reducing role for strict liability that is discussed in infra Part VII.C.

such tort damages be awarded in wrongful death actions,[64] the proposal fails to address the fundamental problem that damages cannot compensate a dead person. If damage rules should be reformed so that potential victims are compensated fully for facing nonconsensual fatal risks, then damage awards for nonfatal injuries should be formulated so that plaintiffs are compensated both for the actual (nonfatal) injury they have suffered in addition to the possibility that they could have been killed.[65] Such a damages award gives the plaintiff more than full compensation for the nonfatal injury she suffered, but the award is fully compensatory because it accounts for the impossibility of providing compensation in the event of death.

As between these approaches, the safety principle seems to require alteration of the negligence standard rather than increased damages. By giving safety interests greater weight than economic interests, a more exacting negligence standard expressly conforms to the safety principle. And if safety matters more than money, then risk reduction presumably is more important than injury compensation. Risk reduction directly protects the security interests of potential victims. Injury compensation for bodily harm does not protect security interests directly, but rather promotes the victim's economic interests to offset the loss of bodily integrity. Altering the negligence standard to require safety investments above the cost-benefit amount therefore seems to be more faithful to the safety principle than increasing tort damages to encompass the loss of life's pleasures.

IV

MODIFYING COST-BENEFIT ANALYSIS TO IMPLEMENT
THE SAFETY PRINCIPLE

A negligence rule based on the safety principle can be conceptualized as a remedy for the distributive inequity characteristic of some cost-benefit outcomes. Basing legal rules on the safety principle, how-

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[64] E.g., William M. Landes & Richard A. Posner, The Economic Structure of Tort Law 186-89, 314-15 (1987). The proposal by Landes and Posner was subsequently developed in McClurg, supra note 61.

[65] Very few, if any, physical risks threaten only death. Instead, risks threaten a range of different physical injuries in addition to the possibility of death. The probability of injury P therefore can be decomposed into two parts. Let $P1$ denote the probability that the potential victim will suffer a nonfatal injury, and let $P2$ denote the probability of fatal injury. The overall risk is $P = P1 + P2$ and has an associated WTA measure. The potential victim could use the WTA risk proceeds to purchase a guarantee to a tort award from the potential injurer in the event of a nonfatal injury. By the same reasoning used in the text accompanying supra note 60, this guarantee implies a tort award of $D = WTA/P1$. Because the tort award is based on the WTA measure for the total risk, rather than the WTA measure for the risk of nonfatal injury $P1$, it includes compensation for both the nonfatal and fatal injuries.

ever, poses a difficult practical problem: How much more weight do safety interests deserve? Absent a defensible resolution of the problem, one might acknowledge the moral relevance of the safety principle, but nevertheless conclude that it is not useful for promulgating health and safety regulations.

One way to solve the problem is to quantify the distributive inequity created by cost-benefit rules. To what extent are potential victims disadvantaged inequitably by cost-benefit legal rules? And to what extent do potential injurers benefit inequitably from such rules? Answers to these questions can be derived from cost-benefit methodology. Once the inequity has been quantified, it can be redressed by altering the relative weights given to safety and economic interests. Increasing the weight given to safety interests advantages potential victims while disadvantaging potential injurers, so the weights can be altered in this manner until the inequity is adequately redressed.

This approach to the safety principle yields a well-defined decision rule that modifies CBA by giving at least twice as much weight to the relevant safety interests whenever conventional CBA unfairly disadvantages potential victims. The distributive concern is not present in all contexts, making modification unnecessary. These contexts involve numerous potential victims, parties who impose reciprocal risks on one another, and contractual relationships, like product transactions, that create risks threatening injury to the buyer.

A.   Developing the Safety Principle with Cost-Benefit Methodology

Perhaps surprisingly, cost-benefit methodology can identify the distributive inequity created by cost-benefit legal rules. In CBA, the entitlement of potential victims is expressed by the WTA measure for monetizing nonconsensual risks. The WTA measure is constructed on the assumption that potential victims would agree to face the risk in exchange for receipt of their WTA risk proceeds. In effect, the detrimental welfare effects of the risk imposition are fully offset by the welfare gain of increased wealth. If potential victims are not compensated, though, the risk imposition necessarily makes them worse off relative to a situation without the risk. As a matter of definition, risks that reduce the welfare of potential victims correspond to the WTP measure.[66] Thus, unless potential victims receive the WTA risk proceeds to which they are entitled, their entitlement (expressed by the WTA measure) turns out to be no entitlement at all (the WTP measure).[67] The correspondence between entitlements and the risk mea-

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[66] See supra notes 42-49 and accompanying text.
[67] See infra app. § 3.

sures employed by CBA therefore shows why cost-benefit legal rules can disadvantage unfairly potential victims who are not compensated for facing the risk.

The amount of the distributive inequity depends on whether potential victims are entitled to be compensated for all nonconsensual risks or only for unreasonable risks. Limiting the entitlement to compensation for unreasonable risks would seem to correspond to the negligence rule, which provides tort damages only for injuries caused by such risks. This conventional interpretation of the entitlement underlying a negligence rule, however, incorrectly assumes that tort damages are the sole means of compensation.[68] As argued above, potential victims also can be compensated by altering the negligence standard to impose more exacting safety requirements on potential injurers. The amount of such compensation—that is, the amount of safety investments required above the cost-benefit level—can be based on an entitlement that gives potential victims the right to be compensated for any nonconsensual risk-threatening physical injury, whether reasonable or not. Contrary to the conventional view, the rule of negligence need not be based on an entitlement limited to compensation for unreasonable risks.

To see why, suppose that potential victims are entitled to be compensated for facing any nonconsensual risk, whether reasonable or not. (As will become clear, this assumption gives fullest expression to the safety principle.) Now consider once again the outcomes produced by a cost-benefit negligence standard. This standard permits risk whenever the cost of risk elimination, say $50, exceeds the WTA measure, say $30. The potential victim, by assumption, is entitled to $30 for facing this reasonable risk, and the potential injurer owes the $30 to the potential victim. Nevertheless, under the cost-benefit negligence standard, the potential victim does not receive her $30, nor does the potential injurer pay the $30. The cost-benefit negligence standard therefore produces a distributive inequity that can be quantified by the WTA measure for the degree of risk sanctioned by CBA: Potential victims are undercompensated by this amount, and potential injurers receive a windfall in the same amount.

The size of the inequity produced by the cost-benefit negligence standard suggests a remedy. For the level of reasonable risk permitted by CBA, the potential injurer owes the associated WTA amount to the potential victim. If the potential injurer is forced to spend that

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[68] See, e.g., Morris, supra note 54, at 878-79 (using nonnegligent injuries as example of "uncompensated" entitlement because entitlement holder, potential victim, does not have right to monetary compensation).

money on further risk reduction, she no longer inequitably benefits at the potential victim's expense. Under the cost-benefit negligence standard, the potential injurer must spend money on safety only if the cost B is less than the safety benefit, expressed by the WTA measure. To force the potential injurer to expend an additional amount on safety equal to the WTA measure, the cost-benefit negligence standard must be modified to require safety expenditures for which $B < 2\text{WTA}$. The additional safety expenditures required by this more exacting negligence standard reduce the amount of risk faced by potential victims.[69] The risk reduction makes potential victims better off and therefore is a form of compensation that differs from the payment of damages in the event of injury.

The rationale for this more demanding negligence standard can be expressed in terms of the hypothetical contract between the potential injurer and victim. The initial agreement between the parties, expressed by the cost-benefit negligence standard, gives the potential injurer the right to impose risks whenever $B > \text{WTA}$, as in the earlier example permitting the risk involving a $50 safety investment and $30 WTA measure. For such risks, the potential victim is entitled to receive the $30 from the potential injurer. Rather than purchasing a right to damages, which are inadequate in the event of death, the potential victim could return the $30 to the potential injurer in exchange for the potential injurer's promise to spend that money on risk reduction. (Any other exchange is not feasible.) This exchange reduces by $30 the potential injurer's cost of precaution ($50), thereby modifying the cost-benefit duty to require safety investments for which the reduced cost of precaution ($50 - $30 or $B - \text{WTA}$) is less than the safety benefit expressed by the WTA measure of $30. More formally, the cost-benefit duty $B < \text{WTA}$ is modified by the potential injurer's receipt of the WTA risk proceeds to yield a duty of $B - \text{WTA} < \text{WTA}$, or $B < 2\text{WTA}$.

Under this approach, the WTA measure for potential victims (the initial transfer from potential injurer to potential victim reflected in the cost-benefit standard) is converted into something like the WTP measure (the secondary transfer from potential victim to potential injurer). The resultant modification to CBA therefore more closely conforms to the economic facts of the problem described above, which show that from the perspective of potential victims, an entitlement that should correspond to the WTA measure, in the absence of com-

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[69] See supra note 63 and accompanying text. This same logic suggests that strict liability might be justified on deterrence grounds whenever it reduces risk below the level attainable by a negligence standard. See infra Part VII.C.

pensation, actually corresponds to the WTP measure. The approach does not give the potential victim monetary compensation for facing nonconsensual risks. Compensation, however, occurs whenever the potential victim derives some benefit from the WTA risk proceeds. The approach lets the potential victim benefit from the WTA risk proceeds by allowing her to spend the money to protect herself from injury (the secondary transfer representing the conversion of the WTA measure into a WTP measure), thereby giving the potential injurer a duty to spend more on safety than is required by CBA.

Relative to the cost-benefit outcome, the more exacting negligence standard eliminates the windfall of potential injurers and enhances the welfare of potential victims. This standard gives the safety interests associated with otherwise uncompensated risks twice as much weight as the economic interests of potential injurers, the type of weighting sanctioned by the safety principle.[70] Hence a negligence standard based on the safety principle can mitigate the distributive inequity characteristic of the cost-benefit outcome. Whether this particular modification to conventional CBA is either economically or normatively defensible is a matter that will be addressed later. For present purposes, the important point is that cost-benefit methodology can operationalize the safety principle.

B.   Contexts in Which Conventional Cost-Benefit Analysis Is Distributively Defensible

When the risky behavior threatens numerous individuals, is reciprocal, or occurs in certain types of contractual settings, CBA yields distributive outcomes that do not disadvantage potential victims unfairly. For these contexts, there is no obvious distributive rationale for rejecting cost-benefit outcomes.

1.   Numerous Potential Victims

The analysis so far has assumed that the risky interaction involves one potential injurer and one potential victim, such as an automobile driver who must take care to avoid hitting a pedestrian. In many situations, though, the precautions taken by a potential injurer affect more than one potential victim. If a driver takes care to avoid going

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[70] The uncompensated risk measure includes components of economic loss, and the additional weight given to such safety interests is not mandated by the safety principle. See supra Part I (arguing that safety principle does not govern tradeoffs between economic interests). However, the potential victim still will face nonconsensual fatal risks under this approach, making her less well off than in a world in which she is compensated fully for facing nonconsensual risks. Inclusion of economic interests therefore does not seem to benefit potential victims unfairly.

off the road because of the chance that I may be hit on the sidewalk, that care also reduces the likelihood that anyone next to me on the sidewalk will be hit. Any care exercised towards me also can benefit others. Similarly, any care the driver exercises towards other pedestrians also can benefit me. In these settings, safety precautions are a *public* good, meaning that any protection the precaution provides to one individual is unaffected by the fact that others are also protected by the precaution.

When safety precautions are a public good, conventional CBA does not create the type of distributive problem characteristic of non-consensual risk impositions involving two parties. Suppose there is one driver and ten potential victims, each with the same WTA measure for the risk in question. Conventional CBA compares the *total* social cost with the *total* social benefit of any given safety investment. The total cost is given by the driver's burden of risk reduction B. The total benefit is the sum of the ten individual WTA risk measures, since elimination of the risk would confer a benefit of this amount on all ten potential victims. Conventional CBA requires the driver to make safety investments costing $B < 10\text{WTA}$. As argued above, when potential victims are not monetarily compensated for facing nonconsensual risks, their entitlement to the WTA risk proceeds gives them a right to be protected by safety expenditures costing at least $B < 2\text{WTA}$. In this situation, conventional CBA gives each potential victim substantially greater protection than is minimally required by her entitlement when she is the sole potential victim.

The entitlement of each potential victim, however, could yield a different duty of care. Just as one potential victim hypothetically would bargain with the potential injurer for safety investments costing $B < 2\text{WTA}$, the group of ten potential victims hypothetically might bargain for safety investments costing $B < 20\text{WTA}$. In this case, the group of ten potential victims would give the potential injurer an amount equal to 10WTA in exchange for the potential injurer's promise to spend the money on further risk reduction. The potential injurer's cost of precaution would be reduced from B to $B - 10\text{WTA}$, transforming the cost-benefit duty of care $B < 10\text{WTA}$ into $B - 10\text{WTA} < 10\text{WTA}$, or $B < 20\text{WTA}$.

