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Valuing future life and future lives: A framework for understanding discounting

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Abstract

This article offers a conceptual framework for separating the distinct theoretical concepts that are often confounded in discussions of discounting. Two distinctions are emphasized: (a) the difference between discounting a future outcome because it confers less utility and discounting future utility *per se*, and (b) the differences between discounting one's *own* future utility and discounting the utility of *others* who will be alive in the future. Within this framework, I discuss and clarify the continuing controversy over discounting future life and future lives.

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1. Introduction

Many personal and public decisions have consequences that extend across time. Lying in the sun confers an attractive tan in the near future but unattractive wrinkles in the distant future. Vaccination is painful and inconvenient, but prevents future disease. Using

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coal as a fuel source reduces the costs of electricity for this generation, but contributes to global climate warming that may harm future generations.

In most formal analyses, future consequences are given less weight or "discounted" relative to more immediate consequences. Typically, discounting is codified via the discounted utility model (DU), which dictates that the overall value, V, of a sequence of outcomes $(x_0, x_1, \ldots, x_t)$, equals the sum of the *discounted* utilities of each of the individual consequences, where δ^t is the discount factor applied to the utility in period t:

$$V(x_0, x_1, \ldots, x_t) = u(x_0) + \delta^1 u(x_1) + \cdots + \delta^t u(x_t) \tag{1}$$

In most applications of DU, discount rates range from 2% to 10% per year (Lyon, 1990). The choice of the discount rate is often critical. It can determine the cost-effectiveness of "Pap" smears (Eddy, 1990), hypertension treatment (Coyle & Tolley, 1992), and screening programs for gastrointestinal parasites (Anderson & Moser, 1985); the appropriate strategy for dealing with heart disease (Cretin, 1977), kidney failure (Klarman, Francis, & Rosenthal, 1968; Stange & Sumner, 1978), prostate tumors (Woodward, Boyarsky, & Barnett, 1983), and tropical pathogens (Barnum, 1987); and the appropriateness of circumcising male infants (Ganiats, Humphrey, Taras, & Kaplan, 1991), performing elective hysterectomies (Cole & Berlin, 1977), saving premature babies (Boyle, Torrance, Sinclair, & Horwood, 1983), implementing a national vaccination program for hepatitis (Krahn & Detsky, 1993), recovering helium from natural gas production (Owen, 1983), and building a national nuclear waste storage facility (Schulze, Brookshire, & Saddler, 1981).

Although the discount rate is a crucial parameter in many policy decisions, it is often assigned with little explicit justification. As Baumol (1970) comments: "Despite the critical nature of [the discount rate], in some calculations it is assigned a value almost cavalierly, with little attempt to show that the selected figure is not chosen arbitrarily and capriciously" (p. 273). Similarly, Krahn and Gafni (1993) remark: "Most analyses, including those who take great care to measure costs and consequences, pull their discount rates either out of the air or off the shelf, and the lucky number is most often 5%" (p. 415).

The lack of explicit justification for the magnitude of the discount rate reflects a more fundamental failure to identify the theoretical basis for discounting. As Goodin (1982) comments:

> Justifications [for discounting] tend ... to come in the rushed preliminaries to more detailed discussions ... We are asked to make do with brief allusions to an ill-sorted jumble of slightly different arguments having rather different bases and quite different implications (p. 54).

When justifications for discounting are offered, they often differ across analyses. Sometimes discounting is justified by appealing to concepts of investment and opportunity costs. Elsewhere, discounting is used to reflect the common assumption that people have a time preference – that they care less about future utility than current utility. In still other cases, discounting has been used to reflect uncertainty or anticipated decreases in the utility of future consumption. For distant future consequences, discounting has been used to reflect diminished empathy for future generations.

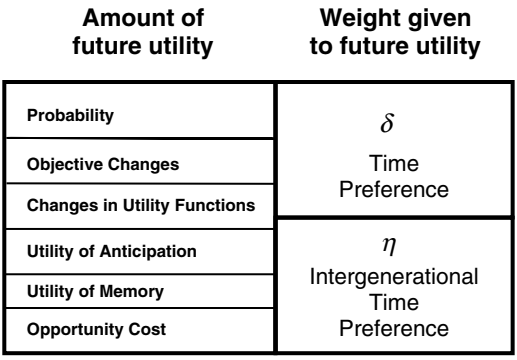

Fig. 1. Conceptual framework for organizing concepts relevant to intertemporal choice.

