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Why Law Now Needs to Control Rather than Follow Neo-Classical Economics

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ARTICLE

Why Law Now Needs to Control Rather than Follow Neo-Classical Economics

JOHN WILLIAM DRAPER*

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This article argues that neo-classical economics places an emphasis on short-term gain over precaution,¹ and in doing so, places the lives of a myriad of individual humans—and even the species itself—at risk. Given the foreseeable risks, if humanity wants to survive longer, we need to rethink our economic principles and priorities and the relationship between economics and law.

Neo-classical economic theory is the basis of the current system of law and economics.² Professor John Mixon explains: “The neoclassical model limits its theory of person to two and only two characteristics: (1) people are rational, and (2) people are self-interested.”³ Although the model is purported to employ amoral procedures in an effort to objectively explain and predict human behavior in a world of limited resources, its focus is on efficiency in a utilitarian view of resource use with a market ideal of maximum profit. Sadly, as Mixon notes, “There is no assumption that people in the market are honest, truthful, fair, or just, except to the extent they gain some advantage from such behavior.”⁴ What’s more, the neoclassical model, in predicting human activity, makes no accommodation for resource conservation,

1. The “precautionary principle” takes the approach of better safe than sorry. There is scientific and legal literature on the topic. *See, e.g.*, CAROLINE E. FOSTER, SCIENCE AND THE PRECAUTIONARY PRINCIPLE IN INTERNATIONAL COURTS AND TRIBUNALS: EXPERT EVIDENCE, BURDEN OF PROOF AND FINALITY (2011); JOAKIM ZANDER, THE APPLICATION OF THE PRECAUTIONARY PRINCIPLE IN PRACTICE: COMPARATIVE DIMENSIONS (2010) (discussing the role played by the precautionary principle when addressing issues in the EU); Cass R. Sunstein, *Beyond the Precautionary Principle*, 151 U. PA. L. REV. 1003, 1003 (2003). The principle is discussed in writings on environmental law. *See, e.g.*, BÉNÉDICTE SAGE-FULLER, THE PRECAUTIONARY PRINCIPLE IN MARINE ENVIRONMENTAL LAW: WITH SPECIAL REFERENCE TO HIGH RISK VESSELS (2013); LUCIANO BUTTI, THE PRECAUTIONARY PRINCIPLE IN ENVIRONMENTAL LAW: NEITHER ARBITRARY NOR CAPRICIOUS IF INTERPRETED WITH EQUILIBRIUM (2007); Phillip M. Kannan, *The Precautionary Principle: More than a Cameo Appearance in United States Environmental Law?*, 31 WM. & MARY ENVTL. L. & POL’Y REV. 409 (2007).

2. Neo-classical economics is being increasingly absorbed in legal reasoning. John Mixon, *Neoclassical Economics and the Erosion of Middle-Class Values: An Explanation for Economic Collapse*, 24 NOTRE DAME J.L. ETHICS & PUB. POL’Y 327, 328 (2010). Neo-classical theory is manifested in several ways. Consider, for example, the shareholder primacy norm. *See* Jill E. Fisch, *Measuring Efficiency in Corporate Law: The Role of Shareholder Primacy*, 31 J. CORP. L. 637 (2006).

3. Mixon, *supra* note 2, at 328.

4. *Id.*

pollution abatement, population control, or the recognition of any Earthly limits.⁵

We build profit-maximization into our law, especially in the areas of corporations and securities, through statute,⁶ regulation,⁷ and case law.⁸ We embed maximization in order to support current corporate fiduciary duties and economic growth. In this way, economics are changing the law. Instead of being driven by economics, law needs to place limits on the theory and practice of economics, especially where the use of economic principles supports the taking of lives in return for proprietary gain.

5. *Id.* at 333.

6. New Jersey was the first state to relax corporate law in the late nineteenth century. In 1913, Governor Woodrow Wilson tightened the standards and “provoked a mass corporate migration to Delaware.” Harwell Wells, *The Rise of the Close Corporation and the Making of Corporation Law*, 5 BERKELEY BUS. L.J. 263, 282 n.120 (2008). The Delaware chartering and renewal process was relaxed to the point of providing no oversight. The doors were opened, and Adolf Berle’s notion of shareholder primacy walked in. See Adolf A. Berle, *Corporate Powers as Powers in Trust*, 44 HARV. L. REV. 1049, 1051 (1931). Theorists followed: Wealth maximization is the acknowledged purpose of the firm in the two dominant schools of corporate thought: shareholder primacy and the managerialist school that defends management discretion. See William W. Bratton & Michael L. Wachter, *Shareholder Primacy’s Corporatist Origins: Adolf Berle and The Modern Corporation*, 34 J. CORP. L. 99, 145–46 (2008).

There are examples of required profit-maximization at the federal level. See, e.g., Employee Retirement Income Security Act § 404(a)(1)(A)(i), 29 U.S.C. § 1104(a)(1)(A)(i) (2012) (requiring ERISA fiduciaries to discharge their duties “for the exclusive purpose of . . . providing benefits to participants and their beneficiaries”).

What’s more, protection of short-term economic interests crops up in procedural law. See Class Action Fairness Act of 2005 (CAFA), Pub. L. No. 109-2, 119 Stat. 4 (2005) (codified as amended at 28 U.S.C. §§ 1332, 1452–1453, 1711–1715). This law was sought by big business, and it may serve to insulate the profits of big business from some of the public’s pain and recourse) as well as in criminal law (exclusive ownership rights and criminal penalties for violations thereof). See Digital Millennium Copyright Act § 103(a), 17 U.S.C. § 1204 (2012) (potentially serving to prevent the adoption of new technologies).

7. See Exec. Order No. 12,291, 3 C.F.R. § 127 (1982), *reprinted in* 5 U.S.C. § 601 (1988) (revoked 1994).

8. See, e.g., *Dodge v. Ford Motor Co.*, 170 N.W. 668, 684 (Mich. 1919) (discussing that a business corporation is organized in a way where its purpose is primarily to maximize profit of its shareholders); see also *Revlon, Inc. v. MacAndrews & Forbes Holdings, Inc.*, 506 A.2d 173, 182 (Del. 1986) (noting that a corporation’s primary role is to maximize the profit of its shareholders); *eBay Domestic Holdings, Inc. v. Newmark*, 16 A.3d 1, 28–30 (Del. Ch. 2010) (same).

I begin with a most brief overview of the various sources of risk to the human species and its life support system. Then I will move on to look at how neo-classical economics interacts with significant risk.

There are two troubling problems with current applications of neo-classical economics (especially visible in the form of cost-benefit analysis): (1) the placing of property rights above, or even on a par, with all other fundamental rights violates moral and legal principle and (2) the system of neo-classical economics has no built-in brake; by valuing only the racing engine of short-term maximization, the system has no means or mechanism by which to adequately and consistently slow down to protect the life support system of the planet. By utilizing this expression of cost-benefit analysis, humanity puts itself at risk using neo-classical economics to kill that life support system⁹ largely in the name of material well-being.

To be sure, material well-being is important. But more is not always better. When increased consumption causes humanity to encounter and exceed the physical limits of the planet, more is not better. In fact, it can turn out to be deadly.¹⁰

9. Scientists say human activity has pushed Earth beyond four of nine “planetary boundaries.” Joel Achenbach, *Scientists: Human Activity Has Pushed Earth Beyond Four of Nine “Planetary Boundaries,”* WASH. POST (Jan. 15, 2015), https://www.washingtonpost.com/national/health-science/scientists-human-activity-has-pushed-earth-beyond-four-of-nine-planetary-boundaries/2015/01/15/f52b61b6-9b5e-11e4-a7ee-526210d665b4_story.html [<https://perma.cc/M3S6-85SF>].

10. “Rioting in response to soaring food prices recently has broken out in Egypt, Cameroon, Ivory Coast, Senegal and Ethiopia. In Pakistan and Thailand, army troops have been deployed to deter food theft from fields and warehouses.” Bob Davis & Douglas Belkin, *Food Inflation, Riots Spark Worries for World Leaders: IMF, World Bank Push for Solutions; Turmoil in Haiti*, WALL ST. J. (Apr. 14, 2008, 11:59 PM), <http://www.wsj.com/articles/SB120813134819111573> [<http://perma.cc/7UPN-SZQ5>]. Other countries “at risk of social upheaval . . . include Indonesia, Yemen, Ghana, Uzbekistan, and the Philippines. In countries where buying food itself requires half to three-quarters of a poor person’s income, there is no margin for survival. *Id.* (internal quotations omitted). For another deadly example of exceeding physical limits, consider the effect of overpopulation in Rwanda. See JARED DIAMOND, *Malthus in Africa: Rwanda’s Genocide*, in COLLAPSE: HOW SOCIETIES CHOOSE TO FAIL OR SUCCEED 311–28 (2005).

Neo-classical economics assumes profit maximization as a social goal and a property right.¹¹ The law protects our fundamental rights,¹² including property rights. But when we protect the right to property at the expense of lives, even mere statistical lives, the world becomes a more deadly and unjust place.

Most people would agree that it is immoral to take lives in return for money.¹³ But that's what neo-classical economics does; it places a value on the lives of people and deems those lives expendable if that value is lower than any conflicting property right *before* they die.¹⁴ Professors Frank Ackerman and Lisa Heinzerling do a stellar job of providing concrete examples in their book¹⁵ and earlier article.¹⁶

This calculation is more than just a moral problem. Arguably, such an implementation could be considered a violation of

11. With the ascendancy of the law and economics movement (based on neo-classical economics), the self-interest of maximization won out even over non-corporate law. For example, according to Professors Easterbrook and Fischel, "Managers have no general obligation to avoid violating regulatory laws, when violations are profitable to the firm." Frank H. Easterbrook & Daniel R. Fischel, *Antitrust Suits by Targets of Tender Offers*, 80 MICH. L. REV. 1155, 1168 n.36, 1177 n.57 (1982) ("[M]anagers not only may but also should violate the rules when it is profitable to do so.").

12. The fundamental rights of "life, liberty, and property" arise in the due process clauses of the Fifth and Fourteenth Amendments to the Constitution. Those fundamental rights may not be taken without due process of law. See JOHN E. NOWAK & RONALD D. ROTUNDA, *Procedural Due Process—Requirement for Fair Adjudicative Procedure*, in CONSTITUTIONAL LAW 641, 641 (8th ed. 2010).

13. "[M]orally, the killing of people for money is not an acceptable role since it amounts to murder, which contravenes the principles of universal public morality." EDWARD H. SPENCE ET AL., MEDIA, MARKETS, AND MORALS 18 (2011). Whether or not money is involved, the imperative is simple: "Thou shalt not kill." *Exodus* 20:13; *Deuteronomy* 5:17.

14. Cass R. Sunstein, *The Real World of Cost-Benefit Analysis: Thirty-Six Questions (And Almost as Many Answers)*, 114 COLUM. L. REV. 167, 181–88 (2014). See Mixon, *supra* note 2, at 328, for more on the moral position of neo-classical economics.

15. For example, drivers using cell phones are willing to pay more than people at risk of being killed are willing to pay to avoid that risk. See FRANK ACKERMAN & LISA HEINZERLING, PRICELESS: ON KNOWING THE PRICE OF EVERYTHING AND THE VALUE OF NOTHING 1–2 (2004).

16. For example, using standard cost-benefit analysis, smokers' lives are worth less than the savings from reduced expenditures on pensions, housing, and health care. See Frank Ackerman & Lisa Heinzerling, *Pricing the Priceless: Cost-Benefit Analysis of Environmental Protection*, 150 U. PA. L. REV. 1553, 1553–54 (2002).

criminal law as well. Taking money in return for taking lives certainly has the *sound* of a criminal violation. The protection of life is embedded deeply in the roots of Western law's Judeo-Christian heritage.¹⁷ The use by neo-classical economics, especially cost-benefit analysis (CBA), of the value of statistical lives (VSL) provides a clear example that flies in the face of these common notions of justice. Money should not matter more than life. Neo-classical economics and CBA do that. They are therefore immoral, if not illegal, and they need to be discontinued and replaced by a system that honors and protects life.

Neo-classical economics encourages the use of infinite resources to maximize profits in a short time frame. This winner-take-all approach encourages environmental destruction and erosion that cumulates in foreseeable risks to the life support system of the planet.¹⁸ Thus, we find that the human problem of the twenty-first century is, in part, rooted in the neoclassical economic theory of the late twentieth century and its implementation in law.

Neo-classical economics provides the decision procedures commonly used to analyze risk: CBA and discounting. Those procedures have deficiencies, and those deficiencies are shared with neo-classical economics and at least to a degree, its greater theory, utilitarianism.

17. "Thou shalt not kill." *Exodus* 20:13; *Deuteronomy* 5:17. The imperative is both legal and moral.

18. One counter argument is that prices of rare resources would go up over time, such that no depletion would occur. This is wonderful in theory, but the fact is that people pay more for the rarer, more precious, commodity. The fewer Sumatran rhino horns there are available in the face of great demand, the more they are worth, and the more people will pay, even in the face of criminal sanctions. See EDWARD O. WILSON, *THE FUTURE OF LIFE* 79–88 (2002); see also JORGE H. MALDONADO & ROCIO DEL PILAR MORENO SÁNCHEZ, CENTRO DE ESTUDIOS SOBRE DESARROLLO ECONÓMICO (CEDE), SERIE DOC. CEDE No. 2009-22, DOES SCARCITY EXACERBATE THE TRAGEDY OF THE COMMONS? EVIDENCE FROM FISHERS' EXPERIMENTAL RESPONSES 5–9 (2009), <http://ssrn.com/abstract=1502899> [<https://perma.cc/SYM5-5ZE9>] (discussing the effect of differences in source stock on the levels of extraction). See also BARRY SCHWARTZ, *THE PARADOX OF CHOICE: WHY MORE IS LESS* 95 (2004), for more on competition for inherently scarce goods.

We analyze and cope with risks through views that have long been developed. Here, I will compare two of the three main views of risk: the objective view and the moral view.¹⁹

The objective view is statistical or quantitative. It dispassionately attempts to employ a unitary metric to drive a mechanical CBA.²⁰ The unitary metric fails in our biological world.²¹ It results in precise numbers that say nothing about the moral choices under consideration.²²

Instead, in this article, I will rely on a third view of risk, the moral view. The morality of protecting lives should prevail over claims of right to property or prosperity.

The deeper problem is our response to risk. This article argues that neo-classical economics should be displaced by theory and practice that do a better job of protecting all of us from significant risk. Humanity should move to eventually ban the use of unrestricted neo-classical economics, including cost-benefit analysis, in cases of significant risk as well as for insignificant risks that cumulate or interact to cause significant risk.

19. The third, the subjective view, is largely a sociological theory. I will not discuss the subjective view of risk which includes sociological risk analysis. It considers an increasing feeling of underlying fear in the context of the world risk society, see ULRICH BECK, *WORLD RISK SOCIETY* 19–47 (1999), but its focus on subjectivity is not well suited to displace the claims of the objective view.

20. “Benefit and burden are measured by inquiring into the preferences, as expressed in dollars, of those affected by the risk impositions at issue.” Gregory C. Keating, *Pressing Precaution Beyond the Point of Cost-Justification*, 56 VAND. L. REV. 653, 681 (2003).

21. From a biological perspective, selection theory that takes account of both altruism and selfishness is known as multilevel selection theory. Arriving at a unitary metric is likely to be impossible in the absence of a single statistical method of accounting. According to biologists David Sloan Wilson and Edward O. Wilson, “there is no single statistical method that captures all aspects of multilevel selection theory.” See David Sloan Wilson & Edward O. Wilson, *Rethinking the Theoretical Foundation of Sociobiology*, 82 Q. REV. BIOLOGY 327, 337 (2007). When one considers altruism toward one’s loved ones and friends, it’s easy to envision at least some altruistic behavior.

22. Keating, *supra* note 20, at 681.

The unrestricted use of subjective preference (whether or not it is expressed in dollars) is objectionable because it compares harms—death and inconvenience, for example—which are not comparable morally speaking, and permits a sufficient quantity of trivial benefit to justify some irreparable injury. Harms must be comparable in urgency and in the benefit or injury they work on the lives of those they affect before they may be traded against one another.

Id.

I. FORESEEABILITY OF CATASTROPHE

Generally, we do not want to be negligent. When a risk is foreseeable, we tend to avoid negligence by planning ahead or by using some kind of risk analysis. The law of negligence protects defendants when the result is not foreseeable.²³ One cannot be found negligent if the risk was not foreseeable. However, if and when one can foresee the risk, and the risk to life, liberty, or property is significant, a finding of negligence is possible.

As we will see in the moral view of risk, we should not harm others, either through intent or through negligence. Foreseeability of catastrophe should be enough to justify having a discussion about taking a new course. The ability to talk about catastrophe from a cause and effect standpoint would seem to be enough to justify discussion, especially in the face of man-made irreversible catastrophe. Unfortunately, studies of man-made risk show increasing probabilities of catastrophe on many fronts. How should we think about this combination of problems?

We do not think about this combination of problems in order to prove negligence. The required decision pertains to how humanity will avoid its own negligence, especially that which may lead to mass death.

We, as a species, need a healthy respect for certain types of catastrophe. These would not be far-fetched concepts; the catastrophe must be at least foreseeable. Unfortunately, many significant risks to the human species are more than foreseeable. In many instances, we already see some of their effects.

II. FORESEEABLE CAUSES OF CATASTROPHE

Foreseeable catastrophes are well-documented in Jared Diamond's list of Twelve Causes of Human Collapse and in the computer runs described in *Limits to Growth: The 30-Year Update (LTG30)*,²⁴ which demonstrate the need for humanity to reach sustainable levels of population, consumption, and pollution.

23. See generally *Palsgraf v. Long Island R.R. Co.*, 162 N.E. 99 (N.Y. 1928).

24. DONELLA MEADOWS ET AL., *LIMITS TO GROWTH: THE 30-YEAR UPDATE* (2004).

When we consider collapse—and the details of collapse—we find a detailed and supported list of causes in Jared Diamond’s *Collapse: How Societies Choose to Fail or Succeed*. Diamond’s book constitutes a catalogue of potential scenarios, all based largely on historical and archaeological record.

We should look at the human situation another way as well. The latest in-depth quantitative overview of earthly limits, environmental overshoot, and consequent significant risk is found in *LTG30*. Although it is past time for replacement by a new edition,²⁵ the book has analytic value.

Through the *LTG30* authors’ eyes, we see that each risk is dynamic and also part of a larger dynamic. We can quickly find ourselves engaging in complex system theory. There are many moving parts. We need to slow down and figure out what we’re doing—before we break something, run into a wall, or run off a cliff.

Positive feedback loops enhance the possibility that small changes in initial conditions can have huge effects as events develop.²⁶ Professor of cliodynamics,²⁷ Peter Turchin, explains:

[N]onlinear interactions between various processes can produce internally driven irregular behavior—mathematical chaos. Mathematicians have proven that a dynamical system affected by two sources of cyclic behaviors will, under certain conditions, behave chaotically—in an erratic manner that looks random but in reality is completely internally generated.²⁸

A system’s complexity can force it to evolve to increasingly complex states that are increasingly unstable—until the equivalent of an avalanche occurs. All it takes is one significant discontinuity. Consider the world economy.²⁹ Or one can argue

25. A 2012 edition was planned. MEADOWS ET AL., *supra* note 24, at xxii.

26. See S.H. Schneider, *The Changing Climate*, SCI. AM., Sept. 1989, at 73, for a scenario with strong positive feedback.

27. See PETER TURCHIN, *WAR AND PEACE AND WAR: THE RISE AND FALL OF EMPIRES* 10–11 (2007), for a description of cliodynamics, “the study of processes that change with time.”

28. *Id.* at 286.

29. “The world’s economy is a soft-paste porcelain vase set on a wobbly plant stand in the heart of an active earthquake zone.” Jim McTague, *Could Fed Miscalculations Lead to \$10,000 Gold?*, BARRON’S (Sept. 17, 2012),

that human civilization itself is an unstable system all the more subject to avalanche, especially as humanity is deep in environmental overshoot. We will examine overshoot shortly.

We don't know exactly where we are in relationship to the edge of the cliff or to some significant crash. Given the risks, enumerated just ahead, it seems reasonable to believe that we should slow down, steady ourselves, and find out. Even if we don't find out clearly, it seems rational to take some precaution. Here is what humanity is up against.

A. Diamond's Twelve Causes of Human Collapse

Toward the end of *Collapse*, Jared Diamond distills the dozen most serious environmental problems facing past and present societies. They fall into four categories: (1) the destruction or loss of natural resources, (2) natural resource ceilings, (3) harmful things we produce or move around, and (4) human population. Let's briefly review them. As can be seen in *LTG30* with the World3 model, the problems can combine in any number of ways to bring about collapse.

First, loss of resources can occur in many ways. Humanity is destroying natural habitats,³⁰ destroying wild food sources,³¹ losing biodiversity,³² and causing soil damage and erosion.³³

<http://www.barrons.com/articles/SB50001424053111904819604577643612978622748> [<http://perma.cc/8LE3-J6EY>].

30. See JARED DIAMOND, *COLLAPSE: HOW SOCIETIES CHOOSE TO FAIL OR SUCCEED* 487–88 (2005). This includes deforestation (a major factor in collapses of past societies), as well as destruction of wetlands, the ocean bottom, and reefs. For example, at least 30 percent of coral reefs worldwide were in critical condition in 1997, and 95 percent of those checked around the world showed degradation and species loss. Don Hinrichson, *Coral Reefs in Crisis*, 47 *BIOSCIENCE* 554, 554 (1997). With more trawlers and warmer seas in the last 19 years, the situation is unlikely to have improved.

31. See DIAMOND, *supra* note 30, at 488.

32. See *id.* at 488–89. “A significant fraction of wild species, populations, and genetic biodiversity has already been lost, and at present rates a large fraction of what remains will be lost within the next half-century.” *Id.* at 488. The costs of wild species extinction and population loss are many. The species are irreplaceable. Their loss may bring harmful consequences, for instance, by breaking or interfering with the food chain for other species—or our food chain! “Elimination of lots of lousy little species regularly causes big harmful consequences for humans, just as does randomly knocking out many of the lousy little rivets holding together an airplane.” *Id.* at 489. At least in an airplane, the

Secondly, in regard to resource ceilings or limits,³⁴ there is a ceiling or limit on the amount of energy sources, particularly fossil fuels, available in the world.³⁵ There is also a limit or ceiling on fresh water utilization.³⁶ And there is the photosynthetic ceiling, something that Professor Diamond says has become serious only recently. By the middle of the twenty-first century, most of the available sunlight will be used by humans and little will be left over for forests or other plant species.³⁷ Third, there are the harmful things we produce or move around: toxic chemicals, alien or invasive species, and atmospheric gases. We have insecticides, pesticides, herbicides, PCBs, mercury, and other toxins that we can absorb through our skin, our food, our water, or merely through the air.³⁸ Introduced, alien or invasive species devastate native species that have developed no tolerance or defense mechanisms for

rivets are not connected to each other. In ecosystems, if one species goes, it may take others in a chain reaction.

33. *See id.* at 489–90. “Soils of farmlands used for growing crops are being carried away by water and wind erosion at rates between 10 and 40 times the rates of soil formation, and between 500 and 10,000 times soil erosion rates on forested land.” *Id.* at 489. On top of erosion, salinization, acidification, and alkalization have severely damaged somewhere between 20 and 80 percent of the world’s farmland. *See id.* at 489–90.

34. To Dana Meadows and the other authors of *Limits to Growth*, ceilings are called limits. In their view, limits can be exceeded, but only for a brief period of time called overshoot. If usage is not then carefully reduced, collapse occurs. In the language of Jared Diamond, limits are known as ceilings. *Id.* at 490. Diamond does not have the luxury of a computer program to prove the details of the collision with ceilings. He employs historical cause and effect.

35. *See id.* at 490. With increasing extraction, our current reserves of our most valuable fossil fuels will last only a few more decades. Then the fuels will be the dirtier, the more expensive to extract, with increasing extraction, processing, and environmental costs for each remaining source. *Id.* We will not be the first to face an energy limit. Norse Greenland and Easter Island had their energy limits. What wood they had for cooking and heat was used up, and the result contributed to their collapse.

36. *See id.* We face the depletion of aquifers in the U.S. southwest, in China, in the middle east, and in other places all over the world. Also consider the increasing costs of the increasing need for desalinization. Already, more than a billion of us lack access to safe, reliable drinking water. *Id.*

37. *See id.* at 491.

38. *Id.* at 491–92. Prior societies have not faced the challenges of toxic chemicals. The results include birth defects, mental retardation, a drop in our sperm counts, and 130,000 air pollution deaths annually in the United States alone. Even the worst pollution in the United States is mild compared to that of China, the former Soviet Union, and many Third World mining sites. *Id.* at 492.

protection.³⁹ And atmospheric gases play a role in global climate change contributing at the very least to polar ice melt and a projected rise in sea levels.⁴⁰ Finally, the last two serious environmental problems facing past and present societies involve population. Consider the vast human population⁴¹ and its expanding footprint.⁴²

Our footprint is enormous. As it is, the Earth cannot support humanity, and our consumption is overshooting our environmental resources. The developed First World consumes and wastes thirty-two times more per capita than does the Third World, but our developing-world kin are moving to increase their footprint and impact. If they were to succeed, current consumption and waste would be surpassed twelve-fold.⁴³ If China alone succeeded, the footprint would double.⁴⁴

If China fully modernizes, it will place a strain on the planet that is a threat to all of us. They can't have the same quality of life unless we all work to change our technology and standards. It's not just China. And it's not just the Third World. We're all in this together.

