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The Externality of Discounted Externalities

Abstract: This article addresses an unexplored problem in the externalities literature: the present value of future externalities. The problem arises because externalized costs and benefits occur in the future, and therefore should be discounted, yet discount rates used by corporate decision-makers are typically higher than the appropriate social discount rate.

In simple terms, corporations discount the future too much, and therefore underproduce potential future benefits and overproduce potential future costs. Our key insight is that the impact of high corporate discount rates, relative to the socially appropriate discount rate, is an *additional externality*. We refer to the additional costs that arise when corporations use higher-than-optimal discount rates as "the externality of discounted externalities."

Policy makers should take into account the difference between corporate and social discount rates. Regulators and courts that seek to incentivize corporations to make decisions about the future in socially optimal ways should not ignore the externality of discounted externalities.

Keywords: climate change, externalities, valuation, ESG, regulatory policy, discount rates, arbitrage

I. Introduction

In 2018 and 2019, two Boeing 737 MAX aircraft crashed, killing everyone on board (Leggett 2019). The first crash, a Lion Air flight from Indonesia, killed 189 people. The second crash, an Ethiopian Airlines flight, killed 157 people (BBC 2019). The Boeing Company immediately grounded its entire Boeing 737 MAX fleet, and numerous investigations ensued (Isidore 2020).

Both crashes were linked to design faults (Beech and Suhartono 2019). Some critics attributed the crashes to a "self-regulation problem": Faced with competitive pressure, Boeing rushed the model's design and production and skirted the traditional lengthy certification process for new model aircraft (Schacter 2021, 639–40; Gelles et al. 2019). After several government investigations and multiple

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lawsuits, including shareholder litigation in Delaware, the crashes ultimately cost the company tens of billions of dollars (Baker 2019).[1]

Imagine the decision-makers at Boeing ten years before the crashes. How should they have measured the impact of potential, future crashes? What if they knew there was a nontrivial chance that several hundred people would die from two design-flaw-related crashes in ten years? Suppose that Boeing, as a rational corporate actor, had correctly calculated the probability and costs of such accidents, and also anticipated that it would be financially responsible for the entirety of those expected costs ten years hence. Even so, the company would reduce those future costs to a present value, to accurately compare them to the then-current costs of precaution or insurance.

Expected future costs are a function of the likelihood of the event and the ultimate cost if the event occurs. Those future costs must be adjusted again, reducing them to a present value. The amount of the adjustment depends on a discount rate, which describes how much those future expected costs should be reduced in comparing them to current costs. The discount rate for a company depends on a number of factors, including factors related to its cost of equity and debt capital (Palmiter et al. 2019, 282–89).[2] The higher the discount rate, the lower the present value. The lower the discount rate, the higher the present value.

When calculating whether to invest in precautions to avoid future crashes, Boeing—like most companies—would have used a discount rate much *higher* than society would have preferred. That is, it would have valued the future too little. Accordingly, it would have spent less money to avoid those future crashes than society would have preferred—and it would have done so *even if the costs were otherwise correctly calculated and internalized*.

This example illustrates our central claim. In evaluating future costs and benefits, corporate actors will tend to use a discount rate that is higher than what is socially optimal. And the difference between the corporate discount rate and the social discount rate acts as an externality.[3] Scholars, judges, and regulators have ignored these "discounted externalities." They should not.

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Corporations and other business associations frequently make decisions that matter to human safety, sometimes with expected future benefits (for example, decisions to research and develop an anti-Alzheimer's drug, to install side-impact airbags in automobiles, or to reduce the use of saturated fat in foods) and other times with expected future costs (for example, decisions to market e-cigarettes, rush airplanes to market with software glitches in their stabilization systems, or source precious metals from suppliers who use slave or indentured labor). Scholars recently have emphasized the importance of judicial oversight of social externalities that arise from corporate action (Condon 2022; Condon et al. 2021; Badawi and Partnoy 2022, 362; Mitchell 2001, 49–65).

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[1] *In Re* The Boeing Co. Derivative Litig., C.A. No. 2019-0907-MTZ, 2021 WL 4059934 (Del. Ch. 2021).

[2] For example, based on 2024 data, Boeing's weighted average cost of capital (WACC), one common measure, was approximately 10 percent, whereas the social cost of capital would have ranged between a fraction of a percent and government borrowing rates of approximately 5 percent (Value Investing 2024).

[3] An "externality" is a cost that, unless internalized by regulation, will not be borne by the corporation. Pigou coined the term "externality;" for more on externalities, see Pigou (1932); Daley and Farley (2004); Machol and Rizk (2013, 80) ("Fossil fuel energy has several externalities not accounted for in the retail price."); Zasloff (2015); Unerman et al. (2018, 497); Condon 2022; Miazad (2022, 1651–53).

Simply put, corporations both save lives and kill people. The problem of how to promote the former and reduce the latter often reduces to two issues: valuation and internalization. Valuation refers to the assessment in financial terms of lives saved or positively affected versus lives lost or negatively affected (Matthews and Lave 2000). Internalization refers to how society incentivizes companies to take those external benefits and costs into account, by offering benefits when there are positive spillover effects on human lives and imposing fines, taxes, or penalties when human lives are harmed (Goodwin 2007).

Much of the current discussion concerning the broadening of corporations' responsibilities to take into account their impact on matters of environmental, social, and governance (ESG) concern can be understood as an application of these two issues (Greenfield 2018; Greenfield 2014, 518; Greenfield 2008a; Greenfield 2008b; Greenfield 2006). How do we understand the costs of corporate action on human well-being, environmental sustainability, or the health of democracy? And how do we design regulatory or policy tools to force businesses to internalize those costs?

These issues of valuation and internalization are complex and nuanced, and they have been the focus of numerous scholarly treatments in the legal, economic, and finance literature (Buchanan and Faith 1981; Hayden 1989; Condon 2022; Gadinis and Miazad 2020; Miazad 2022; Condon 2021; Dharampala and Khanna 2021). The first issue, valuation, is a matter of importance in torts, regulatory theory, insurance, medicine, public health, environmental protection, consumer and worker safety, and countless other areas (Mattiacci 2009, 22; Farber 2019; Miazad 2022). In particular, the financial valuation of human life might seem distasteful, but it is necessary to aid decision-makers in judging the proper level of precaution (to prevent harm) or investment (to create benefit). And analysts have, over time, derived a fairly stable range of values for decision-makers to use as estimates (Viscusi 2018, 28; Viscusi 2021, 3).

The second problem, internalization, has been the subject of myriad analyses since the writings of Ronald Coase, Guido Calabresi, and A. Douglas Melamed (Coase 1960; Calabresi and Melamed 1972). One prominent, longstanding notion is that regulators should subsidize or fund positive externalities and tax, regulate, or punish negative externalities (Bator 1958; Marshall 1920; Pigou 1932; Mankiw 2024, 190–97). Regulations should depend on these policy options unless, following Coase, those affected by positive or negative externalities can negotiate costlessly with those who create the externalities (Coase 1960, 6–8). Coasian negotiation and arbitrage can benefit both actors when there is a difference between how actors are affected by the externality (Partnoy 2019, 1021; Partnoy 1997, 227). In the classic example, if sparks from a railroad burn a farmer's crops, and the value of those crops is greater than the cost of installing spark arresters on the trains, then the farmer can pay the railroad to install the arresters (Coase 1960, 1).

Costs and benefits that occur in the future raise problems in addition to valuation and internalization. Future costs and benefits are often unknowable and variable, and parties differ in their assessments (Arrow et al. 2013). Future costs and benefits are frequently undercounted and underconsidered in ways that vary depending on who is making the assessment (Plumer 2018).