Fig. 1 outlines a conceptual framework for sorting out the factors that are often conflated in discussions about discounting.[1] The left side lists six factors that may affect the expected *amount* of utility a future outcome confers: (1) its probability, (2) changes in the objective consequence itself, (3) changes in utility functions, (4) utility from anticipation, (5) utility from memory, and (6) opportunity costs. These factors must be distinguished from *time preference* (δ, in the upper right corner of Fig. 1) which pertains to the relative *weight* given to future utility. Strictly, the DU model expresses time preference, because the discount factor operates on utility itself. This time preference relevant to outcomes that occur later within one's own life must, however, be distinguished from an *intergenerational* time preference, which pertains to the degree of concern one has for the welfare of future individuals. There is an important difference between discounting one's *own* future utility and discounting the utility of someone else who will be alive in the future. The type of time preference pertinent to distant outcomes might be considered an empathic discount rate, representing the diminution of empathy felt for people who are more temporally remote (η in the lower right corner of Fig. 1).

Much of the debate surrounding discounting has been sustained by the tendency to confuse the distinct theoretical concepts represented in Fig. 1. Resolving these distinct concepts helps illuminate several areas of controversy, including the magnitude of the discount rate, the appropriateness of discounting all outcomes at the same rate, and the legitimacy of applying conventional discount rates to distant future outcomes.

2. Factors affecting the expected *amount* of utility a future consequence confers

2.1. Probability

The passage of time may reduce the probability that a future consequence will actually occur. For example, the government may collapse before your bond matures, you may die

[1] I will use the term *discounting* broadly to encompass *any* reason for caring less (or more) about a future consequence, including factors that affect the *amount* of utility of a future consequence and *time preference* (preference for immediate utility over delayed utility, or vice versa). Broome (1995) also discusses this distinction, and notes that some of the controversy about discounting results from differences in how the term is used.

before getting a chance to cash it in, and so on. Similarly, when calculating the number of expected cancers caused by a future radiation spill, it seems reasonable to account for the possibility that scientists will have a cure by then, or even to incorporate the possibility that civilization will already have been destroyed by an asteroid before the radiation spill occurs. However, for distant future consequences, discounting at conventional rates implies either an unrealistic optimism about the promise of future technological fixes or pessimism about the likelihood of future extinction. Since the discounted utility model has no explicit term to account for such changes in probability, this must be represented separately.

2.2. Quality, magnitude, and duration

The passage of time may affect the quality or magnitude of a consequence. For example, a bottle of wine may taste better or worse when consumed later because of chemical reactions occurring within it, and atomic decay may reduce the radioactivity of a barrel of nuclear waste, such that a future spill would be less deadly. The timing of a consequence may also determine its duration. For example, if the sale of Viagra was delayed for 5 years, impotent men would have experienced 5 fewer years of benefits and if global climate warming can be postponed, fewer generations would suffer its effects.

2.3. Changing utility functions

The *subjective* value of a given *objective* consequence may change over time. On a short time scale, the pleasure derived from a unit of "consumption" depends on the levels of recent consumption. It is better to eat when hungry, drink when thirsty, and have sex when amorous. On a longer time scale, tastes change as we age – eating cotton candy, getting muddy, and being tickled become less pleasurable, while listening to classical music and gardening become more so. Anticipated changes in the utility of a consequence provides an obvious reason for caring when it occurs, because, ceteris paribus, people will prefer experiencing something when it will be most enjoyed.

Anticipated increases in wealth are sometimes offered as a rationale for discounting future rewards, because a change in consumption levels is presumed to affect wealthier people less. For example, the Intergovernmental Panel on Climate Change (Houghton, Jenkins, & Ephraums, 1990) recommended a social discount rate of 2.4% per year, based on estimates that GNP would grow by 1.6% per year and that each 1% increase in GNP reduces the marginal utility of consumption by 1.5%. The presumption that the utility (or disutility) of a consequence depends on wealth is questionable. Why, for example, would the extinction of the polar bear be assumed to affect wealthier people less?