39. *See id.* at 491–92. An invasive species can have a major impact on a society. For instance, stowaway rats contributed to the destruction of Easter Island's palms by eating the seeds. TERRY HUNT & CARL LIPO, UNRAVELING THE MYSTERY OF EASTER ISLAND: THE STATUES THAT WALKED 29–31 (2011). "There are by now literally hundreds of cases in which alien species have caused one-time or annually recurring damages of hundreds of millions of dollars or even billions of dollars." DIAMOND, *supra* note 30, at 492.

40. *See* DIAMOND, *supra* note 30, at 493. This, too, is a challenge not faced by prior societies. The gases consist of former refrigerator coolant, carbon dioxide (mostly from burning fuels), and methane (from herds of sheep and cattle). As a result, global warming and sea level rise occur. "The areas thereby threatened include much of the Netherlands, Bangladesh, and the seaboard of the eastern U.S., many low-lying Pacific islands, the deltas of the Nile and Mekong Rivers, and coastal and riverbank cities of the U.K. (e.g., London), India, Japan, and the Philippines." *Id.*

41. *See id.* at 494. There are over seven billion of us on this cozy planet, and a powerful momentum is carrying the number upward. Because a disproportionate percentage of the population is young, even with the immediate implementation of a two-child policy, Earth's population will increase for the next seventy years. *Id.*

42. *See id.* at 494–96.

43. The number is twelve-fold rather than thirty-two-fold probably because there are already First World inhabitants with high-impact lifestyles.

44. *Id.* at 495

First World governments do not acknowledge that it is impossible for the Third World population to reach current First World standards.⁴⁵ Even now the First World cannot maintain its standards due to resource depletion. To attempt to bring everyone up to those standards is not only impossible but downright dangerous. Diamond asks, "What will happen when it finally dawns on all those people in the Third World that current First World standards are unreachable for them, and that the First World refuses to abandon those standards for itself?"⁴⁶ That dawning is already taking place.⁴⁷ Either they manage to move here, or, when they stay there, we look like hypocrites. Jared Diamond hits the nail when he explains the ultimate conundrum of economic development: "[T]he cruelest trade-off that we shall have to resolve: encouraging and helping all people to achieve a higher standard of living, without thereby undermining that standard through overstressing global resources."⁴⁸ Human population growth affects and exacerbates all the other problems.

We are currently on a non-sustainable course. Any one of the twelve problems Diamond enumerates could limit our lifestyle, to say the least, within the next fifty years: "The single most important problem is our misguided focus on identifying our single most important problem. . . . [T]hey all interact with each other. If we solved 11 of the problems, but not the 12th, we would still be in trouble, whichever was the problem that remained

45. Ted Trainer, *Our Unsustainable Society; Basic Causes, Interconnections, and Solutions*, in *THE COMING AGE OF SCARCITY; PREVENTING MASS DEATH AND GENOCIDE IN THE TWENTY-FIRST CENTURY* 83, 90 (Michael N. Dobkowski & Isidor Wallimann eds., 1998).

Above all, the limits-to-growth analysis makes clear that the conventional conception of development is totally mistaken about goals. It is not possible for all Third World people to rise to the living standards of the rich countries. Yet, that goal is still taken for granted in almost all official development theory and practice.

Id.

46. DIAMOND, *supra* note 30, at 496.

47. See, e.g., Drew Hinshaw, *Allure of Wealth Drives Deadly Trek: Young Men in Senegal Join Migrant Wave Despite Growing Prosperity at Home*, *WALL ST. J.* (June 12, 2015 12:40 PM), <http://www.wsj.com/articles/young-men-in-senegal-join-migrant-wave-despite-growing-prosperity-at-home-1434127244> [<http://perma.cc/LVH6-NYZM>].

48. DIAMOND, *supra* note 30, at 496. Somehow, the idea of success must come to involve less consumption and less risk.

unsolved.”⁴⁹ Diamond is right. We must solve them all. We don’t have twelve single problems. They are connected, and some reinforce others.

B. LTG30’s Three Basic Causes of Human Failure

The three basic causes of human failure are too much consumption, too much pollution, and too much population.⁵⁰ We, especially those of us in the First World, consume much more than we need—or than the planet can support. Our systems of subsidies encourage the consumption,⁵¹ and calls for austerity meet with protest.⁵² So many of us demand too much from such a small and over-run planet.

1. Consumption

Humanity’s ecological footprint is unsustainable. As Edward O. Wilson warns, we ought to worry about permanent environmental damage, wherever it is:

Earth, unlike the other solar planets, is not in physical equilibrium. It depends on its living shell to create the special conditions on which life is sustainable. The soil, water, and atmosphere of its surface have evolved over hundreds of millions

49. *Id.* at 498.

50. *Id.* at 487–96; MEADOWS ET AL., *supra* note 24, at 238–44. Harvard’s Pulitzer Prize-winning scientist, Edward O. Wilson explains the challenge of the current human situation:

The race is now on between the technoscientific forces that are destroying the living environment and those that can be harnessed to save it. We are inside a bottleneck of overpopulation and wasteful consumption. If the race is won, humanity can emerge in far better condition than when it entered, and with most of the diversity of life intact.

WILSON, *supra* note 18, at xxiii.

51. See David P. Coady et al., *How Large Are Global Energy Subsidies?* 12 (Int’l Monetary Fund, Working Paper No. 15/105, 2015), <https://www.imf.org/external/pubs/ft/wp/2015/wp15105.pdf> [<https://perma.cc/VA25-TL6H>].

52. “[Greeks] have rebelled against the crushing austerity measures that Europe has demanded in exchange for bailing out the indebted government.” Michael Birnbaum, *Greece Fails to Make Key IMF Debt Payment*, WASH. POST, (June 30, 2015), https://www.washingtonpost.com/world/europe/european-leaders-seek-last-ditch-offer-to-bring-greece-from-brink-of-default/2015/06/30/960aded8-1ea2-11e5-a135-935065bc30d0_story.html [<https://perma.cc/T5ZP-HXZ3>].

of years to their present condition by the activity of the biosphere, a stupendously complex layer of living creatures whose activities are locked together in precise but tenuous global cycles of energy and transformed organic matter. The biosphere creates our special world anew every day, every minute, and holds it in a unique, shimmering physical disequilibrium. On that disequilibrium the human species is in total thrall. When we alter the biosphere in any direction, we move the environment away from the delicate dance of biology. When we destroy ecosystems and extinguish species, we degrade the greatest heritage this planet has to offer and thereby threaten our own existence.⁵³

Wilson argues that our environmental footprint is too large and that the risk is great. The typical economist wants quantitative data proving that there is a statistically significant risk, more than a background risk, of collapse or extinction soon.

For such quantitative data, let us look at the position of some well-known systems dynamics scholars. The phenomenon of limits to growth was explored originally from 1970 to 1972 in the System Dynamics Group of the Sloan School of Management at Massachusetts Institute of Technology (MIT). Initially, the study led to the publication of *Donella Meadows et al., The Limits to Growth* (1972), with twelve internally consistent scenarios of world development reaching from 1900 to 2100, all based on computer modeling.⁵⁴ In 1972, there was hope for a gradual downward adjustment in humanity's footprint. The 1992 update, with a slightly updated computer model (World3), yielded the second edition, *Donella Meadows et al., Beyond the Limits*. This update contained one major new finding: humanity had already overshot the limits of Earth's carrying capacity.⁵⁵

53. WILSON, *supra* note 18, at 39.

54. See generally Graham Turner, *A Comparison of the Limits to Growth with Thirty Years of Reality*, 18 GLOBAL ENVTL. CHANGE 397 (2008), for a nice description of that modeling.

55. MEADOWS ET AL., *supra* note 24, at ix-xiii. The idea of planetary overshoot was introduced in the 1987 report of the U.N.-sanctioned Brundtland Commission, *Our Common Future*, that:

popularized the idea of sustainability and a narrower concept, sustainable development [T]he report described the extent of world poverty and global environmental calamity and articulated, for the first time, sustainability's "Three Es"—environment, economics and social equity—arguing how all three realms must be

More years passed, and a third edition was published.⁵⁶ For more details of the assumptions and the workings of World3, it is best to read the work itself, especially the Authors' Preface to *LTG30*.

The numbers help us better understand the size of our ecological footprint, its trajectory, and the implications for the not-so-distant future, a future that is racing to meet us with increasing speed:⁵⁷

For those who can respect numbers, we can report that the highly aggregated scenarios of World3 still appear, after 30 years, to be surprisingly accurate. The world in the year 2000 had the same number of people (about 6 billion—up from 3.9 billion in 1972) that we projected in the 1972 standard run of

optimized, and how, over the long term, a just and truly sustainable world cannot have one without the other.

Robert Eagan, *Sense & Sustainability*, 133 *LIBR. J.* 40, 40 (2008).

56. In addition to updating the earlier works, the authors had other purposes behind the preparation of *Limits to Growth: The 30-Year Update*. Among other reasons, they wished to:

- stress that humanity is in overshoot and that the resulting damage and suffering can be greatly reduced through wise policy;
- offer data and analysis to contradict prevailing political pronouncements that humanity is on the correct path for its twenty-first century;
- inspire the world's citizens to think about the long-term consequences of their actions and choices—and muster their political support for actions that would reduce the damage from overshoot

MEADOWS ET AL., *supra* note 24, at xix.

57. Humanity's increasing speed—and the effects thereof—have been well known for some time:

We live in a world of accelerating change. The rate of change produces pressure upon available procedures of adjustment. A single basic statistical projection conveys some sense of the magnitude of change in our world: In the 30 years from 1970 to the year 2000 there will be more construction than came to pass from 3000 bc to date. The endangered-planet crisis in part arises because our technological abilities are evolving so much more rapidly than are our abilities to solve social and political problems. Tensions have always resulted from the inability of political man to cope with the changes wrought by technological man, but these inabilities now threaten irreversible disaster on a planetary scale.

RICHARD A. FALK, *THIS ENDANGERED PLANET: PROSPECTS AND PROPOSALS FOR HUMAN SURVIVAL* 67 (1971) (internal quotations omitted).

World3. Furthermore, that scenario showed a growth in global food production (from 1.8 billion tons of grain equivalent per year in 1972 to 3 billion in 2000) that matches history quite well. Does this correspondence with history prove that our model was true? No, of course not. But it does indicate that World3 was not totally absurd; its assumptions and our conclusions still warrant consideration today.⁵⁸

Certainly, World3 population projections were not absurd. And neither were the other projections. For the fortieth anniversary of the 1972 Limits to Growth, Australian Physicist Graham Turner did a comparison of the 1972 limits to growth projections with forty years of real world data, including population,⁵⁹ services per capita,⁶⁰ food per capita,⁶¹ industrial output per capita,⁶² non-renewable resources,⁶³ and persistent pollution.⁶⁴ Using the World3 model as a predictive validation technique,⁶⁵ Turner found that humanity remains on track for disaster. It's getting closer.⁶⁶ Clearly, we have reached the point of foreseeability.

2. Population

In light of all the other factors, it is easy to see that getting a handle on the population problem is only the beginning. Here is World3's core question: *How may the expanding global population and material economy interact with and adapt to the earth's limited carrying capacity over the coming decades?*

58. MEADOWS ET AL., *supra* note 24, at xviii.

59. Graham Turner, *On the Cusp of Global Collapse? Updated Comparison of the Limits to Growth with Historical Data*, 21 GAIA 116, 116–24 (2012).

60. *Id.* at 119.

61. *Id.*

62. *Id.*

63. *Id.* at 120.

64. *Id.* at 121.

65. Turner, *supra* note 59, at 121.

66. *Id.* at 123.

[T]he alignment of data trends with the model's dynamics indicates that the early stages of collapse could occur within a decade, or might even be underway. This suggests, from a rational risk-based perspective, that planning for a collapsing global system could be even more important than trying to avoid collapse.

Id.

To be more specific, the carrying capacity is a limit. Any population that grows past its carrying capacity, overshooting the limit, will not long sustain itself. And while any population is above the carrying capacity, it will deteriorate the support capacity of the system it depends upon. If regeneration of the environment is possible, the deterioration will be temporary. If regeneration is not possible, or if it takes place only over centuries, the deterioration will be effectively permanent.⁶⁷

When we consider Easter Island, especially in light of its extinctions,⁶⁸ we can see that it represents an example of such effectively permanent deterioration. The island's carrying capacity has been eroded.

There are four ways a society can approach its carrying capacity. Two of them involve staying beneath the limits. It is already too late for the first two options.⁶⁹ We are now facing the *LTG30's* choice between option three and option four:

The third possibility for a growing society is to overshoot its carrying capacity without doing massive and permanent damage. In that case the ecological footprint would oscillate around the limit before leveling off. This behavior . . . is called damped oscillation. The fourth possibility is to overshoot the limits, with severe and permanent damage to the resource base. If that were to occur, the population and the economy would be forced to decline rapidly to achieve a new balance with the recently reduced carrying capacity at a much lower level. We use the phrase overshoot and collapse to designate this option . . .⁷⁰

When we are led to consider collapse—and the details of collapse—we see the tie-in to Jared Diamond's *Collapse: How Societies Choose to Fail or Succeed*. Diamond's book contains a

67. MEADOWS ET AL., *supra* note 24, at 137.

68. DIAMOND, *supra* note 30, at 102–09.

69. MEADOWS ET AL., *supra* note 24, at 137.

First it can grow without interruption, as long as its limits are far away or are growing faster than the population. Second, it can level off smoothly below the carrying capacity, in a behavior that ecologists call logistic, or S-shaped, or sigmoid growthNeither of these options is any longer available to global society, because it is already above its sustainable limits.

Id.

70. *Id.* at 137–38.

catalogue of potential scenarios, and the latest full quantitative overview is found in *LTG30*, as updated by Graham Turner.⁷¹

The quantitatively-oriented economist is likely to want numbers. There are plenty of quantitative references that could be discussed in a longer work. However, the interaction of the numbers is not simple. As you might imagine, it takes a computer program to draw them all in and consider them all at once. Many of the numbers and calculations are implicit in the structure of the World3 model.⁷² The model's purpose, structure, its growth and erosion processes, limits, delays and feedback loops are best described in *LTG30*.⁷³ Read *LTG30*. For now, let's get some idea of what we might find there.

3. Overshoot and Collapse

The process of exceeding limits, going into the red, is called overshoot, which “means to go too far, to go beyond limits accidentally—without intention.”⁷⁴ Overshoot can describe sliding past a stop sign on an icy road, drinking too much alcohol the night before the morning after, building too many fishing boats for the fish population to sustain, or creating too many chlorinated chemicals for the upper atmosphere to accommodate, thereby depleting the ozone layer for decades, until it can recover.

71. See GRAHAM TURNER, MELBOURNE SUSTAINABLE SOC'Y INST., RESEARCH PAPER NO. 4, IS GLOBAL COLLAPSE IMMINENT? AN UPDATED COMPARISON OF THE LIMITS TO GROWTH WITH HISTORICAL DATA 4–5 (Lauren Rickards ed., 2014), http://sustainable-dev.unimelb.edu.au/sites/default/files/docs/MSSI-ResearchPaper-4_Turner_2014.pdf [<http://perma.cc/AM7L-J3Y4>] [hereinafter MSSI RESEARCH PAPER]; Turner, *supra* note 59, at 116–24 (2012); Graham Turner, *A Comparison of the Limits to Growth with Thirty Years of Reality*, 18 GLOBAL ENVTL. CHANGE 397, 401–02 (2008).

72. Other models and simulations have been attempted. See, e.g., Akira Onishi, *A New Frontier Science of Economics: Global Model Simulation* (Ctr. for Glob. Modeling, Found. for Fusion of Sci. & Tech., Working Paper, 2008), <http://ssrn.com/abstract=1198943> [<http://perma.cc/ND4T-TJYQ>]. Onishi's model appears to be economic in nature. If a model is based solely on economics and does not include natural limits, its predictions will be of limited value. It is worth noting that Professor Onishi believes that one needs to use a “cosmic mind” of “human solidarity” to be successful at thinking about humanity's future. *Id.* at pt. 6(9); see also AKIRA ONISHI, GLOBAL MODEL SIMULATION: A FRONTIER OF ECONOMIC SCIENCE (2010).

73. See MEADOWS ET AL., *supra* note 24, at 129–62, 285–93.

74. *Id.* at 1.

Overshoot beyond the limits is a reality. We have been living it since the early 1990s.⁷⁵ Humanity is going deeper and deeper into trouble. We need to make progress on both fronts, population and impact per person, in order to increase our chances of survival. We were twenty percent past Earth's sustainable carrying capacity in 2002, and our consumption continues to increase.⁷⁶ We are not paying attention to the signs and the studies. We do not have another 30 years to dither.⁷⁷ We must work immediately to begin to change the way we live.⁷⁸ We need

75. As the authors of *LTG30* observe:

It now appears that the global per capita grain production peaked in the mid-1980s. The prospects for significant growth in the harvest of marine fish are gone. The costs of natural disasters are increasing, and there is growing intensity, even conflict, in efforts to allocate fresh water resources and fossil fuels among competing demands. The United States and other major nations continue to increase their greenhouse gas emissions even though scientific consensus and meteorological data both suggest that the global climate is being altered by human activity. There are already persistent economic declines in many localities and regions. Fifty-four nations, with 12 percent of the world population, experienced declines in per capita GDP for more than a decade during the period from 1990 to 2001.

MEADOWS ET AL., *supra* note 24, at xiv.

76. See *id.* at xiv (citing Mathis Wackernagel et al., *Tracking the Ecological Overshoot of the Human Economy*, 99 PROC. ACAD. SCI. 9266–71 (2002)); MSSS RESEARCH PAPER, *supra* note 71, at 6–8.

77. “[T]o accommodate *sustainably* the anticipated increase in population and economic output of the next four decades, we would need six to twelve additional planets.” MATHIS WACKERNAGEL & WILLIAM REES, *OUR ECOLOGICAL FOOTPRINT: REDUCING HUMAN IMPACT ON THE EARTH* 91 (1996). Two of those four decades are gone, humanity has made no major steps toward sustainability or population control, and no additional livable planets are in sight.

78. BECK, *supra* note 19, at 10–11.

People are better adapted to the future than are social institutions and their representatives. The decline of values which cultural pessimists are so fond of decrying is in fact opening up the possibility of an escape from the “bigger, more, better” creed, in a period that is living beyond its means both ecologically and economically. Whereas, in the old system of values, the self always had to be subordinated to patterns of the collective, the new orientations towards the “we” are creating something like a cooperative or altruist individualism. Thinking of oneself and living for others – once considered by definition contradictory – are revealed as internally and substantially connected with each other.

Id.

Changing the way we live means slowing down, not speeding up. The answer does not lie in hurrying to build new coal-fired power plants in Texas

to study and ask new questions. We need to care enough to discuss and attempt to agree soon on any implementational goals to reach sustainability.⁷⁹

The local specifics pertaining to exceeding our footprint are not limited to economic decline. Donella Meadows et al. note examples of how quality of life can be adversely affected at the local level.⁸⁰ These quality of life matters are not limited to only some of us. They affect all of us, including the rich. It also appears that the problems are increasing at an increasing rate. Welcome to overshoot.

However, the authors of *LTG30* also view overshoot from a practical, societal, standpoint. They see overshoot and subsequent decline as a failure to prepare for the future:

Welfare loss will occur, for example, when there is no ready replacement for dwindling reserves of oil, for scarcer wild fish, and for expensive tropical woods, once these resources start to deplete. The problem is worse when the resource base is erodible and gets destroyed during overshoot. Then society might experience collapse.⁸¹

ahead of increased restrictions, see Rebecca Smith, *Burning Debate: As Emissions Restrictions Loom, Texas Utility Bets Big on Coal: Planned TXU Plants Raise Global-Warming Concerns*, WALL STREET J. (July 21, 2006), <http://www.wsj.com/articles/SB115344549183413209> [perma.cc/26RP-Z4P3], any more than it does in building a new coal-fired power plant weekly in China, see Terence Chea, *Asia, Particularly China, Shares Pollution with the U.S. – The Impact of Breakneck Economic Growth Is Being Felt Across the Pacific*, PHILA. INQUIRER, July 30, 2006, at A3.

79. See MEADOWS ET AL., *supra* note 24, at xv.

80. *Id.* at 123.

Jakarta emits more air pollution than human lungs can bear. The forests of the Philippines are nearly gone. The soils of Haiti have been worn down in places to bare rock. The cod fisheries off Newfoundland have been closed. Parisians have to endure summer days of reduced speed limits to cut down pollution from their fuming cars. Several European countries saw thousands die prematurely as the summer of 2003 set new records for high temperatures. The chemical load in the Rhine was for many years so high that dredged silt from Dutch harbors now has to be treated as hazardous waste. Skiers visiting Oslo in the winter of 2001 found hardly any useful snow.

Id.

81. *Id.* at xxi.

The authors give an example of collapse in a different context. When the dot-com bubble burst in 2000, it took three years for the air to come out of the stock market. The erodible resource was investor confidence. When it eroded sufficiently, the market collapsed.⁸²

Environmental overshoot is the result of a combination of factors. The authors of *LTG30* explain the three causes of overshoot: (1) growth or acceleration, (2) “some form of limit or barrier, beyond which the moving system may not safely go,” and (3) a “delay or mistake in the perceptions and the responses that strive to keep the system within its limits.”⁸³ All three are “necessary and sufficient to produce an overshoot.”⁸⁴ Ultimately, it appears that humanity will need to control its own speed and use sensors to keep us from exceeding earthly limits, and employ systems of clear signals and responses designed to reduce delays.

Our survival depends not only on the timing of our response to signals, but also on the nature of the actions we take in response to those signals. If our response is successful, then after overshoot we get oscillation rather than collapse. In Norway, the government bought up and retired fishing boats until the fish stocks could regenerate.⁸⁵ In New England, sawmills were shuttered after too many were built for sustainability and the forests were depleted.⁸⁶ These are local examples of adjustment and recovery.

Fifteenth-century Norse Greenland is an example of collapse when regeneration does not take place in the face of overshoot.⁸⁷ According to the authors of *LTG30*, if the damage is irreversible, if there is collapse, it stands to be catastrophic:

Nothing can bring back an extinct species. Fossil fuels are permanently destroyed in the very act of using them. Some pollutants, such as radioactive materials, can't be rendered harmless by any natural mechanism. If the climate is significantly altered, geological data suggest that temperature and precipitation patterns probably will not return to normal

82. *See id.*

83. *Id.* at 1.

84. *Id.*

85. MEADOWS ET AL., *supra* note 24, at 163.

86. *Id.*

87. *See* DIAMOND, *supra* note 30, at 248–52.

within a time period meaningful to human society. Even renewable resources and pollution absorption processes can be permanently destroyed by prolonged or systematic misuse. When tropical forests are cut down in ways that preclude their regrowth, when the sea infiltrates fresh water aquifers with salt, when soils wash away leaving only bedrock, when a soil's acidity is changed sufficiently to flush out the heavy metals it has stored, then the earth's carrying capacity is diminished permanently, or at least for a period that appears permanent to human beings.⁸⁸

Overshoot and then collapse is a possibility. Combined with nonlinearities (thresholds beyond which a system's behavior suddenly changes), erosion, a stress that multiplies itself if it is not quickly remedied, converts overshoot to collapse.⁸⁹ Once past the critical threshold, erosion loops turn overshoot and oscillation into overshoot and collapse.⁹⁰ Although erosion loops are normally dormant, when overshoot occurs without correction, the loops can lead overshoot into a downhill spiral. For example, overgrazed grasslands can erode, and erosion can lead to desertification and the complete loss of land fertility.⁹¹

4. Erosion Loops and Pollution

There are several erosion loops in the World3 model. For example, when people are hungry, they work the land harder, depleting it of its nutrients in the short run in an effort to produce more food.⁹² The result is lower food production from increasingly diminished soil fertility. Another example occurs in a weakening economy, when services per capita decline. When reductions in family planning services occur, the population increases, which brings further decline in services per capita. There are also erosion loops that can adversely affect the industrial capital plant and pollution absorption mechanisms.⁹³ One example of an erosion loop in a pollution absorption mechanism is illustrative. Air pollutants can weaken or kill

88. MEADOWS ET AL., *supra* note 24, at 163–64.

89. *See id.* at 164–67.

90. *See id.*

91. *Id.* at 165. Consider the land in much of the Middle East, including the cradle of civilization.

92. *Id.* at 164.

93. *Id.* at 165.

forests. In doing so, they diminish a sink for carbon dioxide, a greenhouse gas.⁹⁴

Some erosion loops are *not* included in World3. Social erosion is one example. When elites use their power and repression to grab wealth, inequality can lead the middle classes to frustration and anger. If the elites respond by hiring guards and using additional force, the spiral can lead to revolution and social breakdown.

Erosion loops are now beginning to get serious public attention. As the authors of *LTG30* report, “When we first published our results in 1972, the majority of people thought human disruption of natural processes on a global scale was inconceivable. Now it is the subject of newspaper headlines, the focus of scientific meetings, and the object of international negotiations.”⁹⁵

We are now beginning to see some of these erosion loops in action, as they help us increase our speed toward collapse. For example, the southern ocean CO₂ sink is not only full, between 1981 and 2004 it has weakened or eroded, releasing carbon dioxide, apparently as a result of a warming world. And the effects of that erosion help to further reduce the sink’s absorption capabilities.⁹⁶ We need to avoid more environmental overshoot and erosion.

C. More than Mere Foreseeability

Sadly, we cannot grow our way out of overshoot. Our species has gone too far. Quickening our pace will not help when we need to slow down. The situation seems sufficiently dire that we should consider using law to make positive changes soon. First, though, we need to disengage the law that is making matters worse. And we need to do it soon.

Both science and social science predict mass death.⁹⁷ We are far beyond the point of foreseeability. Even the Pope is most

94. MEADOWS ET AL., *supra* note 24, at 166.

95. *See id.* at 166–67.