In some respects, one might expect corporate decision-makers to be less susceptible to typical flaws in reasoning about the future because even future costs and benefits can be reduced to present value and monetized by routine, commonplace financial tools (Carney et al. 2020, 171–75). Many future costs, if internalized and properly valued, can be monetized by way of insurance policies (Miazad 2022). Future benefits, assuming internalization and proper valuation, likewise can be monetized by

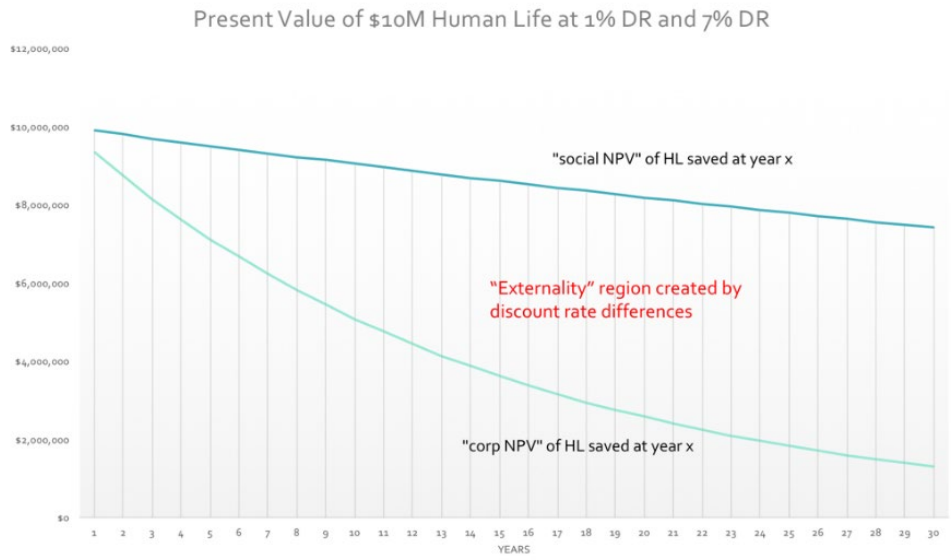
way of investment instruments (Parkinson 2021). Economically rational corporate actors are more likely to account for the future than are those whose decision-making is not so easily reduced to a financial calculus (Browning et al. 1999, 126–39; Ariely 2009).

But an additional complication arises for corporate actors, and this complication has heretofore been unaddressed in the legal literature: For reasons that are largely rational, corporations typically utilize a discount rate in evaluating future costs and benefits that is significantly higher than an appropriate social discount rate. That means that rational corporate actors value future benefits and costs much less than society does, and less than a government making socially optimal decisions would. For businesses, future costs are less worth avoiding and future benefits less worth chasing than society (or public-spirited government) would prefer. This is not a function of economic irrationality or a lack of public-spiritedness on the part of corporations. It is instead a function of economic *rationality*. The implication of this differential is that even if future costs and benefits are properly valued and properly internalized, they nevertheless are undercounted by corporate decision-makers. That is, even if externality costs are eventually completely borne by a company, either due to reputation-related costs, litigation, or fines, a rational corporate decision-maker will nevertheless undercount those costs. Corporations will care about the future less than society would prefer.

This paper contributes to existing legal literature by exploring the implications of the fact that corporate discount rates are typically higher than social discount rates and government discount rates (Partnoy 2012, 236–38). Our key insight: The difference between the valuation at the corporate discount rate and the government or social discount rate is a kind of externality, which we label a "discounted externality." This insight has implications for ESG literature and environmental, consumer safety, and corporate governance regulatory policy (Badawi and Partnoy 2022, 322–35; Partnoy 2017).

The importance of discounted externalities is depicted in Figure 1, which we discuss at greater length below and in Part IV-B. Suppose that one human life is estimated to be valued at $10 million, an amount consistent with current regulatory approaches (Partnoy 2017, 407). The top line of Figure 1 shows the social present value ("social NPV") of a $10 million future life if it is saved at the time set forth on the x-axis. The bottom line shows the corporate net present value ("corp NPV") of the same cost. Note that both lines are declining, reflecting the common assumptions about the "time value of money": A dollar today is worth more than a dollar tomorrow.

Figure 1



The gap between the two lines reflects the difference between two values of a future life if we assume different discount rates. Because of discount rate differences, society values a future life lost or saved at a particular future time as more valuable than a corporation does. In other words, the corporation is less willing to invest to save lives or take precautions to avoid their loss than society would prefer. This conclusion is true even if both the corporation and society place the same value on the future life (for example, $10 million), and if the future cost is internalized to the company by way of subsidies or fines. We can think of the discount rate difference as a kind of "second-order" externality—an externality arising from differential discounting of future externalities.

Second-order externalities are not captured by current academic, legal, or regulatory thinking, which emphasizes "first-order" externalities, particularly in the ESG literature (Pigou 1932; Coase 1960; Condon 2022; Miazad 2022; Edmans et al. 2022; Strine 2022). In the typical conception, the problem is framed as involving costs that are externalized to society or third parties instead of being internalized by the corporation (Badawi and Partnoy 2022, 327–31, 359–67). Such a limited conception drastically undercounts the value of future lives saved and future lives lost by corporate decision-making. Moreover, as corporate discount rates increase, the resulting second-order externalities are magnified. Policies based on the current approaches to externalities in the literature do not take into account these magnified costs and potential benefits.

Externalities related to human safety are particularly important, given both the difficulty of determining future costs and the likely gap between corporate and social (or governmental) discount rates. If corporations are currently making decisions that could save lives in the future, they will underinvest (from society's perspective) in lifesaving options because their discount rate is too high. If corporations are currently making decisions that will cost lives in the future, they will take less care and fewer precautions (from society's perspective) because their discount rate is too high.

Without addressing the differences between the social discount rate and corporate discount rate, the benefits to human life that corporations could create and the costs to human life that corporations

could impose will forever be undervalued. Such undervaluation will have profound effects on matters as disparate as medical advancement, consumer safety, employee well-being, climate change, and resource use. Moreover, any discussion of ESG initiatives will be significantly incomplete without attentiveness to the difference in discount rates (Bergman et al. 2020).

Discounted externalities thus raise numerous policy concerns. Should we impose taxes or regulations based on the differences between corporate discount rates and social discount rates? Should we incentivize companies to use lower discount rates in assessing actions, such as airplane design, that pose future risks? Might regulation or corporate governance changes play a role in internalizing the additional externalities that arise from discounting?

In addition, might the Coasian insight that externalities can be the source of bargaining between parties also hold for discount rate externalities (Coase 1960, 15)? Does the difference between public and private discount rates offer opportunities for arbitrage between those parties? Such arbitrage, if properly managed, might benefit both private parties and society as a whole, both now and in the future.

Part II describes the problem of externalities generally, the typical regulatory tools used to address them, and the difficulty of their valuation.

Part III describes the discounting and present value challenges faced by regulators, corporate executives, and other key decision-makers.

Part IV is the heart of our novel contribution, the introduction to the concept of "discounted externalities." It presents our argument that private and public discount rates are likely to differ and describes the impact of this difference. We assess private, government, and social discount rates, how they are calculated, what they mean, and how they might be used. We argue here that the best way to conceptualize these differences in discount rates is as second-order externalities. Part V assesses possible policy options. In particular, we consider situations in which bargaining among parties across long-term time horizons is unlikely to lead to optimal contracting solutions, so that regulatory intervention can be beneficial. We give some examples of substantive areas where there are opportunities for time-horizon arbitrage.