2.4. Utility from anticipation

People often derive utility from anticipating good things and disutility from anticipating bad things. Thus, delaying a good thing may increase the utility it confers by prolonging the period of pleasurable anticipation. Conversely, getting bad things over with quickly can reduce the period of dread (Loewenstein, 1987; Elster & Loewenstein, 1992).

However, when considering outcomes that extend beyond one's own lifetime, it is not generally reasonable to invoke utility from anticipation. One may derive vicarious pleasure

from imagining benefits that will be enjoyed by others in the future, but it does not follow that one would derive more anticipatory utility from a benefit delayed by 200 years than from one delayed by 100 years, because one will not be alive to reap any utility during those additional 100 years.

2.5. Utility from memory

People also derive utility from remembering good things that occurred in the past, and disutility from looking back upon bad experiences. Utility from memory may have the opposite effect of utility from anticipation. It could motivate the desire to accelerate good things and postpone bad things, so as to increase the duration of pleasurable memories, and curtail the duration of painful ones. However, for experiences that are eventually forgotten (or which cease to affect utility when recalled), delay would not reduce the duration of the memory, and, thus, would not reduce the total utility from memory. In these cases, utility from memory would not provide a normative basis for preferring good things sooner or bad things later – unless there is a reason to count future utility differently than current utility.

2.6. Opportunity cost

Consequences that can be invested at a positive real interest rate are worth less when received later because profitable investment opportunities are foregone. When expressing the value of a future consequence in terms of this year's dollars, it is appropriate to discount, because if 1 dollar today can be exchanged for $(1+r)^t$ dollars in the future, something worth $\$X$ in the future is worth just $\$X/(1+r)^t$ today. This means that $\$X/(1+r)^t$ invested today at r percent for t years will return $\$X$. It does *not* mean that $\$X/(1+r)^t$ *of consumption* now confers the same benefit as $\$X$ worth *of consumption* in year t, or that those dated consumption levels should be considered equally attractive. As Cowen and Parfit (1992) note, "may be transformed into" should not be confused with "is as good as" (p. 153). To use their analogy, one may be able to transform a frog into a prince, but that does not mean that a frog *is* a prince, or that a frog who remains a frog is as good as a prince.

Discounting expresses the multiple of compound interest $(1+r)^t$ as a dividing factor, to give us discounted future consequences. However, it would be mathematically equivalent and conceptually clearer to express costs and benefits from a future perspective: as *undiscounted* future effects and *compounded* opportunity costs of past expenditures.

Whether expressed as a divisor or a multiplier, the legitimacy of the compounding factor $(1+r)^t$ rests on the requirement that investment actually occur. For example, the choice to forgo spending $\$X$ today to prevent $\$10X$ of damages in year t might be justified by arguing that if the $\$X$ was invested at rate r for t years, the resulting amount would cover the cost of the damages (that $\$X(1+r)^t > \$10X$). However, it is inappropriate to multiply $\$X$ by $(1+r)^t$ unless the $\$X$ will, in fact, be invested at rate r for t years. If the $\$X$ will be consumed rather than invested, the interest rate is irrelevant, and cannot be used to justify discounting.

Discounting future outcomes at the market interest rate is often controversial for outcomes such as health, where the legitimacy of the investment metaphor is unclear. For example, Stokey and Zeckhauser (1978, p. 175) consider the possibility that "ordinary discount rates are not appropriate for discounting flows that consist of intangibles such as

pain and suffering, or improved health, or especially changes in the risk of death", yet Fuchs and Zeckhauser (1987) contend that "Self-respecting economists should not ... use different [discount] rates because it is health that is being valued" (p. 265). Similarly, while many have contended that health outcomes should be discounted at rates below the market interest rate (see, e.g., Coyle & Tolley, 1992), others draw the opposite conclusion: "Most observers are reluctant to use the discount rates applied in other markets ... because of the belief that markets for health cannot be perfect, so that financial market discount rates ... would provide only a lower-bound estimate of the appropriate discount rate to apply in evaluating health policy" (Moore & Viscusi, 1990, p. 394).