Whether the entitlements of the potential victims require a duty of $B < 2\text{WTA}$, or $B < 20\text{WTA}$, is a distributive matter. The duty of $B < 2\text{WTA}$ can be justified if the focus is limited appropriately to the exchange between one potential victim and the potential injurer. The duty of $B < 20\text{WTA}$ can be justified if the focus is appropriately limited to the exchange between the group of potential victims and the potential injurer. Because each potential victim is both an individual

and a member of the group, either of these duties, or anything in be-
tween, would be acceptable to each of them. The cost-benefit duty
has the interesting feature that it lies approximately in the middle of
the range of acceptable bargains for safety precautions that reduce the
risk faced by a large number of potential victims.[71] The apparent fair-
ness of this "Solomonic" solution to the distributive problem is
appealing.

Moreover, an entitlement is conceived most easily as a right an
individual holds against others, and particularly against others acting
in concert.[72] Cases involving numerous potential victims do not pit
the interests of each potential victim against more broadly based so-
cial interests, the type of situation in which individual rights are most
important. Instead, these cases raise the question of whether each po-
tential victim should be able to benefit from the entitlement held by
others who are also exposed to the risk. Conventional CBA essen-
tially combines the individual entitlements, giving each potential vic-
tim more protection than she would receive if she were the sole
potential victim. Each potential victim benefits from the group rather
than being harmed by the group, so there is no apparent reason why
conventional CBA unfairly disadvantages individual potential victims
in this context.

2. *Reciprocal Risks*

Conventional CBA requires modification when it yields distribu-
tively problematic outcomes. Cases involving reciprocal risks do not
pose a distributive problem, so there is no need to modify CBA in this
context.

The analysis so far has assumed the potential injurer unilaterally
imposes a risk on a potential victim who poses no risk to the potential
injurer. Not all risk situations are of this type. For situations in which
two parties impose risks on one another, the relative weight given to
economic and safety interests depends on the degree of reciprocity
between the parties.

Consider the extreme case of perfect reciprocity in which the two
individuals involved in the risky interaction (such as automobile driv-

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[71] If there are only two potential victims, for example, the bargaining range is between
2WTA and 4WTA, in which case conventional CBA chooses the rule least favorable to
potential victims (based on 2WTA). In the example used in text, by contrast, the midpoint
of the bargaining range is 11WTA, and conventional CBA relies on 10WTA. Thus, as the
number of potential victims increases, conventional CBA becomes increasingly favorable
to potential victims and relies on a WTA measure that approaches the midpoint of the
bargaining range.

[72] Cf. supra notes 30-32 and accompanying text (discussing safety principle as embody-
ing absolute right to safety comparable to individual's constitutional rights).

ers) are identical in all relevant respects, including the degree of risk that each imposes on the other, the severity of injury threatened by the risk, the reasons for the risky behavior, and so on. As there are no relevant individual differences, the two individuals can be conceptualized as one entity. Whatever safety precautions required of one individual will be required of the other. Whatever safety benefits accrue to one person will accrue to the other. Each individual effectively pays for her own safety, just as a single individual pays for her own self-protection, so each of the two reciprocally situated individuals monetize risk in terms of the WTP measure.[73]

When potential victims effectively pay for their safety, there is no distributive problem requiring modification of CBA. Cost-benefit outcomes are problematic distributively only if potential victims are entitled to be compensated for facing risk, as reflected in the WTA measure. For contexts that involve the WTP measure, potential victims pay for their own safety. The costs and benefits of risk reduction are internalized by the individual, who prefers to pay for only those safety investments costing B that are less than her willingness to pay to eliminate the risk: $B < WTP$. The potential victim's preference for safety corresponds to the cost-benefit duty of care in this context, so there is no compelling reason to modify CBA in these circumstances.

The appropriate weight given to economic and safety interests accordingly depends on the degree of reciprocity between the parties. For one extreme—the case of unilateral, nonconsensual risk impositions threatening serious physical injury to a sole potential victim— the decision rule requires safety investments for monetarily uncompensated risks costing $B < 2WTA$. For the other extreme—the case of perfect reciprocity—the rule requires safety investments costing $B < WTP$. Most cases will fall between these extremes, so that the appropriate weighting of the respective interests depends on the relative degree of risk posed by each individual, the relative severity of the threatened injuries, the relative cost of safety precautions, and so on. The individual who is more like the potential injurer (because she poses a much greater threat to the other, would suffer a less severe injury, or whatever) will have economic interests that receive less weight than the safety interests of the party more akin to the potential victim.

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[73] For a formal demonstration of this point, see Geistfeld, supra note 60, at 851-52. For analyses of how bilateral risks affect the welfare properties of different tort rules, see Jennifer H. Arlen, Liability for Physical Injury When Injurers as Well as Victims Suffer Losses, 8 J.L. Econ. & Org. 411 (1992); Arlen, supra note 56.

3. Contractual Settings in Which the Risk Threatens Buyers

Cases in which the risk grows out of a contractual relationship and threatens physical injury to the buyer provide another context in which risk is monetized with the WTP measure. In the products liability context, for example, the manufacturer (potential injurer) sells a risky product to a consumer (potential victim). The consumer chooses to purchase the product and must pay for it. The product's price is based on its production costs, including the cost of safety investments. The relevant inquiry accordingly asks how much the consumer would be willing to pay for any given safety investment made by the manufacturer.

When potential victims both pay for and benefit from safety investments or guarantees of injury compensation, there is no concern about fairly distributing the benefits and burdens of the legal rule between potential injurers and victims.[74] The type of distributive inequity that can justify the safety principle does not exist in these circumstances, eliminating the need to modify CBA.[75]

V

MODIFIED COST-BENEFIT ANALYSIS
AND THE EFFICIENCY-EQUITY TRADEOFF
IN WELFARE ECONOMICS

To remedy a distributive problem characteristic of some cost-benefit outcomes, CBA can be modified in a manner consistent with the safety principle. Whether the modification would be acceptable to economists is an open question. Insofar as conventional CBA fully satisfies the requirements of welfare economics, any modification of CBA would reject the economic underpinnings of CBA, an outcome many economists undoubtedly would not accept.

As suggested by its name, modified CBA is best understood as a decision rule that departs from conventional CBA without rejecting

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[74] When potential victims have different preferences for safety, the cost-benefit rule will be more advantageous to some potential victims and less advantageous to others. In these contexts, however, the distributive issue involves different types of potential victims and does not involve any distributive inequities between potential injurers and victims. The safety principle has no obvious relevance for resolving distributive issues between potential victims. Moreover, it is virtually impossible to devise legal rules to effectuate desired transfers between classes of buyers/potential victims. See Richard Craswell, Passing On the Cost of Legal Rules: Efficiency and Distribution in Buyer-Seller Relationships, 43 Stan. L. Rev. 361 (1991).

[75] Contractual settings in which the risk threatens the seller (like an employee) might not require modification of CBA. The contractual relationship creates the opportunity for transfer of the WTA proceeds to the potential victim. To the extent the transfer occurs, there is no need to modify CBA.

the underlying methodology. Modified CBA relies on cost-benefit methodology to quantify the costs and benefits of risk regulation, and to identify and quantify the distributive inequity created by some cost-benefit legal rules. To redress the inequity, modified CBA regulates risks in a manner that requires more than the cost-benefit amount of safety. Although these regulations are allocatively inefficient, they satisfy the requirements of the efficiency-equity tradeoff widely accepted by welfare economists.

Recall that conventional CBA is based on the premise that questions of allocative efficiency can be separated from distributional issues.[76] The basic idea is that allocative efficiency can be determined by reliance on hypothetical compensation (or the hypothetical agreement underlying CBA), because the appropriate income transfers can be handled by lump-sum taxes assumed to be free of transaction costs. This assumption, which makes it possible to separate questions of allocative efficiency from distributional concerns, is no longer made by welfare economists. The "new" new welfare economics recognizes that the government often does not have the information required to make lump-sum tax redistributions: "It is this limitation on the information of the government which results in taxation being distortionary, and which gives rise to the trade-off between equity and efficiency."[77]

For example, suppose that principles of distributive justice require a redistribution from more able to less able individuals. To effectuate such transfers, the government must determine whether someone is of high or low ability. The government cannot rely on self-reporting, however, because anyone who says she is of high ability would be submitting voluntarily to a higher level of taxation used exclusively for the benefit of someone else. Everyone has an incentive to identify herself as being of low ability, so the government cannot observe costlessly whether someone is of high or low ability. To address this problem, the government must base the tax structure on observable characteristics having some relationship to individual ability. Typically the government relies on income measures as such a proxy. These measures are imperfect, as higher incomes can be associated with higher levels of ability, effort, or greater luck. Moreover, taxation based on income influences individual incentives to earn income. Efforts to distribute income from an allocatively efficient outcome are likely to distort individual behavior, yielding allocatively

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[76] See supra Part II.B.

[77] Joseph E. Stiglitz, Pareto Efficient and Optimal Taxation and the New New Welfare Economics, in 2 Handbook of Public Economics 991, 992 (Alan J. Auerbach & Martin Feldstein eds., 1987).

inefficient outcomes. Hence the tradeoff between equity and alloca-
tive efficiency.

For this reason, welfare economists do not evaluate transfer
mechanisms, such as income taxes, solely in terms of allocative effi-
ciency. According to the current welfare criterion, any given transfer
is economically optimal if it is the least costly method of satisfying a
given distributional need.[78] This criterion minimizes the loss of alloca-
tive efficiency for any given distributive requirement, which is why it is
called, somewhat misleadingly, the efficiency-equity tradeoff.[79]

What, then, does the current welfare criterion require of the
transfers to which potential victims are entitled? The methodology of
CBA assumes that tax transfers can redress any distributive inequities
created by cost-benefit decision rules.[80] The assumption is sound in
principle: Potential victims could receive tax transfers that approxi-
mate the WTA risk proceeds to which they are entitled. The assump-
tion is unrealistic, though, because the government does not have the
requisite information, the same problem underlying the "new" new
welfare economics and its recognition of the efficiency-equity
tradeoff.

For each individual to receive tax transfers based on her WTA
risk proceeds for uncompensated risks, the government would have to
calculate the appropriate risk measure for each individual for every
instance of nonconsensual risk imposition, and the associated transfer
payments would have to occur within a sufficiently short time period.
The impracticality of that approach is obvious. Individuals face differ-
ent risks, have different levels of wealth, and differ in their prefer-
ences for facing risk. Each of these characteristics affects the WTA
measure. The tax transfers could correspond roughly to each individ-
ual's wealth or income, but normative concerns are likely to eliminate

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[78] E.g., Tresch, supra note 53, at 13-14 (1981). Some have interpreted the efficiency-
equity tradeoff to reflect the idea that economic concerns may be traded off against con-
cerns of justice, but that conception of the tradeoff is not defensible. Ronald Dworkin, Is
Wealth a Value?, 9 J. Legal Stud. 191, 201-05 (1980). Instead, distributional concerns must
serve as constraints for efficiency analysis.

[79] The term is misleading because it assumes that equitable advances necessarily come
at the expense of efficiency. The general problem that makes lump-sum transfers impossi-
ble also may make it impossible to achieve allocatively efficient outcomes, creating the
possibility that regulations can yield outcomes that are more efficient and equitable than
unregulated outcomes. See Louis Putterman, John E. Roemer & Joaquim Silvestre, Does
Egalitarianism Have a Future?, 36 J. Econ. Literature 861, 862-65 (1998); see also Isabel H.
Correia, On the Efficiency and Equity Trade-Off, 44 J. Monetary Econ. 581 (1999) (using
general-equilibrium analysis to show that some non-lump-sum redistributive measures can
enhance allocative efficiency).

[80] See supra note 53 and accompanying text.

differences in WTA measures attributable to wealth inequalities.[81] The only feasible approach is for the government to give each individual an equal tax transfer. Numerous potential victims will be undercompensated, and others will be overcompensated.