96. *Id.* at 167.

97. The business as usual (BAU) approach is on track for disaster in about 2030. *See* MSSJ RESEARCH PAPER, *supra* note 71, at 7; *see also* MARTIN J. REES, OUR FINAL HOUR: A SCIENTIST’S WARNING: HOW TERROR, ERROR, AND ENVIRONMENTAL DISASTER THREATEN HUMANKIND’S FUTURE IN THIS CENTURY—ON

eloquent with the details of similar concerns.⁹⁸ As the sciences and religion⁹⁹ see the same problem, it's time to consider law's alignment with that vision.

To do that, we will need to think about how law currently treats risk. We will find that law does not treat risk with respect by protecting life. Instead, we will discover that law attempts to treat risk as a short-term money-making opportunity.

III. HOW HUMANITY TREATS RISK

Aside from science, there is another context for the protection of humanity. It is the manner in which we treat risk. Some of humanity's approach to dealing with risk is the product of genetic programming and some is learned.

We have already come a long way. Historically, traditions were the justification for action. Traditions have become less important and social practices are under continual examination and reform.¹⁰⁰ Risk has displaced the divine and the magical. In a sense, science has grown up. According to sociologist Niklas Luhmann, "[society] seeks to comprehend misfortune in the form of risk. And no longer, for example, in the form of magic and witchcraft; and hardly any longer in the form of religion, having accepted a purely benevolent God and a devil who has forfeited

EARTH AND BEYOND 7–8 (2003) ("I think the odds are no better than fifty-fifty that our present civilisation on Earth will survive to the end of the present century."). We are entering what "may well be the most destructive of the possible scenarios." John B. Cobb, Jr., *The Threat to the Underclass*, in *THE COMING AGE OF SCARCITY*, *supra* note 45, at 25, 26.

98. See Francis, Encyclical Letter *Laudato Si'* 16–43 (May 24, 2015), http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html [<https://perma.cc/5YPJ-4KYT>]

99. See Justin Gillis, *For Faithful, Social Justice Goals Demand Action on Environment*, N.Y. TIMES, June 21, 2015, at A1; David O'Reilly, *Rabbis Issue a Letter on the Environment*, PHILA. INQUIRER (June 15, 2015), http://articles.philly.com/2015-06-15/news/63415018_1_climate-change-tikkun-pope-francis [<https://perma.cc/SHN5-WVV6>]; Rabbi Arthur Waskow et al., *A Rabbinic Letter on the Climate Crisis*, SHALOM CTR., <https://theshalomcenter.org/civicism/petition/sign?sid=17> [<https://perma.cc/2NCG-8TSC>] ("In Leviticus 26, the Torah warns us that if we refuse to let the Earth rest, it will "rest" anyway, despite us and upon us – through drought and famine and exile that turn an entire people into refugees.").

100. Consider, for example, the traditional Papal position on birth control and its functional irrelevance in light of the negative replacement birthrate in modern Italy.

his cosmological function if not his very existence.”¹⁰¹ We do not accept fate as causation.¹⁰² At least these views seem to be held by many of us in the West.

Thoughts of risk occur earlier in our thinking than thoughts of doom, and for that reason, risk considerations are important for this article. Risk has an option or a choice built into it. There is no choice in doom. By the time we think of doom in a given situation, we have finished thinking of risk. It’s too late; risk has become reality. When it comes to thinking about catastrophic collapse, at least there is hope implicit in risk, whereas with doom there can be no hope. In that sense, risk is a positive. It represents a challenge, even an opportunity.

Weighing risk is a way of analyzing our place and our situation in the world. To some degree, risk analysis is in the process of displacing religion in that regard. This change may or may not be desirable. There is nothing to stop us from relying on both.

A. How We Learn to Approach Risk as Individuals

At the larger level society is interested in risk. In part, this is because we all know risk. It’s part of our normal development. As teenagers, we test boundaries. We take risks in order to learn about ourselves and the world around us. Taking risks is part of finding out what we are capable of doing.¹⁰³

Risk, experienced as part of the teen brain’s development, is hard-wired into every one of us.¹⁰⁴ We are each bio-chemically “programmed” to seek risk as part of our development. As teens, we seek the new and the edge¹⁰⁵ in order to get the thrill of

101. NIKLAS LUHMANN, *RISK: A SOCIOLOGICAL THEORY*, at viii (Walter de Gruyter ed., Rhodes Barrett trans., 1993).

102. British sociologist Anthony Giddens contends that the concepts of risk and fate are antithetical. When weighing risk, there is no divine influence, no magic, no active cosmic spirit. Fate and destiny may exist, but risk is dominant. See ANTHONY GIDDENS, *THE CONSEQUENCES OF MODERNITY* 111 (1990).

103. See FRANCES E. JENSEN & AMY ELLIS NUTT, *THE TEENAGE BRAIN: A NEUROSCIENTIST’S SURVIVAL GUIDE TO RAISING ADOLESCENTS AND YOUNG ADULTS* 103–04 (2015).

104. See *id.*; BARBARA STRAUCH, *THE PRIMAL TEEN: WHAT THE NEW DISCOVERIES ABOUT THE TEENAGE BRAIN TELL US ABOUT OUR KIDS* 204 (2003).

105. See STRAUCH, *supra* note 104, at 96–105. In our modern world, teens flirt with death as part of normal maturation. See *id.* at 188. Those adults who

anticipation and a reward of dopamine.¹⁰⁶ We may desire risk in order to keep things interesting.¹⁰⁷

This choice is not so unusual. Keeping life interesting may ultimately be an object of concern. When it comes to teens, we may need to decide whether it is preferable to busy teens or to guide them. Either or both may be preferable to teens staying on autopilot. Accidents and death rates tell us that teens do not do a good job of selecting the risks to take.¹⁰⁸

On the other hand, once we become adults, our view changes as our frontal lobes have become connected to our brains.¹⁰⁹ We become responsible, responsible for ourselves and then also for others. “To take unnecessary risks is commonly seen as foolhardy, careless, irresponsible, and even ‘deviant’, evidence of an individual’s ignorance or lack of ability to regulate self.”¹¹⁰ Our view and our behavior tends to change for the significant risks we can sense. That is the adult side of risk.

As we take the adult perspective, and we search, we find more and more risks. It would seem that humanity has an inherent tendency to run into problems involving risk. But we all take risks, and we think that risk taking is not inherently bad. We regard taking risks as an important part of human liberty.

These are our risk assumptions. They color our risk perceptions.

B. How We Perceive Risk

Some risks are unacceptable—unacceptable to parents, to individuals, and to society as a whole. When risks are greater

bungee jump or engage in other extreme sports have not stopped. See DEBORAH LUPTON, RISK 149–50 (1999).

106. See JENSEN & NUTT, *supra* note 103, at 105–10.

107. Overcoming risks can be a most positive experience. Whether bungee jumping or smoking cigarettes, engaging in risky behavior is often merely part of an escape from everyday life. We don’t want too much predictability, let alone boredom. LUPTON, *supra* note 103, at 149–51 (citing STANLEY COHEN & LAURIE TAYLOR, ESCAPE ATTEMPTS: THE THEORY AND PRACTICE OF RESISTANCE TO EVERYDAY LIFE 160 (2d rev. ed., 1992)).

108. See *Teenagers*, INS. INST. FOR HIGHWAY SAFETY, HIGHWAY LOSS DATA INST. (2013), <http://www.iihs.org/iihs/topics/t/teenagers/fatalityfacts/teenagers> [<http://perma.cc/59RB-R8L9>].

109. See JENSEN & NUTT, *supra* note 103, at 37.

110. LUPTON, *supra* note 105, at 148.

than what we're used to, they get special treatment. At least they should. But when we don't understand new risks, typically we find it difficult to know how to act.

New technology, even if it is just new to one of us, makes this easy to see. A child touches a Glock for the first time. The risks are unknown. Squirt guns don't kill family members. Imagine the child's immediate confusion. This is risk. It seems strange, but it is within the realm of probability.

Probability is not always straightforward. As Jason Daley points out in *Discover Magazine*, "our risk perception is often at direct odds with reality."¹¹¹ Consider the introduction of HIV/AIDS. This new disease meant that past behavior with certain risks, now has a new, much greater, risk.

Such great risks have an impact. They cause an adjustment to our thinking, sometimes known as reflexivity.¹¹² As technology, science, and our environment change around us, we must be vigilant to know about and respond to the risks.

Our social networks are critical.¹¹³ People learn about risk either over a lifetime of experiences or through their social networks.¹¹⁴ We like to feel safe with what we know. When we do not, we may feel that risks are beyond our control and therefore

111. Jason Daley, *What You Don't Know Can Kill You*, DISCOVER: SCIENCE, TECHNOLOGY, AND THE FUTURE (Oct. 3, 2011), <http://discovermagazine.com/2011/jul-aug/11-what-you-dont-know-can-kill-you> [<http://perma.cc/69BR-PMZ5>].

112. "Reflexivity means a response to conditions that arouse fear or anxiety that is active rather than passive. Reflexivity is a defining characteristic of all human action, involving the continual monitoring of action and its contexts." LUPTON, *supra* note 105, at 15 (citing GIDDENS, *supra* note 102, at 36–37); see also BECK, *supra* note 19, at 78–79.

113. The genetic endowment of the individual human is unlikely to see modern risks as clearly as do connected and educated groups. Jason Daley provides support in *Discover Magazine*:

Our hardwired gut reactions developed in a world full of hungry beasts and warring clans, where they served important functions. Letting the amygdala (part of the brain's emotional core) take over at the first sign of danger, milliseconds before the neocortex (the thinking part of the brain) was aware a spear was headed for our chest was probably a very useful adaptation. Even today, those nano-pauses and gut responses save us from getting flattened by buses or dropping a brick on our toes. But in a world where risks are presented in parts-per-billion statistics or as clicks on a Geiger counter, our amygdala is out of its depth.

Daley, *supra* note 111.

114. See LUPTON, *supra* note 105, at 112.

more a matter of fate. Social networks may relieve some of these feelings and help us gain a deeper understanding.

Some people and situations, it seems, defy the odds; genetic predispositions can override a healthy diet; fate can override preventative action.¹¹⁵ Preventative action is not fail-safe. On occasion, even preventative action itself has been known to snare the risk-averse.

Risks different from or greater than what we are used to can exist beyond our perceptions. It is very possible for there to be a lot more risk than what each of us has (or even all of us have) experienced (or even learned about) to date.

Teenagers, because their brains are not fully developed, don't always see the consequences of their actions. That part of the brain, known as the pre-frontal cortex has not yet developed or engaged.¹¹⁶ At the same time, as we will see, the risks facing all of us have increased. Our teens are not exempt from the increased risks of modern society. Their risks seem to be greater than ever.¹¹⁷ In order to protect teens' futures, parents sometimes need to step in—like a surrogate pre-frontal cortex—to provide a measure of foresight.

In a sense, we are all still teenagers. As adults, we may still engage in that same risky behavior we learned earlier. Maybe we should listen to that little worry in the back of our mind, the one that says, "Slow down." As with teenagers, not only are the risks greater, the environment is more challenging than what our forebears experienced. And just like teenagers, we may have some trouble seeing it. And it is more complicated than that. Seeing the problem, alone, is not enough.

Science is taking us to new places on the roadmap of risk. If we are not flexible enough to modify our views of risk and our behavior, we may wind up like the teenager who failed to appreciate the risk of catching HIV/AIDS and what it meant. Our decision making must become more flexible, and we must become more aware of these new risks—and create social and legal structures and systems so that we are ready for even more.

115. *See id.* at 111 (citing Charlie Davison et al., *The Limits of Lifestyle: Reassessing 'Fatalism' in the Popular Culture of Illness Prevention*, 34 SOC. SCI. & MED. 675 (1992)).

116. *See* JENSEN & NUTT, *supra* note 103, at 107, 269–70.

117. *See id.* at 104.

Anthony Giddens writes about risk and modernity. He describes a “risk culture” in which the potentially disastrous effects of risks are far more wide-reaching than in previous generations.¹¹⁸ Millions stand to be affected by errors, whether the errors bring about economic collapse or a nuclear meltdown.¹¹⁹

According to Giddens, the notion of risk moves through two stages. In the first stage, assessment of risk is seen as a means of promoting certainty, with the precision of risk calculations “bringing the future under control.”¹²⁰ However, “[t]he second stage is where we are not able to precisely calculate risk, but rather develop ‘scenarios’ of risk with various degrees of plausibility. One example is global warming, subject [at that time] to expert dispute over whether or not it is happening and how serious its ramifications are.”¹²¹

There is growing doubt about the validity of knowledge, but overall we are not discussing or dealing with that doubt or its seriousness directly. As experts increasingly disagree about risks and lay people instead are forced to make their own imprecise assessments, “people have become increasingly cynical about the claims to progress offered by traditional modernity.”¹²² Cynicism, however, does not constitute action. And as “normal accidents” increase, we increasingly view government’s failure to provide adequate security as scandalous.¹²³

118. Variations in risk perceptions may be cultural as much as they may be generational.

119. ANTHONY GIDDENS, *MODERNITY AND SELF-IDENTITY: SELF AND SOCIETY IN THE LATE MODERN AGE* 4 (1991).

120. Anthony Giddens, *Living in a Post-traditional Society*, in *REFLEXIVE MODERNIZATION: POLITICS, TRADITION, AND AESTHETICS IN THE MODERN SOCIAL ORDER* 56, 58 (1994).

121. LUPTON, *supra* note 105, at 74.

122. *Id.* at 75.

123. BECK, *supra* note 19, at 56 (citing CHARLES PERROW, *NORMAL ACCIDENTS: LIVING WITH HIGH-RISK TECHNOLOGIES* (1984)). An increase in normal accidents is consistent with the act of one painting backwards into a corner. Encounters with the wall become more common.

“Normal accidents” is the name Charles Perrow (1984) gives in his book to this predictability with which what was considered impossible occurs – and the more emphatically it is denied, the sooner, more destructively and shockingly it occurs. In the chain of publicly revealed catastrophes, near-catastrophes, whitewashed security faults and scandals the technically centred claim to the control of governmental and industrial authority shatters – quite

Our perceptions are critical. We must develop them well and with clarity as they shape our responses. Let us organize our responses according to our perceptions and our views.

C. How We Respond to Risk

There are many factors that contribute to both how we perceive and how we respond to risks. Lack of social autonomy, lack of autonomy in the workplace, and anxiety about job loss are among the factors that influence how we construct, view, and deal with risk.¹²⁴ The choices or lack of choices we face when confronted with risk bear greatly on our state of mind and our behavior. People may respond habitually rather than rationally to the risks they see, by merely including a pattern of risk avoidance in their everyday lives.¹²⁵ Our routine responses, however, may not constitute sufficient action when confronted with new risks. Consider some of our routine responses.

For one, we often blame others. When portraying others as a risk, we have represented them as dirty, unhygienic, pathological, and contaminating (as vermin). This is what the Nazis did to the Jews, to justify extermination.¹²⁶ The difference in our analysis of many of today's risks is that there is no identifiable single source of blame.¹²⁷ In many instances, as we shall see shortly, we have only our forebears and ourselves to blame. However, blame is not productive. It is backward looking and does not contribute to problem solving.¹²⁸

independently of the established measure of hazards: the number of dead, the danger of the contaminations, and so on.”

Id.

124. See LUPTON, *supra* note 105, at 116–17.

125. See *id.* at 122.

126. See *id.* at 130.

127. However, we remain capable of scapegoating. Consider Americans' post-9/11 response of blaming Muslims in general for terrorism.

128. See Joseph Tainter, *Competition, Expansion, and Reaction: The Foundations of Contemporary Conflict*, in *THE COMING AGE OF SCARCITY*, *supra* note 45, at 174, 190.

The identification of historical scapegoats too easily becomes an excuse for failures of contemporary action. Moreover, to the extent that European colonial expansion was made likely by previous events and processes, such as peer polity competition, the search for a scapegoat can always be shifted further back in time. A morally

We sometimes respond to risk with the paralysis of confusion, like deer before the headlights of doom.¹²⁹ We might lack the political fortitude to face the risks, even the risks of extinction. Or we may simply be “just one person.” There may be many reasons—or mere excuses—for our paralysis. Ultimately, if there is a real risk, the cause of our inaction does not matter.

It may help us to differentiate and distinguish danger from risk.¹³⁰ Even after we recognize the risks¹³¹—or maybe more precisely, the dangers inherent in an external situation—the omission of prevention can constitute a risk. The decision to take or not to take an action, in relation to a danger, can constitute a risk. According to sociologist Niklas Luhmann, risk is the consequence of decision, whereas danger is caused externally.¹³² Some of those risks are manmade, based on decisions. And some of those risks are external to human choice, and those really are dangers. As dangers are interpreted, decision risks are created. We live in a world where mixtures of both risk and danger are plentiful.

Risks can live on both sides of a decision involving a danger.¹³³ As dangers are out of human control, a failure to

neutral approach to history must be adopted or else dialogue reduces to accusations and defensiveness.

Id. It may be argued that even torturers may be forgiven. Glen Pettigrove, *Hume on Forgiveness and the Unforgivable*, 19 UTILITAS 447, 455–64 (2007).

129. Craig A. Rimmerman, *Critical Reflections on the Doomsday, Apocalyptic Vision*, in THE COMING AGE OF SCARCITY, *supra* note 45, at 283, 293–94.

Those who worry that the doomsday perspective paralyzes citizens who might otherwise mobilize politically have a legitimate point. We should not forget that in the early 1980s the Brown University student body voted to have cyanide tablets in every student’s dormitory in case of a nuclear holocaust. Much was made at the time regarding the resignation, futility, and passivity associated with the Brown student body’s response.

Id.

130. One deduces a conflictual situation, risk “from a general definition of the dangers one wishes to prevent.” Robert Castel, *From Dangerousness to Risk*, in THE FOUCAULT EFFECT: STUDIES IN GOVERNMENTALITY 281, 288 (Graham Burchell et al. eds., 1991).

131. See, e.g., DIRK PROSKE, CATALOGUE OF RISKS: NATURAL, TECHNICAL, SOCIAL AND HEALTH RISKS (2009), for a compilation and description of risk measures and their interdependence.

132. See LUHMANN, *supra* note 101, at 21–22.

133. Luhmann explains:

respond can seem to be more politically safe than a response that turns out as failed or unnecessary.

The risks of dealing with dangers pose a critical pair of questions (reliability and cost) for any risk analysis connected with collapse or extinction. Both the reliability of risk prevention and its cost must be considered. When it came to global warming, the George W. Bush administration decided that it would cost our economy too much to do anything about it.¹³⁴ It did not appear to be a matter of reliability of prevention so much as cost.

Let's say you decide you cannot touch that third rail of risk, human extinction, and you say, "The risks are too great; I can't get involved. I might make a mistake." If your existence and your way of life are part of the foreseeable cause, there is an obligation to respond. A duty is imposed on the humanity who has driven and pushed risk out of control to get it back under control before catastrophe occurs.¹³⁵ If that is impossible, we should at least minimize the impact.

When it comes to evaluating collapse or even extinction, the concept of risk comes into play. The way we view risk makes a difference. Our view frames our response.

Because perceptions of risk are influenced by our experiences and beliefs, assessments of and responses to risk are subjective. Yet some risks seem clear cut. When one looks at the risks posed

Even if it is only a question of danger in the sense of natural disaster, the omission of prevention becomes a risk. It is apparently easier to distance oneself politically from dangers than from risks—even where the probability of loss or the extent of loss is greater in the case of danger than in that of risk; and presumably also independently of the question (but this would require meticulous inquiry) of how reliable prevention in each case would be and what it would cost.

Id. at 31.

134. See Press Release, The White House, Press Briefing by Ari Fleischer (Mar. 28, 2001), <http://georgewbush-whitehouse.archives.gov/news/briefings/20010328.html> [<https://perma.cc/K5UM-KE6D>]; see also Terry Barker & Paul Ekins, *The Costs of Kyoto for the U.S. Economy*, 25 *ENERGY J.* 53, 53 (2004); Charles Wilson, *Global Warming Issue Still With Us*, *BULK TRANSPORTER* (Aug. 1, 2001), <http://bulktransporter.com/archive/global-warming-issue-still-us> [<http://perma.cc/Z4Q9-JSL9>].

135. The nature and extent of duty to avoid catastrophe merits deeper consideration elsewhere.

by HIV/AIDS or guns, for example, there also seems to be a more objective side.¹³⁶

The possibility of human extinction may present an objective risk, but how we weigh that risk against other concerns depends on our perspective, and in that sense, the risk is subjective. It is based on the values we hold.

An objective risk tends to lead us to examine cause and effect, scientific causation. When we examine for risks, we tend to look for some human intervention as playing a role, and sometimes we can track causation to our own behavior.¹³⁷

Some of that causation may be a side effect of our own technological achievements.¹³⁸ According to cultural studies professor Nico Stehr and technology professor Gotthard Bechmann, “Technology and the concomitant awareness of capability has occupied nature’s territory, and both surmise and experience indicate that this can more easily prove destructive than constructive. The fear that things could go wrong is therefore growing rapidly and with it the risk apportioned to decision-making.”¹³⁹ The knowledge that the choices others make can have a catastrophic impact on one’s life is unsettling and is growing as well.¹⁴⁰ Subjectively, we know something is wrong.

There are two competing approaches to the study of risk in the social sciences. One is quantitative, characterized by statistical modeling and cost-benefit analysis; the other is sociological, characterized by social views, trends and theories. The quantitative approach has been referred to as the “objective

136. That objectivity has holes in it. First, some teenagers (or others) may not share adults’ view of objective risk. Secondly, over time, with HIV vaccines and gun locks or other technology, risks may change and the views held by adults may change.

137. *See generally* TED STEINBERG, *ACTS OF GOD: THE UNNATURAL HISTORY OF NATURAL DISASTER IN AMERICA* (2d ed. 2006).

138. Some causation can also come from ignoring the risks that we have created or enhanced. *See id.*

139. Nico Stehr & Gotthard Bechmann, *Introduction*, in NIKLAS LUHMANN, *RISK: A SOCIOLOGICAL THEORY*, at xxxii (Rhodes Barrett trans., 2005).

140. There has been a prompt legislative response to the twenty-first century’s most visible cause of this unsettling feeling. The USA Patriot Act, Pub. L. No. 107-56, 84 Stat. 1116 (2001), was passed only six weeks after 9/11. And the depth of that unsettled feeling, in part, then permitted the pursuit of two wars—and yet more unsettled feelings.

view of risk,” while the sociological approach has been labeled the “subjective view of risk.”¹⁴¹ Each attempts to inform social policy.

How we respond to risk depends on our view. We have different views of risk. They fall into at least three main categories with the addition of an analysis of the moral view of risk, rooted in religion and philosophy. I am concerned with building a case against a purely objective view of risk. For the purposes of this argument, let us acknowledge but dispense with the subjective view. I will start with the objective view and then compare it to aspects of the moral view of risk.

1. The “Objective” View of Risk

The quantitative type of risk study, the objective view of risk, is also known as the technico-scientific approach to decisionmaking. It arises from the fields of engineering, statistics, actuarialism, psychology, epidemiology, and economics. Debates over risk in these fields tend to consider how well a risk has been identified or calculated (and to what level of confidence), the effects of the risk, the accuracy of the science that has been used to measure and calculate risk, and the degree to which predictive models are inclusive.

These days, many in the fields of business, insurance, and economics favor the use of the term “uncertainty” over “risk” when considering potential catastrophes. They take the view, developed by economist Frank Knight,¹⁴² that uncertainty has unknown probabilities, but with risk, the probabilities are known. Clearly, when it comes to risk of human extinction or collapse, the probabilities are unknown.¹⁴³ Hopefully, they will never become known.

For the purposes of this discussion I will instead use the term, “risk,”¹⁴⁴ which is widely used in numerous fields, including

141. See LUPTON, *supra* note 105, at 19.

142. See FRANK KNIGHT, *RISK, UNCERTAINTY AND PROFIT* (1921).

143. Huge risks with a small probability of coming about can nevertheless occur with more frequency than is statistically probable. Daniel A. Farber, *Probabilities Behaving Badly: Complexity Theory and Environmental Uncertainty*, 37 U.C. DAVIS L. REV. 145, 145–47 (2003). Farber’s arguments add credibility to arguments for precaution.

144. “In everyday language the term ‘risk’ is understood as a pseudonym for danger or peril, for some unhappy event which may happen to someone; it

law¹⁴⁵ and sociology,¹⁴⁶ when the probabilities are unknown. When one talks about extinction or collapse, risk makes more sense intuitively. It lies somewhere between common notions of uncertainty and danger. “Uncertainty” does not begin to convey the seriousness of the issue at hand.¹⁴⁷ Yet “danger” conveys a sense of alarm¹⁴⁸ that some people may not accept. “Risk” it is.

One “objective” method of quantitatively measuring and calculating risk is unrestricted cost-benefit analysis (CBA). CBA is a decision procedure;¹⁴⁹ each implementation weighs and compares costs and benefits anew. An estimate of relative probability may operate between the costs and the benefits. Ultimately, CBA’s design, *inter alia*, maximizes property rights and consequent liberty.

There are different methods to calculate the “cost” side just as there are different methods to arrive at the “benefit” side of the analysis. Some risk measures of costs, as with environmental regulations, are done by calculating the number of lives saved. Costs can also be calculated as the value, within a single life, of the number of years (containing measures of the quality of those years) that have been or will be lost or placed at risk.

Much has been written on the use of cost-benefit analysis to solve issues of catastrophic risk. For Judge Richard A. Posner,¹⁵⁰ cost-benefit analysis is indispensable in any rational decision-making process related to catastrophic risk.¹⁵¹ Since President

designates an objective threat.” François Ewald, *Insurance and Risk*, in THE FOUCAULT EFFECT, *supra* note 130, at 197, 199.