To animate the issues with a concrete example, Eddy (1990) calculated that a program which triannually screened women for cervical cancer would increase life expectancy by 96 days. He then goes on to report: "After discounting [by] 5%, the increase in life expectancy is approximately 10 days" (p. 219). The legitimacy of this procedure depends on the context of the choice. If the decision is between spending money on the screening program or investing it at a real interest rate of 5%, discounting the future life years is an awkward but legitimate way of expressing the compounded opportunity cost of present expenditures. (Again, it would be clearer to simply report the undiscounted benefits – the 96 extra days of life – and then compare this value to the value of the future benefits obtainable by investing the money, and spending it later.)

However, if the decision being made is between spending money now on this screening program or spending money now on some other program, discounting is not legitimate, because, if the money is spent rather than invested, compounding will not occur. When there is no compound interest to be expressed, there is no remaining reason to discount the additional years of life at the market interest rate.[2] Indeed, it would then make no more sense to discount these future life years than it would to report that the life expectancy in the US is "really" only 19 years – that it is reported to be 75 years only because people forget to discount future life years by 5% per year. The women whose lives are extended by the prevention of cervical cancer will fully live the additional days of their life, not some discounted version of them.

Discounting at the market interest rate is also controversial for long-term outcomes. Although most analysts accept the common practice of discounting near-term outcomes at market interest rates, many feel uncomfortable when such discounting is applied to very distant outcomes. For example, many balk at the implication that it is not worth spending $1 today to prevent $1 billion dollars of damages 425 years from now, which a 5% discount rate implies. As Cline (1992, pp. 235–236) notes, many reject the practice of discounting dis-

[2] Similarly, discounting for opportunity costs is also inappropriate if one is comparing outcomes that cannot be invested. For example, although money can be invested and (perhaps) be used to save future lives, a life itself cannot be "invested" to offset or negate lives lost in the future. Consider the following thought experiment: Two asteroids are threatening to collide with earth. The smaller asteroid is projected to collide with earth in 10 years, killing a few hundred people. The larger asteroid is projected to collide with earth in 1000 years, killing a few billion people. NASA can blow up one of the asteroids, but not both. If future deaths were discounted at the market interest rate, blowing up the small asteroid may be judged to be more worthwhile. However, defending that choice with an opportunity cost argument requires an account of how the people who are saved from the smaller asteroid can be "invested" to compensate for the much larger loss of life that will later occur when the larger asteroid collides. It is difficult to understand how that would work. (The people who are saved by preventing the impact of the small asteroid could, through reproduction, create more people, but it would be strange to interpret this as *compensation* for the later loss of life.)

tant future consequences with the following argument: (1) Distant future consequences are important. (2) If discounted at conventional rates, distant future consequences are not important. (3) Therefore, discounting distant consequences at conventional rates is wrong.

Though the conclusions of this argument seem correct, its second premise is false (or at least ambiguous). Discounting future consequences at the market interest rate does not mean that future consequences are considered less *important*. Rather, such discounting is merely a way to account for the enormous future opportunity costs of current expenditures (by expressing them as a dividing factor, as discussed above). However, the legitimacy of discounting distant future consequences at the market interest rate does rest on two strong assumptions: that the interest rate will remain equally high throughout this period, and that intermediate generations will continue to invest the money (Cline, 1999).

Cowen and Parfit (1992) argue that opportunity costs may not provide an *independent* reason for discounting, when viewed from the perspective of society as a whole. On their view, the opportunity costs of consumption are determined by the marginal return to capital, which, in turn, depends on investment levels, which depend upon how highly future benefits are weighted. If society as a whole valued all future periods equally, it would continue to invest until the rate of return on those investments (and, thus, the opportunity cost) was driven to zero. Thus, they argue that the social discount rate cannot be justified by appealing to opportunity costs – that opportunity costs are the *result* of valuing future outcomes less, not a *reason* for doing so.