II. The Problems of Externalities and Their Valuation

As noted above, the term "externalities" refers to the costs and benefits of an actor's decisions that are not borne by the actor (Unerman et al. 2018, 497). Whether the actor is a natural person, government entity, or business corporation, costs and benefits that are not felt by the decision-maker will be underconsidered by that decision-maker (Boudreaux and Meiners 2019, 1). External benefits will be underproduced from a social perspective, and external costs will be overproduced (ibid. at 23–24).

That is why externalities have long been considered a common rationale for social and regulatory policy, especially when Coasian negotiation and arbitrage is impossible or costly (Boudreaux and Meiners 2019, 20). The tort system, for example, operates to cause private actors to internalize the potential costs of negligent behavior (Mattiacci 2009). Fines and taxes on costly behavior incentivizes payers of those fines and taxes to measure more carefully the costs of their behavior (Pigou 1932).

Public subsidies are often used to encourage private actors to make investments that will spin off positive social benefits (ibid.). Sometimes, externalities are managed by command-and-control regulation—car companies are required to install airbags, and polluters are prohibited from releasing certain effluents into the water supply.[4] In general, the response to externalities has been one of these possibilities: the taxing or penalization of negative externalities, the subsidy of positive externalities, or the regulation of both. Each is imperfect but workable depending on the situation.

Depending on the relevant decision-maker, the public policy options vary. Sometimes, ex ante regulation—a permitting system for new real estate developments, for example—is appropriate (Bhagwat 1999, 1317). Sometimes, ex post settling up—through tort judgments, civil fines, or criminal liability, for example—is the mechanism best tailored to satisfy regulatory goals.[5] Sometimes norms are more capable than hard law (Posner 1997; Gadinis and Miazad 2020). Sometimes the best policy incentive is a subsidy or tax. Sometimes the best policy is to allow for and streamline arbitrage possibilities between parties—carbon trading is an example (Adrian et al. 2022).

Another difficulty with externalities is valuation. Some of the difficulty is profound, even philosophical. What is harm? What is benefit? The entire project of regulatory response to externalities depends on a shared understanding of what constitutes harm or benefit, but these definitions are contested in many situations. Is the extinction of a small, insignificant fish a harm that counts? *Tenn. Valley Auth. v. Hill*, 437 U.S. 153 (1978). How about the extinction of a koala (Hill 2022)? Is aesthetic harm a cost that matters, say, when a forest is cut down for a ski resort? *Sierra Club v. Morton*, 405 U.S. 727, 734 (1972). Is the loss of personal freedom experienced by those required to get vaccinated a harm that should be measured in the public health calculus of vaccine mandates? *Nat'l Fed'n of Indep. Bus. v. Dep't of Lab.*, 142 S. Ct. 661 (2022). Is the discomfort experienced by bigots when they see a same-sex couple a harm that counts? The answers to these questions necessarily depend on a set of contested assumptions about what is and is not a harm.

Fortunately, where the understanding of harm and benefit is at its most secure is around the value of human life. A broad social consensus exists to value life; we want to avoid its loss and incentivize its preservation. The loss of lives is a harm; the saving of lives is a benefit.

But even here, the question of valuation is complicated (Viscusi and Aldy 2003, 5). While the value of each individualized human life may be priceless, people do not always act as if it is. People smoke cigarettes, eat french fries, or free solo climb El Capitan even when they know the risks involved. The risks are, to some, worth the benefit of the activity. We do not take infinite precautions to protect even our own children—we put them inside automobiles to transport them to Grandma's, and we allow them an occasional hot dog. We accept the possibility of death and even act in ways to increase its probability. A potentially longer life expectancy is not worth the costs of infinite precautions or the limits imposed by them.

It is one thing to make one's own risk/reward trade-offs. It is another to make such decisions for others within regulatory policy, institutional decision-making, or corporate priority setting. In these

[4] *Motor Vehicles Mfrs. Ass'n of the U.S. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29 (1983); *E. I. du Pont de Nemours & Co. v. Train*, 430 U.S. 112 (1977).

[5] See, for example, Hanson and Logue (1998, 1349) (arguing that "the best regulatory response to [cigarette] market failures is generally to rely as little as possible on command-and-control regulation and to adopt some form of victim-initiated ex post incentive-based regulation, such as enterprise liability or smokers' compensation").

settings a third-party decision-maker—a regulator, college administrator, or chief operations officer, for example—decides whether to impose a precaution on one party to reduce the probability of death or injury to another party. Such decision-makers must weigh the benefits of safety precautions against their costs (Office of Management and Budget 2003). Often, these calculations are seat-of-the-pants judgments. Other times more precise calibrations of costs versus benefit will be necessary. And for the calculations to be correct, the balance must include a chosen—even if implicitly so—value for a saved or expended life.

Consider, for example, the question of whether the Environmental Protection Agency should impose new controls on carbon emissions that will save one hundred lives if such controls will cost $10 billion economy-wide. A conscientious regulator can make that decision only if she is able to place a monetary value in the equation for the value of a life. We know from our own experience that a life is not worth an infinite amount. But a life is worth considerably more than zero. The decision to move forward with the regulation will depend on what figure is used.

It might seem distasteful to place a numerical limit on the value of life. But there is no avoiding this necessity in a variety of contexts, including tort judgments, insurance actuarial tables, and regulatory cost-benefit analyses. Indeed, current regulatory and tort approaches require such estimates (Posner and Sunstein 2005, 539–52; Sunstein 2014, 85). Regulatory agencies have been required to engage in cost-benefit analysis since 1981, Exec. Order No. 12291, 46 Fed. Reg. 13193 (Feb. 17, 1981), and tort liability statutes have long provided for damages for wrongful death (Posner and Sunstein 2005, 543–49). These analyses specify a range for the financial value of a human life. They are by nature incomplete and even obtuse. But there is no way to perform a host of regulatory, economic, and legal calculations without some placeholder for a life's value.

Economists have been working for several decades to develop a valuation of human life that is sufficiently accurate to be useful. There is extensive, and controversial (Ackerman and Heinzerling 2002, 1556), literature in economics devoted to assessing the value of human life, with various mechanisms and ways to calculate it (ibid. at 1556; Thaler and Rosen 1976, 265–302; Posner and Sunstein 2005, 537; Viscusi and Aldy 2003). There is no one value; if we take into account individuals' own behaviors, some people value their lives less or more than others. In fact, some lives are widely considered to be worth more than others—it makes sense for a regulator or jury to value a child's life more than that of a middle-aged professor. Life values are thus variable and frequently unpredictable (Adler and Posner 2000, 1142–46). Nevertheless, the valuations continue, and must.

The value of a statistical life is usually estimated in one of two ways. First, researchers survey people and ask them "stated preferences" questions that indicate how much they value a life (Viscusi 1992). Second, researchers calculate "revealed preferences" based on data regarding people's decisions to engage in risky activities. Examples of "revealed preferences" include differences in wages for jobs (for example, coal mining) that have relatively high pay but also higher safety risks, or differences in traffic fatalities given increased risk, such as driving conditions, distances, and speeds. [6] Both

[6] For example, in 1987, the federal government gave states the opportunity to choose a speed limit for rural interstate highways that was higher than the uniform national maximum speed limit; most states with rural interstate highways adopted 65 mph speed limits, while a few retained 55 mph speed limits. These differences enabled researchers to test drivers' apparent trade-offs between speed and risk, based on the assumption that driving faster saved time and made people better off (Ashenfelter 2006, 16–22).

approaches are based on the idea that people will accept some increase in the probability of death in exchange for an increase in well-being or wealth.