The funding of these tax transfers creates additional problems. To ensure that the government has the appropriate amount of resources to distribute to potential victims in each period, and to ensure that potential injurers have the appropriate incentives for exercising care, the transfers should be funded by a scheme that requires potential injurers to pay their outstanding WTA obligations to the state.[82] Ideally, this funding scheme would require potential injurers to pay fines each time they imposed uncompensated risks on another, but that approach is not feasible. A more realistic form of this funding scheme relies on a system of strict liability. Injurers would compensate fully accident victims for nonfatal injuries and would pay a fine to the state based on the WTA measure for uncompensated fatal risks.[83]

Leaving aside the difficult problems posed by such a funding scheme,[84] it would incur substantial administrative costs. In many contexts, the scheme would require a shift from current regulatory regimes in which compensatory damages are not available, as often occurs with environmental regulation, to a regime of strict liability. In other contexts, the scheme would require a shift from negligence-based regimes, such as the tort system, to strict liability. In both settings, the shift to strict liability would increase administrative costs.[85]

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[81] See infra notes 96-97 and accompanying text.

[82] Any other funding scheme would need to figure out the total resources that should be distributed to potential victims in each period, a daunting task. Moreover, a funding scheme not based on the WTA obligations of individual potential injurers will create further inequities. Some taxpayers will pay more than their WTA obligations, and some of these individuals will receive tax transfers less than their WTA risk proceeds. For such individuals, inequities in funding will exacerbate inequities in distribution.

[83] Let $P1$ denote the probability that the potential victim will suffer a nonfatal injury, and let $P2$ denote the probability of fatal injury. The overall risk is $P = P1 + P2$. For reasons provided earlier, the plaintiff is fully compensated for the nonfatal injury if she receives tort damages equal to $D = WTA/P1$. See supra note 65. For these same reasons, to satisfy fully the obligation pertaining to fatal risks, the defendant must pay a fine to the state equal to $D = WTA/P2$.

[84] For cases that settle, this funding scheme would cause a substantial increase in administrative costs if an additional judicial proceeding were required to calculate and collect the fine. Daniel L. Rubinfeld, On Determining the Optimal Magnitude and Length of Liability in Torts, 13 J. Legal Stud. 551, 553-57 (1984). Moreover, agency problems in the plaintiff-lawyer relationship render the theoretical attributes of these schemes indeterminate, making it "more difficult to use them as an effective policy tool." Marcel Kahan & Bruce Tuckman, Special Levies on Punitive Damages: Decoupling, Agency Problems, and Litigation Expenditures, 15 Int'l Rev. L. & Econ. 175, 176 (1995).

[85] See Mark Geistfeld, Should Enterprise Liability Replace the Rule of Strict Liability for Abnormally Dangerous Activities?, 45 UCLA L. Rev. 611, 627-33, 639-46 (1998) (pro-

The scheme then would incur the additional administrative costs, which also would be substantial, of collecting and distributing the fines. The scheme incurs these substantial costs merely to effectuate tax transfers poorly tailored to the individual circumstances of potential victims, resulting in the undercompensation of some and the overcompensation of others.

For various reasons, then, the income tax system is a crude mechanism for redressing inequities between potential injurers and victims. Inequities between individuals, in philosophical terms, are a matter of corrective justice, whereas inequities pertaining to wealth and income are a matter of distributive justice.[86] The tax system is an effective mechanism for implementing distributive justice; it is not a good mechanism for implementing corrective justice, which in this context requires the collection and distribution of payments, based on individual WTA measures, unrelated to income or wealth. Compared to the tax system, modified CBA is a less costly and more effective transfer mechanism for redressing individual inequities between potential injurers and victims.[87]

Modified CBA therefore satisfies the requirements of the efficiency-equity tradeoff in welfare economics. The approach is methodologically sound.[88] Moreover, the approach is consistent with

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viding reasons why strict liability can be expensive to administer and empirical data suggesting that shift from negligence to strict liability would increase total administrative costs); see also John Fabian Witt, Note, The Transformation of Work and the Law of Workplace Accidents, 1842-1910, 107 Yale L.J. 1467, 1485 & n.96 (1988) (providing evidence that liability insurance rates for employers increased after adoption of workers' compensation); John Fabian Witt, The Accidental Republic: Amputee Workingmen, Destitute Widows, and the Remaking of American Law, 1868-1922, at 350-52 (2000) (unpublished Ph.D. dissertation, Yale University) (providing further evidence that adoption of workers' compensation increased employer liability premiums).

   [86] The two forms of justice are described in Stephen R. Perry, Tort Law, in A Companion to Philosophy of Law and Legal Theory 57, 71-78 (Dennis Patterson ed., 1996).

   [87] Modified CBA therefore represents an important example of how an allocatively inefficient legal rule may be able to effectuate normatively desirable distributions in a more cost-effective manner than would the tax system. Cf. Chris William Sanchirico, Taxes Versus Legal Rules as Instruments for Equity: A More Equitable View, 29 J. Legal Stud. 797 (2000) (providing analytical reasons why allocatively inefficient legal rules may be more effective transfer mechanisms for purposes of distributive justice than tax system). But cf. Louis Kaplow & Steven Shavell, Should Legal Rules Favor the Poor? Clarifying the Role of Legal Rules and the Income Tax in Redistributing Income, 29 J. Legal Stud. 821 (2000) (arguing that tax system is presumptively superior to allocatively inefficient legal rules for redistributing income from rich to poor).

   [88] In the presence of ideal redistributive institutions, the cost-benefit test can assume the marginal social value of money is equal for all individuals, as the ideal redistribution will equalize the marginal social value of money across individuals. When the required distributions cannot be made by some other institution, the marginal social value of money will not be equal for all individuals, so CBA must weight individual costs and benefits in terms of the marginal social value of money for the individual. See R. Layard & A.A.

President Clinton's executive order requiring federal agencies to consider issues of "equity" and "distributive impacts" when employing CBA.[89]

The consistency of modified CBA with the methodology of modern welfare economics is confirmed by the Pareto principle. The methodology of CBA was derived by welfare economists in an effort to operationalize the Pareto principle as a device for comparing alternative economic states.[90] Due to the importance of the Pareto principle in modern welfare economics, it is important to ask whether the principle is consistent with modified CBA. Recall that modified CBA conforms to conventional CBA for cases in which there is no distributional problem, as occurs in situations of perfect reciprocity.[91] An important implication of this equivalence is that modified CBA complies with the Pareto principle, providing further support for the conclusion that this decision rule satisfies the requirements of welfare economics.[92]

VI .
NORMATIVE PROPERTIES OF MODIFIED
COST-BENEFIT ANALYSIS

Any given entitlement must be normatively justified.[93] Ultimately, then, modified CBA can be defended only if it corresponds to

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Walters, Income Distribution: Allowing for Income Distribution, in Cost-Benefit Analysis 179, 184-85 (Richard Layard & Stephen Glaister eds., 2d ed. 1994). This type of weighting is relied upon by modified CBA. Without a transfer of real money between potential injurers and victims, the marginal social value of money is higher for potential victims, who have not received their due, than for potential injurers, who have paid less than they should. The more exacting safety requirements imposed by modified CBA reduce the marginal social value of money for potential injurers, who are forced to spend more money on safety, while decreasing the marginal social value of money for potential victims, who are able to spend their WTA risk proceeds in a beneficial manner.

[89] See Exec. Order No. 12,866, § 1(a), 3 C.F.R. 638, 639 (1993), reprinted in 5 U.S.C. § 601 (1994).

[90] See supra Part II.B.

[91] See supra Part IV.B.2.

[92] The reason is that the Pareto principle "takes no interest whatever in *distributional* issues, which cannot be addressed without considering conflicts of interest and of preferences." Sen, supra note 51, at 352. Because modified CBA conforms to conventional CBA in the absence of distributional issues, it complies with the Pareto principle. Cf. Louis Kaplow & Steven Shavell, The Conflict Between Notions of Fairness and the Pareto Principle, 1 Am. L. & Econ. Rev. 63 (1999) (using contexts in which individuals are symmetrically situated to show how legal rules justified by nonwelfarist notions of fairness can violate Pareto principle).

[93] Different forms of entitlements have different efficiency and distributive effects. E.g., Morris, supra note 54, at 847-49. Distributive considerations serve as a constraint on economic analyses such as CBA. See supra note 78 and accompanying text. As the distributive desirability of any given entitlement form cannot be determined solely with economic

a normatively defensible entitlement. Modified CBA corresponds to an entitlement held by potential victims that gives them the right to be compensated for facing nonconsensual risks. The unique feature of this entitlement is that compensation can take the form of risk reduction, relative to a baseline cost-benefit amount, rather than monetary compensation. Other than this feature, the entitlement corresponding to modified CBA is flexible enough to accommodate a wide range of normative concerns, as indicated by the following rationale for an entitlement that is consistent with modified CBA:

> The security interests of potential victims are more important than the economic and liberty interests of potential injurers, so individuals are entitled to their bodily security. Ideally, the entitlement cannot be impaired by another absent consent. For those contexts in which consent cannot be obtained, the potential injurer cannot impose risks if the risky behavior is normatively unacceptable. Most nonconsensual risky interactions, however, involve normatively acceptable behavior on the part of both parties, as in typical interactions between automobile drivers and pedestrians. It would not be desirable to ban these risky activities (driving), so in these contexts an individual's bodily security can be impaired without consent, as long as the potential injurer adequately compensates the potential victim for facing the risk. A generalized system of compensatory damages is undesirable, however, because potential victims may be killed by the risk. Consequently, potential injurers must compensate potential victims prior to the risk imposition. The absence of a preexisting relationship between the parties means that potential injurers cannot compensate potential victims monetarily prior to the risk imposition. Instead, potential injurers provide compensation by expending the amount owed to potential victims on further risk reduction. This expenditure will be in addition to the safety expenditures required of the potential injurer in the baseline situation of full monetary compensation. As a result, the duty of care in these circumstances gives the safety interests of potential victims greater weight than the economic and liberty interests of the potential injurer.

As this rationale for the entitlement indicates, modified CBA can be limited by moral concerns that do not depend solely on costs, benefits, and other consequences of the risky behavior. The entitlement determines whether modified CBA is the appropriate decision rule. As a result, modified CBA is appropriate—that is, it conforms to a normatively justified entitlement—only if there is a good moral reason for the legal rule to trade off the interests of potential injurers and

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analysis, even the most ardent proponents of the economic analysis of law must acknowledge that any given entitlement form ultimately requires normative justification.

victims. If one set of the competing interests is normatively unaccept-able, for example, then it would be inappropriate to trade off such interests (like sadistic pleasures) against the competing set of norma-tively acceptable interests (physical security). In such contexts, the legal rule would not have to mediate competing interests, making modified CBA an inappropriate decision rule.

Another important normative aspect of modified CBA involves the baseline duty of care defined in cost-benefit terms. One rationale for this baseline is that it corresponds to the duty of care that potential injurers would exercise in situations of strict liability with full mone-tary compensation for all injuries.[94] An entitlement that gives poten-tial victims the right to full compensation therefore seems to justify a baseline duty of care defined in cost-benefit terms. Another rationale for the cost-benefit baseline is that cases of actual consent, involving the transfer of real money, correspond to cost-benefit outcomes (as reflected in the hypothetical contract underlying CBA).

Finally, prudential reasons dictate that any normative theory of risk regulation will involve departures from cost-benefit outcomes that are neither routine nor very large.[95] This prudential requirement also justifies the cost-benefit baseline. This requirement seems to be satisfied by modified CBA, which departs from cost-benefit outcomes only for nonconsensual, nonreciprocal risks threatening physical in-jury to a few individuals in noncontractual settings.

The cost-benefit baseline is defined in terms of the WTA mea-sure, which seems defensible due to the way in which the measure corresponds to various rationales for the safety principle.[96] The mea-sure should be acceptable to potential victims. Given that the risk of physical injury must be translated into a monetary measure, potential victims presumably would prefer to monetize the risk themselves.

The WTA measure would be troubling if it instantiated indefen-sible wealth inequalities. An individual's valuation of the WTA mea-sure depends on wealth, and the WTA measure determines the amount of safety investment and the degree of risk to which the indi-vidual is exposed. If health and safety are primary goods, an individ-ual's entitlement to these goods should not depend on wealth. However, this concern does not require the rejection of modified

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[94] In a regime of strict liability with fully compensatory damages, potential injurers take the cost-benefit amount of care. See supra note 63.

[95] See supra Part I.

[96] Recall that the WTA measure is based on the premise that potential victims should not have to pay to protect themselves from nonconsensual risks. It includes the cost of risk aversion, and the amount by which it exceeds the WTP measure is largely attributable to the fact that money is a poor substitute for health or life. See supra Part II.A.

CBA, as the WTA measure can be constructed on the assumption that the parties to the hypothetical contract have average wealth.