3. Time preference (discounting future *utility*)

The previous sections outlined six factors that may affect the expected *amount* of utility a future consequence confers. Each consideration could be explicitly represented in models of intertemporal choice – by including a probability term to account for uncertainty, by permitting the utility of consumption to depend on time, by including arguments in the utility function for anticipation and memory, and so on. However, none of the considerations discussed thus far justifies the type of discounting expressed in the discounted utility model (DU), which dictates that future *utility* should be discounted – that pleasure or pain occurring in the more distant future ought to receive less consideration than pleasure or pain in the nearer future, *even* if it is equally certain and equally intense when experienced.[3]

Many believe that discounting utility is irrational (see, e.g., Broome, 1991; Elster, 1986; Jevons, 1871; Lewis, 1946; Pigou, 1920; Ramsey, 1928; Rawls, 1971; Sidgwick, 1874/1930) attributing it to a *cognitive illusion* (which causes people to see future pleasures or pain in some diminished form) or to a *weakness of will* (which causes people to choose options against their better judgment). These critics argue that one should want their life, *as a whole*, to go as well as possible, and that counting some parts of life more than others

[3] Kahneman and Snell (1990) introduced the term *decision utility* to refer to the weight that a consequence receives in choice and the term *experienced utility* to refer to the actual hedonic quality of experience – the goodness or badness of a consequence. DU dictates that the *decision utility* accorded to a given amount of anticipated *experienced utility* diminishes as the experienced utility is increasingly delayed. Though the distinction between decision utility and experienced utility is largely ignored in modern economic literature (see Kahneman, Wakker, & Sarin, 1997, for a discussion), the concepts can be recognized in earlier discussions of intertemporal choice. For example, Bohm-Bawerk (1888/1959) writes: "We accord to goods which are intended to serve future ends a value which falls short of the true intensity of their future marginal utility" (p. 253).

interferes with this goal. By this view, it is irrational to prefer a smaller immediate pleasure over a greater future pleasure (or a greater future pain over a smaller immediate pain), because now and later are equally parts of one life, and choosing the smaller good or the greater bad makes one's life, as a whole, worse. As Rawls (1971) comments:

> Rationality requires an impartial concern for all parts of our life. The mere difference of location in time, of something's being earlier or later, is not a rational ground for having more or less regard for it (p. 293).

Even economists, who are typically reluctant to dispute the rationality of individual preferences, sometimes question whether discounting future utility is compatible with rationality. For example, Becker and Murphy (1988) ponder:

> Although fully myopic behavior is formally consistent with our definition of rational behavior, should someone who entirely or largely neglects future consequences of his actions be called rational? (p. 684)

The widespread belief that rationality entails temporal neutrality has, however, been challenged by some contemporary philosophers (see, e.g., Parfit, 1971, 1984; Zemach, 1978, 1987). These philosophers deny the conventional assumption that there is any enduring, irreducible entity over time to whom all future utility can be ascribed; they deny that all parts of one's future are *equally* parts of oneself. They argue, instead, that a person is a succession of overlapping selves related to varying degrees by memories, physical continuities, and similarities of character and interests, etc. By this view, it may be just as rational to discount one's "own" future utility, as to discount the utility of another distinct individual, because the distinctions between the stages of one's life may be as "deep" as the distinctions between individuals.

To illustrate this argument with an extreme example, consider the plight of Seth Brundle, the main character in the 1986 movie *The Fly*. In a scientific experiment gone awry, Seth becomes genetically fused with a housefly and gradually metamorphoses into "Brundlefly" (a human-fly hybrid). Under these exceptional circumstances, it seems clearly rational for Seth to discount "his" future utility – to give less weight (perhaps no weight at all) to the future utility of Brundlefly. This example compels the conclusion that *some* predicted changes *would* justify diminished concern for one's future utility, and lends credibility to the contention that it can be rational to discount future utility. However, it remains unclear exactly which types of changes ought to affect future concern, and what degree of discounting might be justified in more conventional situations.

Differing views about the rationality of time preference often prompt a debate about whether the social discount rate ought to reflect individual time preferences. Some believe that it should. For example, Eckstein (1957) states: "A social welfare function based on consumers' sovereignty must accept people's tastes including their intertemporal preferences" (p. 75). However, Bentham (1789) had argued that the government ought, at least, inform people of the negative consequences of their time preferences: "A government which does not strive against such [intertemporal] prejudices is wrong in suffering the people, for want of some instruction, which ought to be and might be given to them, to quarrel with their own interest" (pp. 187–188). Others take a more strongly paternalistic view. For example, Goodin (1982) contends: "There is no more reason that public policy should reflect people's inability to weight time neutrally than that it should reflect people's incapacity to think rationally about large numbers or perform fancy arithmetic" (pp. 54–55).