In other words, researchers assume that the change in wealth required to engage in a risky activity is roughly equal to the increased probability of death from the activity multiplied by the value of life. (Equivalently, the value of life is assumed to be roughly equal to the change in wealth divided by the change in the probability of death.) Thus, stated preferences studies ask subjects how much of an increase in wealth they would require to engage in a risky activity, and revealed preferences studies examine how much of an increase in wealth people actually require (Chestnut et al. 2012). Both approaches result in a range of value estimates of human life. Depending on the assumptions, these approaches tend to calculate the value of a statistical life to be in the range of $9–10 million per life (Hutson 2013).[7]

For our purposes, we can be agnostic as to how precise these estimates are. We need only note that the estimated value of a human life is significant and relatively stable. Researchers provide us a rough estimate—$10 million per statistical life—to plug into calculations about how corporate actors, making decisions in the current time period, will value or undervalue the impact of their decisions on human life in the future. We will return to that issue in Part IV. First, a few words in general about the difficulties of making decisions about the future.

III. The Problems of the Future—Uncertainty, Motivation, Discounting

Another ubiquitous puzzle for regulators, scholars, and economists is the problem of the future. Humans naturally prioritize the present; future benefits and costs are variable, difficult to foresee, and often ignored even when certain (Dhami and Sunstein 2022, 69–76). Individuals smoke cigarettes, overeat, and fail to purchase health insurance. Corporate managers make decisions that impose long-term costs on their companies to nudge up current returns.[8] Public officials push through short-term tax cuts instead of investing in infrastructure or in solutions to climate change.[9]

The future is a problem even when one is not enjoying guilty pleasures with future costs but rather balancing current goods with future goods. For a parent, it can be the choice between paying for a family vacation now or saving for college. For a scholar, the choice can be between preparing for tomorrow's class or writing a few more words in the book that will be published in two years. For the corporate executive, it is the choice between using current cash to give employee bonuses or to invest in the research of new products or innovations. For a public regulator, it can be the choice between improving roads now or investing in infrastructure projects that will reduce carbon emissions a decade hence. For a landowner, it can be whether to cut trees to expand a field for livestock or to preserve a forest for a future generation.

[7] For example, some recent estimates were $9.7 million by the Environment Protection Agency in 2013, $9.4 million by the Department of Transportation in 2014, and $9.3 million by the Food and Drug Administration in 2015 (McGinty 2016). There are complications one could add to the calculations—for example, some policymakers frame the analysis in terms of quality-adjusted life years, or QALYs, to try to avoid some of the difficulties associated with differences in life expectancies and life quality (see Ryen and Svensson 2015).

[8] For instance, a recent study shows that, over the past three decades, investors are increasingly discounting US firms' future cash flows, indicating a prioritization the short term over the long term (Sampson and Shi 220).

[9] For an example, see Tax Cuts and Jobs Act, Pub. L. No. 115-97, 131 Stat. 2054 (2017).

Human beings are notoriously flawed in evaluating the future. We over- and underestimate risks. We miscalculate payoffs. We engage in wishful and overly optimistic thinking. We make decisions without adequate information.

Among the difficulties the future presents to human decision-makers are uncertainty, motivation, and discounting. We next consider each in turn.

A. Uncertainty

By its very nature, the future is uncertain. Economists typically assume that future outcomes in a financial or economic calculation will have some relation to the present value of the thing calculated (Brealey and Myers 2003, 14). But that relation is often unclear and variable. The closer the future moment is to the present, we can safely assume less variability. The further into the future, the variability increases. Tomorrow, you are likely to look quite similar to how you look today. But give it ten years, or fifty. The same is true for less mundane matters. The variability that regulators or executives must account for in their decision-making about public policy or corporate strategy becomes massive as the time horizon recedes (O'Mahony 2021, 7).

Notice that this is a different kind of uncertainty than exists with present-day probability calculations. The uncertainty of present time calculations arises from a variability of outcomes (United States Environmental Protection Agency 2022). A spin of a roulette wheel has an unpredictable outcome because of the number of possible slots in which the ball can come to a rest. This kind of unpredictability *reduces* over time. The more spins of the roulette wheel, the more the actual results trend toward their actuarial likelihood. If you flip a coin twice, there is a good chance that you will get the same outcome on both flips. But if you flip it a thousand times, the outcomes will trend toward 500/500. The variability decreases (Engländer and Volkov 2018).

This is the same reason why financial advisers use diversification to design a stock portfolio for long-term success. With diversification, the longer term is less variable than the short term, because the results will trend toward the actuarial mean. When uncertainty is a function of present-day variability of outcomes, and that variability is predictable, a longer time horizon can reduce uncertainty. The actual bell curve of outcomes matches with the predicted bell curve of outcomes.

In other ways, however, a longer time horizon increases uncertainty. When the variability of outcomes is uncertain or unknowable, or if a future outcome depends on a series of contingent events rather than independent events, a longer time horizon will expand the possible outcomes. The further in the future, the more individuals are involved in making more decisions. The ultimate outcome becomes contingent on an increasing number of subsidiary outcomes. The bell curve expands (O'Mahony 2021, 4–5).

In a number of ways, corporate decision-makers have an advantage with regard to the uncertainty problem. They are less likely to engage in obviously flawed probability judgments arising out of psychological, cognitive, behavioral, or heuristic habits because their financial interests are dominant and they have the incentives, resources, and capacity to make decisions about the future in a more rational manner than individuals (Bainbridge 2022, 23; Pi et al. 2014, 143; Baron et al. 1988; Greenfield 2014, 518). Moreover, the larger the corporation the greater the number of decisions made, and the more likely the actual returns from decisions will trend toward their expected value (Engländer and

Volkov 2018). A large, diversified corporation is its own diversified portfolio, with its decisions producing a set of outcomes closer to the expected trend line than is the case with individuals.

B. Motivation

Two motivational problems arise when attempting to incentivize decision-makers in the present to value future costs and benefits. The first is institutional and the second is individual. How are institutions encouraged to value the future? And how are individuals within those institutions encouraged to value the future?

These two problems have different implications depending on whether one considers public actors such as regulatory agencies or private actors such as corporations and other businesses. In the public sector, one can reasonably presume that the motivation of the entity itself is less of a problem. The fact that the institution is ostensibly dedicated to the public good frees it to consider the long-term implications of present-day decisions on long-term public interest. There is no short-term profit motive or need to maximize shareholder returns in the short term (Friedman 1970). The long term can thus be more easily and explicitly considered and weighed.

That is not to say that a public institution is neutral between long-term gains and short-term gains. In the political push and pull necessary to secure funding, short-term gains may be more helpful in winning continued budgetary support for an institution. And institutional reputation may turn more on short-term successes than on long-term successes. Even so, these short-term pressures are likely less salient than they are in private, for-profit institutions.

The difficulty in government institutions is how to incentivize their individual human actors to act in a way that is consistent with future benefits and costs. It is quite difficult to use monetary incentives to encourage public servants to consider the future costs and benefits of their present-day actions; a sense of public service and altruism will typically be the best motivational tool. Such is not immaterial. But a sense of public service alone is not as robust a motivational tool as a sense of public service turbocharged with financial incentives.