145. See, e.g., RICHARD A. POSNER, *CATASTROPHE: RISK AND RESPONSE* (2004).

146. See, e.g., BECK, *supra* note 19; LUHMANN, *supra* note 101; LUPTON, *supra* note 105.

147. Some in economics would insist that the term is “uncertainty” in any event.

148. What’s more, danger is outside of human control, whereas risk is within human control.

149. See, e.g., MATTHEW D. ADLER & ERIC A. POSNER, *NEW FOUNDATIONS OF COST-BENEFIT ANALYSIS* 12, 62–100 (2006).

150. Judge Posner sits on the Seventh Circuit of the United States Court of Appeals.

151. See POSNER, *supra* note 145, at 139. However, Posner’s work has been severely criticized. See Pat O’Malley, *Catastrophe: Risk and Response*, by Richard A. Posner, 4 L., *PROBABILITY & RISK* 187, 187–89 (2005) (book review).

Reagan's Executive Order 12,291,¹⁵² cost-benefit analysis has been the manner in which executive agencies of the United States government measure the extent and effect of potential regulations.¹⁵³ Cost-benefit analysis continues as the risk management tool of the U.S. government.¹⁵⁴

However, theorists of the objective view of risk are moving away from CBA, toward well-being analysis (WBA). The failings of CBA are well documented—and CBA is scathingly rebuked—by law professor Lisa Heinzerling and economist Frank Ackerman in their fine 2004 work *Priceless: On Knowing the Price of Everything and the Value of Nothing*. University of Chicago law professor Jonathan Masur, a one-time proponent of CBA, and his co-authors have more recently accepted Heinzerling and Ackerman's position that CBA should no longer be used as a decision procedure.¹⁵⁵ Instead, Masur and co-authors recommend that decisions be made by use of WBA.¹⁵⁶

After examining unrestricted cost-benefit analysis and its temporal tool, discounting, I will conclude coverage of the objective view of risk with a few thoughts on WBA.

a. Unrestricted Cost-Benefit Analysis

Economists use cost-benefit analysis as a decision-making tool. CBA's methodology was originally developed as a decision-making tool for flood management.¹⁵⁷ More recently, CBA has

152. Cost-benefit analysis was adopted as an overriding element of regulation, wherever not forbidden by statute. See Exec. Order No. 12,291, 3 C.F.R. § 127 (1982), reprinted in 5 U.S.C. § 601 (1988) (revoked 1994); Elena Kagan, *Presidential Administration*, 114 HARV. L. REV. 2245, 2277–78 (2001).

153. ADLER & POSNER, *supra* note 149, at 3–4.

154. Exec. Order No. 13,563, 76 Fed. Reg. 3821 (Jan. 21, 2011).

155. John Bronsteen, Christopher J. Buccafusco & Jonathan S. Masur, *Well-Being Analysis vs. Cost-Benefit Analysis*, 62 DUKE L.J. 1603, 1689 (2013). But see Jonathan S. Masur & Eric A. Posner, *Unquantified Benefits and Bayesian Cost-Benefit Analysis* (Coase-Sandor Inst. for Law & Econ., Working Paper No. 730, 2015), <http://ssrn.com/abstract=2646063> [<https://perma.cc/PJU4-PGYP>].

156. Bronsteen, Buccafusco, & Masur, *supra* note 155, at 1615.

157. See JULES DUPUIT, *ÉTUDES THÉORIQUES ET PRATIQUES SUR LE MOUVEMENT DES EAUX COURANTES: SUIVIES DE CONSIDÉRATIONS RELATIVES AU RÉGIME DES GRANDES EAUX, AU DÉBOUCHÉ À LEUR DONNER, ET À LA MARCHE DES ALLUVIONS DANS LES RIVIÈRES A FOND MOBILE* [STUDIES ON FLOOD MANAGEMENT]

been used for the same thing in the Netherlands.¹⁵⁸ Unrestricted CBA¹⁵⁹ simply weighs both sides, the cost and the benefit, to help governments and businesses make “more efficient” decisions.

In the business world, CBA holds tremendous appeal; efficiency is a good thing. CBA helps businesses make efficient decisions that in turn help maximize profits.¹⁶⁰ Of course, humanity needs business decision-making and at least some efficiency to continue. We need our markets to be able to handle the trillions of decisions and adjustments in a much more efficient manner than that provided by any other model. CBA works easily in the market context as it focuses on market efficiency and wealth maximization.

Implicit in CBA is an expression of human preference.¹⁶¹ CBA considers preference, generally calculated in terms of dollars or other unitary metric.¹⁶² All human interests, in the eyes of those using CBA, may be measured by a common standard, and between any two competing interests some quantitative rate of exchange can be determined that enables the rational balancing of one against the other.¹⁶³

(1848). Costs of flood control were weighed against the savings with a calculated probability of the risk of flood.

158. David Wolman, *Turning the Tides*, WIRED, Jan. 2009, at 108, 111. Employing the Dutch approach to flood risk analysis, with measurement of potential cost of damage helping to determine the amount of protection afforded by government action, might violate the U.S. Constitution. *Id.* at 113. Consider the need for equal protection under the law. See U.S. CONST. amend. XIV, § 1. Ultimately, humanity must protect equality and fundamental rights.

159. Uses of CBA and unrestricted CBA are interchangeable here. Law or regulation could impose restrictions on CBA. Instead, CBA is used to restrict or limit regulation.

160. There are two reasons why the entrepreneur is expected to maximize profits. One is the evolutionary expectation connected to survival in a competitive world; the other involves preferences in the institutional and social role of the entrepreneur in the market. Ignacio Sánchez-Cuenca, *A Preference for Selfish Preferences: The Problem of Motivations in Rational Choice Political Science*, 38 PHIL. SOC. SCI. 361, 365 (2008) (citing A.A. Alchian, *Uncertainty, Evolution, and Economic Theory*, 58 J. POL. ECON. 211 (1950)). The concept of profits need not be static; profits can come in many forms.

161. ADLER & POSNER, *supra* note 149, at 12.

162. *Id.* at 13; Keating, *supra* note 20, at 677.

163. This goes way back, certainly to Nicholas Kaldor’s early efforts in welfare economics where income aggregation and distribution was the subject of the work. See, e.g., Nicholas Kaldor, *Welfare Propositions of Economics and Interpersonal Comparisons of Utility*, 49 ECON. J. 549, 550–51 (1939). It may go back to Bismarck’s economists in late nineteenth-century Germany.

i. Three Immediate Problems with CBA

This sounds straightforward, but CBA has three complications worthy of immediate note. By visiting them, we will see better the functions and limits of CBA. After that, I will review the arguments in favor of the decision procedure. The three complications are externalities, the property right in CBA, and the problem implicit in CBA's governmental application.

a) Externalities

The notion of externalities relates to preferences in CBA. Some things don't get calculated into costs and benefits when employing CBA.¹⁶⁴ These additional factors, known as externalities in the neoclassical model of economic theory, have no direct cost to the entity making the decision (business or otherwise), but they do have a cost to others or to society as a whole. We can thank economist A.C. Pigou for making the concept of externalities part of economic jargon. He viewed them largely as market failures.¹⁶⁵

Externalities are side-effects. When we try to fix each with a band-aid, it's like playing whack-a-mole. As side effects ripple outward from an event, and in places compound and multiply, we are likely to find that chasing externalities is an endless and frustrating task.¹⁶⁶

Risk can work to have considerations of life and death on both sides of a cost-benefit equation. However, financial considerations tend to be more common. The notion of cost is most commonly expressed in financial terms. Thus, currency tends to be the unitary metric.

When multiple risks are involved, the matter of "risk-risk tradeoffs" arises. See *RISK VS. RISK: TRADEOFFS IN PROTECTING HEALTH AND THE ENVIRONMENT* (John Graham & Jonathan Weiner eds., 1995), for a more economic analysis of this phenomenon.

164. Costs are weighed against benefits. Probability is factored in, and assumptions are made based on those costs and benefits. Inevitably, some factors go unmeasured, beyond the realm of consideration. Those are externalities. In neo-classical economic theory, costs and benefits do not capture them. They may not fit the model, or they may be too difficult to calculate.

165. Carl Circo, *Does Sustainability Require a New Theory of Property Rights?* 58 U. KAN. L. REV. 91, 116 (2009) (citing STEVEN SHAVELL, *FOUNDATIONS OF ECONOMIC ANALYSIS OF LAW* 108 (2004)).

166. As Ronald Coase notes, "[I]f I am right, current economic analysis is incapable of handling many of the problems to which it purports to give answers." RONALD H. COASE, *THE FIRM, THE MARKET, AND THE LAW* 15 (1988)

Let's define externalities. An externality is an imposition of harm, cost, or even something positive, that is external to the calculations used at the source. Pollution is an easy example. Unless the polluter pays for all damage and its consequences (some of which may not yet be known), at least some costs would be external to the polluter's activity.

b) CBA's Property Right

Secondly, there is a property right, a fundamental right, implicit in CBA. According to economist Harold Demsetz, the right of property includes "the right to benefit or harm oneself or others."¹⁶⁷ With harms to others, we encounter a problem with the economic view: There is an imposition rather than cooperation, and that imposition can constitute a negative impact on any of our fundamental rights, including life itself. We need to think with care when we use our property.¹⁶⁸

The big problem arises with the implementation of those principles, those property rights, when their cumulative impositions and consequent risks pose a significant and foreseeable risk to statistical lives, or even to all life. When the externalities inherent in our economic system (e.g., too much CO₂ based on the imposition of property rights) pose a significant and foreseeable risk to the human community, it's time to reconsider

(noting that *The Problem of Social Cost* has not had immense influence on the field of economics though he believes, in time, it will). Contrary to conventional wisdom, Coase did not call for the internalization of externalities. Pierre Schlag, *Coase Minus the Coase Theorem—Some Problems with Chicago Transaction Cost Analysis*, 99 IOWA L. REV. 175, 185 (2013).

167. Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347, 347 (1967). Demsetz's theory of economics supports the violation of law as long as it is done in the name of maximizing profits. Beware. If anyone is above the law, their self-interest could harm the health and safety of all.

168. Property systems are not oriented toward careful thought. They are already quite well established and integrated with economic systems. Law professor Carl Circo says Demsetz believed that property must be governed by economic principles and community preferences for private ownership: "Whatever the property regime, however, he argued that basic economic considerations dictate that 'the emergence of new private or state-owned property rights will be in response to changes in technology and relative prices.'" Circo, *supra* note 165, at 118 (quoting Demsetz, *supra* note 167, at 350). There is nothing wrong with Demsetz's analysis per se, but humanity may also need to change its systems of ownership and use in response to catastrophic risk.

our priorities. We can justify this especially for high cost risks.¹⁶⁹ Maybe the issue is how a sound system of life, liberty, and property should consider and develop rules to address externalities. We shall see. Externalities are part of CBA, and our property regime helps enhance them.¹⁷⁰

c) Regulatory Application of CBA

Finally, we encounter the problem implicit in the governmental application of CBA: CBA is used to regulate against risks to life, liberty, and property. As the use of CBA is a norm in governmental risk analysis,¹⁷¹ we cannot talk about the way governments address risk without addressing CBA. In the interest of efficiency, costs attributable to regulation are carefully examined and minimized by advocates and regulators. According to philosopher John Rawls, CBA assumes “that all human interests are commensurable, and that between any two, there always exists some rate of exchange in terms of which it is rational to balance the protection of one against the protection of the other.”¹⁷² Regulations and protection, the benefits, cannot be justified using CBA without calculating and considering the costs.

169. Demsetz does not limit himself to a competitive perspective.

[I]n a much later piece, Demsetz concluded that “communal rights are the more efficient social arrangement under some circumstances.” Similarly, Robert Ellickson has shown that some forms of group ownership of land can be more efficient than individual ownership, especially within a close-knit group, for certain limited purposes, such as establishing the most efficient land boundaries for a particular land use or to spread risks efficiently in certain situations involving high-cost risks.

Circo, *supra* note 165, at 118 (quoting Harold Demsetz, *Frischmann’s View of “Toward a Theory of Property Rights,”* 4 REV. OF L. & ECON. 127, 130 (2008); citing Robert C. Ellickson, *Property in Land*, 102 YALE L.J. 1315, 1332–35, 1341–44 (1993)).

170. Using Demsetz’s approach of internalization via the allocation of property rights is not the only means by which externalities may be internalized. And in some cases it may not be the most effective. Civil liability, regulation, and criminal sanctions are other means to battle externalities. Each can limit only certain externalities and can function only as a band-aid applied to reduce the effect rather than to get at the cause.

171. See Sunstein, *supra* note 14, at 168–78 (demonstrating government use of CBA through thirty-six stylized scenarios), for a nice description of regulatory implementation of CBA.

172. JOHN RAWLS, *POLITICAL LIBERALISM* 312 (rev. ed. 1996).

However, when costs of regulation exceed its benefits there is an efficiency problem. According to law professor Gregory Keating, “[e]conomic theory is deeply critical of pressing precaution beyond the point of cost-justification.” To press precaution beyond the point of maximum efficiency is regarded as irrational. We are all better off with more dollars and fewer precautions. Additional precaution makes us worse off. “Our welfare could be improved by retreating back to the point of cost-justified precaution and by putting the money saved to better use elsewhere.”¹⁷³ This fiscal limitation is imposed on, for example, environmental regulations. The U.S. government’s implementation of CBA is part and parcel of the regulatory system for risk and appears to cross nearly all administrative boundaries.¹⁷⁴

Unfortunately, CBA is not designed to regulate risk. It cannot measure all risk; it misses externalities. CBA captures the financial part of the equation and is part of decision-making. But CBA is designed—and used—to maximize efficiency and thus to help maximize profits—which maximizes impact. In this way CBA adds to risk, especially when replicated in billions of decisions.

University of Chicago’s Jonathan Masur and Eric Posner, recent proponents of CBA, are correct to recognize that CBA is an inappropriate tool for certain kinds of decision-making, especially political decisions.¹⁷⁵ However, politics is often about money,¹⁷⁶

173. Keating, *supra* note 20, at 659. Keating notes that it is fundamental to the economic analysis of risk that taking more than cost-justified precaution is wasteful and irrational. *Id.* at 659 n.19 (citing LOUIS KAPLOW & STEVEN SHAVELL, *FAIRNESS VERSUS WELFARE* 52 (2002); THOMAS C. SCHELLING, *CHOICE AND CONSEQUENCE* 17 (1984); Herman B. Leonard & Richard J. Zeckhauser, *Cost-Benefit Analysis Applied to Risks: Its Philosophy and Legitimacy*, in *VALUES AT RISK* 31, 35 (Douglas MacClean ed., 1986)).

174. However, CBA is not used for at least some decisions involving the U.S. military.

175. “Cost-benefit analysis cannot cope with inherently political questions involving contested normative issues... such as abortion, affirmative action, and religious accommodation.” Jonathan S. Masur & Eric A. Posner, *Climate Regulation and the Limits of Cost-Benefit Analysis*, 99 *CAL. L. REV.* 1557, 1563 (2011). These political and policy decisions are not fit for regulatory agencies: “Instead of looking to cost-benefit analysis to resolve political questions, in certain cases, policymakers must instead make political judgments.” *Id.*

and we have built that translation into our regulatory system through the use of CBA, which encourages maximum gain. Unfortunately, in certain regulatory contexts CBA is used as a politically-palatable substitute for morality, but even then it's still largely about the money.

In CBA, we encounter numerous problems and inconsistencies with valuation. Consider the crafting of environmental regulations, which, according to Frank Ackerman and Lisa Heinzerling, “has almost always involved consideration of economic costs, with or without formal cost-benefit techniques. What is unique to cost-benefit analysis, and far more problematic,” they argue, “is the other side of the balance, the monetary valuation of the benefits of life, health, and nature itself.”¹⁷⁷ Typically, we do not value these gifts, these ends, in dollar terms, but economists do. As a result, we have a limited view of our economic benefits in which “analysts often ignore the distinction between valuing risk and valuing life, and act as though they have produced a valuation of life itself.”¹⁷⁸ Our first valuation problem is that our view of the benefits of regulation has been too limited.¹⁷⁹

If life, health, or nature receive an artificially low value, less regulation and less protection is justified. As life, health, and the environment have no natural prices, we need to consider how artificial valuations are calculated. Contingent valuation surveys represent a kind of opinion poll in which researchers survey a cross-section of the affected population for how much, hypothetically, they would be willing to pay to preserve or protect something that can't be bought in a store.¹⁸⁰ These surveys are used to produce prices for things that appear to be priceless: “For example, the average American household is supposedly willing to pay \$257 to prevent the extinction of bald eagles, \$208 to

176. “[I]n a capitalist society such as the United States a connection between money and political power is inevitable.” MICHAEL L. MEZEY, REPRESENTATIVE DEMOCRACY: LEGISLATORS AND THEIR CONSTITUENTS 191 (2008).

177. Ackerman & Heinzerling, *supra* note 16, at 1557.

178. ACKERMAN & HEINZERLING, *supra* note 15, at 68.

179. An effort to expand the view of benefits should not require us to guess at their value. In deference to current law, recent work by Masur and Posner claims that it is better to just “guess” at the values of unquantified benefits than to try to calculate the unquantifiable. Masur & Posner, *supra* note 155, at 44.

180. Ackerman & Heinzerling, *supra* note 16, at 1557–58.

protect humpback whales, and \$80 to protect gray wolves. These numbers are quite large[,] since there are about 100 million households in the country . . .”¹⁸¹ We’ll return to regulation. For now, let’s stick with pricing.

ii. Pricing

One problem with the contingent valuation survey is in the manner of survey and tabulation itself. Responses that deviate from a range are tossed out, as are responses of protest. “[P]rotest rates of 50 percent or more are common.”¹⁸² Protests may speak to the impropriety of pricing the priceless, but economists overcome protests by disregarding them entirely. The result is precise data that is blindly inaccurate.

Another approach to pricing the unpriced offered by Ackerman and Heinzerling, “infers what people are willing to pay from observation of their behavior in other markets. To assign a dollar value to risks to human life, for example, economists usually calculate the extra wage—or “wage premium”—that is paid to workers who accept riskier jobs.”¹⁸³ Pay differential for the riskier job is used to price the employee’s value of his or her own life.¹⁸⁴ By this approach, a life was worth about \$6.3 million in the year 2000¹⁸⁵ and from \$7 to \$9.1 million in 2013.¹⁸⁶

181. *Id.* at 1558.

182. ACKERMAN & HEINZERLING, *supra* note 15, at 164 (citing ROBERT C. MITCHELL & R.T. CARSON, USING SURVEYS TO VALUE PUBLIC GOODS 34 (1989)). According to Ackerman and Heinzerling, “Dismissing these responses creates a danger that valuations of health and nature will reflect an ad hoc process of censorship by economists, not a true cross-section of popular attitudes.” *Id.*

183. Ackerman & Heinzerling, *supra* note 16, at 1558.

184. Such wage-risk analysis, although widely accepted, is flawed due to an asymmetry of risk information, limited occupational choices, race discrimination, and differential values of women and the population outside the workforce. ACKERMAN & HEINZERLING, *supra* note 15, at 76–80.

185. Ackerman & Heinzerling, *supra* note 16, at 1558, 1584 n.20. Philosopher John Broome points out the inherent problem with this measurement: “[N]o finite amount of money could compensate a person for the loss of his life, simply because money is no good to him when he is dead.” John Broome, *Trying to Value a Life*, 9 J. PUB. ECON. 91, 92 (1978).

186. Sunstein, *supra* note 14, at 181–82. More recent estimates of value are in line with this: “[A] reasonable middle ground between infinity and lifetime earning” produces a recent VSL of about \$9 million. W. Kip Viscusi, *Pricing Lives for Corporate and Governmental Risk Decisions*, 6 J. BENEFIT-COST ANALYSIS 227, 244 (2015).

The value, or price if you will, varies by calculator and by geographic location.¹⁸⁷ It is not necessarily an average; the elderly may be devalued.¹⁸⁸ Prospective value may also vary by the circumstances of death,¹⁸⁹ but, prospectively, the value of a life, even if it is just a statistical life, cannot be valued by expected future earnings. People won't stand for it.¹⁹⁰

The value of a statistical life (VSL) is essential to calculate the costs and benefits of environmental regulations. Avoided deaths are the basis (the benefit) for implementing many such regulations. Since the government uses VSL, Kip Viscusi advocates that corporations use VSL as a shield, even a safe harbor, in decision-making where risk involves the loss of lives.¹⁹¹ This could immunize corporations from punitive damage awards.¹⁹²

187. "In 2008 the U.S. Environmental Protection Agency valued a generic American life at \$7.22 million, while the Department of Transportation uses a figure of \$5.8-million." Differences in value vary greatly. When evaluating the cost of lives saved in the prevention of HIV in Africa, the nonprofit group Population Services International "calculated a cost of \$200 to \$700 per infection avoided. Bear in mind: In countries where antiretroviral drugs are not available, an infection prevented is likely to be a life saved." Peter Singer, *America's Shame*, CHRON. HIGHER EDUC., Mar. 13, 2009, at B6, B8–B9, <http://chronicle.com/article/America-s-Shame/30309> [<https://perma.cc/V65X-7D6L>].

188. "[I]n 2002, [the U.S. Office of Management and Budget]—for the first time ever—put its official stamp of approval on [the conclusion that a seventy-five-year-old is not worth as much as a forty-year-old] when it estimated that people age seventy and older were worth about sixty-three cents on the dollar compared to younger people." ACKERMAN & HEINZERLING, *supra* note 15, at 74 (citing OFFICE OF AIR & RADIATION, EPA, EPA 420-R-02-022, FINAL REGULATORY SUPPORT DOCUMENT: CONTROL OF EMISSIONS FROM UNREGULATED NONROAD ENGINES, Ch. 10 (2002)). But that's not the end of the injustice. "The money that would have been spent protecting the elderly doesn't go to protecting the young; it stays in the pockets of the people who are endangering the lives of the elderly." *Id.* at 75.

189. "[E]qual risks of death may not look equally bad. . . . [E]ven for an ultimate value such as life and death, the social context is decisive in our evaluation of risks." *Id.* at 71 (citing E. J. MISHAN, COST-BENEFIT ANALYSIS: AN INFORMAL INTRODUCTION (4th ed. 1988)).

190. "A price list with different values for different lives is difficult to reconcile with ideals of democracy and equal treatment under the law, let alone the sacredness of every human being." *Id.* at 72.

191. Viscusi, *supra* note 186, at 242.

192. *See id.*

Let's not overlook the ex post use of VSL. Value is important after loss as part of corrective justice in tort law.¹⁹³

Even with a complex system for measuring and valuing risks, it may be preferable to avoid strict quantitative analysis and find an easier approach that does not rely on explicit valuations, valuations of costs or life, health and the environment. There is, says Richard Posner, “an argument for ranking risks by their expected costs and deliberately disregarding the lowest ranked ones.”¹⁹⁴ He notes other ways of ranking risks, including “an argument for giving attention disproportionate from expected-costs to those risks that are easier to think about because their probability of materializing is greater, or (a related point) because they have materialized in the past and so we have actual experience with them—we don't have to imagine them.”¹⁹⁵ Thus, we are not tied to using measures of the value of life, health and nature, especially the lowest ones, which would result in the greatest “efficiency” and put us at greater risk. However, arguments in favor of maximizing economic efficiency¹⁹⁶ have been winning the day for decades.¹⁹⁷ We are deeply in ecological debt, and there is no easy way out.

193. A tort is an injury to person or property. Let's assume that there are regulations that protect life, and that some tortfeasor violates those regulations. The law of torts is invoked, and corrective justice steps in. “Corrective justice . . . seeks to correct the wrong done to the victim by imposing a comparable evil on the tortfeasor.” Carsten Gerner-Beuerle, *Calabresi, Posner, and Some Common Areas of Confusion: The Value of Life in Law and Economics* 3 (Feb. 17, 2009), <http://ssrn.com/abstract=1345583> [<https://perma.cc/J6MJ-STBR>].

194. POSNER, *supra* note 145, at 121.

195. *Id.*

196. Ultimately, scientifically, humanity is truly more efficient if it uses less. Efficiency in science and efficiency in economics may not have quite the same meanings. Currently, the notion of maximizing efficiency in economics translates into wringing out every possible dollar in benefit.

197. “The objective of society is to maximize economic efficiency and thus social welfare.” SIMON REICH, *THE FRUITS OF FASCISM: POSTWAR PROSPERITY IN HISTORICAL PERSPECTIVE* 32 (1990). Along the same lines, Milton Friedman's view that corporations have an obligation to maximize profits (and thus economic efficiency) won a sweeping victory in the 1980s. Leo E. Strine Jr., *Human Freedom and Two Friedmen: Musings on the Implications of Globalization for the Effective Regulation of Corporate Behavior*, 58 U. TORONTO L.J. 241, 259–62 (2008).

iii. Arguments for CBA

Let us review the arguments in favor of CBA. Over the years, there have been a number of them. The arguments tend to fall into two broad categories. First, there are economic assertions that better results can be achieved through the use of cost-benefit analysis. Secondly, there is the transparency argument, those legal and political claims that a more objective and open government process will come from this kind of analysis.¹⁹⁸

We get better results from CBA through efficiency as efficiency is good.¹⁹⁹ When efficiency is maximized, profits are maximized. When the government minimizes regulatory costs, the free market is allowed to boom. Efficiency is the lure.²⁰⁰

In order to measure most accurately the costs and the benefits and arrive at the most efficient result, everything has to be placed in dollar terms, even life and health. With life and health on the line, dollars are measured as a substitute for risk assessment.²⁰¹

Add to this a history of special interest groups—or their economists, attorneys, and other lobbyists—appearing before congressional committees, commenting on proposed regulations, or posting information on their web sites bemoaning their high costs, the extravagant costs, of regulation. They push hard; they lobby for more favorable numbers and less regulation. They manipulate CBA to get their desired results, and they argue that the government's use of it is inaccurate. The notion that the current system produces rules that are terribly expensive and that better economic analysis would protect us from this harmful

198. Ackerman & Heinzerling, *supra* note 16, at 1560.

199. “To the economist, the observation that efficiency is good is tautological because economics defines efficiency as the course of action that maximizes what human behavior recognizes as good.” Circo, *supra* note 165, at 125.