The most contentious aspect of modified CBA involves the relative weights given to economic and safety interests. In considering the difficulty posed by this issue, it must be recognized that the entitlement corresponding to modified CBA does not require any particular weighting of interests. The version of modified CBA developed above gives the otherwise uncompensated safety interests of potential victims twice the weight it gives to the economic interests of potential injurers. One rationale for this particular duty is that it eliminates the potential injurer's windfall relative to the cost-benefit baseline. This duty, though, permits reasonable risks for which potential victims will not be compensated in the event of injury, thereby reducing their welfare relative to a world without the risk. This reduction in the welfare of potential victims means they are not compensated fully for facing nonconsensual risks under modified CBA. The degree of such undercompensation would be reduced by more exacting duties that reduced risk further, but more exacting duties would impose increasingly higher costs on potential injurers. The normatively acceptable duty depends on the appropriate distribution of the benefits and burdens of nonconsensual risks between potential injurers and potential victims, an issue that modified CBA cannot resolve. Consequently, modified CBA does not require a particular distributive outcome; it merely gives structure to the distributive problem and relies on risk reduction as a form of compensation.[97]

For these reasons, modified CBA is a regulatory approach capable of accommodating a wide range of normative considerations, including those based on the safety principle. The vagueness of the safety principle makes it difficult to reach firm conclusions in this regard, but it appears that modified CBA defensibly implements the normative principle that safety matters more than money.

VII
MODIFIED COST-BENEFIT ANALYSIS AND THE TORT VERSION OF THE SAFETY PRINCIPLE

Another way to determine whether modified CBA defensibly implements the safety principle is to ask whether modified CBA is con-

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[97] In evaluating this problem, whatever welfare loss an individual faces in her role as potential victim should be considered in conjunction with the welfare gain she receives in her role as potential injurer. By permitting some nonconsensual risks, modified CBA benefits all individuals in their roles as potential injurers. By mitigating the welfare loss of potential victims, modified CBA enhances the likelihood that everyone, on balance, benefits from this form of risk regulation.

sistent with important tort practices. Tort law has long accepted the
safety principle.[98] Tort law and modified CBA also share common
objectives. The traditional understanding of torts considers compensation to be the "first purpose of tort law."[99] The traditional understanding considers deterrence to be a subsidiary purpose of tort
law.[100] Modified CBA also has a primary purpose of compensation, as
it is designed to mitigate the welfare losses suffered by potential victims. Under modified CBA, the risk reduction induced by the safety
principle is a form of compensation for potential victims, thereby unifying the rationales of compensation and deterrence in a manner that
makes deterrence subsidiary to compensation, per the traditional understanding of tort law. Hence the tort version of the safety principle
plausibly corresponds to the version implemented by modified CBA, a
correspondence that can be analyzed more directly by comparing the
requirements of tort law with those of modified CBA.

To proceed, we need not resolve the ongoing debate whether tort
law is best understood in terms of corrective justice or wealth maximization. Unlike the conventional economic analysis of tort law,
which purports to answer all tort questions, modified CBA depends
on normative justification for the specification of initial entitlements.
Modified CBA therefore cannot explain all tort rules, as the decision
rule applies only to forced tradeoffs between normatively acceptable

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[98] The weighting of interests sanctioned by the safety principle underlies the various
defenses to intentional torts involving property. See, e.g., Restatement (Second) of Torts
§ 77 (1965). Because intentional torts are the only area of tort law in which the safety
principle has been recognized widely, some tort scholars have argued that the principle is
not relevant for accidental injuries. See David G. Owen, The Moral Foundations of Products Liability Law: Toward First Principles, 68 Notre Dame L. Rev. 427, 469-70 (1993). An
obvious problem with this argument is that defenses to intentional torts turn on the question of whether the conduct was reasonable. For example, absent a threat to personal
safety, it is not reasonable to cause serious harm to another in defense of property, because
safety interests are more important than property interests. Restatement (Second) of Torts
§ 77 cmt. i; Keeton et al., supra note 7, § 21, at 132-33. The question of reasonableness,
which addresses the mediation of normatively acceptable, competing interests, is central to
negligence law. Hence, tort law's invocation of the safety principle to determine the issue
of reasonableness for intentional torts is likely to be relevant in the negligence context. In
particular, by elevating safety interests over property interests in the intentional-torts context, the tort system sanctions the use of the WTA measure for accidental harms, as this
risk measure corresponds to an entitlement that gives such priority to the respective interests. See supra Part III.A. The WTA measure, with its distributive implications, forms the
basis of the safety principle as implemented by modified CBA.

[99] Restatement (Second) of Torts § 901 cmt. a (1979); see also Keeton et al., supra note
7, § 2, at 7 (stating that "primary purpose [of tort law] is to compensate for the damage
suffered").

[100] Restatement (Second) of Torts § 901 cmt. a; see also Keeton et al., supra note 7, § 2,
at 9 (noting that "[t]he idea of punishment, or of discouraging other offenses, usually does
not enter into tort law").

interests of potential injurers and victims. Such tradeoffs are governed by the negligence standard, the rule of strict liability for abnormally dangerous activities, and the risk-utility standard in products liability. The tradeoffs sanctioned by each of these tort rules conform to the tradeoffs sanctioned by modified CBA. This conformity suggests that tort law and modified CBA implement the safety principle in similar ways, providing further grounds for concluding that modified CBA defensibly implements the safety principle.

A.   The Potential Fit Between Modified Cost-Benefit Analysis and Tort Law

As a number of legal philosophers have argued, important aspects of tort law are hard to square with cost-benefit analysis or wealth maximization.[101] As formulated, the argument is debatable.[102] But even if valid, the argument is not applicable to modified CBA, which conforms to the methodological requirements of welfare economics by depending on normative justification for specification of initial entitlements.[103] Due to this dependence, modified CBA cannot determine all tort rules, making it necessary to determine which rules have the potential for conforming to modified CBA.

Some legal philosophers argue that the structure of tort adjudication is not plausibly explained in economic terms.[104] The tort system relies on case-by-case adjudication involving an injured plaintiff and a defendant whose actions causally contributed to the injury, and there is no obvious efficiency rationale for these limitations. Potential injurers could be induced to take efficient precautions if those who created unreasonable risks were sued by anyone, not merely someone injured by the risk. Limiting the class of defendants to risk *creators* also may be inefficient, because one who did not create the risk may be capable of preventing the injury at lowest cost.

Even if the structure of tort adjudication is efficient, the efficiency rationale renders the structure contingent. With changes in the relevant economic facts, the structure of tort adjudication should

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[101] See Perry, supra note 86, at 66-68.

[102] See Mark Geistfeld, Economics, Moral Philosophy, and the Positive Analysis of Tort Law, in Philosophy and U.S. Tort Law (Gerald Postema ed., forthcoming 2001). A more forceful critique would focus on the inability of CBA to determine initial entitlements, which implies that CBA is incapable of determining every aspect of tort law. Cf. id. (arguing that any moral theory of tort law can be translated into social welfare function).

[103] See supra notes 46-47 and accompanying text.

[104] E.g., Jules L. Coleman, Risks and Wrongs 374-85 (1992); Weinrib, supra note 6, at 48 (concluding that "structure [of tort law] is precisely what economic analysis ignores"). Some moral philosophers find this to be the most persuasive critique of the economic interpretation of tort law. Perry, supra note 86, at 66.

change according to the efficiency rationale. Such contingency is not plausible, however, if the plaintiff-defendant relationship is an essential aspect of a "tort" as legal philosophers claim.

This critique of the economic analysis of tort law does not apply to modified CBA. Under this approach, the bilateral nature of the plaintiff-defendant relationship is expressed in terms of a hypothetical contract between potential injurers and potential victims. The hypothetical contract determines the parties' tort rights and obligations to one another and provides the basis, in the event of breach, for the tort action. The bilateral nature of the relationship is as fundamental as the bilateral buyer-seller relationship in contract actions.

Much as actual contracts are governed by contract rules determining enforceability and the like, the hypothetical contract embodied in modified CBA is governed by tort rules that determine analogous questions of enforceability and the like. The content of a tort duty can be derived from modified CBA for those circumstances in which one party hypothetically must contract with another. The requirement of hypothetical contracting, which includes specification of the parties to the hypothetical contract, is an aspect of the initial entitlement requiring normative justification. The specification of tort duties is not merely an economic matter, then, so even if it would be efficient to impose tort duties on more individuals such as potential rescuers, the expanded duties would be barred if normatively undesirable. The entitlement simply would specify that there is no need for such parties hypothetically to contract with one another in these circumstances (or that a hypothetical contract between these parties is not enforceable in these circumstances). Such a limitation of the entitlement does not imply that hypothetical contracting is inappropriate in all circumstances.

Similarly, modified CBA cannot determine the circumstances in which hypothetical contracting is required. The hypothetical contract is a method for trading off the competing interests of two parties. For situations in which forced tradeoffs would be morally problematic, the entitlement would not require hypothetical contracting, even if the entitlement otherwise requires tradeoffs between the parties in other contexts. Entitlements of this type form the basis of intentional torts, such as ordinary battery, which typically require actual consent rather than hypothetical consent.[105] For such entitlements, the entitlement holder is not forced to trade off her interest in bodily security against normatively unacceptable liberty interests of another, such as the pleasure a sadist derives from harming others. Rather, the individual

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[105] Restatement (Second) of Torts §§ 892-892D (1979).

must consent to such a bodily invasion. Whether the requirement of actual consent is inefficient is irrelevant to an assessment of modified CBA, because modified CBA would not be applicable in such cases.

For largely the same reasons, modified CBA cannot determine how tort law should value the competing interests governed by the hypothetical contract. Tort law values individual interests objectively rather than in terms of the individual's own subjective valuation.[106] By excluding consideration of individual differences, an objective standard cannot yield tort rules that are cost-effective for each person, creating the potential for inefficiencies. The objective standard is consistent with modified CBA, however. Because the hypothetical contract applies only to circumstances in which forced tradeoffs are normatively acceptable, the terms of the contract also must be normatively acceptable. That is, the entitlement can specify the type of interests the entitlement holder must trade off with another party who is subject to the same limitations. That specification could rely entirely on subjective valuations, objective valuations, or some mix. The hypothetical contract embodied in modified CBA is merely a method for trading off specified interests; it does not require interests of a certain type.[107]

At best, then, the tradeoffs made by modified CBA can conform to tort rules requiring forced tradeoffs between the normatively legitimate interests of potential injurers and potential victims. In the vast majority of cases, this type of tradeoff is made by the tort system on the basis of the negligence standard, the rule of strict liability for abnormally dangerous activities, and the risk-utility liability standard in products liability.

B. The Negligence Standard

In noncontractual settings, "accident law is still on the whole the law of negligence."[108] The negligence standard, which determines the amount of care owed by potential injurers to potential victims, therefore governs most nonconsensual risky interactions. The well-known Learned Hand negligence standard arguably determines the required

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[106] See Restatement (Second) of Torts § 283 cmt. e (1965) (stating that interests advanced by injurer's conduct do not depend upon actor's subjective evaluation, but rather on "the value which the law attaches to [them]"); id. § 291 (stating that party "is not excused because he is peculiarly inconsiderate of others . . . nor is he negligent if his moral or social conscience is so sensitive that he regards as improper conduct which a reasonable man would regard as proper").

[107] For example, CBA can be based on measures of individual well-being that need not correspond to individual preferences. See generally Adler & Posner, supra note 41.

[108] 3 Fowler V. Harper et al., The Law of Torts § 12.1 (2d ed. 1986).

care with conventional CBA.[109] The disproportionate standard for negligence gives safety interests more weight than economic interests, conforming to the safety principle. Though perhaps less well known than the Hand negligence standard, the disproportionate standard might be used by English and Commonwealth courts,[110] and some tort scholars claim that courts in the United States also rely on it.[111]

Which of these two standards ought to apply to negligence actions has been a source of debate among tort scholars. The conventional cost-benefit negligence standard has been embraced by economically oriented tort scholars,[112] whereas many legal philosophers have argued for the disproportionate standard.[113] Most jurisdictions, though, do not use either of these negligence standards. The vast majority of jurisdictions in the United States define negligence in terms of how a reasonably prudent person would have acted in the circumstances confronted by the defendant.[114] The few jurisdictions requiring more specific guidelines use jury instructions vague enough to be consistent with both the cost-benefit and disproportionate negligence standards.[115]

The reasonable-person negligence standard is consistent with modified CBA, which relies on different standards of care for different contexts. For nonreciprocal risky behavior threatening serious physical injury to a few individuals, modified CBA gives greater weight to safety interests in conformance with the disproportionate standard.[116] Otherwise, modified CBA conforms to conventional

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[109] See supra notes 59-60 and accompanying text. I qualify this claim because the case adopting this standard involved contributory negligence. See United States v. Carroll Towing Co., 159 F.2d 169 (2d Cir. 1947). The amount of care someone exercises for her own protection is not governed by the safety principle. See supra text accompanying note 40.