Here again, then, actors within corporate institutions may have an advantage. To be sure, compared to individuals within public institutions, it is less likely that corporate actors will make decisions with the public interest—much less *future* public interest—in the forefront of their minds.[10] Having said that, provided that the corporate entity itself can internalize the benefits it creates in the future it can devise ways to monetize those benefits for individual decision-makers. It can do so by way of compensation mechanisms that track corporate performance. Future benefits can simply be discounted to present value and monetized by way of salary incentives, stock options, or other financial tools. The same is true with regard to future costs. This process will not be perfect because of the problem of uncertainty discussed above. But this mechanism exists in a corporate setting, and does not exist in a public institution setting.

In comparison to the problem of public actors personalizing the external benefits or costs of the future, corporate actors stand in an advantageous position. To the extent that a corporate entity can internalize the external benefits or costs, it is easier for those corporate entities to monetize and share

[10] See, for example, Gantler v. Stephens, 965 A.2d 695, 706 (Del. 2009) (holding that "enhancing the corporation's long term share value" is a "distinctively corporate concern").

those benefits or costs with the responsible individual actors. Responsible actors can receive stock options or other contingent income streams that bring the interests of the individual actors into closer alignment with those of the corporate entity, compared to individuals within a public institution.

C. Discounting

We now turn to the problem of discounting. Even when future benefits and costs are calculated correctly (or nearly so), and even when they are internalized by the decision-maker, future costs and benefits are discounted in comparison to current costs and benefits. This is in one respect a behavioral and psychological problem—the future is abstract and the present is concrete. I am hungry now; I want to spend now; I enjoy my SUV now; I want my tax break now. We leave for the future the problems of obesity, credit card debt, global warming, and decaying infrastructure.

But the problem of the future is also a financial problem. A rational economic actor will discount future gains and costs because of the operation of financial markets. A $10 million gain in ten years—even if certain—is not worth $10 million now. Because of financial interest on money and investment gains, one can invest something less than $10 million now and expect to end up with $10 million in ten years. At a 1 percent interest rate, for example, you could invest approximately $9 million now and have $10 million in a decade.[11] If you can expect to earn 7 percent on your money, you would only have to invest about $5 million now to end up with $10 million in a decade.[12] A rational economic actor, then, expecting to earn 7 percent on their money, would prefer a $6 million payment now to a $10 million payment in ten years. The same rational actor expecting to earn 1 percent on their money would prefer the $10 million payment in ten years to any present payment less than $9 million.

The same is true for costs. A rational economic actor, facing a 7 percent interest rate, would pay up to $5 million to avoid a $10 million loss in a decade. If they have to pay any more than $5 million of current funds to avoid that future cost, they would instead be better off investing current funds at 7 percent and ending up with more than $10 million in ten years. They could then pay off the $10 million loss and pocket the remainder. A rational actor who could expect only a 1 percent return on their money would be willing to pay up to $9 million in current funds to avoid a $10 million loss in the future.

This difference between a future gain or loss and its present value is known as the discount rate. It is a financial truism that the *higher* the discount rate, the *less* future costs and benefits matter in the present. The *lower* the discount rate, the *more* future costs and benefits matter.

When rational actors make decisions about the future, they calculate the present value of future costs and benefits. The future costs and benefits have to be discounted to present value for these decisions to be made. The higher the discount rate, the less the future matters in making current decisions. The lower the rate, the more the future matters. The lower the rate, the further into the future one's time horizon stretches. The higher the discount rate, the shorter one's time horizon is.

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[11] Present value can be calculated using the formula: $PV = FV/(1+r)^n$ where FV represents the future value, r represents periodic rate of return, and n represents the length of the period. The present value of $10 million in ten years with a 1 percent interest rate is $9,052,869.55.

[12] The exact value is $5,083,492.92, using the formula above.

The present value of future gains and losses—and thus the impact on current decisions of economically rational actors—is highly responsive to changes in the discount rate. Consider our hypothetical statistical life, valued at $10 million. At a 7 percent discount rate, the present value of the cost of that life lost in one year could be estimated as $10 million divided by 1.07, or approximately $9.35 million. The present value today of the cost of a human life lost in ten years would be $10 million divided by 1.07^{10}, or approximately $5.1 million. The present value today of the cost of a human life lost in one hundred years would be $10 million divided by 1.07^{100}, or approximately $11,500. In contrast, if the discount rate is 1 percent instead of 7 percent, the present value of that life is significantly higher. At a 1 percent discount rate, the present values for one, ten, and one hundred years of the loss of a $10 million life would be approximately $9.9 million, $9.1 million, and $3.7 million, respectively. With a higher discount rate, the present value of that life plummets over time: At a 30 percent discount rate, the present values for one, ten, and one hundred years of the loss of a $10 million life would be approximately $7.7 million, $725,000, and $0, respectively.

The variation in the valuation of future lives is not a function of altruism or lack thereof. Nor is it a function of one's ability to forgo the proverbial marshmallow (Watts et al. 2018; Shoda et al. 1990). It is a function of financial markets and the costs of capital.

Herein lies another difference between corporate actors and public actors. Public institutions are not as keenly dependent on financial markets for funding and financial gains, and the scope of potential investments by public institutions is much more constrained than it is for corporate actors. Moreover, corporate actors are driven by, and dependent on, financial returns in ways that public actors are not. Opportunity costs are thus higher, potential returns from investments are higher, and the cost of capital are higher for corporate actors than for public actors. This means that corporate actors will discount future gains and losses much more than public actors. Again, this is not a product of bad faith by corporate executives or a function of character defects of those who make decisions for the corporate entities. The divergence in discount rates is a product of the difference between the motivations of the two kinds of institutions, as filtered through financial markets.

What's more, different companies have different discount rates. This is because, in part, the effective discount rate is also affected by alternative uses for investment capital. For example, let's say a decision-maker has $1 million in cash to invest and that amount can be dedicated to a new endeavor that has a potential for windfall. The present value of those potential windfall gains now becomes the comparator for other investments. The use of that $1 million for other investments now comes with an opportunity cost of missing out on the potential windfall. In effect, the discount rate for other investments has gone up. Because financial markets impose different rates and costs on different actors, the discount rate will be different for different actors.

Consider one example for illustrative purposes: the rise in popularity of electric scooters in a number of cities across the nation. These scooters provide a fun and inexpensive way to travel around town, but they are quite dangerous both for riders and pedestrians (Zetlin 2019). Helmets are encouraged but not generally required, riders use them on the street as well as on sidewalks, and the scooters go as fast as 15 mph (Irfan 2018). Nevertheless, their popularity has been significant in major cities, including Austin, Washington, DC, and Denver (Raphelson 2018).

One of the anomalies of the scooter market is the ubiquity of start-up firms occupying a major market niche. The market initially was dominated not by mature companies but by start-ups such as Spin and Bird (Huddleston 2018). The domination of start-ups in this risky market might have been a function

of discount rates. The more mature a company, the more likely it would have a low cost of capital and thus likely would apply a relatively low discount rate in assessing future costs and benefits. Start-ups, in contrast, have higher discount rates owing to their higher effective cost of capital. The present value of future costs is lower for such entities.

The risks of injury and death arising from the use of electric scooters will thus matter less to start-ups than to more mature companies. If a company faces, say, a future tort judgment for loss of life, the present value of that tort judgment will be greater for a mature company than for a start-up. To put numbers to this: If a mature company faces a cost of capital of 7 percent, a $10 million tort judgment in five years has a present value of a little over $7 million. In contrast, some start-ups have a discount rate of 30 percent or more.[13] With a 30 percent discount rate, a $10 million loss in five years has a present value of only $2.7 million. That means that a mature company would have to earn more than $7 million in current funds to merit such a risk. A start-up would only need to earn more than $2.7 million to be willing to run that risk.