200. Ackerman and Heinzerling explain the lure: “Cost-benefit analysis supposedly furthers efficiency by ensuring that regulations are only adopted when benefits exceed costs and by helping direct regulators’ attention to those problems for which regulatory intervention will yield the greatest net benefits.” Ackerman & Heinzerling, *supra* note 16, at 1560.

201. Gregory Keating describes the implementation: “‘Cost-benefit’ analysis requires risks to be reduced to the point where the costs of further precautions exceed their benefits. If the marginal costs of eliminating significant risks exceed the marginal benefits, significant risks will continue to exist.” Keating, *supra* note 20, at 684–85.

result remains one of the persistent arguments offered in favor of CBA.²⁰² Economists present CBA as a kind of moral imperative.²⁰³ For them, the notion of better economic analysis means more precise CBA rather than consideration of other regulatory schemes.

Proponents argue that CBA leads to more open and *objective* government decision-making. Ackerman and Heinzerling explain that agency decision-making based on objective standards is “the holy grail of administrative law. . . . The idea is to prevent an agency from either making arbitrary decisions or, more invidiously, from benefiting politically-favored groups through its decisions. Cost-benefit analysis has been offered as a means of constraining agency discretion in this way.”²⁰⁴

CBA seems objective, but using it for regulatory decisions can lead to bizarre and risky results. We will see the exercise of subjective choice and discretion in what is arguably an objective approach to decision-making. We will return to CBA after an introduction to discounting.

b. Introduction to Discounting and Valuation of the Future

Because we value something differently now than we do in the future, we use discounting. It is the flip side of earning interest in a savings account.²⁰⁵ With that savings account, the bank pays you interest for saving. Your balance accrues the interest and amounts to more later.²⁰⁶ In economics, that interest represents something called the “time value of money.”

202. Ackerman & Heinzerling, *supra* note 16, at 1560–61. “One widely cited study claims that the cost of life-saving interventions can reach as high as \$99 billion for every life-year saved.” *Id.* at 1561 (citing Tammy O. Tengs et al., *Five-Hundred Life-Saving Interventions and Their Cost-Effectiveness*, 15 RISK ANALYSIS 369, 377 app. A (1995)).

203. If CBA is a moral imperative for conservative economists, how come CBA has not been applied by those economists to missile defense systems? See ACKERMAN & HEINZERLING, *supra* note 15, at 216–18.

204. Ackerman & Heinzerling, *supra* note 16, at 1562.

205. “Discounting is just compound interest in reverse.” ACKERMAN & HEINZERLING, *supra* note 15, at 182.

206. Certainly, with inflation, that amount would need to be greater later. However, adding an inflation rate and a real interest rate in order to take inflation into account only complicates the thinking and generally changes

Discounting is another way to implement the time value of money. Instead of getting paid interest, one receives less up front. One gets less by taking her money now as opposed to later (when it would include interest). For example, with the lottery, the winner can take the smaller lump sum now or a larger amount spread over time. When we apply discounting, we are saying that something is worth less to us tomorrow than it is today. We prefer to have things now.²⁰⁷

Discounting is necessary in CBA (as most everything is reduced to the dollar). Some benefits are not immediate, and some costs do not accrue immediately. When, in the course of conducting cost-benefit analysis, future benefits or future costs are encountered, a discount rate is employed. According to William R. Cline, senior fellow at the Peterson Institute for International Economics, “[c]onventional discounting, even with low discount rates, makes present day values of benefits to be received far in the future vanishingly small. The reason why we discount the value of expected future benefits is that people tend to prefer consumption sooner rather than later.”²⁰⁸ Cline observes that, when asked to choose between getting \$100 today or \$100 in a year’s time, most of us prefer \$100 now: “When people save money they forestall consumption today. Generally, they are only willing to do that because the savings can be invested to yield an interest premium that ensures future consumption will be larger.”²⁰⁹ Discounting encourages consumption.

nothing in the outcome. Unfortunately, the psychology of inflation (the looming nature of price increases) serves to increase consumption.

207. A preference for immediate gratification is implicit in the weighing process of discounting. How would Ben Franklin view this?

Ben Franklin was a person who believed in sensible habits, in frugality, in moderation, in discipline. Sometimes he has been mocked for his attitudes, but on the whole we think it is fair to say that his mindset was one that many people, at least in principle, would still find admirable today. Yet discounting discourages all of the habits of mind and behavior that Franklin embraced.

ACKERMAN & HEINZERLING, *supra* note 15, at 202. Franklin’s frugality, moderation, discipline, and moral weighing are a far cry from the public impatience and empty precision of the mechanics of discounting.

208. William R. Cline, *Meeting the Challenge of Global Warming*, in *HOW TO SPEND \$50 BILLION TO MAKE THE WORLD A BETTER PLACE* 1, 5 (Bjorn Lomborg ed., 2006).

209. *Id.*

At a basic level, there are two kinds of discounting: financial discounting and risk discounting. Financial discounting is dollars for dollars. Financial discounting pertains to investment return decisions, but financial discounting is purely financial—at least until it is applied to something priceless, like life or liberty.

The second kind of discounting, risk discounting, takes many forms, including gambling, destabilizing speculation, and stabilizing insurance. Risk discounting includes decisions to risk something more precious than money or property. Discounting in the area of the fundamental rights²¹⁰ of life and liberty carries special significance. That significance is highlighted in the area of life and health, where we encounter the characteristic of *irreversibility*. The meaning may be expressed with the term *incommensurability*, which we will consider shortly.

The discount rates used by neo-classical economists tend to be based on *consumption* preferences, preferences in favor of consumption based upon principles of financial discounting. The more we consume, the better. The converse is the less we save, the better. In that sense, discounting de-emphasizes the future. It provides a justification for us to use, to consume, and to destroy today. Whatever it is, it's worth less tomorrow. This is the way discounting works with CBA—and with risk.

i. Governmental Discounting

When discounting is applied to governmental policy, especially risk analysis, humanity's future may be similarly de-emphasized.²¹¹ Richard Posner contends that, “[t]he effect of discounting on cost-benefit analyses of responses to catastrophic risks tends to be dramatic because the benefits of the responses are likely to be spread out over a very long time while many of

210. Fundamental rights are, in a basic Constitutional sense, the rights to life, liberty and property granted under the Fifth and Fourteenth Amendments to the U.S. Constitution. See JOHN E. NOWAK & RONALD D. ROTUNDA, CONSTITUTIONAL LAW § 11.7 (8th ed. 2010).

211. Ackerman and Heinzerling see discounting as a subversion of the future through a misuse of preferences. The honoring of rights in the protection from “workplace hazards and environmental toxins” is lost “when lives saved in the future are shrunk to insignificance through discounting.” ACKERMAN & HEINZERLING, *supra* note 15, at 192. Immediate selfishness should not be allowed to subvert the public judgement that future harms have significance. *Id.* Humanity, collectively and individually, should not give up the right to a future.

the costs may have to be incurred in the present and near future.”²¹² When the costs and benefits of a policy occur at different times, governments monetize and discount future costs and benefits and treat them as equivalent to fewer dollars today.

The resulting sale price effect offers a decreased cost of pollution now. We are to use now in the interest of discounting those later costs of pollution. With discounting, the present can be rewarded at the cost of the future,²¹³ as though the future can always absorb costs shifted forward in time. Many neo-classical economists foresee no limits,²¹⁴ but humanity cannot borrow infinitely against its resource base.²¹⁵ Ackerman and Heinzerling note that discounting employs a worldview of market economics that typically assumes stable problems with declining control costs. It treats precautionary investment in environmental protection as “a needless expense” by ignoring the possibility of catastrophic and irreversible harms.²¹⁶ As a result, over time, we increasingly find that we have turned our backs on known significant and irreversible risks.

212. POSNER, *supra* note 145, at 151. Many of us engage in this kind of analysis with retirement savings, so it isn’t entirely foreign to us.

213. This is not about financial discounting; one can’t just take the cost savings and invest them.

214. Those economists employ no accounting for the physical limits of the Earth. For example, there are limits on the amounts of greenhouse gases such as carbon that can be sustained in the atmosphere. Humanity is currently exceeding the limits of the planet with its behavior. See generally JAMES E. HANSEN, STORMS OF MY GRANDCHILDREN, THE TRUTH ABOUT THE COMING CLIMATE CATASTROPHE AND OUR LAST CHANCE TO SAVE HUMANITY (2009). It seems we have a tendency to ignore the most significant risks until it is too late. Once humanity passes the point of irreversibility, it’s too late. We will have exceeded the planetary limits too greatly for too long a time.

215. Economist William Baumol recognized the inability to borrow infinitely in an early article on discounting the benefits of public projects: “If we poison our soil so that never again will it be the same, if we destroy the Grand Canyon and turn it into a hydroelectric plant, we give up assets which like Goldsmith’s bold peasantry, ‘. . . their country’s pride, when once destroy’d can never be supplied.’” William J. Baumol, *On the Social Rate of Discount*, 58 AM. ECON. REV. 788, 801 (1968). Irreversibility has significance. See discussion *infra* Section III.C.2.b. Humanity should be concerned with irreversibility—and limit liberty where risks to life are significant.

216. ACKERMAN & HEINZERLING, *supra* note 15, at 185–86.

Yet, Judge Posner says discounting is required for CBA to deal with catastrophic risk.²¹⁷ In order to use CBA in risk analysis, we must discount the future. The unspoken reason for discounting seems to be that we have limited resources and cannot afford infinite costs, even in the future. What's more, discounting is a norm in neo-classical economics.

Instead of looking at the costs of today, let's consider the benefits, the value of our future. When we consider a large number of years, say a few centuries, into the future, discounting makes considerations of future costs seem miniscule. Ackerman and Heinzerling provide a great example: "At a discount rate of five percent, for example, the death of a billion people five hundred years from now becomes less serious than the death of one person today."²¹⁸ In this regard, applying discounting to long time frames makes humanity's future seem meaningless.²¹⁹ But discounting is ordinarily a necessary part of an accurate CBA.²²⁰

217. Posner points out that, "as a practical political matter," it would be absurd "not to discount future costs at all." He observes that "the present value of benefits conferred on our remote descendants would approach infinity." This would render CBA unworkable. "Because resources are limited, we couldn't make the expenditures called for by a cost-benefit analysis of catastrophic risks that eschewed discounting to present value even if we wanted to." POSNER, *supra* note 145, at 152–53.

218. Ackerman & Heinzerling, *supra* note 16, at 1571 (citing WILLIAM J. BAUMOL & ALAN S. BLINDER, *ECONOMICS: PRINCIPLES AND POLICY* 386–87 (6th ed. 1994); DEREK PARFIT, *REASONS AND PERSONS* 357 (1984)).

219. When Judge Posner considers how to give weight to the welfare of future generations, he finds the literature on the subject "immense but inconclusive." POSNER, *supra* note 145, at 153. This is critical if one agrees to the application of CBA to risks of human extinction. In the context of using CBA to cope with long-term societal risks, Judge Posner finds no best method of valuing or weighing the needs of humanity's future generations. How come? The logic of discounting "breaks down when costs or benefits spread over a century or longer. No individual will experience both the beginning and the end of the transaction; no one is able to make the personal judgment that the trade-off is, or is not, worthwhile." ACKERMAN & HEINZERLING, *supra* note 15, at 187. The decision-making tool of discounting is lethal in the long term.

220. If, for some reason, humanity finds that it must use unrestricted CBA to test regulations in order to avoid extinction, Richard Posner offers an interesting approach that might help us save ourselves: negative discounting. If the disaster that we consider is severe enough to make future generations poorer than we are, rather than richer, that possibility might argue for using a negative discount rate to determine the present value cost of the future disaster. See POSNER, *supra* note 145, at 164–65. Posner assumes that we will make future generations richer. *Id.* at 164. We are not obligated to make future generations richer than ours, but we are obligated not to leave the next

This calculation applies fairly to the risks to human life. We use regulations to save lives and the environment in a much shorter time frame. Discounting may then involve placing a value on a statistical life.²²¹ Economists' measurements of that value are often based on labor market data.²²² What we do with that value in discounting turns out to be problematic. According to law professor Cass Sunstein, "human beings cannot be banked, and they do not earn interest. In applying the usual discount rate for money to human lives and environmental amenities, regulators have not been sufficiently reflective."²²³ When used in connection with law and its regulation, CBA, in effect, discounts future humans. This reflects a misalignment between our law and our religious, moral, and intellectual heritages.

generation starving, impoverished, and poisoned. If we can get to the point where each of us leaves the world a better place, it would be wonderful. But that is an aspiration, not an obligation.) Negative discounting emphasizes the future and the long term over the present and the short term. Negative discounting may be morally problematic. Is the cost of the future always too much? It may be helpful to consider the circumstances when negative discounting could be useful.

221. There is a substantial literature on the value of a statistical life. See, e.g., Orley Ashenfelter, *Measuring the Value of a Statistical Life: Problems and Prospects*, 116 *ECON. J.* C10 (2006); Georges Dionne & Paul Lanoie, *Public Choice About the Value of a Statistical Life for Cost-Benefit Analyses: The Case of Road Safety*, 38 *J. TRANSPORT ECON. & POL'Y* 247 (2004); Louis R. Eeckhoudt & James K. Hammitt, *Background Risks and the Value of a Statistical Life*, 23 *J. RISK & UNCERTAINTY* 261 (2001); Per-Olov Johansson, *Is There a Meaningful Definition of the Value of a Statistical Life?*, 20 *J. HEALTH ECON.* 131 (2001); Randall Lutter et al., *The Cost-Per-Life-Saved Cutoff for Safety-Enhancing Regulations*, 37 *ECON. INQUIRY* 599 (1999); Sujitra Vassanadumrongdee & Shunji Matsuoka, *Risk Perceptions and Value of a Statistical Life for Air Pollution and Traffic Accidents: Evidence from Bangkok, Thailand*, 30 *J. RISK & UNCERTAINTY* 261 (2005); Viscusi, *supra* note 186.

222. W. KIP VISCUSI, *RATIONAL RISK POLICY* 46–47 (1998). The use of labor market data has problems. "[F]or incurring workplace hazards, white workers get far more than African American workers do—a finding that seems to cast doubt on government's use of labor markets to produce a value for life." Cass R. Sunstein, *Your Money or Your Life*, *NEW REPUBLIC* (Mar. 15, 2004), <http://www.newrepublic.com/article/books-and-arts/your-money-or-your-life> [<http://perma.cc/7Y5K-93JY>] (reviewing ACKERMAN & HEINZERLING, *supra* note 15) [hereinafter *Your Money or Your Life*].

223. *Your Money or Your Life*, *supra* note 222.

ii. Life Years

With public health considerations, a more complex matter is at stake than the mere yes/no question of existence. As a result, economists and theoreticians have developed measurements that consider length and quality of life. The concept of the life year was created to measure changes in average length of life. For example, an increase or a decrease in the number of cancer cases results in a shorter or a longer average life span.

These measurements have gotten amazingly precise. Not only is there the concept of life years, there have been attempts at refinement. One includes an effort at fairness. The notion of equity-adjusted years of life saved (EYLS) has been developed.²²⁴ An early refinement in the 1970s involved the concept of quality-adjusted life years (QALYs).²²⁵

QALYs or other measures of life years are tools used to evaluate the level of protection from risk in regulating against it. Economists Paul Dolan & Jan Abel Olson explain the basis of the QALY in relation to health care: “Since health is a function of both length of life and quality of life, the ‘quality-adjusted life-year’ (QALY) has been developed in an attempt to combine the value of these attributes into a single index number.”²²⁶ It would seem that we can quantify any set of relative characteristics into a unitary metric.

Such quantification may be problematic.²²⁷ Once we decide what a QALY (or other life year) is worth, on average,²²⁸ across

224. See Lars Lindholm et al., *How Many Lives Is Equity Worth? A Proposal for Equity Adjusted Years of Life Saved*, 52 J. EPIDEMIOLOGICAL COMMUNITY HEALTH 808, 808–10 (1998) (“Under certain conditions, the Swedish politicians are prepared to sacrifice 15 of 100 preventable deaths to achieve equity.”).

225. See Matthew D. Adler, *QALYs and Policy Evaluation: A New Perspective*, 6 YALE J. HEALTH POL’Y, L. & ETHICS 1, 3 n.3 (2006) (citing Robert M. Kaplan, *Utility Assessment for Estimating Quality-Adjusted Life Years*, in VALUING HEALTH CARE: COSTS, BENEFITS, AND EFFECTIVENESS OF PHARMACEUTICALS AND OTHER MEDICAL TECHNOLOGIES 31, 35 (Frank A. Sloan ed., 1996)).

226. Paul Dolan & Jan Abel Olson, *Equity in Health: The Importance of Different Health Streams*, 20 J. HEALTH ECON. 823, 823 (2001).

227. See ACKERMAN & HEINZERLING, *supra* note 15, at 98–102, for a critical analysis of the use of QALYs in health care.

228. In 2004, the common benchmark value was \$50,000 per QALY in the United States or £30,000 per QALY in the United Kingdom, although based on published data those reference points may have been too low. See Christopher

the board, for humanity, we need to determine how many QALYs are at risk. Then we can multiply. How many QALYs is all of humanity worth? How much should we expend? To how much effort should we go? In order to make those calculations, how much should we discount future humans and the entire future of life in order to arrive at a number for the benefit side of a cost-benefit analysis?

Cambridge University Professor Martin Rees has an answer to these questions: “The odds could be so heavily against the emergence (and survival) of complex life that Earth is the unique abode of conscious intelligence in our entire Galaxy. Our fate would then have truly cosmic resonance.”²²⁹ In short, *no dollar value could ever be placed on all future human life*. This conclusion is consistent with the notion of *sacred values*,²³⁰ a topic that merits further investigation elsewhere.

c. The Deficiencies of CBA

Even within the objective view of risk, purely economic views or purely quantitative measures cannot effectively deal with catastrophic risk at a global level. Traditional CBA is fundamentally flawed and can cause harm when we make decisions of significance regarding human life. The deficiencies are both practical and moral.

There are at least two practical inabilities: determining probability and measuring benefit. Both the probabilities and benefits are necessary to calculate responses to risk within unrestricted CBA. Only with these figures can we determine the cost we should reasonably incur.²³¹

Evans et al., *Use of Quality Adjusted Life Years and Life Years Gained as Benchmarks in Economic Evaluations: A Critical Appraisal*, 7 HEALTH CARE MGMT. SCI. 43, 43 (2004).

229. REES, *supra* note 97, at 157.

230. “*Sacred values* are ideals so transcendent that they have no equivalent in anything material. People in all societies have them.” Sharon Begley, *The Key to Peace in the Mideast May be ‘Sacred Beliefs’*, WALL ST. J. (Aug. 25, 2006), <http://www.wsj.com/articles/SB115645687096244884> [perma.cc/9AZ7-DJUP] (emphasis added).

231. One would think that costs and benefits should be arrived at independently and then compared. However, when we use CBA to protect from risk, in simple terms, we place a value on what is being protected (the benefit), and we may use a discount rate to discount that value if it is in the future. We

We cannot know the probabilities of our collective demise. Without estimable probabilities, we cannot use costs to determine benefits or vice versa. According to Judge Posner, when one cannot assign probabilities and the risk is great, taking appropriate action becomes a matter of choosing between two extremes. It is like deciding to have surgery, all or nothing.²³² There is no middle ground. When we consider the potential tragedy caused by global warming, for example, too many possible issues or variables are not subject to quantification or measurement to make the necessary calculations using CBA.²³³ Humanity is left with what looks like a judgment call.

Extreme events confound standard methods of coping with uncertainty. For example, since 2001 insurance companies have terminated coverage for losses due to terrorism. And as “the end of the world or the human race is not an insurable loss,” Judge Posner correctly observes that insurance practices “[cannot] yield useful information about the likelihood of extinction events.”²³⁴ Quantitative risk evaluation fails us in this extreme area.²³⁵ This consideration and others will force us out of a cost-benefit view of risk and into considering other methods.

then calculate the probability of the risk. Finally, we multiply that probability against the possibly-discounted value to arrive at the amount to expend to protect against the risk (the cost). Ultimately, we need to know three figures: cost, benefit and probability. In order to get there, we use the two figures we can ascertain to triangulate the third.

232. POSNER, *supra* note 145, at 57–58.

233. As Judge Posner observes, “[N]o probabilities can be attached to the catastrophic global warming-scenarios, and without an estimate of probability an expected cost cannot be calculated.” *Id.* at 49–50.

234. *Id.* at 176.

235. Even using a substitute method of analysis known as “inverse cost-benefit analysis” cannot help here. Inverse CBA calculates probability based on government spending to prevent a risk and an estimated benefit. First, as the risk of human extinction is not currently on governmental radar, the amount of spending to prevent human extinction does not provide any guidance whatsoever. (Using CBA, expected cost (C) is the product of probability (P) and loss (L): $C=PL$. *Id.* at 176–77. But now, to implement inverse CBA, cost must be determined based on current expenditure. With matters of possible human extinction, current cost C is either zero or unknown. Probability (P) is unknown. The loss (L) is arguably infinite. Either zero C or infinite L will prevent us from arriving at a probability. We have both. Thus, this approach to determining risk is bound to fail.) Secondly, this approach to calculating probability is also problematic in that government spending may not be based on risk at all but solely upon politics.

We can't know the benefit of human existence, but for CBA we need to arrive at a credible monetary value. Without a measure of benefit,²³⁶ CBA cannot provide reliable guidance,²³⁷ and it should not be employed to regulate behavior.

Infinity is the first problem in measuring the benefit. If the value of your life is infinite, it is immeasurable.²³⁸ To force a measurement of value in advance of death is not only immoral, it may be illegal. From the standpoint of criminal law, from the general view of moral philosophy, and from the Abrahamic religious tradition, trading lives for money should be illegal. But, according to legal scholar Carsten Gerner-Beuerle, the discipline of law and economics neglects this: "The question [is] whether our society *ought* to be committed to preserving life at any cost; whether the value of life (for purposes of the law) *ought* to be infinite."²³⁹

Even if the value of life is not an infinitely large number, it is incalculable. The quantitative, techno-scientific approach to risk assessment has not, to date, been able to fully calculate and consider the value of all of human life, present and future.²⁴⁰ Should one be able to place a dollar figure on human extinction? How?²⁴¹ There seems to be no rational decision-making in

236. Measuring the benefit is especially a problem in the face of possible human extinction. As Richard Posner has observed, a surprisingly common reaction to human extinction, if everyone dies all at once without warning, is that "there is *no* loss," "no 'conscious pain and suffering'" from the perspective of the tort lawyer. POSNER, *supra* note 145, at 170. This reflects one of the limitations of the current economic perspective. It would seem that foreseeability is not limited to everyone dying at once—or without warning.

237. See Ackerman & Heinzerling, *supra* note 16, at 1564.

238. By definition, infinity is unlimited, indefinite and immeasurable. See WEBSTER'S II NEW RIVERSIDE DICTIONARY 355 (rev. ed., 1996), for definitions of *infinity* and *infinite*.

239. Gerner-Beuerle, *supra* note 193, at 1.

240. Actually, Judge Posner placed a very rough dollar value on the extinction of humanity. We are a bargain at only \$600 trillion, a "minimum estimate" achieved by doubling the population of the Earth to twelve billion to account for at least some future for humanity and by valuing the average individual life at a mere \$50,000. POSNER, *supra* note 145, at 141, 165–71. This is merely a crude estimate. A complex calculation may not be any more right. Religious and moral leaders are likely to insist that money is irrelevant here.

241. Are we not priceless? See *generally* ACKERMAN & HEINZERLING, *supra* note 15. If we are priceless, it becomes impossible to measure the benefit when lives are at risk. "Because important categories of benefits are priceless, cost-benefit analysis in practice frequently turns out to be 'complete cost-incomplete

attempting to measure the dollar value of something that is morally repugnant. Even the rational secular-humanist economist stops in his tracks when faced with these issues. Without a quantified benefit or an estimate of probabilities, he cannot arrive at a proper cost or amount to expend in order to avoid the risk.²⁴²

By the way, there is yet another reason for inaccurate cost calculations: Other agendas intrude, and so not even the costs of the precautions are known or, maybe, knowable.²⁴³ For example, when industry testifies about the costs of proposed regulations, those costs are often inflated; industry has, in some cases, estimated costs to be twice the actual costs.²⁴⁴ It is difficult to be precise when those who know the most about the inputs may be obfuscating. Even when it comes to studies commissioned by the government, the costs of regulation may not be accurately

benefit analysis.” *Id.* at 207; see also GUIDO CALABRESI & PHILIP BOBBITT, TRAGIC CHOICES 39 (1978), for the proposition that, to the extent that life is beyond price, a refusal to save lives is horribly costly. Again, CBA is flawed for the purpose of lifesaving.

242. “Postmodernism thrives because some are willing to believe that where there is uncertainty, where propositions are not mathematically or logically demonstrable, there can be no weighing of evidence, there can be no truth.” James Gordley, *The Science of Conjecture: Evidence and Probability Before Pascal*, 6 INT’L. J. EVID. & PROOF 191, 193 (2002) (book review). An economic description of the “principles underlying postmodernization” includes “the appeal to unadorned market relations, the erosion of the state as a source of dependence, the weakening of workplace solidarities and the elevation of the private over the public in matters of cultural and social provision.” Christopher Stanley, *Repression and Resistance: Problems of Regulation in Contemporary Urban Culture*, 21 INT’L. J. SOC. L. 23, 30 (1993). Postmodernism in the form of CBA fails in the face of possible human extinction.