[110] Weinrib, supra note 6, at 147-52; Stephen G. Gilles, The Invisible Hand Formula, 80 Va. L. Rev. 1015, 1026 n.28 (1994); Keating, supra note 6, at 349-60; cf. B.S. Markesinis & S.F. Deakin, Tort Law 146 (3d ed. 1994) ("It is fair to say that the 'Hand formula', loosely conceived, is an approach followed by the English courts in appropriate cases.").

[111] E.g., Richard W. Wright, The Standards of Care in Negligence Law, in Philosophical Foundations of Tort Law, supra note 47, at 249, 260-61.

[112] See, e.g., Landes & Posner, supra note 64, at 86-88 (arguing that Hand formula minimizes accident costs and that "something like [it] has long been used to decide negligence cases").

[113] See Weinrib, supra note 6, at 147-52; Keating, supra note 6, at 349-60; Wright, supra note 111, at 274-75.

[114] Gilles, supra note 110, at 1017 & n.6.

[115] Id. Judge Richard Posner's preference for the Hand formula is beginning to influence courts, however. See U.S. Fid. & Guar. Co. v. Plovidba, 683 F.2d 1022 (7th Cir. 1982) (Posner, J.) (adopting Hand formula for admiralty actions).

[116] The particular weighing scheme embodied in modified CBA does not accord with the disproportionate standard as articulated by some tort scholars. Some have argued that this standard renders cost considerations irrelevant when the risk is substantial. See Weinrib, supra note 6, at 149; Wright, supra note 111, at 261-63. A fundamental problem with this

CBA. The different standards of care under modified CBA quite plausibly correspond to the way in which jurors apply the reasonable-person negligence standard in different contexts. Jurors are likely to feel that safety matters more than money when the risk threatens serious physical injury. Jurors are also more likely to give greater weight to any given individual's safety interests when the risk threatens only that person or a few others, because the requirements of due care are significantly less demanding in those circumstances as compared to cases in which the risk threatens numerous individuals. Jurors also may find it fair to require greater safety from potential injurers who impose nonreciprocal risks on others. By contrast, jurors are more likely to equate safety with money when the risk threatens economic loss or property damage.

These conjectures are consistent with the way in which judges interpret the negligence standard.[117] The conjectures are also consistent with individual assessments of risk.[118] If jurors evaluate risk in this way, then the reasonable-person negligence standard trades off eco-

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argument is that it fails to explain why the rule of strict liability for "abnormally dangerous" activities does not depend solely on the level of risk, nor does it explain why English courts have not applied strict liability to such activities. See Geistfeld, supra note 85, at 623 n.43.

Another formulation of the disproportionate standard holds that proportionately greater weight should be given to security interests as the risk increases. See Keating, supra note 6, at 349-60. This standard might be consistent with modified CBA. Consider a risk, defined in terms of the WTA measure, that receives twice as much weight under modified CBA as ordinary economic interests. The WTA measure increases with risk at an increasing rate. See infra app. § 1. Consequently, if the WTA measure is $100 for a risk of 1 in 10,000, it could be $250 for a risk of 2 in 10,000. For the smaller risk, potential injurers would have to spend up to $200 on precaution costs (twice the WTA measure of $100), whereas they would have to spend up to $500 once the risk doubles. The required safety expenditures therefore increase at a higher rate than do increases in risk. Under modified CBA, then, economic interests face proportionately higher burdens as the risk increases, even though there is no change in the relative weight given to security interests and ordinary economic interests.

[117] A survey of 100 judges found that most applied the negligence standard in a manner consistent with CBA for cases involving property damage, whereas all judges applied the negligence standard in a manner that favored safety over money for an otherwise identical case (in cost-benefit terms) involving serious personal injury. W. Kip Viscusi, How Do Judges Think About Risk?, 1 Am. L. & Econ. Rev. 26, 40-46 (1999).

[118] Studies have found that lay individuals find the following contextual features to be relevant to the valuation of risk:

> (1) [T]he catastrophic nature of the risk; (2) whether the risk is uncontrollable; (3) whether the risk involves irretrievable or permanent losses; (4) the social conditions under which a particular risk is generated and managed, a point that connects to issues of consent, voluntariness, and democratic control; (5) how equitably distributed the danger is or how concentrated on identifiable, innocent, or traditionally disadvantaged victims, which ties to both notions of community and moral ideals; (6) how well understood the risk process in question is, a point that bears on the psychological disturbance produced by different

nomic and safety interests in roughly the same manner as modified CBA.

Of course, the reasonable-person negligence standard is unlikely to implement modified CBA perfectly, but perfection is not required. The appropriate question is whether the reasonable-person negligence standard plausibly conforms to modified CBA. If the negligence standard should be defined solely in cost-benefit terms, why rely on the reasonable-person standard? Or if the disproportionate negligence standard is appropriate for all cases, why not define the negligence standard in those terms? The reasonable-person standard gives jurors a great deal of flexibility to determine the weights that should be given to safety and economic interests in any given case. Such flexibility is not required by the cost-benefit and disproportionate standards. The flexibility is easier to rationalize in terms of a context-dependent approach, like modified CBA, which varies the weights given to safety and economic interests across the range of cases. Rather than confuse jurors by giving them detailed instructions on how the weighting of interests depends on various contextual features, the appropriate weighting can be expressed simply with the reasonable-person negligence standard. Hence the reasonable-person negligence standard plausibly conforms to modified CBA.

C. The Relationship Between Negligence and Strict Liability

Negligence is the dominant liability rule for nonconsensual risks, with strict liability largely limited to cases involving "abnormally dangerous" activities.[119] Why strict liability should be limited in this manner is one of the more perplexing problems faced by tort scholars.[120] This limited role of strict liability is consistent with modified CBA.

Modified CBA increases the standard of care above the cost-benefit amount whenever the resultant risk reduction is needed to compensate potential victims. The approach assumes that the more exacting negligence standard will reduce risk below the level attainable by the cost-benefit standard or a rule of strict liability.[121] Although the assumption is likely to be valid for most cases, there is an

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risks; (7) whether the risk would be faced by future generations; and (8) how familiar the risk is.

Pildes & Sunstein, supra note 22, at 57; see also W. Kip Viscusi, Corporate Risk Analysis: A Reckless Act?, 52 Stan. L. Rev. 547, 552 (2000) (describing study which found that mock jurors tend to reject corporate decisions involving risks to others that are based on CBA).

[119] See Restatement (Second) of Torts §§ 519-520 (1977).

[120] "The choice between negligence and strict liability is fundamental; yet after centuries of debate, no clear choice has been made." Richard A. Epstein, Torts § 4.1 (1999).

[121] See supra note 63 and accompanying text.

important class of cases for which strict liability would lead to lower risk levels.

The degree of risk reduction that can be attained by a negligence standard depends on the evidence available to plaintiffs and courts concerning the burdens and benefits of various safety precautions. When good evidence concerning required safety precautions is unavailable, a potential injurer who fails to take such precautions will escape liability. Due to problems of proof, then, potential injurers can satisfy the enforceable requirements of the negligence standard, even when they have failed to exercise reasonable care. This particular evidentiary problem does not arise under strict liability, making it capable of reducing risk when negligence, as a practical matter, cannot.

The rule of strict liability for abnormally dangerous activities is largely limited to these situations and is hard to explain on other grounds.[122] This limitation is consistent with modified CBA. According to the rationale for modified CBA, in some contexts potential victims can be compensated by more exacting safety requirements that reduce risk below the cost-benefit baseline level, a baseline attained by strict liability.[123] When potential injurers can rely on the lack of evidence to forego required safety expenditures, there is no risk reduction below the baseline level that serves to compensate potential victims. Evidentiary problems therefore undermine the rationale for modified CBA, leaving strict liability as the best means of compensating potential victims in these cases. The rationale for modified CBA therefore explains why the tort system limits strict liability to situations in which the risk reduction attainable by a negligence standard does not compensate potential victims adequately.

D. The Risk-Utility Standard in Products Liability

Product sellers face tort liability for injuries caused by defective products. Whether a product is defective in most cases is determined

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[122] See Geistfeld, supra note 85, at 646-58 (arguing that rule of strict liability for abnormally dangerous activities is most plausibly understood in terms of its ability to reduce risk below level attainable by negligence standard for contexts in which plaintiffs have difficulty proving lack of reasonable care); Mark Geistfeld, Tort Law and Criminal Behavior (Guns), 43 Ariz. L. Rev. (forthcoming 2001) (showing how deterrence rationale for strict liability is required if rule is to be consistent with negligence for third-party criminal behavior). Notice that this interpretation of strict liability also suggests strict liability may be appropriate if it leads to the same risk level as negligence, and potential victims would be compensated inadequately under a negligence rule. A good example of such a case involves reasonable behavior that creates a high degree of nonreciprocal risk and only implicates the interests of the two parties to the lawsuit. See id. Together, these roles for strict liability persuasively explain the rule of strict liability for abnormally dangerous activities. See id.

[123] See supra note 63.

by negligence principles reflected in the risk-utility liability standard, which compares the risk posed by a particular product configuration with the utility of that configuration.[124] If the product can be reconfigured to reduce or eliminate a risk, the inquiry asks whether the reduced risk (or safety benefit) exceeds the decreased utility stemming from the product alteration (the increased cost of the safety investment). When the risk (benefit) exceeds the utility (cost), a product without the configuration is defective, thereby subjecting the seller to tort liability.[125]

The risk-utility liability standard, though based on negligence principles, differs from the reasonable-person negligence standard that applies to injuries not caused by products. The difference in the two liability standards is consistent with modified CBA. Unlike the risky interactions governed by the reasonable-person negligence standard, product risks grow out of a contractual relationship and typically threaten injury to the buyer (consumer). Product risks are monetized appropriately in terms of the WTP measure, since the vast majority of potential victims both pay for and receive the benefits of tort liability.[126] When potential victims monetize risk in terms of the WTP measure, they prefer safety investments that satisfy the cost-benefit or risk-utility liability standards, as reflected in the hypothetical contract between a consumer and manufacturer.

Product transactions obviously involve actual contracts, but these contracts are not reliable due to the inability of most consumers to make well-informed choices concerning product risk.[127] A hypothetical contract between the manufacturer and a well-informed consumer therefore forms the basis for ascertaining a manufacturer's duty of care. For mass-marketed products, the contract must involve a well-informed *average* consumer.[128]

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[124] The risk-utility test determines design and warning defects. Restatement (Third) of Torts: Products Liability § 2 cmts. d, i (1997).

[125] E.g., id. cmt. f ("[A]n alternative design is reasonable if its marginal benefits exceed its marginal costs.").

[126] See supra Part IV.B.3. Additional consideration must be given to bystanders—those who do not benefit from the product use—as these individuals may monetize the product risk in terms of the WTA measure, depending on the degree of reciprocity. As long as the vast majority of product-caused injuries are suffered by users, the risk-utility test ordinarily will approximate closely the appropriately modified cost-benefit test.

[127] See Mark Geistfeld, Products Liability, in 3 Encyclopedia of Law and Economics 347 (Boudewijn Bouckaert & Gerrit De Geest eds., 2000).

[128] See Restatement (Third) of Torts: Products Liability § 2 cmt. d (1997) ("Assessment of a product design in most instances requires a comparison between an alternative design and the product design that caused the injury, undertaken from the viewpoint of a reasonable person."); Mark Geistfeld, Inadequate Product Warnings and Causation, 30 U. Mich. J.L. Reform 309, 322-29 (1997) (showing how legal requirements for adequate product warnings depend on informational needs of average consumer).

The average consumer would prefer to pay for a safety investment that is less costly than the associated risk, monetized in terms of the WTP measure. If consumers as a group were well informed, these safety investments would be made by a manufacturer seeking to maximize profits. Product transactions in this hypothetical, well-functioning market would satisfy the risk-utility test, so a product failing the test would breach the hypothetical contract. The breach stems from the fact that consumers are not well informed of the risk. By taking advantage of consumers in this way, the manufacturer did not adequately respect their security interests, thereby subjecting it to tort liability.