We can generalize this. The riskier the product or service, the more likely we will observe start-ups—and other companies with high discount rates—provide those goods and services.

The implications of this phenomenon include the greater likelihood that those suffering injuries or death from risky goods and services will bear the costs of their own losses without compensation. One of the reasons why start-ups have a high cost of capital and thus a high discount rate is their higher risk of failure. And another way to describe why start-ups prioritize the near term is that they know that there is a good probability that they will not survive far into the future. If they fail, those suffering (for example) a broken bone or concussion from a crash of an electric scooter will have no one from whom to recover a tort judgment. Consumers, investors, and regulators would be well advised to take these discount rate–driven differences into account.

IV. Differences in Discount Rates as Externalities

A. Differences in Discount Rates

As noted above, corporations both kill people and save lives. They fail to take precautions in ways that would save lives (by failing to correct aircraft design flaws, for example), or they produce products or services that will cost lives over time (cigarettes or opioids). They also invest in safety protections (airbags), warn users of latent defects (cancer risk of gasoline), and produce goods and services that will save lives (COVID-19 vaccines).

Governments, too, invest in safety and produce benefits that save lives over time (food purity standards or speed limits). And they also make decisions that cause injury and death (improvements in highways that increase speed, or the introduction of troops into armed conflict).

For the reasons set out above, the discount rate for government will tend to be significantly lower than the discount rate for corporate institutions. Government discount rates are determined, in part, in the market for government debt. Short-term debt reflects Federal Reserve policy. Long-term debt reflects

[13] Venture capitalists typically use discount rates in the range of 30–70 percent, and discount rates during the start-up stage of venture capital investments are commonly between 50 and 70 percent (Partnoy 2017, 409; Bhagat 2014, 94).

(1) real economic growth and the overall productive capacity of the economy, and (2) inflationary expectations.[14]

But these actual discount rates set by market and government forces can differ from social discount rates, or a "philosopher's discount rate." Indeed, from a philosophical perspective, a legitimate argument exists that the most defensible discount rate is zero. The philosopher John Rawls and the economist Frank Ramsey have argued against discounting future generations merely because of timing (Rawls 1971, 294; Ramsey 1928). Similarly, in the nonprofit foundation context, Michael Klausner has argued that financial discounting and the discounted cash flow approach cannot be justified based on philosophical principles about intergenerational comparisons of social good (Klausner 2003). Some have even argued for a negative discount rate (Fleurbaey and Zuber 2013).

These three rates—private, government, and social—are useful benchmarks to consider in assessing present value. They also indicate when arbitrage gains might be possible. In thinking through the intuition behind why social discount rates are less than private discount rates, consider matters of sustainability (Partnoy 2012, 236–38). A company that faces economic decisions related to sustainability likely will consider its own cost of capital in making decisions. This cost (or opportunity cost) of capital can be quite high, depending on various risks or the availability of other investments. A company considering, for example, shifting its auto fleet to EVs or retrofitting its facilities to use solar power might use a double-digit discount rate.

If the same project were undertaken by a federal agency, the discount rate might be mandated by statute to be 7 percent, depending on the nature of the project. The US Office of Management and Budget sets a "base rate" for discounting of 7 percent for investments and regulatory programs designed for the general public.[15] The government's discount rate, being lower than that of private actors, will mean that the government will undertake these kinds of projects more often than private actors will.

Still, from a social perspective even the government discount rate may be too high, undervaluing future generations. Even at a 7 percent discount rate, future costs and benefits dwindle significantly as the time horizon recedes: A $100 benefit in one hundred years is worth just twelve cents today. This difference matters. For example, if the Federal Emergency Management Agency's decisions about flood mitigation are based on a 7 percent rate, they are only willing to spend twelve cents today to produce each $100 in flood mitigation value in a hundred years. With a discount rate of 1 percent, that same $100 benefit would be worth $37 in today's value. If we think future generations deserve to be taken into account in flood mitigation planning, one way to do this is to force the agency to use a lower discount rate.

B. Second-Order Externalities from Differences

Because of differences in discount rates, future benefits and costs will be treated differently by corporations than by society or government, even when perfectly internalized. Even with the conservative assumption that a corporation's cost of capital and thus discount rate is 7 percent, the

[14] See, for example, Kliesen (2004) (describing long-term US government rates as reflecting both the long-run real market interest rate and long-run market-based inflationary expectations).
[15] Other parts of the government set lower rates (Partnoy 2012, 238).

present value to that corporation of a human life in ten years would be about $5 million.[16] At a government borrowing rate of 1 percent, meanwhile, the present value of that life would be about $9 million. And this difference increases as the time horizon extends.

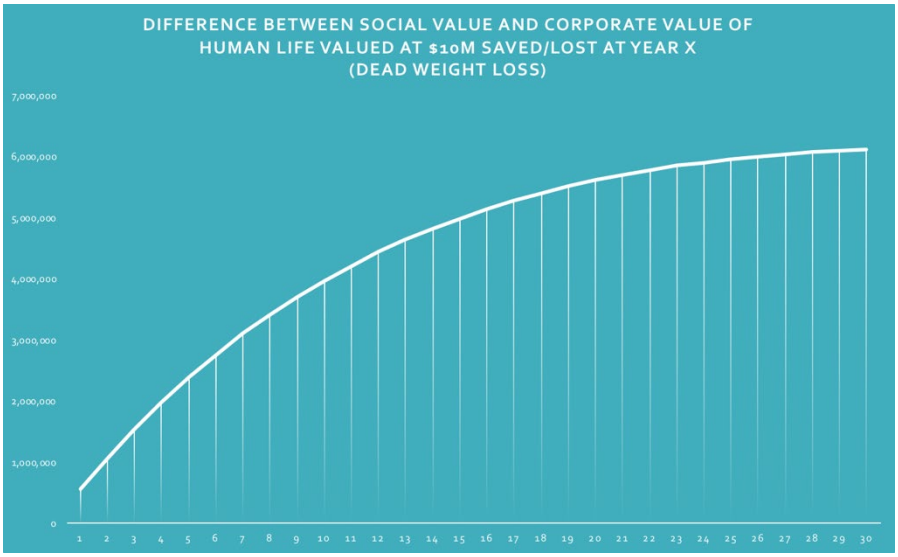
These insights are illustrated in Figure 1, appearing above. The top line is what we call the "social net present value" of a $10 million statistical life in year x. This line assumes a discount rate of 1 percent. The lower line represents the "corporate net present value" of a $10 million statistical life at year x. This line assumes a discount rate of 7 percent. It is worth remembering that both of these discount rates are likely conservative estimates—the social discount rate may be less than 1 percent and the corporate discount rate may be considerably higher than 7 percent. If so, these lines will diverge even more starkly. Even under the conservative assumptions we use here, the separation is severe.

Because of discount rate differences, society values a future life lost or saved as much more valuable than a corporation does. The corporation is much less willing to invest to save lives or take precautions to avoid their loss than society would prefer. We can think of the discount rate difference as creating a kind of second-order externality. The first-order externality is the traditional concept of costs that are not internalized by the decision-maker. But a differential between the social discount rate and the private discount rate results in a further externality, or, alternatively, a relative magnification of the first-order externality.