243. The subjectivity of CBA, its limited view, reflects the perspective of the economist designing the model. Even though traditional CBA falls within the objective view of risk, it invokes subjective preferences. Thus, despite its quantitative veneer, CBA is no more transparent than any other subjective way of viewing risk. This is because its unitary metric is morally incomparable to the loss of life. Keating, *supra* note 20, at 680–81. Traditional CBA obscures this subjective decision-making and lends itself well to reducing public debate. Ackerman & Heinzerling, *supra* note 16, at 1578. Thus, CBA, which prides itself on being scientific, quantifiable, and objective (which should be more transparent), not only fails to accurately measure risk, it helps to obscure risk.

244. Ackerman & Heinzerling, *supra* note 16, at 1580 (citing Eban Goodstein & Hart Hodges, *Polluted Data: Overestimating Environmental Costs*, 35 AMER. PROSPECT 64, 64 (1997)); see also Thomas O. McGarity & Ruth Ruttenberg, *Counting the Cost of Health, Safety, and Environmental Regulation*, 80 TEX. L. REV. 1997, 1998–99 (2002).

portrayed.²⁴⁵ Ultimately, even the costs of regulation may not be fully calculable, and those costs may not matter as much as the *significant* risks to fundamental rights addressed by regulation.

Our view of risk informs our decision-making processes and helps us analyze choices we face. However, when infinite amounts of money cannot begin to compensate for decisions that involve enormous downside risks, CBA bares its lack of a moral component. CBA is blind to risk, and is thereby rendered not only irrelevant but dangerous.

CBA even fails in the face of moral norms. The mindset of the cost-benefit analyst seems foreign to most of us.²⁴⁶ The thinking seems foreign because it is morally wrong to hide behind the “objectivity” of CBA while turning lives into dollars in an attempt to maximize profits or efficiency. Implicit subjectivity in CBA reveals to us the little man behind this strange and mystical curtain. We will encounter problems of implicit subjectivity with discounting as well.

There is a deeper issue of moral limits here. Should humanity decide to place limits on practices that harm or even kill people? What limits should humanity use to protect life? For now, let us put three more nails in the coffin of CBA — moral unfairness and incommensurability, practical flaws of discounting, and the immorality of maximizing income in the face of catastrophic risk — and then wrap up the objective view with a visit to well-being analysis.

245. Consider the 2010 study commissioned by the Office of Advocacy of the U.S. Small Business Administration which arrived at a \$1.75 trillion annual cost of regulation. Lisa Heinzerling & Frank Ackerman, *The \$1.75 Trillion Lie*, 1 MICH. J. ENVTL. & ADMIN. L. 127, 128–29 (2012).

246. Ackerman and Heinzerling compare the thinking behind VSL to everyday life:

Most religions tell us that every human life is sacred; it is obviously illegal, as well as immoral, to buy and sell human lives. Most parents tell their children to eat their vegetables and do their homework, even though the rewards of these onerous activities lie far in the future. Monetizing human lives and discounting future benefits seem at odds with these common perspectives.

Ackerman & Heinzerling, *supra* note 16, at 1563.

i. Moral Fairness and Incommensurability

Beyond the problem of infinity and other problems of measurement, CBA has a moral fairness problem.²⁴⁷ The comparability problem, or more precisely, the commensurability problem, underlies unrestricted cost-benefit analysis: *Dying is different from buying*. Gregory Keating explains that the value system implicit in CBA “treats all human interests—urgent ones like adequate nutrition and physical integrity and luxuries like the consumption of fine wines—as fungible at some ratio of exchange.”²⁴⁸ What’s more, CBA “insists that the cost-justified level of precaution is the only level of precaution that is ever justified. More stringent precaution simply squanders resources.”²⁴⁹ CBA considers precautions ultimately proven unnecessary to have been thrown away or wasted.²⁵⁰ However, resources used for precaution are not necessarily squandered; there is a special value involved in protecting life.

Natural resources that are not used are not necessarily squandered either. Personal preferences don’t always lean toward consumption. As it downgrades the future,²⁵¹ CBA may not comport with the reality of human decision-making. We may

247. When we care about risk, we find that “the economic interpretation [of reasonable care] is not innocuous when it comes to fixing the appropriate measure of precaution when life itself is at stake.” Keating, *supra* note 20, at 656.

248. *Id.*

249. *Id.* “Our common law of negligence, by contrast, treats the physical integrity of the person as an especially urgent interest, and our juries are repulsed by the claim that accidental deaths should not be prevented whenever the costs of prevention exceed the value—economically conceived—of the lives at risk.” *Id.* at 656. There is a sense of fairness. “Fairness, in the sense that concerns us, is inherently relational and interpersonal: What kinds of gains to some are sufficiently important to justify inflicting accidental death on others?” *Id.* at 668. For that matter, what kinds of gains to some are sufficiently important to justify taking on the significant risk of inflicting accidental death on *all* of us?

250. Connected with this, assumptions (in neo-classical economics) in favor of efficiency and maximization help demand or even require consumption.

251. “Cost-benefit analysis systematically downgrades the importance of the future in two ways: through the technique of discounting and through predictive methodologies that take inadequate account of the possibility of catastrophic and irreversible events.” Ackerman & Heinzerling, *supra* note 16, at 1571.

prefer the future by conserving and saving.²⁵² We have much more latitude and choice than CBA permits, and it appears that humanity will need the extra range of choice. Assumptions about the timing of our needs involve risk and need to involve notions of moral fairness.

CBA and neoclassical economics fail to account for issues of fairness (justice or equity). Neo-classical economics may bestow the same fairness considerations as employed by typical five-year-olds,²⁵³ but worse, it actually treats humanity as sociopathic.²⁵⁴ It teaches us to maximize and thus to act unfairly.²⁵⁵ This unfairness, due to commercial society's limited view of the costs, benefits, and externalities, is arguably immoral.²⁵⁶ Can economics ultimately find a way to account for fairness? This is important, for when weighing lives, CBA's fairness problem runs even deeper.

CBA relies on measuring and weighing. Due to the exponential power of discounting, large future risks may appear to be quite small—and thus CBA measures merely a tiny benefit in precaution. In observing shortsighted choices leading to environmental devastation and death from preventable causes, Ackerman and Heinzerling ask, “How can bizarre, hypothetical calculations about tiny sums of money stand in the way of using

252. Ackerman and Heinzerling find Americans to be very different as citizens than as consumers: “The tension between Americans’ personal saving habits and their enthusiasm for Social Security implies a sharp divergence between the temporal preferences of people as consumers and as citizens.” *Id.* at 1573.

253. See Yoella Bereby-Meyer & Shelly Fiks, *Changes in Negative Reciprocity as a Function of Age*, 26 J. BEHAV. DEC. MAKING 397, 401–02 (2013).

254. See Mixon, *supra* note 2, at 329–36 (citing Lynn A. Stout, *Taking Conscience Seriously*, in MORAL MARKETS: THE CRITICAL ROLE OF VALUES IN THE ECONOMY 157, 159 (Paul Zak ed., 2008)). “[H]omo economicus is a sociopath. The hallmark of sociopathy is extreme selfishness as shown by a willingness ‘to lie, cheat, take advantage [and] exploit.’” Stout, *supra*, at 158–59 (citing BENJAMIN J. WOLMAN, THE SOCIOPATHIC PERSONALITY 42 (1987)). Sociopaths, who learn to be bad, are to be contrasted with psychopaths, who are born bad. See Mixon, *supra* note 2, at 330–32.

255. We are taught to maximize the benefit to ourselves without regard to effects on others.

256. See PAUL HEYNE, “ARE ECONOMISTS BASICALLY IMMORAL?” AND OTHER ESSAYS ON ECONOMICS AND RELIGION 1 ((Geoffrey Brennan & A.M.C. Waterman Eds., 2008).

our knowledge and resources to do the right thing?"²⁵⁷ Beautiful question.

These preferences, upon which we rely to make our decisions in CBA, may be transient. We construct them anew each time,²⁵⁸ either individually, or in groups.²⁵⁹ If we are not careful, we could build systems of law upon fleeting values and views using CBA.²⁶⁰ If that happens, once the views erode from under it, the law is floating on air without foundation. It seems possible that the law could contribute to collapse. We must work to find a more solid touchstone to help us systematize law and help humanity protect itself.

Moral considerations, not CBA, are more likely to help us decide whether to preserve or consume. When I start to develop this below,²⁶¹ we will encounter possible reconnections between economics and morality and ultimately between law and morality.

All too easily, humanity can mislead itself by how it frames its choices between preservation and consumption. Surveying and sampling of preferences and economic modeling have blind spots.²⁶² Willingness to pay fails to capture the significance of

257. ACKERMAN & HEINZERLING, *supra* note 15, at 223.

258. See Dan Simon et al., *The Transience of Constructed Preferences*, 21 J. BEHAV. DECISION MAKING 1, 11 (2008).

259. There is a connection between the way humans act individually and the way we act in groups. We each share the same biochemical "wiring," many of the same responses to stimuli. There are probably variants at each end of a bell curve reflecting various tendencies, for individuals and for groups, but the bulk will be in the same general range.

260. Paul Heyne considers economists' view and use of values and incentives: "The good economist is often perceived as immoral because he is suspicious of what Adam Smith called the 'man of system' who in his own conceit supposes that the members of a great society can be moved about as easily as the hand moves the pieces on a chessboard." HEYNE, *supra* note 256, at 8.

261. See *infra* Section III(C)(2).

262. For example, the consumption preferences of individuals can be misleading:

In a classic example of this distinction [between valuing the environment as a consumer and doing so as an expression of public values as a citizen], the philosopher Mark Sagoff found that his students, in their role as citizens, opposed commercial ski development in a nearby wilderness area, but, in their role as consumers, would plan to go skiing there if the development were built. There is no contradiction between these two views; as

the issue of preservation.²⁶³ As Cass Sunstein rightly states, in the face of functionally irreversible choices, “it is obtuse to think that public health, wildlife or pristine areas are valued in the same way as their cash equivalents. Anyone who believed in such equivalence would have an unrecognizable understanding of how health, wildlife and pristine areas are properly appreciated and experienced.”²⁶⁴ We place special values on health and life. Consider your own.

To Ackerman and Heinzerling, the prime deficiency of unrestricted CBA is that it places no *special* value on health or life.²⁶⁵ By forcing everything to be rendered into comparable terms of prices and values, those who support traditional CBA come up with astounding notions such as weighing whether it is cheaper for citizens to kill themselves than it is to provide them with nursing home care and other expensive services related to their aging.²⁶⁶ The cost savings represent money, and that money carries with it a right. Someone has a right to it. That right is a property right. This is an example of the property right in CBA being placed on a par with life itself.

individual consumers, the students would have no way to express their collective preference for wilderness preservation. Their individual willingness to pay for skiing would send a misleading signal about their views as citizens.

Ackerman & Heinzerling, *supra* note 16, at 1566–67 (citing MARK SAGOFF, *THE ECONOMY OF THE EARTH: PHILOSOPHY, LAW, AND THE ENVIRONMENT* 50–53 (1988)).

263. The increased production and consumption associated with CBA does not necessarily translate into increased welfare. See JOHN KENNETH GALBRAITH, *THE AFFLUENT SOCIETY* 131, 145 (1960).

264. Cass R. Sunstein, *Irreversibility*, 9 L., *PROBABILITY & RISK* 227, 244 (2010) [hereinafter *Irreversibility*].

265. “[Economic analysts] have blurred the line between risks and actual deaths, by calculating the value of the reduced risk while pretending that they have produced a valuation of life itself. The paradox of monetizing the infinite or immeasurable value of human life has not been resolved; it has only been glossed over.” Ackerman & Heinzerling, *supra* note 16, at 1565–66.

266. A study, by then-Harvard economist W. Kip Viscusi, concluded “that states, in fact, saved money as a result of smoking by their citizens. Why? Because they died early!” *Id.* at 1553–54. States avoided the expenses of an aging population. “So great, under Viscusi’s assumptions, were the financial benefits to the states of their citizens’ premature deaths that, he suggested, ‘cigarette smoking should be subsidized rather than taxed.’” *Id.* (quoting W. Kip Viscusi, *Cigarette Taxation and the Social Consequences of Smoking* 47 (Nat’l Bureau of Econ. Res., Working Paper No. 4891, 1994), <http://papers.nber.org/papers/w4891.pdf> [<http://perma.cc/8397-LUXK>]).

Senior citizens are not alone in having their lives devalued. CBA gives children the same treatment, only worse, by measuring the value of the time saved by hurried parents' failure to properly fasten their child's safety seat. By that estimate, a child's life is worth only \$500,000.²⁶⁷ Is a moment of hurried inconvenience worth the risk of loss of a child's life? Unrestricted CBA would say so.²⁶⁸ Our accident laws would say not. Criminal laws would object with an even stronger statement of our values. Why should economists be allowed this latitude? The root of Western law is based on moral values, not on economics.

Treating diverse human needs alike is unfair. It is unfair to those who are at risk of death, and all of us seem to bear that risk to some degree. CBA's version of risk analysis weighs risk against calculations of maximum efficiency.²⁶⁹ Unrestricted CBA tries to wring out every last benefit, even the most trivial one, right up to the perceived edge of risk, *ex ante*, before the fact. The competing considerations (trivial benefits vs. devastating injury) are not

267. Ackerman & Heinzerling, *supra* note 16, at 1555–56 (citing Paul S. Carlin & Robert Sandy, *Estimating the Implicit Value of a Child's Life*, 58 S. ECON. J. 186 (1991)).

268. For more examples of the strange and risky results of discounting in the context of CBA, see ACKERMAN & HEINZERLING, *supra* note 15, at 179–203.

269. Ultimately economists arrive at a single metric, some unit of currency, to equate the value of life with principles of efficiency maximization or wealth maximization. Per Carsten Gerner-Beuerle:

[T]he attempt to calculate the value of life constitutes a rather dangerous undertaking. It qualifies what should arguably not be qualified and calls into question the appropriateness of protective, lifesaving measures (because they might be cost-inefficient). Every theory to address legal issues should be coherent. A consequent application of the principle of wealth maximisation to cases involving risks to human life would, however, yield results that are, on their face, contradictory to common perceptions of justice. Assume the following example: A miner has been trapped after an explosion in a mine. To rescue him would necessitate extensive excavation, which would cost €2.5 mill. Assuming that life is valued at €2 mill. (as scholars in, for example, Germany suggest), it would not be cost-efficient to rescue the miner. The resources could be put to a better, to a wealth-maximising use. Should they, consequently, not be invested? The answer is as everybody, presumably also proponents of the approach outlined above, would agree: of course they should be invested in rescuing the miner.

Gerner-Beuerle, *supra* note 193, at 6.

comparable.²⁷⁰ The attempt to measure and compare the incommensurable leads us to take risk, even for small gain, until there is no room for error—no room for normal or foreseeable variance.

Certainly, trivial benefits even spread generously today cannot begin to compensate for the loss of millions, or even billions of lives tomorrow or even thirty years from now. Although in a sense the issue is incommensurability, in another sense the issue runs deeper. Look in the mirror. Even if your current benefits are not trivial,²⁷¹ ask yourself: Are significant risks to the lives and health of others worth it? Is it fair? Keating points out that “[d]evastating injury presents special problems of fairness, both because devastating injuries are especially severe and because they cannot be repaired *ex post*.” Consequently, “[t]he fair treatment of risks of devastating injury requires that we take more than cost-justified precaution against their occurrence.”²⁷² If we are all at risk, the solution must also be equitable and moral.

Ackerman and Heinzerling contend that there is an “intrinsic conflict between cost-benefit analysis and the principles of fairness that animate, or should animate, our national policy toward protecting people from being hurt by other people.” Therefore, “the results of cost-benefit analysis cannot simply be ‘given some weight’ along with other factors, without undermining the fundamental equality of all citizens — rich and poor, young and old, healthy and sick.”²⁷³ The subjective view in

270. “The mistake [in CBA] lies not in undervaluing life or health. The mistake lies in assuming that trivial benefits and devastating losses are comparable. They are not, and it is unfair to treat them as if they are.” Keating, *supra* note 20, at 660; *see also id.* at 664–74.

271. Keating notes:

In a world of distinct persons who affirm diverse and incommensurable conceptions of the ends worth pursuing over the course of a human life, there is no reason to assume that those who are put at risk value the ends pursued through the relevant risk impositions in a way that those imposing the risks do. The fact that you are prepared to run enormous risks for the advancement of medical knowledge does not mean that I am prepared to do so.

Id. at 678. May few insist on exercising liberties reasonably foreseeable to impose significant risks on all.

272. *Id.* at 746.

273. Ackerman & Heinzerling, *supra* note 16, at 1584.

CBA that our efficient economy is worth more than the lives of some of our citizens—and many aliens²⁷⁴—is dead wrong.

ii. Practical Flaws of Discounting

Although I have discussed theoretical problems implicit in discounting above, from a practical standpoint, it is possible to also see fatal flaws in the practice of discounting. At best, the discount rate is chosen by the economist based on the perceived length of time between cost and benefit.²⁷⁵ At worst, the economist shoots from the hip—or holds firmly to an arbitrarily-selected number.²⁷⁶ Then costs, benefits, and probabilities are estimated. At best, the numbers get calculated with great precision but little if any accuracy as to the underlying issue.²⁷⁷

274. The United States routinely values foreign lives at zero, by failing to consider them in decisions to regulate. See Arden Rowell & Lesley Wexler, *Valuing Foreign Lives*, 48 GA. L. REV. 499, 526, 528 (2014). That failure “massively understates even the domestic benefit of protecting those lives.” *Id.* at 559 (citing David Dana, *Valuing Foreign Lives and Settlements*, J. BENEFIT-COST ANALYSIS, July 2010, art 4, at 22). And it even more massively understates the justice implicit in protecting them.

275. See Richard O. Zerbe, Jr., *Should Moral Sentiments Be Incorporated into Benefit-Cost Analysis? An Example of Long-Term Discounting*, 37 POL'Y SCI. 305 (2004).

276. In 2004, economists used “a standard ‘discount rate’ (about 7 percent annually) to convert future dollars into current equivalents.” *Your Money or Your Life*, *supra* note 222. “With a 7 percent discount rate . . . \$1000 in twenty years is worth only \$260 today.” *Id.* The U.S. Office of Management and Budget has also embraced a seven percent discount rate as part of its regulatory review. OFFICE OF MGMT. & BUDGET, EXEC. OFFICE OF THE PRESIDENT, CIRCULAR A-94, GUIDELINES AND DISCOUNT RATES FOR BENEFIT-COST ANALYSIS OF FEDERAL PROGRAMS 7 (1992).

277. Precision is only as good as the quality of the inputs. Relevant quality data is scarce:

Often, the only regulatory benefit that can be quantified is the prevention of cancer, yet cancer has a latency period of between five and forty years. When discounted at five percent, a cancer death forty years from now has a ‘present value’ of only one-seventh of a death today. Thus, one of the benefits that most often can be quantified—allowing it to be folded into cost-benefit analysis—is also one that is heavily discounted, making the benefits of preventative regulation seem trivial.

Ackerman & Heinzerling, *supra* note 16, at 1579. If this is one of the best examples of what CBA and discounting can do together, imagine the worst. Extrapolated from the individual context, we see the problem with using CBA together with discounting to protect humanity from extinction or from inflicting significant self-harm.

In the face of significant risk, such lack of accuracy could be quite harmful.

Even Judge Richard Posner, a long-time proponent of CBA, sees the shortcomings of discounting in protecting against catastrophic loss. In considering the diversion of money to solve global warming within this century, he observed that “discounting future to present values is not a method of helping people to decide how to manage their affairs in the way most conducive to maximizing their welfare. Rather it is a method of maximizing global wealth without regard to its distribution among persons.”²⁷⁸ Society maximizes wealth through use and consumption, because we make more money when we use resources.

Discounting helps maximize current wealth, but it does not protect us from risk. As Ackerman and Heinzerling point out, discounting society’s most profound values represents a “new mathematics of impatience” which “endorses profligacy and shuns discipline.”²⁷⁹ In a way, discounting helps us act more like teenagers.

Discounting itself is asymmetrically skewed. In this article, health and environmental losses are the concern. Losses, including those to the environment and especially to health, get discounted more than gains, financial or otherwise.²⁸⁰ This aspect of discounting requires either countervailing measures or the abandonment of discounting in favor of an entirely different approach.

Discounting does not give us guidance regarding how to deal with risks of possible human extinction. It clouds our view of the risks by distracting us with lucre. If, in any way, the death of one person can equate to a billion deaths, even hundreds of years from now, in the words of philosopher Derek Parfit, “catastrophes in the further future can . . . be regarded as morally trivial.”²⁸¹ We lose sight of the risk, and we throw away the future.

278. POSNER, *supra* note 145, at 152.

279. ACKERMAN & HEINZERLING, *supra* note 15, at 203.

280. See David J. Hardisty & Elke U. Weber, *Discounting Future Green: Money vs. the Environment*, 138 J. EXPERIMENTAL PSYCH.: GEN. 329, 329 (2009).

281. DEREK PARFIT, REASONS AND PERSONS 357 (1984).

iii. Maximizing Income in the Face of Catastrophic Risk

The above title brings to mind the creature that stayed on the road, eating, for a second too long. This section is about the problems implicit in maximizing income all the way to the edge of foreseeable significant risk.

The assumptions, framing,²⁸² and tools (e.g., discounting) of neo-classical economics and cost-benefit analysis are geared to help achieve that maximization.

From the beginning, economists are trained to maximize gains in the face of risk. And although they ostensibly attempt to avoid ethical and moral judgments,²⁸³ law professor John Mixon correctly observes a pattern of contrary behavior in the education of economists: by teaching students to maximize and thus to act unfairly, neoclassical micro-economics courses not only treat psychopathic or sociopathic behavior as normal,²⁸⁴ they present the underlying assumptions as factual and scientific;²⁸⁵ they assume players in the amoral market are amoral;²⁸⁶ they portray government as the enemy;²⁸⁷ and ultimately, they encourage students to turn their backs on community values.²⁸⁸ As a result of this training, students' moral structures may be altered,²⁸⁹ such neo-classical fundamentalism may be absorbed by students as religion,²⁹⁰ and that may produce sociopaths.²⁹¹ According to economist Charles Clark, "the problems we face in our economic system stem from the values upon which neoclassical economic theory is constructed."²⁹² As Clark sees it, "[t]hese values are

282. The emphasis and the framing in neo-classical economics tends to be short-term rather than long-term. *See infra* Section III(C)(1)(b)(i).

283. *See* Mixon, *supra* note 2, at 344–47.

284. *Id.* at 342.

285. *Id.* at 344–48.

286. *Id.* at 348–50.

287. *Id.* at 350–52.

288. *Id.* at 352–53.

289. Mixon, *supra* note 2, at 353–56.

290. *Id.* at 356–57.

291. *Id.* at 357–65.

292. Charles M.A. Clark, *Competing Visions: Equity and Efficiency in the Firm*, in *RETHINKING THE PURPOSE OF BUSINESS: INTERDISCIPLINARY ESSAYS FROM THE CATHOLIC SOCIAL TRADITION* 81, 83 (S.A. Cortright & Michael J. Naughton eds., 2002).

contrary to the true nature of the person and of the just society, and the theories which have been built upon them have become a barrier to a better understanding of our economic system.”²⁹³

As a result, humanity has become a means [to income and wealth], not an end. In the process, some have become roadkill. The direct impact on humanity merely represents a larger problem. The failure to protect life holds an ominous message for the human future.

If we were to consider significant risk in science itself,²⁹⁴ in biodiversity loss, in land use, in resource depletion, in pollution, in climate change, and in a possible environmental avalanche,²⁹⁵ we would see that many of the problems in our economic systems are the same ones we face environmentally. Aside from short-term oscillations, demand is outstripping supply on our overcrowded and increasingly competitive Earth. The neo-classical economist merely sees the problems from the other side, from the standpoint of consumption rather than from the standpoint of preservation and long-term need.

CBA relies on the neo-classical concept of societal income maximization: Maximum income is maximum efficiency; anything less is irrational.²⁹⁶ By wringing every penny out of a risky situation, the exercise of CBA assumes that it is best to maximize our collective income (overall efficiency).²⁹⁷ Such maximization is

293. *Id.*

294. *See REES, supra* note 97, at 73–88.

295. *See supra* Section II(A).

296. *See supra* note 191; *see also supra* Section III(C)(1)(a)(ii).

297. Neo-classical economics deludes itself and attempts to do so for the rest of us:

Economists like to believe that their discipline, at least at the theoretical level, is a positive science, that it contains no value judgments. Whenever values or value judgments are admitted, economics becomes normative economics, and here we typically find discussions of specific policy goals. But almost all economists would contend that in terms of economic theory itself, values play no role, that like the natural sciences, economic theory considers only the facts as we find them in nature. This positive-normative distinction in economics has never stood up to philosophical scrutiny, for, as Gunnar Myrdal has convincingly argued, every aspect of economic theory is normative, that is, reflects values and value judgments.