By this same reasoning, if the risk could be eliminated only by safety investments exceeding the WTP measure of the average well-informed consumer, the manufacturer does not have to make these investments. When the cost of safety exceeds the average consumer's willingness to pay to eliminate the risk, the average consumer would prefer to face the risk rather than pay (in the form of higher product prices) for the safety investment. The manufacturer is not taking advantage of consumer informational problems, so its decision to forego these safety investments adequately respects consumer interests.

Modified CBA therefore is consistent with the risk-utility standard in products liability. The logic of modified CBA also explains why the tort system has had trouble implementing the risk-utility test.

As indicated by the Ford Pinto and General Motors cases discussed at the outset of this Article,[129] jurors in products liability cases often are incensed when manufacturers trade off dollars for lives, even though the risk-utility standard sanctions such a tradeoff.[130] Judges tend to have the same reaction.[131] For some commentators, this behavior seems to be irrational and requires limiting the type of products liability issues that should be resolved by juries or even the tort system.[132] The behavior can be explained with the logic of modified CBA, providing a good example of how modified CBA can help the process of tort reform.

Products liability cases are very similar to those in which the safety principle should be invoked. The difference between the two

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[129] See supra notes 2-4 and accompanying text.

[130] For extensive documentation of this point, see Viscusi, supra note 118, at 552-57 (describing mock juror study); id. at 568-78 (noting examples from case law).

[131] One study of 100 judges found that over two-thirds of them felt that punitive damages were appropriate in a hypothetical case involving the failure to repair an airplane door when the costs of repair exceeded the expected safety benefits. See Viscusi, supra note 117, at 40-46.

[132] See, e.g., Viscusi, supra note 118, at 589 (proposing that "responsibility for deterring corporate misbehavior" be moved from courts to regulatory agencies).

types of cases is unlikely to be apparent to most jurors and judges. Like ordinary tort cases (driver-pedestrian), products liability cases involve *nonconsensual* risk impositions, because the existence of a defect implies that the average consumer chose the product without adequately comprehending its risks. Like ordinary tort cases, in products liability cases the potential injurer (manufacturer) benefits or profits from the risk at the expense of potential victims. And like most ordinary tort cases, products liability cases involve few potential victims, because the amount of safety investments in any given product affects only the user of the product and any bystanders who might be injured by the product. As argued earlier, in cases of nonconsensual risk impositions affecting a few potential victims, jurors are more likely to feel that safety interests deserve greater weight than ordinary economic interests.[133] That weighting is appropriate in some noncontractual settings involving risks monetized with the WTA measure. But safety interests do not deserve greater weight in the products liability context, which primarily involves risks monetized in terms of the WTP measure.

There is no compelling reason to believe that jurors discern the difference between ordinary tort cases and products liability cases. Unless jurors understand why products liability cases are different—why noncontractual contexts in which potential victims do not pay for safety investments differ from contractual settings in which most potential victims must pay for any risk reduction or guarantees of tort compensation—they will have trouble applying the risk-utility test, even when instructed to do so. The risk-utility test must be formulated so that jurors can appreciate the relevant difference between the two contexts, enabling them to understand why manufacturers should give equal weight to economic and safety interests, even though the two sets of interests do not deserve equal weight in other, seemingly similar contexts.[134] This remedy does not require radical tort reform, as some commentators assert, but merely requires improved jury instructions.[135]

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[133] See supra notes 116-18 and accompanying text.

[134] The most promising solution is to rely on the consumer-expectations test framed in a manner that defines expectations in terms of consumer preferences for safety investments satisfying the cost-benefit test. Any other formulation of consumer expectations involves an inherent ambiguity—expectations of risk or safety?—that creates inconsistent results. See Geistfeld, supra note 127, at 367-68.

[135] A point that applies to other tort issues. See Geistfeld, supra note 128, at 329-35 (showing poor guidance provided by current jury instructions for product warnings and providing set of more useful jury instructions); Geistfeld, supra note 60, at 841-43 (showing poor guidance provided by current jury instructions for pain and suffering damages and providing more useful jury instruction).

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Most tort cases require mediation of the conflicting, normatively acceptable interests of potential injurers and victims. Tradeoffs of this type are made by the tort rules of negligence, strict liability for abnormally dangerous activities, and the risk-utility standard in products liability. Such tradeoffs also are made by modified CBA, which makes the tradeoffs in roughly the same manner as the tort system. The tort system and modified CBA also share the similar objectives of compensation and deterrence. The close correspondence between the relevant tort rules and modified CBA suggests that the tort version of the safety principle corresponds to the version implemented by modified CBA, providing further reason for concluding that modified CBA defensibly implements the safety principle.

VIII
THE PRECAUTIONARY PRINCIPLE

The foregoing analysis has assumed the safety principle must be given specificity or content for it defensibly to guide risk regulation. The analysis then has shown how such content can be supplied by cost-benefit methodology. The need to operationalize the safety principle and the usefulness of employing CBA towards that end are aptly illustrated by the precautionary principle, which involves issues pertaining to the safety principle we have yet to address.

So far we have considered how CBA should be modified by the safety principle for a known risk of injury. In many important regulatory contexts, the most difficult policy issue is how to proceed when the risk of injury is not known. Does a substance, such as a chemical or a genetically modified biological organism, pose a threat to human health? And if we are unsure, how should we proceed?

Regulators expend great effort on determining the hazardous properties of substances.[136] They look for plausible biological or chemical interactions that might produce injury, and study how the substance affects human cells and the health of laboratory animals. This risk assessment, though helpful, does not eliminate scientific uncertainty. The fact that mice have a higher incidence of cancer after being exposed to high doses of the substance does not mean that humans exposed to low doses will develop cancer. Often we will not know whether a substance is hazardous, or the level of risk it poses, until it is introduced into the environment.

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[136] See, e.g., John D. Graham, Laura C. Green & Marc J. Roberts, In Search of Safety: Chemicals and Cancer Risk (1988) (discussing methods regulators used to assess risks posed by formaldehyde and benzene).

The need to make regulatory decisions in the face of scientific uncertainty is endemic. To deal with this pervasive problem, regulators in a wide variety of circumstances have adhered to the precautionary principle, the notion of "better safe than sorry."[137] The precautionary principle, like the safety principle, emphasizes safety concerns (the possibility that the substance might be hazardous) over economic considerations (the possibility that the substance will be subject to costly regulation even though it is not hazardous). By relying on the precautionary principle, regulators can control stringently or ban a substance on the ground that it is potentially hazardous, even if the underlying scientific data are inconclusive.

The precautionary principle has been invoked in recent international agreements concerning health, safety, and the environment.[138] The reach of the precautionary principle is enormous given the widespread scientific uncertainty about how substances interact with humans and the environment. The precautionary principle therefore is the most important application of the safety principle in the regulatory context.

Because there has been no well-specified version of the safety principle, there is no well-specified version of the precautionary principle. The vagueness of the precautionary principle has become highly problematic, particularly for the European Union. To address the problem, the Commission of the European Communities has tried to provide more specific guidance. Its lack of success reveals the importance of formulating an operational version of the safety principle.

A much more satisfactory approach to the precautionary principle can be derived from the methodology of CBA. This approach supports the important features of the precautionary principle, while providing the specificity needed for good decisionmaking. Hence the precautionary principle illustrates both the need to operationalize the claim that safety matters more than money, and the value of employing cost-benefit methodology towards that end.

A. Problems Created by the Vagueness of the Precautionary Principle

When regulations are justified with vague claims, the real motivation for the regulation is impossible to discern. Does the precautionary principle address legitimate safety concerns, or does it merely mask trade protectionism or irrational fears of technology? Answers to these questions are crucial due to the distributive impacts of many

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137 See supra notes 15-17 and accompanying text.
138 See id.

health and safety regulations. Different interest groups have different reasons for supporting or opposing regulations. The vagueness of the precautionary principle provides ample room for disagreement, making it hard to justify regulations based on the principle.

When the European Union blocked importation of U.S. hormone-treated beef, did it properly invoke the precautionary principle?[139] Has the European Union properly invoked the precautionary principle as a reason for regulating trade in genetically modified organisms, such as soybeans?[140] Or does the European Union invoke the principle on the basis of irrational concerns or a desire to protect European agricultural interests from foreign competition? Other than the regulators, no one knows. Not surprisingly, "[c]onsumer concerns over food safety have increasingly led to international trade rows in which protectionism is usually the counter-charge to domestic measures aimed at protecting public health or at least bolstering public confidence."[141]

The Commission of the European Communities asserts that the precautionary principle is a "full-fledged and general principle of international law."[142] But if the mere possibility of risk is sufficient to invoke the precautionary principle, precious little prevents its invocation to regulate virtually any potentially hazardous substance disfavored for unexpressed, indefensible reasons. As a critical editorial in the *Wall Street Journal* put it: "The precautionary 'principle' is an environmentalist neologism, invoked to trump scientific evidence and move directly to banning things they don't like—biotech, wireless technology, hydrocarbon emissions."[143] The U.S. State Department has adopted a similar stance. According to one official, "the increasing efforts from within the EU . . . could weaken the scientific basis for regulatory decisions that affect trade. This trend poses a challenge not

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[139] The history of this trade dispute is described in George H. Rountree, Note, Raging Hormones: A Discussion of the World Trade Organization's Decision in the European Union-United States Beef Dispute, 27 Ga. J. Int'l & Comp. L. 607, 611-12, 632-33 (1999).

[140] The European Union, like other jurisdictions, requires labeling for genetically modified foods. Ruth MacKenzie & Silvia Francescon, The Regulation of Genetically Modified Foods in the European Union: An Overview, 8 N.Y.U. Envtl. L.J. 530 (2000).

[141] Science of Banning American Cows Too, Birmingham Post (Eng.), Oct. 14, 1999, at 26, 1999 WL 25286371.

[142] Communication on the Precautionary Principle, supra note 17, at 11. For a description of international environmental policies relying on the precautionary principle, see id. at 26-28.

[143] Editorial, Fear of the Future, Wall St. J., Feb. 10, 2000, at A18.

only to U.S. interests but also to the rules-based, global trading system that we have spent the past 50 years in building."[144]

Is the precautionary principle really a neologism capable of undermining the rules-based approach to regulation? Without something more specific than the claim that safety matters more than money, it is hard to know.

B.   The European Attempt to Develop the Precautionary Principle

In the midst of several disputes involving the precautionary principle, the Commission of the European Communities issued a communication (policy paper) on the precautionary principle to provide "guidance" and "avoid unwarranted recourse to the precautionary principle, which in certain cases could serve as a justification for disguised protectionism."[145]

In the communication, the Commission affirms "that requirements linked to the protection of public health should undoubtedly be given greater weight than economic considerations."[146] The Commission, however, never specifies how much more weight should be given to safety interests. As a result, the "guidance" it provides on the precautionary principle is analytically problematic and unsatisfactory to those who are concerned that the precautionary principle is nothing other than disguised protectionism or extreme environmentalism.

According to the Commission,

> [w]hether or not to invoke the Precautionary Principle is a decision exercised where scientific information is insufficient, inconclusive, or uncertain and where there are indications that the possible effects on the environment, or human, animal or plant health may be potentially dangerous and inconsistent with the chosen level of protection.[147]

The "chosen level" of protection depends, of course, on the appropriate balance between safety and money. What is that balance?

The Commission observes that "reliance on the precautionary principle is no excuse for derogating from the general principles of risk management."[148] It identifies these general principles of risk management as proportionality, nondiscrimination, consistency, ex-

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[144] Alan P. Larson, Remarks at Iowa Governor's Conference on International Trade (transcript available in U.S. Dep't of State Dispatch, June 1, 1999, at 18, 1999 WL 19912583).

[145] Communication on the Precautionary Principle, supra note 17, at 9. The European Commission initiates proposals for all new legislation in the European Union.

[146] Id. at 20.

[147] Id. at 8; see also id. at 13 (discussing same basic criteria for applying precautionary principle).

[148] Id. at 18.

amination of the benefits and costs of action or inaction, and examina-
tion of scientific developments. Of these principles, the concepts of
proportionality and cost-benefit analysis have the potential for deter-
mining the appropriate balance between safety and money, but the
Commission fails to develop that potential.

Proportionality means that "[m]easures based on the precaution-
ary principle must not be disproportionate to the desired level of pro-
tection and must not aim at zero risk."[149] This principle of risk
management merely begs the question concerning the "desired level
of protection."