From society's perspective, the discount rate differentials create a deadweight economic loss that increases over time. This is illustrated in Figure 2. This line is a representation of the value of the externality region from Figure 1. Note that the difference here is measured in dollars per life saved or lost. At ten years, the deadweight loss to society caused by the difference between the social and corporate discount rates is approximately $4 million per life. This multiplies quickly at the scale of corporate decision-making. For instance, in the Boeing example from the beginning of this paper, the loss of 346 lives (each valued at $10 million) from two air crashes, ten years in the future, would be valued by the corporation at approximately $1.7 billion in present value (Leggett 2019). Society, however, would value them at approximately $3.1 billion in present value. (Remember, we do not claim that this figure represents the genuine horror of the lives lost. This is merely a figure one could use to measure the cost effectiveness of ex ante precautions.) Ex ante, society would have wanted Boeing to spend up to $3.1 billion to avoid those crashes. But at an assumed discount rate of 7 percent, the company would have been willing to spend only $1.7 billion in precautions. The $1.4 billion difference between these values is one measure of the deadweight loss to society caused by a corporate discount rate higher than the social discount rate. The $1.4 billion difference between these values is a deadweight loss to society.

[16] For the sake of the example, we assume that the corporation internalizes the entire value of that life in ten years. Such an assumption would be reasonable if, for example, the corporation would be forced to pay such an amount in a tort judgment or would receive such an amount by charging for a new lifesaving drug. In cases in which the corporation would not internalize the entire value of the life, the difference between social and private welfare would increase even more than it would due to discount-rate differentials.

Figure 2

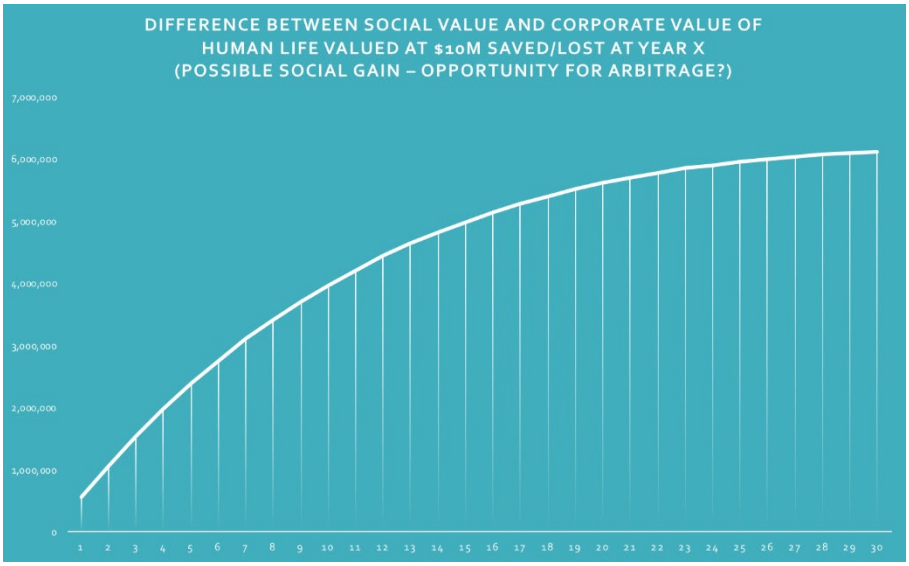


The implications of these insights may be significant, both for regulators and private actors. Once this difference is understood as an externality, the basis for regulatory attention is clear. To disincentivize future loss of life, we could consider the typical regulatory responses to negative externalities: fines, penalties, or taxes. To incentivize future life gains, we could consider the typical regulatory responses to positive externalities: subsidies or mandates.

Another possible implication of these discount rate–driven externalities is the potential for arbitrage. Let's say a corporation can make investments in the present to save a life in ten years, perhaps by developing a new health innovation or by increasing safety measures in their products or services. If a corporation values that human life at $5 million, whereas society values the life at $9 million, gains are possible by arbitrage. The government could borrow $6 million and pay that amount to the corporation to save the life. The corporation would make the investment, and the life would be saved because of the subsidy. In financial terms, the corporation would receive $6 million in value, but society would achieve $9 million in value, less than the $6 million it borrowed. The $3 million of surplus represents social gain from a subsidy. One could call the possibility of this kind of Coasian negotiation "time-horizon arbitrage."

The gap between the public and private present values is the arbitrage gap. This gap represents the potential value of social gain from regulatory attention to the discount rate externality—that is, from attention to the potential of time-horizon arbitrage. This is illustrated by Figure 3. As careful readers will notice, this is the same arc as represented by Figure 2. But instead of framing the discount rate externality as deadweight loss, it could be framed as potential gain from regulatory attention or arbitrage.

Figure 3



V. Some Implications for Law and Policy

In this part, we consider several areas in which discount rate differences present opportunities for regulation or arbitrage. In some of these areas, policymakers already have recognized the potential for benefits; for these areas, we are mostly contributing by recharacterizing the justification for extant policies. In other areas, we argue that policies should change based on a recognition of the importance of discount rates. Our point is not necessarily to dictate policies in each of these areas. Rather, we want to encourage policymakers broadly to consider discount rates more carefully in their assessments.

A. Corporate Decisions About Safety

Corporations make myriad decisions in the present that affect safety in the long term for consumers, employees, and other stakeholders. Corporations undercount potential gains from precautionary lifesaving measures because of the difference between corporate and social discount rates.

One way to address this undercounting would be to impose higher penalties in tort. Even if tort judgments force corporate actors to internalize the full (actuarial) value of lives lost, our insight should cause juries to award a discount rate "kicker" to such awards. That is because even a relatively high recovery value in the future will be discounted significantly ex ante, and such discounting should be taken into account in calibrating the appropriate ultimate judgment. Without such a kicker, a corporation expecting to pay out even the full cost of a lost life will nevertheless undercount the value of that life from a social perspective (compare Regnier and Tovey 2007, 262–63).

For example, for a corporation to fully internalize a $10 million life lost in ten years, it must suffer a present-day internalized cost of $9 million—the social value of that future life. (We are assuming proof and causation.) A present-day $9 million cost to a corporation, at a 7 percent interest rate, is $17 million in ten years. So, unless the tort judgment in ten years is $17 million, the present-day corporate decision-maker will undervalue the loss of a life ten years hence.

Another possible response to corporations undercounting future gains from safety measures is government subsidies. As explained above, this would be a kind of Coasian arbitrage. Properly calibrated, such subsidies could nudge the corporation to take precautions it otherwise would not, at a cost to the government less than the social gain derived. The proper level of calibration might be complex, and the proper amount of subsidy might be uncertain because of the range of variables to be taken into account in planning for future risks. Having said that, the difference in discount rates is among the more knowable factors in the risk equation. Both corporations and governments should be mindful of discount rate differences in negotiating the proper level of subsidy. Indeed, one could think of the "externality region" in Figure 1 above as the bargaining zone between the government and corporations (Sterk 2008, 1299).

These discount rate second-order externalities also strengthen the arguments for command-and-control regulatory initiatives with regard to safety. Regulators should recognize that the discount rate differentials will make it highly unlikely that corporations will properly account for future lives lost or saved. This is especially true if, for example, subsidies are not politically viable and tort judgments are unlikely to be adjusted upward with a discount rate "kicker" (Shavell 2007). The need for regulatory mandates is greatest when externalities are intractable. And, as we have explained, the difference between corporate and social discount rates is inherent in the nature of financial markets and corporations themselves. This further justifies the need for regulatory initiatives.