Clark, *supra* note 292, at 84 (citing GUNNAR MYRDAL, *POLITICAL ELEMENT IN THE DEVELOPMENT OF ECONOMIC THEORY* (1954); GUNNAR MYRDAL, *VALUE IN SOCIAL THEORY* (1958)). The primary value judgment of neo-classical economics seems

a system of selfishness. It is sufficient to be harmful; harmful selfishness is greed, especially if it is intentional.²⁹⁸ CBA is based on greed²⁹⁹ in the name of efficiency. Greed is then the basis for curtailing precaution at the point of cost-justification.³⁰⁰ Although some might think that should work for some business decisions, it is not a model for conducting life. Using unrestricted CBA to make life or death decisions places greed-based efficiency on a par with life itself. For that reason, when applying CBA to regulatory decisions involving significant risk of death or injury, CBA in its pure and most characteristic form, whether formal or informal,³⁰¹ is morally corrupt. Consider the example of fenced elephant herds with no reproductive limits that consume and destroy their food source to the point of starvation.³⁰² Greed alone can kill.

to be greed. Other conceptions include “what human nature entails, and, indeed, . . . the real and ideal order of society.” *Id.*

298. Gross negligence may be sufficient.

299. Packaged as *prosperity* rather than *greed*, the notion seems much more acceptable. Unfortunately, either way, based on humanity’s position, speed, and trajectory, the result is excessive consumption, excessive pollution, and excessive risk of significant harm.

300. An example provided by Keating uses a hypothetical accident and compares the dollar value of a television technician’s life against the greater dollar value of the inconvenience of a billion people who would miss the weekly broadcast of Baywatch were the technician’s life to be saved.

No amount of inconvenience—distributed across a large number of distinct persons—sums to the loss of a single life. We therefore should not decide how to proceed by measuring the victim’s preference for having her life saved in the dollars that she would pay to save it and by comparing the sum to the dollars that the views would pay to have the broadcast continue. The cost to the technician and the benefit to the viewers are not fungible at some ratio of exchange.

Keating, *supra* note 20, at 666. To equate a life with dollars *ex ante*, before the loss, is as wrong in economics as it is in other modes of thought. This is recognized in the moral foundations of our laws. See Hershey H. Friedman & Linda Weiser Friedman, *Is Greed Good? Lessons About Moral Leadership from Psalm 72* (July 16, 2014), <http://ssrn.com/abstract=2467294> [<https://perma.cc/3QUN-8TK8>] (lamenting American political and business leaders’ selfishness as being like that of ancient Israel’s King Solomon).

301. See Amy Sinden, *Formality and Informality in Cost-Benefit Analysis*, 2015 UTAH L. REV. 93, 172 (addressing the difference between formal and informal CBA).

302. DAVID P. BARASH, *THE SURVIVAL GAME: HOW GAME THEORY EXPLAINS THE BIOLOGY OF COOPERATION AND COMPETITION* 123 (2003).

CBA is a tool used by humans. However, its effect is to use the health or the life of another statistically random human being as a means, a means to maximize income, efficiency, and wealth. The lives of others become expendable.

Either way, individually or collectively, as was observed in the war crime trials at Nuremburg,³⁰³ it is immoral to use human life as a means. They can be individuals or statistical groups of twenty or 100, but those statistics turn out to be real: they live with autism, or they suffer other adverse health effects from the selfish decisions we make. Those unconsenting statistical people and the beneficiaries of the decisions are unlikely to realize exactly what has happened, but the people who pay with life or health have been *a means* for the beneficiaries to accrue their gains.³⁰⁴

This happens through maximization. Maximizing utility, maximizing income, maximizing consumption, or maximizing wealth,³⁰⁵ as assumed by neo-classical economics and CBA, are misguided, in that no single person reaps all the benefits or bears all of the burdens of a social practice.³⁰⁶ When we cumulate the costs and the benefits, according to Gregory Keating, the sum of benefits, minus burdens, is “an unreliable guide to the actual

303. 5 Int'l Military Tribunal, *Trial of the Major War Criminals Before the International Military Tribunal: Proceedings 9 January 1946 – 21 January 1946*, 408 (Jan. 17, 1946) (statement of M. François de Menthon).

[The nature of man] is defined in two complementary ideas: The dignity of the human being considered in each and every person individually, on the one hand; and on the other hand, the permanence of the human being considered within the whole of humanity. Every juridical organization of the human being in a state of civilization proceeds from this essential, two-fold conception of the individual, in each and all, the individual and the universal. . . . It is a general conception which imposes itself quite naturally on the spirit: It was professed since ancient pre-Christian times; and in more recent times, the great German philosopher Kant expressed it in one of his most forceful formulas, by saying that a human being should always be considered as an end and never a means.

Id.

304. To make matters worse, given current foreseeable and significant environmental risks, we could all become a means.

305. See, e.g., Richard A. Posner, *The Ethical and Political Basis of the Efficiency Norm in Common Law Adjudication*, 8 HOFSTRA L. REV. 487 (1980) (advocating a system of wealth maximization).

306. One might wonder whether some externalities might be inherent in CBA.

gains and losses of the persons affected by the practice.”³⁰⁷ This is especially the case when loss means death.

The benefits alone can be problematic. If we sum the benefits, with an increasing population, philosopher John Rawls observes that we can get an unjustifiable result:

[W]hen population is subject to change . . . [the principle of maximizing total utility] . . . entails that so long as the average utility per person falls slowly enough when the number of individuals increases, the population should be encouraged to grow indefinitely no matter how low the average has fallen . . . the sum of utilities added by the greater number of persons is sufficiently great to make up for the decline in the share per capita. As a matter of justice . . . a very low average of well-being may be required.³⁰⁸

The benefits may be tiny yet the potentially catastrophic losses may justify curbing the benefit prior to maximization, ahead of the risk.

If we consider human population and its impact on earth and the environment, we would see that the quantitative approach based on the sum of utilities,³⁰⁹ may ultimately destroy the qualitative approach which looks at the quality of one person’s existence. There may be too much quantity (of people) to allow for quality (of life)—or for the avoidance of death or even extinction. The sum of the benefits is a risky approach to decision making.

307. Keating, *supra* note 20, at 671.

308. JOHN RAWLS, *A THEORY OF JUSTICE* 140 (rev. ed. 1999).

309. “What is the good in a world swarming with people having lives barely worth living, even if *overall* the aggregation of the ‘utility’ of its members supersedes that of any alternative, smaller world?” DAVID HEYD, *GENETHICS: MORAL ISSUES IN THE CREATION OF PEOPLE* 57 (1992). The classical utilitarianism of Jeremy Bentham is an example of a principle that implies the “repugnant conclusion,” PARFIT, *supra* note 281, by recommending the creation of a large population in which each person is poverty-stricken. But Garrett Hardin finds that other liberty considerations, qualitative in nature, also rule out the goal:

If our goal is to maximize population it is obvious what we must do: We must make the work calories per person approach as close to zero as possible. No gourmet meals, no vacations, no sports, no music, no literature, no art. . . . I think that everyone will grant, without argument or proof, that maximizing population does not maximize goods. Bentham’s goal is impossible.

Garrett Hardin, *The Tragedy of the Commons*, 162 *SCI.* 1243, 1243–44 (1968).

Our greed, our selfish interest in finding, capturing, and measuring a maximum quantitative benefit, causes us to lose sight of unrestricted CBA's qualitative impact. Reliance on unrestricted CBA, even if done as "risk avoidance,"³¹⁰ runs us into serious problems in the qualitative arena. We need other tools for the risks of today and tomorrow.

The hazards facing humanity are just too great. New risks, never before considered await us. CBA cannot measure, value, weigh, or otherwise assist with risks of new technology. It lacks both a vision of risk and an appropriate weighing mechanism. CBA's purpose is not to protect us. With new hazards, we need tools that align properly with risk. By sociologist Ulrich Beck's analysis of the problem,³¹¹ the risk calculus of the past, alone, cannot begin to reflect the realities and the extreme risks of the future. We will need to employ a new flexibility that considers a wide view of significant risks.

However, we face an economic argument "that it is irrational to press precaution beyond the point of cost-justification—because

310. Risk avoidance can be perilous.

We need as a society to develop a mode of analysis that does not obscure what is at stake and for whom. We need to frame the debate so that it considers the larger question of whether a given risk and its attendant possibilities for avoidance are morally, culturally, and socially acceptable. In the end, we need to reflect upon the very basic question of whether this is the direction we wish to take environmental law and policy: Whether we wish to shape a world in which our children can no longer make mud pies.

Catherine A. O'Neill, *No Mud Pies: Risk Avoidance as Risk Regulation*, 31 VT. L. REV. 273, 354 (2007).

311. BECK, *supra* note 19, at 53–54.

[N]uclear, chemical, genetic, and ecological mega-hazards abolish the four pillars of the calculus of risks. First, one is concerned here with global, often irreparable, damage that can no longer be limited; the concept of monetary compensation therefore fails. Second, precautionary after-care is excluded for the worst imaginable accident in the case of fatal hazards; the security concept of anticipatory monitoring of results fails. Third, the 'accident' loses its delimitations in time and space, and therefore its meaning. It becomes an event with a beginning and no end; an 'open-ended festival' of creeping, galloping and overlapping waves of destruction. But that implies: standards of normality, measuring procedures and therefore the basis for calculating the hazards are abolished; incomparable entities are compared and calculations turn into obfuscation.

Id.; see *id.* at 50–52 for a description of the four pillars of the calculus of risks.

doing so will make everyone worse off.”³¹² To Gregory Keating, the argument “rests on both an inadequate metric of interpersonal comparison and insufficient attention to the actual distribution of burdens and benefits.”³¹³ Here is the flaw in the metric of comparison: “it treats the devastation of some[, let alone all,] as comparable to the receipt of trivial benefits by others—even though the two are not morally comparable.”³¹⁴ The burdens and the benefits are disconnected,³¹⁵ and “the economic surplus realized by taking only cost-justified precaution cannot be used to restore the lives or the health of those devastated by cost-justified risks. . . . [D]eath and devastation are beyond rectification by redistribution.”³¹⁶ For the weak and unlucky, there is no chance of recovery. In effect, our economic system is harming and killing people in the interest of gain. We should reject the neo-classical economic argument.

In the view of Professors Ackerman and Heinzerling, for purposes of risk regulation, CBA should be rejected in its entirety, and we should look elsewhere: “Cost-benefit analysis cannot overcome its fatal flaw: it is completely reliant on the impossible attempt to price the priceless values of life, health, nature, and the future”; instead, they say, “Better public policy decisions can be made without cost-benefit analysis, by combining the successes of traditional regulation with the best of the innovative and flexible approaches that have gained ground in recent years.”³¹⁷ They are correct. We will examine some of those alternative approaches when we consider the *Moral View of Risk*.³¹⁸

Enormous risks that go with life and death decisions may be better answered with a simple (but appropriate) “better safe than sorry.” While flexibility and a variety of views and possible responses increase the number and range of tools available to us to cope with risk, some risks—and some dangers—rise to the level of requiring special treatment. The greater the risk to

312. Keating, *supra* note 20, at 673.

313. *Id.*

314. *Id.*

315. This disconnection is the cost externalization problem.

316. Keating, *supra* note 20, at 673.

317. Ackerman & Heinzerling, *supra* note 16, at 1584.

318. *See infra* Section III(C)(2).

human life, either individually or collectively, the less money matters—and the less important are the costs,³¹⁹ whatever they may be, to save us from collapse or extinction.

d. Well-Being Analysis and its Deficiencies

Why not use Well-Being Analysis (WBA) to measure individual satisfaction instead of using CBA to measure dollars? WBA is a decision tool based on measurements of satisfaction or happiness using ranking of preferences,³²⁰ another unitary metric. Some view WBA as the next step in risk analysis and decision procedure. As Professors Bronsteen, Buccafusco, and Masur tell it, WBA solves many of the problems of CBA.³²¹ In many ways they are correct. WBA happens also to be the subject of an exhaustively detailed book by Matthew Adler.³²² WBA is quite a step forward, and it would be a huge advance if humanity was not already in a very difficult situation with too much consumption, pollution, and population.

Unfortunately, WBA does not reach or employ the necessary decision tools. Like unrestricted CBA, WBA is utilitarian in nature. And as with CBA, the theory focuses with a unitary metric,³²³ measuring the subjective well-being of single

319. A higher marginal utility of consumption (leading to an increase in consumption) at the end of life is replicated at the individual level. Lee A. Lillard & Yoram Weiss, *Uncertain Health and Survival: Effects on End-of-Life Consumption*, 15 J. BUS. & ECON. STAT. 254, 254 (1997). Now, let's say our collective risk grows significantly. If there is a statistically significant effect from the pending death of one person, imagine if it is magnified by billions. The effect of the resultant increase in consumption might be enough to significantly increase risk in and of itself. We need to learn to tread more lightly.

320. MATTHEW D. ADLER, *WELL-BEING AND EQUITY: BEYOND COST-BENEFIT ANALYSIS* 32–36 (2012).

321. See JOHN BRONSTEEN ET AL., *HAPPINESS AND THE LAW* 59–92 (2015); Bronsteen, Buccafusco, & Masur, *supra* note 155, at 1689.

322. ADLER, *supra* note 320; Daniel M. Hausman, *Well-Being and Fair Distribution: Beyond Cost-Benefit Analysis*, 28 ECON. & PHIL. 435 (2012) (book review) (providing a general overview of Adler's book); Mark Sagoff, *Matthew D. Adler, Well-Being and Fair Distribution: Beyond Cost-Benefit Analysis*, NOTRE DAME PHILOSOPHICAL REV., (Dec. 4, 2012), <http://ndpr.nd.edu/news/36051-well-being-and-fair-distribution-beyond-cost-benefit-analysis/> [<http://perma.cc/Y9SJ-77LG>] (book review).

323. Both CBA and WBA render life's decision-making into a series of evaluations, each with a unitary metric. However, a unitary metric does an

individuals as reported at a given moment—and then aggregating them.³²⁴ If humanity stays focused only on the welfare of the individual, we, as a species, will be more likely to fail at the hands of our own selfishness. WBA takes no account of the possibility of too many individuals with too much impact or too deep and wide a collective footprint. There are limits, but they are not implicit in the measurement of individual well-being. They are the Earth's physical limits.

Scientifically speaking, well-being analysis is happiness analysis, not risk analysis. With WBA, we evaluate brief glimpses of satisfaction by having people pick a number out of the air in a subjective evaluation ignorant of humanity's greater situation. WBA analysis does not look at risk. It fails to protect us. It is not designed to do so.³²⁵ Its purpose is to measure happiness. Further, as WBA counts only the happiness of the individual, it fails to take account of the needs of the larger group or of other groups. Both aspects of WBA, a lack of risk analysis and a myopic selfish individual analysis, taken together, multiply the risk to humanity.

Unfortunately, WBA takes no special account of death. Death is merely a zero on the WBA scale of well-being.³²⁶ And, given the effect of averaging people's individual evaluations, death, an eventual reality for all of us, can never be predicted with WBA.

What's worse, as with CBA, there is no special protection or precaution for the life of others in the WBA decision procedure. The lives of those who have not consented to the risk go unprotected. As we maximize individual happiness and well-being in the face of foreseeably-catastrophic risk, WBA merely replaces the property interest in CBA with a liberty interest in happiness, as the primary interest. Unfortunately, each has the

inadequate job of describing the complexity of each of our situations, let alone humanity's collective situation.

324. "The measure of welfare for a period of any duration is the aggregate of a person's moment-by-moment experiences of positive and negative feeling." JOHN BRONSTEEN ET AL., *supra* note 321, at 157.

325. WBA fails to interview the people who are dead, especially those who have lost their lives by risks imposed by others.

326. There are other problems with zero well-being. Consider Ori J. Herstein, *Why 'Nonexistent People' Do Not Have Zero Wellbeing but No Wellbeing At All*, 30 J. APPLIED PHIL. 136 (2013).

fatal deficiency of possibly placing its respective interest higher than the lives of other individuals and groups.

With this, I conclude my analysis of the objective view of risk. The objective view fails to protect humanity individually and collectively. Let us turn now from the quantitative view to a qualitative view.

2. The Moral View of Risk

Westerners tend to analyze laws and regulations in view of economic costs and benefits. However, economics does not consider all motivations. Economics cannot tell us about the worth of other people—or the significance of their rights³²⁷—but economics tries to place a value on those lives. For example, Harvard’s Donald Shepard and Richard Zeckhauser use “willingness to pay” to place a dollar value on the survival of individual lives.³²⁸ Through their economic lens, they envision and build models to evaluate and make decisions that affect the fundamental right to life based purely on economic considerations.

Decision analysis based only on economic considerations is problematic. Is there a moral leader who would condone the placement of a price on the taking of an innocent human life? How do we take into account the rights of those people? When do we implement protection of the most fundamental right, the right to life—before or after the loss? As you think about your life—and your rights—you know the answer.

Human behavior is not based purely on self-interest. Neither are human values.³²⁹ We have many motivations, and the social

327. ACKERMAN & HEINZERLING, *supra* note 15, at 229.

328. Technically, these are reductions in risk of death at various ages. See Donald S. Shepard & Richard J. Zeckhauser, *Survival Versus Consumption*, 30 *MGMT. SCI.* 423, 423 (1984).

329. Spanish sociologist and comparative political thinker Ignacio Sánchez-Cuenca observes: “If people really act out of principles, moral obligations, convictions, or sincere concern for others, the methodological virtues of a theory that does not take into account these factors are of no avail.” Ignacio Sánchez-Cuenca, *A Preference for Selfish Preferences; The Problem of Motivations in Rational Choice Political Science*, 38 *PHIL. SOC. SCI.* 361, 372 (2008). Economic theory fails us. “That theory could only aspire to provide very incomplete explanations. Common sense, folk psychology, and even simple introspection show that the range of motivations that move the agent to act is wider than

and scientific natures of our existence show that we cannot be entirely self-centered. This is but one of many possible moral virtues. If humanity needs moral virtues, so do economists.³³⁰

Frank Ackerman and Lisa Heinzerling explain that we cannot be entirely mechanical in our approach either: “[E]conomists dream of decision rules so precise that no one will need to participate.” They should see Kenneth Arrow’s *Social Choice and Individual Values*,³³¹ “a classic work in economic theory,” as demonstrating “the impossibility of that dream.”³³² Instead we must allow for the voice of the people:

In 1951, Kenneth Arrow proved that the results of democratic decision making cannot be reproduced by a mathematical formula. This crucial result, known as Arrow’s Impossibility Theorem, derailed earlier attempts by economists to represent society’s choices by a “social welfare function”—a quantitative description of what society supposedly prefers. Arrow’s proof has not been refuted, though it may have been forgotten, in the rush to apply cost-benefit analysis.³³³

Decisions cannot be mechanical or mechanically applied. Life is bumpy; nature is not smooth or mechanical. When we

standard self-interest.” *Id.* Sánchez-Cuenca is correct. Neo-classical economics fails to capture all values. Traditional rational choice theory (using models of bounded rationality, evolutionary game theory, etc.) does not account for “the importance of extreme behavior in politics (from suicide missions to joining revolution to volunteering for altruist causes).” *Id.* at 375. Humanity needs to open its eyes to motivations that are not economic.

330. David Lipka, *Do Economists Need Moral Virtues?* (June 12, 2014), <http://ssrn.com/abstract=2449221> [<https://perma.cc/TV5Q-AMD7>]. Specifically, economists need to honor the moral virtue of the survival of humanity.

331. KENNETH J. ARROW, COWLES COMM’N FOR RESEARCH IN ECON., *SOCIAL CHOICE AND INDIVIDUAL VALUES* (John Wiley & Sons, 1951), <http://cowles.yale.edu/sites/default/files/files/pub/mon/m12-all.pdf> [<https://perma.cc/5M4B-WM9B>].

332. ACKERMAN & HEINZERLING, *supra* note 15, at 209.

333. *Id.* (citing Frank Ackerman, *Utility and Welfare II: Modern Economic Alternatives*, in HUMAN WELL-BEING AND ECONOMIC GOALS 81-92 (Frank Ackerman et al., eds. 1997)). See also Peter Bernholz, *A General Constitutional Possibility Theorem*, 51 PUB. CHOICE 249 (1986); Peter J. Hammond, *Social Choice: The Science of the Impossible?*, in ARROW AND THE FOUNDATIONS OF ECONOMIC POLICY 116 (George R. Feiwel, ed. 1987); Kotaro Suzumura & Yongsheng Xu, *Welfarist-Consequentialism, Similarity of Attitudes, and Arrow’s General Impossibility Theorem*, 22 SOC. CHOICE 237 (2004), for more on Arrow’s Impossibility Theorem.

encounter sufficient bumps, we lose control. There is a need for humanity to be directly involved in our “human decisions.” Humanity should not give up control to machines, to science, or to economics.

At the same time, we should not turn our backs entirely on the benefits of measurements or predictions. Providing for a future is a matter of great complexity requiring a wide view.³³⁴ Unfortunately, our narrow-beam spotlights also happen to be very short-range and near term. We need to look beyond the foreseeability of extinction—and we need some faith in that vision.

Too much moral flexibility can reduce our view and add to risk. If we attach moral values to the views of certain risks, we may be able to reduce the flexibility of some views,³³⁵ give ourselves some guidance, and change the way we see and approach those risks.³³⁶ We can do this whether the risks are based on behavior that is scientific or social and cultural in origin and type.

Is there anything in objectivity that can help us see the moral issues of our existence? How can moral issues ever be objective? We can see shades of gray in morality. But there is one place with no gray: the boundary of life and death.

If there is risk in a truly objective sense, it occurs with the moral issue of that boundary. Some life and death is beyond our control. However, when humans have control over that boundary, the risk is moral in nature. For many individual risks, traditional CBA may be employed and a rational weighing can take place. But if human extinction is within our control, it may be the only truly objective societal risk, one that inherently defies someone’s

334. For Ackerman and Heinzerling, there are subtle considerations: “It is of course helpful, when evaluating broad public policies, to quantify everything that is measurable, to price everything that can be priced—while remembering how many essential values are not illuminated by these narrow-beam numerical spotlights.” ACKERMAN & HEINZERLING, *supra* note 15, at 212. Not all weighing works, and we don’t have to achieve perfect efficiency when contexts may vary. “The nature of risks involved, the questions of fairness and distribution of burdens, and the importance of providing for the future, all affect the policies that should be adopted to protect health and the environment.” *Id.* at 212–13.

335. For instance, we may choose to value life and health over convenience, property, or even liberty.

336. Paradoxically, as we shall see, we will need more behavioral flexibility, individually and collectively, to avoid issues of life and death.

special subjective perception or interest: the high power line you just don't touch no matter what the cost. If the risk is real and significant, it is the black and white risk, with no shades of gray; and with no weighing in making the decision itself.

Should we attempt to keep humanity alive at all costs? How come? Or should we *not* knowingly further the extinction of humanity? The latter certainly sounds right, but we should consider all these questions and more.

Objective *views* of risk cannot cope with the issue of extinction. Objective views involve measuring with numbers and quantifying both the costs and the benefits: weighing. Using objective risk or otherwise, can there be any weighing involving the life and death of our own species? If there is weighing, we have degraded ourselves. Human extinction is morally repugnant. What benefit, what amount of profit, for example, could ever be great enough to justify that cost? This is one of the arguments against employing objective views of risk (including neo-classical economics), or at least against using cost-benefit analysis in its pure form. In light of possible extinction, morality and fairness require more than cost-justified precaution.

Gregory Keating sees everyday application of that fairness as he considers risk in the workplace.³³⁷ He correctly concludes that great wealth for society does not justify placing lives in harm's way. Fairness requires something more than higher pay for those who suffer the risks. Additional precaution is justified.

337. Keating, *supra* note 20, at 699.

The fact . . . that a particular level of pesticide residue on produce, or a particular level of benzene or cotton dust in a workplace, maximizes the wealth that society extracts from the activity at issue does not supply those who stand to lose their health or their lives with good reason to accept the level of risk that efficiency licenses. Society is extracting maximum advantage from the activity by putting them in peril of great and readily avoidable harm. If the sacrifice demanded of them could be avoided without imposing a comparable sacrifice on others, then the risk should be reduced

Id. Prior consent, whether or not in the course of employment, is not enough to justify placing lives or health at significant risk. As Aditi Bagchi explains it, "[p]ermission cannot prevent culpability." Aditi Bagchi, *Managing Moral Risk: The Case of Contract*, 111 COLUM. L. REV. 1878, 1902 (2011). For risk-taking with significant risks to life or health to be morally acceptable, we reduce risk to the extent feasible.

a. Basic Moral Law

We start with the most basic and simple moral law:

Thou shalt not kill.³³⁸

There it is in gleaming simplicity, without exceptions or loopholes. At the largest level, this moral imperative is best noted in the unwritten international criminal law of crimes against humanity. Let us differentiate here between killing others and killing ourselves.

i. Killing Others

In this article, we consider combinations of global risks that, with reasonable foreseeability, may lead to death for millions. The law that was born of the death of millions of Jews is found in international criminal law.

The prosecutions at the Nuremberg trials were for crimes against humanity. Arguably, those same rights that were invoked in Nuremberg reach out and touch and protect each and every one of us. Each of us should be entitled to full and equal protection under the law.

Gross negligence with the entire life support system of the planet should be no less culpable than the specific intent required to prove a case of genocide in international criminal law. The purpose of this expression of international criminal law is not to create criminals but to avoid the need for prosecution or the results that come from failure.

If the human imperative is to protect life, we must rank it highly. Life is a fundamental right in the due process clauses of the Fifth and the Fourteenth Amendments to the Constitution of the United States. Life is first, ahead of liberty and property in order—and in rank. Property and liberty support life, and property supports liberty. The ranking of fundamental rights becomes important when property rights come in conflict with lives in being. We should work to avoid inversions in order to save lives.

338. *Exodus* 20:13; *Deuteronomy* 5:17.

ii. Killing Yourself

The ancient prohibition applies here as well. Not only do most states forbid suicide,³³⁹ there are other reasons to avoid certain death. One of those reasons is our view of risk. Without getting to the matter of intent, we try not to be negligent with our own lives.