Examination of costs and benefits is a more obvious way to deter-
mine the "desired level of protection." The Commission, however,
does not explore that possibility, or its relationship to the precaution-
ary principle. As a matter of cost-benefit methodology, the cost of
any given risk, or the associated benefit of risk reduction, is defined in
terms of the WTA or WTP measures. Each measure depends on the
probability and severity of injury. Our inability to know the risk re-
quires resort to the precautionary principle. On what basis, then,
should costs and benefits be computed? The Commission provides no
guidance, ultimately retreating with the statement that "[e]xamination
of the pros and cons [of regulation] cannot be reduced to an economic
cost-benefit analysis" because it includes "non-economic considera-
tions."[150] These "non-economic considerations" presumably pertain
to the protection of public health, and so this particular section con-
cludes with the Commission's invocation of the safety principle.[151]

The Commission's communication on the precautionary principle
is replete with references like the "desired level" of safety. The com-
munication acknowledges that zero risk is not desirable or feasible,
but provides no guidance on how regulators should determine accept-
able risk. This indeterminacy and the central role it plays in triggering
the precautionary principle (whenever there is some scientific indica-
tion of a threat to the "desired level" of safety) give regulators ample
opportunity to invoke the precautionary principle as justification for
indefensible regulations.

Not surprisingly, the communication has deepened the sentiment
that the precautionary principle is mere mush. The editorial board of
the *Wall Street Journal*, for example, argues that this version of the
precautionary principle "surely would lead to all kinds of absurd re-
sults," such as a ban of the automobile.[152] European commentators

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[149] Id.
[150] Id. at 19.
[151] See id. at 20.
[152] Fear of the Future, supra note 143, at A18.

acknowledge that it is "doubtful that the communication will go far in clarifying the EU's use of the principle or convincing the US of its validity."[153]

C.   Developing the Precautionary Principle with Cost-Benefit Methodology

Extreme application of the precautionary principle would ban any potentially hazardous substance, a regulatory approach creating the same problems as the version of the safety principle that permits no tradeoffs between safety and money.[154] For the same reasons the safety principle must sanction some sort of tradeoff between safety and money, cost considerations must be incorporated into the precautionary principle. But once cost considerations become relevant, the precautionary principle must confront the practical problem posed by the safety principle. What is the appropriate weighting of safety and economic interests? As argued above, that weighting can be determined by modified CBA. How the weighting should be affected by scientific uncertainty is the particular problem addressed by the precautionary principle.

The existence of scientific uncertainty requires more than the absence of complete certainty. For reasons given below, scientific uncertainty requires a defensible or reasonable basis for concluding that risk exists, an issue unconnected to cost-benefit methodology (and beyond the scope of this discussion). In this regard, the European Commission adopts a plausible, if undeveloped position: "Recourse to the precautionary principle presupposes: identification of potentially negative effects resulting from a phenomenon, product or process; a scientific evaluation of the risk which because of the insufficiency of the data, their inconclusive or imprecise nature, makes it impossible to determine with sufficient certainty the risk in question."[155]

Identifying the appropriate triggering conditions for the precautionary principle is not enough, however. To see how the precautionary principle can be operationalized by cost-benefit methodology, consider a situation in which scientific evaluation yields the following range of possibilities: The phenomenon, procedure, or substance may pose a significant risk of serious physical injury ("substantial risk"), a very low risk of serious physical injury ("moderate risk"), or an insignificant risk ("no risk"). Suppose further that the weight of the scientific evidence supports the conclusion of moderate risk. The

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[153] When in Doubt . . ., Bus. Eur., Feb. 9, 2000, at 6, 6.
[154] See supra Part I.
[155] Communication on the Precautionary Principle, supra note 17, at 15.

possibility the risk is substantial or nonexistent implies a defensible basis for each of the three conclusions that is not sufficiently strong to rule out the other possibilities. How should regulators proceed?

To assess the costs and benefits of risk regulation, the probability and severity of injury must be specified. Depending on context, the cost of any given risk, or the associated benefit of risk reduction, is defined in terms of either the WTA or WTP measure, and each measure depends on the probability and severity of injury.[156] The resolution of scientific uncertainty—the selection of probabilities and injury types—therefore affects CBA via its impact on the WTA or WTP measures. Once the uncertainty is resolved in some manner that quantifies these measures, CBA can proceed. The methodology does not require any particular resolution of the problems posed by scientific uncertainty. Nevertheless, cost-benefit methodology, considered in light of the safety principle, suggests the following approach.

Consider noncontractual contexts in which the WTA measure is appropriate. This measure is the potential victim's price for facing a specified threat to her bodily security. In situations of scientific uncertainty, the nature of that threat is unknown. In these situations, then, the potential victim hypothetically must contract with the potential injurer, but the item being exchanged (the risk) has essential, unknown attributes. A substantial risk yields a higher WTA measure than a moderate or nonexistent risk. What is the appropriate price for this exchange?

The potential victim prefers to assume that the risk is substantial, because this assumption yields the highest selling price (WTA measure) and ensures that the ultimate resolution of the scientific uncertainty will not be disadvantageous. If the risk were assumed to be moderate or nonexistent, and turned out to be substantial, the potential victim would be undercompensated. For these same reasons, the potential injurer prefers to assume the risk is nonexistent, for if the risk is assumed to be moderate or substantial and turns out to be nonexistent, then the potential injurer will have expended money unnecessarily.

Each party has a reasonable basis for his or her preferred assessment of the risk. How should the dispute be resolved? One plausible approach is to rely on an objective third-party assessment of the

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[156] The probability and severity of injury could be expressed as probability distributions over the range of possible outcomes, with each outcome weighted by the probability of its being true. That is merely one approach to the problem, however, as discussed below.

risk,[157] suggesting that the risk should be assumed to be moderate (the conclusion supported by the weight of scientific evidence).

The implications of this approach are troubling in light of the concern that nonconsensual risks should not unfairly disadvantage potential victims. The security interest of the potential victim is not given any special priority, because the objective assessment of the risk focuses only on scientific evidence. The potential victim, however, is the party forced into the transaction with the potential injurer. The potential victim, as seller, gets to determine the sales price for risks involving a known probability and severity of injury. The price depends on a variety of factors determined by the potential victim. Presumably the price can be determined only on the basis of reasonable factors, so that irrational fears of risk would not count. The price still depends on various reasonable factors that could be altered to yield lower WTA measures. Yet these aspects of the potential victim's valuation of the risk are not second-guessed, presumably because they are reasonable. Is it unreasonable for the potential victim to assume the worst case scenario, given a defensible scientific basis for the conclusion of substantial risk? And if it is not unreasonable for the potential victim to price the risk in this way, what justifies a rejection of that price in the hypothetical contract?

Now consider the implications of adopting the potential victim's assumption that the risk is substantial, the approach that gives priority to security interests pursuant to the safety principle. This approach also conforms to the precautionary principle, since potential victims will assume the worst case scenario for contexts involving the WTA measure. In light of this assumption, the benefit of risk reduction is determined by the potential victim's WTA measure for the substantial risk. That benefit is then compared to the cost of safety precautions pursuant to modified CBA, which need not require the complete elimination of risk.

Thus, even if the regulatory approach adopts the potential victim's preferred assessment of the risk, the approach will often permit activities that impose nonconsensual risks on potential victims. A regulatory approach based on the precautionary principle therefore need not ban any potentially hazardous activity, contrary to the simplistic caricature of the precautionary principle as an "environmental neologism" capable of banning anything.[158]

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[157] Justice Breyer advocates this approach to risk regulation. See Stephen Breyer, Breaking the Vicious Circle 55-81 (1993).

[158] See supra note 143 and accompanying text.

To be sure, this regulatory approach can be criticized on the ground that the potential victim's preferred assessment of the risk—the worst case scenario in the foregoing example—will often mischaracterize the risk. At times, the best case scenario will characterize the risk correctly. Most of the time, the scenario supported by the weight of scientific evidence presumably will be correct. But no approach will provide the correct characterization always. Estimates of uncertain outcomes will not be correct each and every time. Mistakes will be made. Mistakes create error costs, which will be borne by potential injurers, potential victims, or both parties. The distribution of these error costs is a normative matter. The regulatory approach based on the precautionary principle places the error costs on potential injurers, a resolution of the distributive problem that is defensible.

Consider a regulation based on the potential victim's reasonable assessment that the activity in the example above poses a substantial risk. Suppose the risk in fact is moderate. Regulations based on the assumption of substantial risk will produce error costs—potential injurers will be forced to take more costly precautions than would be required in a world of complete scientific knowledge—but what is unfair about this outcome? Potential victims face a lower level of nonconsensual risk than they otherwise would face in a world of no scientific uncertainty, as regulations for substantial risks impose more demanding safety requirements than do regulations for moderate risks. Any amount of nonconsensual risk, however, makes potential victims worse off than in a world without the risk. In what way, then, does this regulatory approach unfairly advantage potential victims? The approach is "advantageous" to potential victims only insofar as it makes potential injurers bear the error costs. However, potential injurers directly benefit from the potentially hazardous activity and do not face the prospect of physical injury. Moreover, potential injurers can avoid the more burdensome regulatory requirements by financing the research needed to reduce the uncertainty.

Cases of scientific uncertainty therefore pose a particular type of distributive problem. In such cases, regulatory errors are inevitable, and someone must bear the associated costs. A regulatory approach based on the precautionary principle places the burden of factual uncertainty on those who directly benefit from an activity that is the source of the uncertainty and concern.[159] This solution to the distributive problem is defensible, and once the precautionary principle is

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[159] The relevant tort norm, by contrast, tries to apportion the burden of factual uncertainty equally between the parties, and can justify (nonideal) outcomes in which potential victims disproportionately bear the cost of factual uncertainty. See Mark Geistfeld, Scientific Uncertainty and Causation in Tort Law, 54 Vand. L. Rev. (forthcoming 2001) (arguing

conceptualized in this way, its method of implementation becomes apparent. The distributive problem depends on context, so the appropriate solution of the distributive problem—the regulatory implications of the precautionary principle—will be context dependent.

Consider contexts in which the risk is monetized with the WTP measure, as in product transactions. The potential victim must pay for any safety investments or guarantees of injury compensation. In these contexts, potential victims no longer prefer to assess the risk in terms of the worst case scenario that reasonably can be maintained. Why pay for safety investments that may be unnecessary? Potential victims also would not assess the risk in terms of the best case scenario, for if the risk materializes it will harm them. In these contexts, potential victims necessarily bear the error costs created by scientific uncertainty, which take the form of overly costly precautions or an excessive risk of injury. Because potential victims bear the error costs, they prefer risk assessments that minimize the cost of error. Risk assessments of this type are likely to be set on the basis of the weight of scientific evidence, which presumably yields the right answer more frequently than other approaches. Potential victims (consumers) also would want to be informed of the uncertainty (via product warnings), because some are likely to defer the purchase until the hazardous properties of the product have been more definitively evaluated.[160]

In these contexts, the precautionary principle does not justify risk assessments based on the worst case scenario. The precautionary principle would seem to require the fair treatment of potential victims, and in these contexts potential victims prefer risk assessments that minimize the cost of error. This type of risk assessment is based on all the available scientific evidence. In other contexts, though, the precautionary principle justifies risk assessments that are not based on all the evidence. Such contexts involve risks monetized with the WTA measure, as in the example discussed earlier. In these contexts, potential victims prefer to monetize the risk in terms of the worst case scenario. As long as this risk assessment is reasonable—a requirement satisfied by valid inferences from at least some of the available scientific evidence—then there is a defensible distributive rationale for monetizing the risk in this manner. Once the risk is monetized, it can be regulated like any other risk under modified CBA. A regulatory approach based on the precautionary principle therefore need not un-

that tort norms justify requirement that plaintiffs establish causation with epidemiological proof in cases of scientific uncertainty).

160 See id. (explaining why disclosure of scientific uncertainty about risk can be material to average consumer's decision of whether to purchase or use particular product).

dermine the "rules-based" approach to regulation, contrary to another simplistic caricature of the precautionary principle.[161]

D. Reconsidering European Risk Regulations in Light of the Precautionary Principle

The version of the precautionary principle advocated by the European Commission can be reduced to a defensible distributive proposition that yields a well-defined regulatory approach: For cases of uncertainty, risk should be monetized in any reasonable manner preferred by potential victims, and the monetized risk then should be used to regulate the activity pursuant to modified CBA. This version of the precautionary principle can justify the European regulatory approach to nonconsensual risks involving the WTA measure, but does not justify the European regulatory approach in settings involving the WTP measure.