If one decides that the social discount rate should reflect individual time preference (either because one believes that time preference is rational or because one believes that the government ought to respect individuals' preferences, whether they are rational or not), it is unclear what rate should be used, because the descriptive research in this area offers little guidance. Over the last two decades, psychologists and economists have conducted dozens of empirical studies attempting to estimate individual's implicit discount rates. The implicit discount rates in these studies are spectacularly variable, ranging from negative to several thousand percent per year (see Frederick, Loewenstein, & O'Donoghue, 2002). Moreover, researchers are often agnostic as to what, exactly, the implicit discount rates imply – whether they reflect time preference, or some of the other considerations discussed in Section 1 (e.g., uncertainty, expectations of greater future wealth, or the perception of opportunity costs) or both. The descriptive studies rarely attempt to isolate or assess the relative effects of these different considerations (see Frederick et al., 2002).

4. Intergenerational time preference (discounting the future utility of *others*)

When evaluating outcomes that affect people who are not yet born, the concept of time preference discussed in the previous section (which refers to the degree of concern people have for their *own* future welfare) must be replaced with the concept of an *intergenerational* time preference (which refers to the degree of concern people have for the welfare of *other* people who will be alive in the future). Although these two types of time preference are often confounded, there is no close connection between them.[4] One person may weight their *own* future utility the same whether it occurs in the near or distant future, but have no concern about consequences that affect *others* who will be alive after they die. Someone else may discount their own future welfare heavily (e.g., by ingesting substances that bring them current pleasure but damage their future health) while being deeply concerned about the welfare of distant generations, and favoring social policies that minimize negative long-term consequences. As Schelling (1995) notes:

> Introspectively, I can find no impatience about an increment of consumption that may accrue to people whom I shall never know and who do not now exist, in the year 2150, compared with an increment closer in time, accruing to the people whom I shall never know, and who do not now exist, who might enjoy it instead in the year 2100... No kind of time preference pertinent to discounting...long-term costs and benefits...can have anything to do with [an individual's preference for immediate vs. delayed consumption] (p. 396).

When focusing on intergenerational time preferences, three issues are central: (1) How much *do* people care about future generations? (an empirical question); (2) How much *should* they care about future generations? (an ethical question); and (3) Should government policies display a concern for future generations beyond that which is expressed in the preferences of the current electorate? (a political question).

[4] The important distinction between intrapersonal time preference and intergenerational discounting is sometimes glossed over because many economic models use infinitely lived agents as a simplification for the reality of overlapping generations (though see Arrow et al., 1996; Broome, 1992; Burton, 1993; Cline, 1992; Cowen & Parfit, 1992; Fuchs & Zeckhauser, 1987; Lind, 1990; Lipscomb, 1989; Sen, 1957; Tullock, 1964).

Some have argued that the intergenerational discount rate ought to be based on the weight that the members of this generation attach to the welfare of future generations—that the government is responsible only for the welfare of the current population, and that any regard for the future derives from the degree of altruism the current electorate sanctions. Marglin (1963) expresses this view:

> I consider it axiomatic that a democratic government reflects only the preferences of the individuals who are presently members of the body politic . . . if after being made aware of future needs, present individuals remain indifferent to the claims of future individuals, then, it seems to me, a democratic view of the state does not countenance governmental intervention on [their] behalf (pp. 97–98).

Others have held that the government represents future as well as current people and ought to register their (predicted) preferences directly—that the state's responsibility to future generations extends beyond the altruism of current citizens (see e.g., Hume, 1751/1927, p. 216; Page, 1977, pp. 169–170; Pigou, 1920; Tenenbaum, 1989, p. 44). In a widely cited passage, Pigou (1920) summarizes this view:

> The state should protect the interests of the future *in some degree* against the effects of our irrational discounting and of our preference for ourselves over our descendants. It is the clear duty of Government, which is the trustee for unborn generations as well as for its present citizens, to watch over, and if need be, by legislative enactment, to defend the exhaustible natural resources of the country from rash and reckless spoliation (p. 29, italics in original).