B. Climate Change and Environmental Protection

Another area where our insight about discount rate externalities should be brought to bear is environmental regulation. Externalities are the paradigmatic rationale for regulation in service of the environment, and regulators already have mapped out numerous schemes to force the internalization of externalities (Goulder and Hafstead 2018). But that is no reason to disregard the discount rate externalities. If anything, the discount rate differential is even more important here than with regard to the safety concerns discussed above. We say that for two reasons.

First, while climate change is certainly more immediate than ever, its worst impacts are still ahead of us by several decades (DiMento and Doughman 2014). Corporate discount rates will suppress the present value of those future harms quite significantly as the time horizon extends (O'Mahony 2021, 47). Rational corporations will simply not consider harms to human life (or the environment) occurring decades in the future as important components of current decision-making. To illustrate, if a corporation is making a current decision that will cost a $10 million life in fifty years (and assuming that loss is internalized to the company), the present value of that loss with a 7 percent discount rate is less than $340,000. Meanwhile, the social present value of that life lost (assuming a 1 percent discount rate) is over $6 million. The size of the externality increases dramatically over time, and corporations left to their own devices do not take climate change into account at anywhere close to the socially optimal level.

Second, regulatory options are fewer here because of the absence of the tort system to provide meaningful deterrence. Climate degradation is an existential risk to the planet, with massive consequences to human life (DiMento and Doughman 2014, 295–314). But it will be difficult if not impossible to trace those costs to discrete decisions by specific actors (Bullock, 1136–38; Saad 2023). The tort system will not be available to settle up costs, and thus no rational corporation will internalize

the present value of future tort judgments as they weigh decisions with climate impacts. And thus tort judgments with a "kicker" to account for discount rate differentials are not available as a remedy in this context in the way they may be in the safety context.

The problem of environmental and climate externalities is already massive. The need to figure out proper and effective regulatory mechanisms to arrest climate change is already pressing. Discount rate externalities make these problems even more dire, and the need even more urgent.

C. Corporate Governance

In addition to regulation, private ordering also can take into account second-order externalities and differences in discount rates. For example, an electric scooter company could explicitly address risk to human life in both decisions and oversight by explicitly addressing such risks at the board level. A safety committee might adopt policies encouraging employees to take future risk to human life seriously, even endorsing the use of a low discount rate with respect to potential future lives lost and lives saved.

To the extent corporate boards do not adopt safety protocols by explicitly considering a social discount rate, judges in corporate law cases could impose a heightened standard of scrutiny. Indeed, this is one way of viewing the recent oversight decisions of the Delaware courts, which have denied motions to dismiss several complaints against companies that have engaged in activities that pose risk to human life. *Marchand v. Barnhill*, 212 A.3d 805 (Del. 2019).

In other words, one way of reading recent *Caremark* oversight decisions in Delaware is that the courts are scrutinizing oversight failures more carefully when they involve "mission critical" oversight risks that relate to ESG issues and potential systemic harms (Armour and Gordon 2014, 67–68).[17] More specifically, several of the leading cases that have permitted *Caremark* claims to proceed have involved risks to human life; conversely, recent cases dismissing *Caremark* claims frequently have involved risks other than risks to human lives (Badawi and Partnoy 2022, 360–69). Arguably, posing a threat to human life is a useful jurisprudential distinction, one that the courts might make explicit in future cases.

For example, the Boeing 737 MAX litigation involved board oversight failures that can be characterized as discounting the risk of human life too much, and not taking the safety precautions the company might have taken if the board had assessed future risks and discounted them at the social discount rate rather than the corporate rate.[18] Of course, these cases also can be viewed as involving boards that did not adequately consider safety regardless of discount rates, but there is nevertheless an argument that if the board were to explicitly consider future risks as less discounted or undiscounted, it would take on additional safety precautions.

Understandably, many boards or managers do not want to have explicit conversations about potential future risks to human life, or the relevant discount rates, given the chance that such conversations, and related documents and testimony, could be discoverable in litigation. The risk of such discovery arguably deters directors and officers from engaging in such precautions or even discussing the

[17] *In re* Boeing Co. Derivative Litig., No. 2019-0907-MTZ, 2021 WL 4059934, at *25 (Del. Ch. Sept. 7, 2021); *In re* Caremark Int'l Inc. Derivative Litig., 698 A.2d 959 (Del. Ch. 1996).
[18] *In re Boeing*, 2021 WL 4059934, at *32–33.

possibility. One way to encourage such discussions would be "shield laws" to protect the details of corporate decision-making and oversight with respect to risk to human life from scrutiny by regulators and tort litigants, and thereby encourage boards to develop a more robust oversight framework (Partnoy 2017). The balancing exercise would be difficult from a policy perspective, particularly given that it is difficult to assess the risk to human life in advance and, accordingly, many oversight and decision-making frameworks are not very precise in measuring the effects of particular safety measures.

But there is little doubt that the difference between social and corporate discount rates should be on the minds of corporate decision-makers when faced with decisions about the future. There is also little doubt that these differences are *not* currently on the minds of corporate decision-makers. The differences should be a part of the regular discourse of decision-making. It might be considered a failure of due diligence and even the duty of care for corporate decision-makers to ignore them when they are material.[19] Moreover, once the externality range is seen as an opportunity for arbitrage, corporate decision-makers could use the externality gap as a basis to petition government regulators for subsidies.

Another possible remedy worth pondering is changes to the structure of corporate governance (Gadinis and Miazad 2020). A governance structure that takes into account the interests of a broad range of stakeholders will act as though long-term costs and benefits matter more than a governance structure that prioritizes the interests of shareholders only (Greenfield 2018, 219–22; Perrault 2015). The more the structure generally mimics the makeup of society, the more likely the discount rate assumed in corporate decisions will be that of broader society. In other words, a corporate structure that includes the views of all the company's most important stakeholders will be more likely to consider the long term. The social cost created by the differential between the corporate and social discount rates will decrease. It will not decrease to zero, since no private actor will likely value the long term as much as society does. But it is reasonable to believe that it will decrease some, because employees and other stakeholders will have a longer time frame than shareholders. Future gains will be valued more highly; future losses will be taken into account more seriously.

For these reasons, a board that accounts for the cost-benefit analyses of its stakeholders will tend to act more socially conscientious than a board that considers only the interests of shareholders. And this change will not come about because the company would be more altruistic, or even more "socially responsible" in the traditional sense (Gadinis and Miazad 2020). It will come about in part because the costs and benefits to other stakeholders will matter, which will drive down the effective discount rate of the company and cause future costs and benefits to be valued more significantly.

VI. Conclusion

Positive and negative externalities have long been an element of the analysis in assessing regulation of corporations and other business entities. Corporations, as profit-seeking entities, can impose negative externalities or disregard positive ones (Greenfield 2008c, 959; Mitchell 2001, 49–65), so regulators have derived mechanisms to incentivize corporations to take external benefits and costs into account by way of taxes, fines, mandates, and subsidies. These efforts are particularly important when aimed at encouraging corporations to take into account the impacts of their decisions on life.

[19] Compare *In re* Walt Disney Co. Derivative Litig., 907 A.2d 693, 755 n.396 (Del. Ch. 2005), *aff'd*, 906 A.2d 27 (Del. 2006).

This paper has identified another important aspect of these analyses that has been largely ignored: discount rates. Whenever costs or benefits occur in the future, even when they are accurately valued and internalized, the difference between the higher discount rate of corporations and the lower social discount rate will produce deadweight social costs. These externalities should also be taken into account in any analysis of the proper level of regulation of corporate decision-making. Moreover, our insight about discounted externalities also suggests potential opportunities for net-gain arbitrage and negotiation between regulators and corporations.

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