The European Commission's failure to limit the precautionary principle in this manner may be unsurprising given the European Union's invocation of the precautionary principle to ban the importation of U.S. hormone-fed beef. Any safety threat posed by the beef is faced by consumers, making the WTP measure appropriate.[162] Consumers would defer willingly to unbiased expert assessment of product risk, but the European Union's regulatory decision ignores numerous scientific studies finding no adverse health effects of these growth hormones and a similar finding by a panel of the World Trade Organization.[163] Instead, the European Union invoked the precautionary principle based on consumer concerns unsupported by scientific study.[164] Even if such consumer sentiments are sufficient to establish a "reasonable" basis for scientific uncertainty, the precautionary principle merely requires that consumers know, via product warnings, whether they are purchasing hormone-fed beef.[165] The consumer can compare any price and quality differences to the cost of uncertainty. Consumers, however, were not given that choice by the European Union's decision to ban the beef.

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[161] See supra note 144 and accompanying text.

[162] The safety threat could be intergenerational if the hormones affect future generations. But consumers would consider any adverse health affects on their progeny, making it unnecessary to account for those interests separately in the quantification of costs and benefits.

[163] See Rountree, supra note 139, at 610 (describing studies); id. at 624-25 (describing finding by WTO panel).

[164] See id. at 609.

[165] The requirement also can be justified on grounds of allocative efficiency. See Geistfeld, supra note 159.

By contrast, the European Union properly has invoked the precautionary principle to regulate trade in genetically modified organisms. The European Union requires product labels notifying consumers that they are purchasing bioengineered food,[166] a defensible regulation that highlights the problematic nature of the European Union's ban on hormone-fed beef. Genetically modified food, however, also can pose a threat to others. Genetically altered fish, for example, have potentially severe adverse environmental effects on a substantial number of bystanders that are monetized with the WTA measure.[167] Potential hazards of this type are governed appropriately by the precautionary principle, so the European Union did not act improperly when it insisted that the precautionary principle be included in the Biosafety Protocol regulating trade in genetically modified organisms.[168]

Hence the European Union is criticized rightly in some contexts, while in others it has proceeded consistently with a plausible version of the precautionary principle. The mixed success of the European Union is predictable given its vague specification of the precautionary principle. Such vagueness and the ensuing political turmoil are unnecessary, as the precautionary principle can be operationalized with cost-benefit methodology.

CONCLUSION

The idea that safety matters more than money is vague and undoubtedly means different things to different people. To guide legal policy, this vague idea must be justified and turned into an operational decision rule. The justification would seem to require a rejection of CBA, since the claim that safety matters more than money seems to be fundamentally inconsistent with a methodology that equates safety and money. However, the safety principle is not inconsistent with cost-benefit methodology.

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166 See supra note 140 and accompanying text. Consistency in labeling has been difficult to achieve due to widespread but different uses and levels of genetically modified food ingredients. See Steve Stecklow, 'Genetically Modified' on the Label Means . . . Well, It's Hard to Say, Wall St. J., Oct. 26, 1999, at A1.

167 See Carol Kaesuk Yoon, Altered Salmon Leading Way to Dinner Plates, but Rules Lag, N.Y. Times, May 1, 2000, at A1 (stating:

A recent study showed, for example, that populations of wild fish could, in theory, be wiped out by mating with certain kinds of genetically engineered fish, should they escape. In addition, there is the possibility of unpredictable environmental disruptions, like those that occur when non-native species invade ecosystems, as the zebra mussels have the Hudson River.).

168 See Brandon Mitchener, Biosafety Agreement Raises Question, Wall St. J. Eur., Jan. 31, 2000, at 4, 2000 WL-WSJE 2944258 (discussing role of Precautionary Principle in Biosafety Protocol); see also supra note 17 (providing sources on Biosafety Protocol).

This methodology shows that cost-benefit outcomes involving nonconsensual fatal risks are distributively inequitable in the absence of adequate transfer mechanisms. An equitable concern about protecting potential victims is the most plausible justification for the safety principle, and altering the regulatory rule to give safety interests greater weight than economic interests defensibly redresses the distributive inequity characteristic of certain cost-benefit outcomes. Cost-benefit methodology therefore provides a good reason for accepting the safety principle rather than being fundamentally inconsistent with it.

Justifying the safety principle does not necessarily make it operational. How much more weight should be given to safety interests than to ordinary economic interests? And in what circumstances is this weighting appropriate?

Potential victims can be disadvantaged by cost-benefit decision rules if they are not compensated adequately for facing the risk. The way in which CBA translates safety interests into money is not the problem, because the WTA measure is the potential victim's assessment of how much money adequately would compensate her for facing the nonconsensual risk in question. Instead, the problem is one of giving the WTA risk proceeds to potential victims when redistributive mechanisms, such as tax transfers or tort damages, are inadequate.

A remedy for the inequity is suggested by cost-benefit methodology. For any nonconsensual risk sanctioned by CBA, the potential victim is entitled to compensation from the potential injurer. For fatal risks, however, the potential victim does not receive the WTA risk proceeds due to the absence of redistributive mechanisms. The potential victim therefore is owed an amount equal to the WTA risk proceeds from the potential injurer. To effectuate this transfer, the potential injurer could be forced to spend the money on further risk reduction. The resultant duty of care gives the otherwise uncompensated safety interests of potential victims twice the weight as the associated economic interests of potential injurers. The safety interests are counted once in the cost-benefit standard of care that defines the baseline level of risk; the safety interests are counted again in the modified standard of care to reflect the transfer between the two parties of the WTA risk proceeds.

A decision rule that gives the relevant safety interests twice as much weight as ordinary economic interests can reduce risk below the levels attainable by the conventional cost-benefit negligence standard and strict liability. Reducing the risk of fatal injuries is particularly valuable for potential victims, because ex post damages will not compensate a dead person and other forms of ex ante compensation are

either infeasible or less desirable than risk reduction. CBA modified in this manner is more beneficial to potential victims, and consequently more distributively fair, than conventional cost-benefit outcomes. Moreover, modified CBA is not unfair to potential injurers. Their welfare level under this rule is the same as their welfare level under conditions of actual exchange (the cost-benefit outcome coupled with payments to potential victims).

Economic and moral theories seem to agree that the most desirable situation occurs when individuals consent to the risks they face.[169] Modified CBA strives to approximate the welfare levels that individuals would attain under conditions of actual consent, but fails to achieve the ideal due to the restricted nature of the exchange between potential injurers and victims. Under this approach, potential victims still suffer a welfare loss from nonconsensual risks, so modified CBA does not eliminate the inequity. The degree to which the inequity should be redressed is not a matter of cost-benefit methodology, however, and more exacting safety requirements are consistent with modified CBA. The basic thrust of this regulatory approach is that risk reduction, below a baseline level defined in cost-benefit terms, is a method of compensating potential victims. The appropriate amount of compensation cannot be determined by modified CBA. But by giving structure to the distributive problem, modified CBA suggests remedies, like the one described above that gives double weight to monetarily uncompensated safety interests.

Whatever the exact form of the remedy may be, modified CBA gives safety interests greater weight than economic interests, suggesting that modified CBA implements the safety principle. Any conclusion in this regard must be tentative, given the vagueness of the safety principle. Perhaps the best way to assess modified CBA is to consider the version of the safety principle to which it corresponds:

> Individuals have a right to bodily security that has legal priority over the economic interests advanced by the risky activities of others. The right is not absolute; in normatively appropriate contexts the individual is entitled only to be compensated for being exposed to nonconsensual risks. In these contexts, the right cannot always be protected adequately by monetary compensation. Money is a poor substitute for health, and ex post monetary compensation is not possible for fatal injuries. For contexts in which individuals are not adequately compensated for facing nonconsensual risks, they have a right to greater protection than they would receive under conditions of full monetary compensation. Whether the right to bodily security is threatened by a particular activity will not al-

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169 See supra note 27 and accompanying text.

ways be knowable scientifically. In these cases, the activity should be regulated on the basis of the risk assessment reasonably preferred by those individuals threatened by the potential hazard.

This version of the safety principle captures most of the ideas plausibly expressed by the claim that safety matters more than money. The version is implemented by modified CBA. With this regulatory approach, legal decisionmakers can employ cost-benefit methodology to formulate health and safety regulations while still respecting the principle that safety matters more than money.

APPENDIX

This Appendix provides the analysis supporting a number of the economic propositions discussed in the text. The analysis involves a potential injurer and the associated potential victim who do not have a contractual relationship with one another. Potential injurers can influence the probability of injury by taking precautionary measures, whereas potential victims cannot influence the probability of injury. The injury kills a potential victim. (Focusing on fatal risks simplifies the analysis without limiting its generality.) An individual who is dead is assumed to have a utility level of zero.

The notation to be used in the analysis is as follows.

- x = level of care taken by the potential injurer, measured as the cost of taking care.
- $p(x)$ = probability that the potential victim will suffer injury when the potential injurer exercises the amount of care x. The function is continuously differentiable with $p'(x) < 0$ and $p''(x) > 0$.
- w_v = wealth of potential victim.
- $V(w_v)$ = potential victim's (von Neumann-Morgenstern) utility of wealth. The function is continuously differentiable with $V'(w) > 0$ and $V''(w) < 0$. It can also be assumed that $V(0) > 0$ so that a living individual with no wealth has greater utility than someone who suffers a fatal injury and is assumed to have zero utility.
- w_i = wealth of potential injurer.
- $I(w_i)$ = potential injurer's (von Neumann-Morgenstern) utility of wealth. The function is continuously differentiable with $I'(w) > 0$ and $I''(w) < 0$.

1. Willingness to Accept Risk

For a given probability p of suffering a fatal accident, the minimum amount of money a potential victim would be willing to accept (WTA) in order to face the risk is the amount that equalizes her utility without risk and her utility when she faces the risk and receives the WTA risk proceeds.

$$(1 - p)V(w_v + WTA) = V(w_v). \qquad (1)$$

For $p = 0$, WTA = 0. For $p = 1$, WTA = ∞. More generally, for each p in the interval $[0, 1]$ there is a unique WTA measure that continuously increases with increases in $p(x)$. This function is well defined even though potential victims who are killed have zero utility. Note that the cost of risk aversion, if it exists, is captured in the individual's valuation of WTA, which includes all costs the risk imposes on the individual.

2. Willingness to Pay to Eliminate Risk

For a given probability p of suffering a fatal accident, the maximum amount of money a potential victim would be willing to pay in order to eliminate the risk (WTP) is the amount that equalizes her utility when facing the risk and her utility when the risk has been eliminated and she pays the WTP amount.

$$(1 - p)V(w_v) = V(w_v - WTP). \tag{2}$$

For $p = 0$, WTP $= 0$. For $p = 1$, WTP $= w_v$. More generally, for each p in the interval $[0, 1]$ there is a unique WTP measure that continuously increases with increases in $p(x)$. The WTP function is well defined even though potential victims who are killed have zero utility. Note that the cost of risk aversion, if it exists, is captured in the individual's valuation of the WTP amount. Finally, note that since the WTP measure is in the range $[0, w_v]$ and the WTA measure is in the range $[0, \infty]$, for any p, WTP $\leq$ WTA.

3. The Case in Which Potential Victims Do Not Receive the WTA Risk Proceeds Prior to the Risk Exposure

In the event a potential victim does not receive her WTA risk proceeds before being exposed to the risk, allocative efficiency requires the amount of care x that maximizes the sum of the parties' expected utilities.

$$I(w_i - x) + p(x)V(w_v). \tag{3}$$

The problem is defined in terms of the indirect utility functions. To convert the problem into one involving wealth, it is necessary to monetize the injury threatened to potential victims, $p(x)V(w_v)$. Equation (2), which holds for any given probability p, can be rearranged to yield:

$$V(w_v) - V(w_v - WTP) = pV(w_v). \tag{4}$$

Hence the injury faced by potential victims, $p(x)V(w_v)$, has a monetary cost given by the WTP measure, which is unsurprising since this measure gives the individual's monetization of the risk whenever the risk exposure makes her worse off than a baseline of no risk.[170]

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[170] See supra notes 44-45 and accompanying text. The analysis here implicitly assumes that the probability of injury is equal in the WTA and WTP settings, which is defensible because the regulatory context under consideration ordinarily involves small risks, and the two measures are approximately equal for such risks. See supra text accompanying notes 45-46. Note also that it is not possible to derive a meaningful expression for $pV(w_v)$ from equation (1), which is used to derive the WTA measure. Multiplying both sides of that equation by $pV(w_v)$ and rearranging yields $(1 - p)V(w_v + WTA) + (p - 1)V(w_v) = pV(w_v)$. When the potential victim does not receive the WTA risk proceeds (WTA $=0$?), this equation makes no sense.