Consider the hot third rail of an electric train-line. As individuals, we know not to come close. Touching that rail means certain death. Such foreseeability requires that we talk about other options long before we would get close to that rail. Generally, we require a margin of safety.

Humanity needs that kind of decision-making—as a group. In the process, we may need to recognize that there are some actions for which we cannot punish. However, it may be to our greater benefit if we were to “nudge” against those actions—to limit their occurrence and their impact.³⁴⁰

We, as a species, need to start engineering the human future—or, given our direction, our momentum, and our overshoot, humanity itself will harm the health and the existence of many millions of current lives in being.

There is a spectrum of different methods and manners of dealing with risk. At one end, there is unrestricted cost-benefit analysis, which allows for greater risk in the name of efficiency and greater overall societal profit. CBA has no risk boundaries. At the other end there is the precautionary principle,³⁴¹ a rule against risk.

339. See Scott P. Johnson & Robert M. Alexander, *The Rehnquist Court and the Devolution of the Right to Privacy*, 105 W. VA. L. REV. 621, 642 n.178 (2003); David LaValle, Note, *Physician-Assisted Suicide: Is There a Right to Die?*, 31 SUFFOLK U. L. REV. 944, 953 n.73 (1998).

340. See, e.g., RICHARD H. THALER & CASS R. SUNSTEIN, *NUDGE: IMPROVING DECISIONS ABOUT HEALTH, WEALTH, AND HAPPINESS* (2008) (the classic text in behavioral economics); Phil Weiser & Gideon Parchomovsky, *Beyond Fair Use*, 96 CORNELL L. REV. 91 (2010) (discussing how nudges may be used to increase user access and use privileges in the realm of copyright, and showing that nudging has a wide range of uses).

341. ACKERMAN & HEINZERLING, *supra* note 15, at 223–29. Ackerman and Heinzerling employ four principles to protect the priceless. One is the precautionary principle, to be discussed shortly. The other three principles use a holistic evaluation of costs and benefits, *id.* at 210–16, learn from the military about the communication and power of moral imperatives without cost comparison, and promote fairness toward those who don’t have a say, including

Any number of stops, gradations, or possibilities may exist in between. We will examine irreversibility, the source of the precautionary principle. Then we'll look at the principle itself.

b. Irreversibility

In its pure form, the precautionary principle commands: "Better safe than sorry." It is black and white; it is red and green. A decision is required. You do it or you don't. In its pure form, there can be no measures. The outcome of the risk is treated as irreversible.

Irreversibility plays a huge role in such domains as public health, medical practice, and environmental protection. Each is a context involving life and death of some living beings or thing(s) (e.g., viruses and plants). Irreversibility is implicit in the precautionary principle.

According to Cass Sunstein, there are "two separate conceptions" of how to deal with irreversibility. One involves the option value, which "calls for a kind of 'irreversibility premium,' embodied in a willingness to spend more on precautions or preparation."³⁴² We'll see more on that shortly. The other "emphasizes losses of goods that are *incommensurable* . . . in the sense that they are qualitatively distinctive and in some cases unique."³⁴³

Consider incommensurability. Some things, like life, are not fungible with the value of the goods and services necessary to sustain them. Compare the value of the food and water necessary to sustain a city of 60,000 for a year, or even five years, with the *value* of the future lives of those 60,000 people. Those people are irreplaceable. In their uniqueness, their lives are incommensurable with the value required to sustain them.

The loss of the unique is irreversible, and, as each human life is unique, special precautions are needed. We know we are not replaceable. Incommensurability touches deep emotional and religious chords. According to Sunstein, "When people fear or deplore certain losses, this kind of irreversibility is often their

the poor, the powerless, and the future (our children and theirs), *id.* at 216–23, 229–33.

342. *Irreversibility*, *supra* note 264, at 230.

343. *Id.* (emphasis added).

animating concern.”³⁴⁴ Irreversibility invokes questions of incommensurability, for example the difference between buying and dying. “What is gained by an understanding of incommensurability is a more vivid appreciation of why certain losses cannot be dismissed as mere ‘costs.’”³⁴⁵ Special precautions are required where losses are incommensurable with each other.

But Professor Sunstein sees the problem for the option value people in traditional economics: “Economists and economic analysts of law often find [the idea of incommensurability] puzzling and opaque, in part because it is outside the scope of neoclassical (or behavioral) economics, and because it does not offer any guidance for how to assess the costs and benefits of social harms.”³⁴⁶ These option value people are often the cornucopian economists³⁴⁷ who subscribe to pure cost-benefit analysis for all decision making. An additional “option value” is the value of irreversibility to them.³⁴⁸ This captures the extra

344. *Id.*

345. *Id.* at 238. Sunstein elaborates:

To say that a social loss is not commensurate with money, in a moral sense, is not to say that human beings can avoid some form of monetization. The point is that in the domains of private choice and democratic judgement, any monetary assignment should be undertaken with an understanding of the nature of the goods at stake. As I have emphasized, this point does not provide any guidance for resolving the important issue of how the assignment of monetary value should occur. But for those concerned about irreversibility in the relevant sense, that is not the only issue. We need to consider ‘how’ goods are valued, not merely ‘how much’ goods are valued.

Id. at 239. Sunstein’s concept of social loss does not begin to convey the significance of human extinction. Despite Sunstein’s interest in monetary assignment, we can place no monetary value on human extinction.

346. *Id.* at 230.

347. “The economist is focused on production and consumption. . . . The planet, he insists, is perpetually fruitful and still underutilized.” WILSON, *supra* note 18, at 24. On the other hand, “[t]he ecologist . . . is focused on unsustainable crop yields, overdrawn aquifers, and threatened ecosystems. . . . The planet he insists is exhausted and in trouble.” *Id.* The “cornucopian view of nature” constitutes “the idea that nature is a vast storehouse of good ‘things’ waiting only to be grasped and used by man.” RICHARD L. MEANS, *THE ETHICAL IMPERATIVE: THE CRISIS IN AMERICAN VALUES* 126 (1969). Picture a verdant and welcoming commons.

348. The option value of irreversible investments is one of three independent literatures in economics pertaining to irreversibility. Beyond

value for an investment to be potentially irreversible. The option value approach may work well for the loss of property.

Thus, we have two ways of looking at the problem. Each side has difficulties appreciating the other. On one side, there are those who identify a value or a price for irreversible losses, or at least the risk of such losses.³⁴⁹ On the other, the likes of Frank Ackerman and Lisa Heinzerling argue, “It is hard to imagine a price for an irreversible loss.”³⁵⁰ It can depend on the nature of the loss. If I lose my childhood photos to a fire, it is irreversible, but not commensurable with other property. There is a special emotional value. But instead of worrying about protecting other property, this article is concerned with protecting life first. Life, and the liberty which supports it, deserve special treatment as they are consistently incommensurable with the property right inherent in the option value approach.

Cass Sunstein suggests “that economic analysts will be unable to understand important debates, in politics, in law, and in ethics, unless they have a sympathetic appreciation of the second conception of irreversibility.”³⁵¹ Further, he notes “that economic analysis of some public health and environmental problems is, in an important sense, obtuse, if it fails to appreciate the animating concern.”³⁵² Sunstein conveys well the significance of the limits of the neo-classical economic mind.³⁵³ For one thing, he recognizes “that an effort to line up all the relevant goods on a

“irreversible investments” is the literature of irreversibility and hysteresis in the study of dynamic systems with multiple equilibria, and the literature of entrainment, the phenomenon of lock-in or lock out, based in complex systems theory. Charles Perrings & William Brock, *Irreversibility in Economics*, 1 ANN. REV. RESOURCE ECON. 219, 219 (2009).

349. See *Irreversibility*, *supra* note 264, at 231 (citing Richard C. Bishop, *Option Value: An Exposition and Extension*, 58 LAND ECON. 1 (1982)).

350. ACKERMAN & HEINZERLING, *supra* note 15, at 185.

351. *Irreversibility*, *supra* note 264, at 230.

352. *Id.*

353. According to Sunstein, here is what neo-classical economists do not get:

[Consider] a claim that natural processes have some kind of intrinsic value simply because they are natural. If that idea seems implausible or contentious, at least we might be able to agree that certain decisions would produce losses that are in a moral sense irreversible even if that claim seems mysterious from the standpoint of economic theory.

Id. at 238 (citing ROBERT GOODIN, GREEN POLITICAL THEORY 41 (1992)).

single metric will make it difficult to understand what is at stake in the domains and politics of law.”³⁵⁴ The use of a unitary metric obscures risk.

However, Sunstein builds an option value into his “Irreversible Harm Precautionary Principle.” Relying on Kenneth Arrow and Anthony Fisher’s 1974 economics essay, *Environmental Preservation, Uncertainty, and Irreversibility*,³⁵⁵ Sunstein gives a purely economic response.

Interpreting an argument in a later paper by Fisher,³⁵⁶ Sunstein invokes an insurance payment step-by-step process. Here he shows the implementation:

If an irreversible harm is on one side and a reversible one on the other, and if decision-makers are uncertain about future costs and benefits of precautions, an understanding of option value suggests that it is worthwhile to spend a certain amount to preserve future flexibility, by paying a premium to avoid the irreversible harm.³⁵⁷

There is an additional cost to preserve an option. The usefulness of the option approach is direct knowledge and exercise of flexibility in seeking to protect the irreversible.

But this does not help us with our values. The option approach will not help us decide whether or not to avoid our own

354. *Id.*

355. *Id.* at 233

Arrow and Fisher imagine that the question is whether to preserve a virgin redwood forest for wilderness recreation or instead to open it to clear-cut logging. Assume that if the development option is chosen, the destruction of the forest is effectively irreversible. Arrow and Fisher argue that it matters whether the authorities cannot yet assess the costs or benefits of a proposed development. If development produces ‘some irreversible transformation of the environment, hence a loss in perpetuity of the benefits from preservation’, then it is worth paying something to wait to acquire the missing information. Their suggestion is that ‘the expected benefits of an irreversible decision should be adjusted to reflect the loss of options it entails’.

Id. (citing Kenneth Arrow & Anthony Fisher, *Environmental Preservation, Uncertainty, and Irreversibility*, 88 Q.J. ECON. 312, 319 (1974)).

356. See Anthony C. Fisher, *Uncertainty, Irreversibility, and the Timing of Climate Change Policy* 9 (2001), http://stephenschneider.stanford.edu/Publications/PDF_Papers/timingFfisher.pdf [perma.cc/5YYB-DPAL].

357. *Irreversibility*, *supra* note 264, at 233.

extinction. While it may help analyze costs, in its unrestricted form the option approach is unlikely to help determine the most effective approach(es) to take in the interest of safety. When liberty or life is placed at risk, the situation calls for a moral response.

It is possible to misinterpret irreversibility in the context of human extinction. Considering irreversibility, the focus should be on safety first, not cost first. According to the U.N. Framework Convention on Climate Change:

Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing [regulatory] measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost.³⁵⁸

“Global benefits” can come without making any expenditure toward security. There is a sufficient safety interest to protect first from the most significant risks. Those risks are not limited to climate change. Cost could become a factor once a measure of safety has been calculated and established.

Feasibility may at some point be an issue. However, some goals may not appear to be feasible at first. We may decide we need to train ourselves to reach. Or maybe we merely need to time our jump. We need to begin a conversation on how we, all of humanity, need to view significant risk.

c. The Precautionary Principle

The risks of contracting HIV/AIDS or playing with guns are black and white and do not tend to come in shades of gray. If you ask a parent, these are objective risks that any adult can recognize. And these are great risks, deserving special treatment. Although our treatment of these risks may vary in relation to our

358. UNFCCC, May 9, 1992, 1771 U.N.T.S. 164, 170; *see also* INDUR GOKLANY, *THE PRECAUTIONARY PRINCIPLE: A CRITICAL APPRAISAL OF ENVIRONMENTAL RISK ASSESSMENT* 6 (2001) (quoting United Nations Framework Convention on Climate Change, art. 3(3)).

circumstances and our views,³⁵⁹ we tend to readily accept that these represent great risks at one end of the spectrum of risk.

This black and white view has led to the “better safe than sorry” argument that teenagers have heard for years. This is the root of a concept called the precautionary principle: The principle tells us that, given the risks, there are some boundaries you just don’t cross. Even though the risk may be indeterminate, there may be a general perception of danger.³⁶⁰ Consider horrific mortal injury, incurable disease, or death to self or others. These are clear boundaries to which any parent—or physician³⁶¹—would agree.

We need to plan for risk in our law and policy so that later we do not regrettably discover that we were too late in risk assessment and communication. Reactions can be too late. As Princeton’s Richard Falk observed 40 years ago, “we tend too often to *react*, rather than to *prevent* and given the scale of our newer undertakings the consequences of error are increasing at a fast pace.”³⁶² Finding ourselves lucky enough to be here now does not justify continuing to react rather than prevent. The risks in

359. For example, we may lock up the guns, or we may refuse to allow guns in our homes.

360. Law professor Steven Schwarcz describes treatment of catastrophic risk created by our systems:

Perhaps the most relevant example for systemic risk is regulation designed to address the risk of catastrophic events or large, irreversible effects where the actual level of risk is indeterminate. In these cases, regulators often apply a precautionary principle that presumes benefits will outweigh costs. In the principle’s most utilized form, regulators may decide to regulate an activity notwithstanding lack of decisive evidence of the activity’s harm, such as controlling low-level exposure to carcinogens notwithstanding lack of proof of a causal connection between such exposure and adverse effects to human health.

Steven L. Schwarcz, *Systemic Risk*, 97 GEO. L.J. 193, 234-35 (2008) (citing JAMES SALZMAN & BARTON H. THOMPSON, JR., ENVIRONMENTAL LAW AND POLICY 16 (2d ed. 2007); Robert G. Chambers & Tigran A. Melkonyan, *Pareto Optimal Trade in an Uncertain World: GMOs and the Precautionary Principle*, 89 AM. J. AGRIC. ECON. 520, 528 (2007); Cass R. Sunstein, *Irreversible and Catastrophic*, 91 CORNELL L. REV. 841, 848 (2006); Cass R. Sunstein, *Beyond the Precautionary Principle*, 151 U. PA. L. REV. 1003, 1006-07, 1017-18 n.266 (2003)).

361. The precautionary principle “is, essentially, a restatement of a popular rendition of the Hippocratic oath, namely, ‘first do no harm.’” GOKLANY, *supra* note 359, at 1–2.

362. FALK, *supra* note 57, at 190.

science—and the risks seen through science—are increasing faster now than ever. Reaction, at some point, will be inadequate.

The precautionary principle may help us morally. It may help us with our thinking. And it may help us with single individual simple choices. But life is not so simple. According to Ackerman and Heinzerling, “The general idea of the precautionary principle is easy enough to describe: we should pay attention to early warnings of serious hazards, rather than wait for final proof and precise quantification of the expected impacts. The difficulty comes in implementation.”³⁶³ Practically speaking, how do we live? Do we stop eating? Do we stop burning coal? What do we change, and to what degree? Here is what we are up against: We already know that we can’t lock the teenager in his room all his life.³⁶⁴ We must accept some risk.

If we reject unrestricted cost-benefit analysis entirely, and we attempt to deal with risk with the black-or-white banning of dangerous activity, at this point, we cannot live.³⁶⁵ We are all together in this larger community of risk, and as we will see when we consider the risks in our modern everyday life, some stemming from our everyday conveniences, we cannot employ the raw dictates of the precautionary principle. We would lose our liberty.

Do we subject *all* risks to special precaution beyond the point of cost justification? Hardly. Professor Keating suggests that it behooves us to eliminate or feasibly reduce only *significant* risks

363. ACKERMAN & HEINZERLING, *supra* note 15, at 225.

364. We must at some point be able to take risk. It is part of normal individual development.

365. Keating offers the example of a tanker truck full of gasoline, an accident, an explosion, waiting to happen. Although it is a threat to our community of risk, it is also a benefit. We need that fuel, and we are willing to accept some risk of devastating injury or death to some in our community to get it. Losses will be concentrated on an unlucky few. Keating, *supra* note 20, at 679. Keating then asks and answers the hard question, “[w]hat can be said by way of justification to those who lose?” *Id.* at 680,

The only answer is that the relevant practices of risk imposition were to their ex ante advantage and that their lives and limbs were not, therefore, sacrificed either to the general good, or to the lesser interests of others. There was no alternative way of reconciling liberty and security which would have improved their life prospects, and perhaps have avoided their devastation, without working a greater hardship on another class of persons.

Id. at 680.

of devastating injury: “[A] significance requirement is necessary to prevent both safe and feasible risk reduction from inflicting harms to our liberty greater than the harms that insignificant risks of devastating injury inflict on our security.”³⁶⁶ All risks would not qualify for these restrictions.³⁶⁷ “The imposition of insignificant—but real—risks of devastating injury is so pervasive that the elimination of insignificant risks of devastating injury would cripple our freedom of action.”³⁶⁸ One could respond that human extinction is significant if anything is.³⁶⁹

Economists and others have attacked the precautionary principle, saying that it cannot be employed in its pure form and that when it is employed, it is vague, ambiguous, and watered down.³⁷⁰ Let’s not allow ourselves to be restricted to an all-or-nothing choice between a norm with excessive risk (CBA) and a principle that arguably cannot be implemented as such.³⁷¹ We

366. *Id.* at 661.

367. We need to place life interests over liberty interests, but only where risks to life and health are significant.

368. Keating, *supra* note 20, at 661.

369. Significance is not a question of probability but a question of how bad it would be if it happened. This then justifies an investigation into probability.

370. See John S. Applegate, *The Taming of the Precautionary Principle*, 27 WM. & MARY ENVTL. L. & POL’Y REV. 13 (2002); Michael S. Carolan, *The Precautionary Principle and Traditional Risk Assessment*, 20 ORG. & ENV’T 5 (2007); Giovanni Immordino, *Self-Protection, Information and the Precautionary Principle*, 25 GENEVA PAPERS ON RISK & INS. THEORY 179 (2000); Derek Turner & Lauren Hartzell, *The Lack of Clarity in the Precautionary Principle*, 13 ENVTL. VALUES 449 (2004); Cass R. Sunstein, *The Precautionary Principle as a Basis for Decision Making*, ECONOMISTS’ VOICE, Apr. 2005.

371. Consider this attack on the precautionary principle by well-known CBA proponent, Judge Posner:

The “precautionary principle” (“better safe than sorry”) popular in Europe and among Greens generally is not a satisfactory alternative to cost-benefit analysis, if only because of its sponginess—if it is an alternative at all. In its more tempered versions, the principle is indistinguishable from cost-benefit analysis with risk aversion assumed. Risk aversion, as we know, entails that extra weight be given the downside of certain prospects. In effect it magnifies certain costs, but it does not thereby overthrow cost-benefit analysis, as some advocates of the precautionary principle may believe.

POSNER, *supra* note 145, at 140. The thumb on the scale of safety is an acknowledgment that CBA fails to adequately account for risk. The long-term interest in safety is a countervailing tendency to the interest in short-term gain

like safety.³⁷² When confronted with the choice, most people choose safety over money.³⁷³

When we choose liberty or property over life, we have misplaced our priorities. Look at externalities. When property conflicts arise and it comes down to the right to achieve efficiency and in doing so, to pollute, versus the right of another to be free of pollution, we encounter conflicting priorities. For economist Ronald Coase, the issue should not be which interest to protect so much as how best “to avoid the more serious harm.”³⁷⁴ This approach better supports—or at least works better with—precaution than does CBA.

When we consider externalities, we often see “market failure.” Law professor Carl Circo notes that, “[u]nder [circumstances of market failure], economic analysis supports a legal rule that ‘avoids the greater harm,’ such as a rule that imposes ‘the burden (or duty) of cost avoidance or abatement on the party that can do so at the lowest cost.’”³⁷⁵ If we are not careful, decisions to avoid harm can all too easily get re-characterized into issues of cost. When we consider humanity’s impact on the life support system of the planet, lowest cost may not avoid greater harm.

inherent in CBA. The purposes are different. Neither can entirely displace the other.

372. Ackerman and Heinzerling observe that the U.S. military establishment successfully avoids CBA based on safety or security considerations. See ACKERMAN & HEINZERLING, *supra* note 15, at 216–20. When safety has mattered most, Americans have not used CBA:

Advocates of Cold War military spending could have seen the situation in terms much like our interpretation of the precautionary principle. The actual military risk was uncertain, and the danger of being exposed to attack in the high-risk case seemed much greater than the danger of spending too much in the low-risk case. Preparing for the high-risk case did not bankrupt the nation, but created jobs and industries that sustained economic growth.

Id. at 228. The same could easily be said for the health and environmental risks we face today. Consider, e.g., the costs of a catastrophic climate change disaster. When we compare it to the cost of preventative safety, we discover that the costs are not symmetrical.

373. See SCHWARTZ, *supra* note 18, at 125.

374. Ronald H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 2 (1960).

375. Circo, *supra* note 165, at 120 (quoting DANIEL H. COLE & PETER Z. GROSSMAN, *PRINCIPLES OF LAW AND ECONOMICS* 87 (2005)).

For now, we have considered risk, something we all live and know. How we perceive risk and how we respond varies in the context of “objective” views, subjective views, and moral views. Let’s recognize a moral need, even a legal need, to reduce risk especially when we encounter the irreversible. And let’s recognize that need especially in the context of risk of death and extinction, including foreseeable risk of harm to the Earth’s life support system.

Is humanity at any risk of extinction? Are there real dangers or just concerns? Are these matters that dollars and cents will solve, or do they run deeper?³⁷⁶ The foreseeability of collapse is not reassuring.

IV. CONCLUSION

Neo-classical economics and its purely quantitative approach to decision making should be replaced by theory and practice that do a better job of protecting humanity from significant risk of collapse or extinction. Implementation of neo-classical theory puts individual lives at risk and when multiplied on a grand scale, works against the common welfare of the population. In response, sociologists, and the late Ulrich Beck in particular, employ a subjective view of risk that is both outspoken and wary.³⁷⁷

The philosophical footing for neo-classical economics is part of the problem. The utilitarian theory common to CBA and WBA is incompatible with a long future on a limited planet. Humans

376. Money may not solve the problems discussed herein. *How to Spend \$50 Billion to Make the World a Better Place*, examines nine different categories of possible options. Of those, only two—climate change and safe and adequate water—pertain directly to issues in this article. The options are ranked by economists setting economic priorities. Climate change and water do not make it into the group of four top priorities (1. control of HIV/AIDS; 2. providing micronutrients to fight malnutrition among children; 3. trade liberalization; and 4. control of malaria). See Jagdish N. Bhagwati et al., *Expert Panel Ranking*, in *HOW TO SPEND \$50 BILLION TO MAKE THE WORLD A BETTER PLACE* 165, 166 (Bjorn Lomborg ed., 2006); Bjorn Lomborg, *Introduction: What Should We Do First?*, in *HOW TO SPEND \$50 BILLION TO MAKE THE WORLD A BETTER PLACE*, at xi, xiii, xv (Bjorn Lomborg ed., 2006). In some ways, it can be said that the top priorities selected are the “easy” issues.

377. See, e.g., BECK, *supra* note 19.

exhibit plenty of self-interest already, without employing specialized systems to magnify it.

The use of utilitarian philosophy causes us to focus on our own individual perceptions of need, without regard to the physical limits of the planet. As a result, we are selfishly using up significant portions of the life support system of the planet—and thereby impairing the human future.³⁷⁸

Our neo-classical economics has become a specialized system that is assisting in environmental disaster. It may be true at this stage that each effort to use nature harms the biosphere a bit more.

While we lack a perfect understanding of scientific cause and effect, we can understand and foresee the possibilities for environmental disaster. Requiring proof of cause and effect for a disaster is both impossible and immoral. The lessons of Chernobyl, Bhopal, and the Deepwater Horizon spill teach us that the kinds of life-and-death risk we face require more precaution than is currently employed.

Known foreseeability enhances the duty to act. Arguably, an intentional failure to act to save millions of lives could reasonably constitute sufficient gross negligence to attract the attention of criminal authorities. Instead, humanity should embrace a duty to act that is rooted in both morality and law.

With risk to life foreseeable, certain activities should be curtailed. A humanity interested in survival will need new limits on behavior. And law will need to have a role in setting those limits including limiting systems of decision making, such as CBA. Law should govern economics rather than the other way around.

The President's Office of Information and Regulatory Analysis (OIRA) needs to scrap its use of CBA immediately. In the interest of fairness to all, it needs to be scrapped in all other countries simultaneously. We can no longer afford to compete against each other without limits. We are killing the planet.

Given our competitive economic systems, our best approach is for all nations to agree to stop the competition. Thus, it seems

³⁷⁸. This paves the way for us to consider the question of what approach or philosophy to use. We will need to explore and consider ways to think about thinking that will further the survival of the human species.

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that the time and the situation are right for a new global economic system that respects both science and the law. If we can use our laws, our choices, and our defaults to encourage human survival, we, as a species, stand a better chance of surviving longer. And together we can make the world a better place.

I would stop here, but there remains a final troubling matter to address: the matter of economic displacement. If the entire international economic system were to move at once to some system other than neo-classical economics, there would be massive human displacement and suffering. The transition needs to be phased in. It needs to start very soon, and we need to discuss the required changes even sooner.

In the face of environmental overshoot, humanity cannot continue as we have. Either we will adjust first, or collapse will occur. Given our current economic and political systems, a sufficient adjustment on the part of our species would require a global effort at the highest levels. Given our tendency to continue with previous behavior, it is reasonably foreseeable that failure to cooperate in making sufficient changes could doom the human species. For example, if we do not cooperatively outgrow neo-classical economics together, the divisions and discontinuities from just a few competitors could lead to collapse. An affirmative decision on the part of the human species is likely to be required. And before that, we need to talk about the problems and the possible solutions. Let the conversation begin, please.