Still others have argued that the utility of future generations must be discounted because utility maximization across generations would otherwise require excessive sacrifice from the current generation. The rationale is as follows: if the return to capital is positive into the indefinite future, and utility is increasing in consumption, then any amount of utility that the current generation sacrifices by foregoing consumption can be more than offset by greater utility gains to distant future generations. In other words, unless their utility is discounted, distant generations become "utility monsters" (Nozick, 1974) on whose behalf earlier generations must be sacrificed in the name of utility maximization. Koopmans (1967) called this result the *paradox of the indefinitely postponed splurge* (see also Arrow, 1983; Chakravarty, 1962; Solow, 1974).

Keeler and Cretin (1983) reinvented this "paradox" to allegedly prove that future health benefits must be discounted at the same rate as costs (at the market interest rate):

> . . .failure to discount benefits implies that we should always be willing to transfer resources away from present health needs to buy additional years of life for future generations . . . We conclude that *any* cost-effectiveness analysis using lower discount rates for benefits than costs is difficult to justify (pp. 305–306, italics in original).

Keeler and Cretin's argument has been widely cited in defense of the common practice of discounting future health benefits at the market interest rate. For example, the guidelines for decision and economic analyses of the Center for Disease Control (1994) state:

> An example of the inconsistencies that arise when monetary costs are discounted and nonmonetary health outcomes are not discounted is shown below. Assume that an investment of $100 today would result in saving 10 lives (or 1 life per $10 of invest-

> ment). If the $100 were invested at a 10% rate of return, then 1 year from now the $100 would be worth $110. With $110, it would be possible [to] save 11 lives. In 2 years, the $100 original investment would net $121, and it would be possible to save 12 lives. On the basis of these calculations, the returns in the future look so appealing that one might never choose to save any lives in the present! *To correct for this possible inconsistency*, both monetary and non-monetary benefits should be discounted (p. 72, my emphasis).

These objections are misplaced. There is nothing "inconsistent" about foregoing current benefits for the greater gain of future generations. There may, however, be limits to our generosity. Thus, rather than concluding that future benefits *must* be discounted, we should instead be asking how much we are willing to sacrifice to confer benefits upon future generations. If we are unwilling to do what maximization requires, we should reject maximization as a distributional principle (see Rawls, 1971, pp. 297–298). Discounting the utility of future generations is nothing but an awkward and oblique way of addressing considerations about intergenerational equity that ought to be dealt with explicitly. Moreover, discounting future utility misrepresents the preferences of those who also oppose excessive inequality across generations when future generations bear the costs. For example, suppose that some technology could substantially increase everyone's welfare for the next five generations, but at the expense of greatly decreasing the welfare of the sixth generation (because of some disastrous, but temporary, side effect). Utility maximization might dictate that this technology be adopted, *especially* if future utility is discounted. However, many would oppose this choice, because of the intergenerational inequity of its effects. When maximization and equity conflict, maximization can give way. Abandoning the dictates of maximization removes the need to introduce a discount factor as an awkward way of preventing utility maximization models from generating patently unreasonable results.

5. Conclusions

This article proposes a framework for organizing the reasons why an individual or society might discount future outcomes relative to more immediate outcomes. Two distinctions are emphasized: (1) the difference between discounting a future outcome because it confers less utility and discounting future utility *per se*, and (2) the difference between discounting one's *own* future utility and discounting the utility of *others* who will be alive in the future.

Being clear about the various bases for discounting is important, because it is difficult to evaluate the normative legitimacy of a particular discount rate, without knowing *what* that discount rate is supposed to represent. For example, in a decision about circumcision, should the future benefits (a lower risk of penile cancer) be discounted when being compared to the immediate costs (pain and possible infection)? If discounting is supposed to account for opportunity costs, it cannot be justified in this case, because relief from the pain of circumcision cannot be invested at the market interest rate and later used to compensate for future cancer. If discounting is supposed to reflect time preference (preference in favor of immediate utility over future utility), then one must ask whether there is any rational basis for such a preference – what reason is there for counting the future welfare of our child less than his more immediate welfare when making decisions on his

behalf? Without first isolating the basis for discounting, such questions may not get asked, much less answered.

The framework offered here can help to clarify the legitimacy of particular practices (such as discounting future health benefits), improve elicitation procedures, including those that attempt to measure generational weights (Cropper, Aydede, & Portney, 1992; Frederick, 2003) and refine normative models of intertemporal choice, by focusing scrutiny on the justification for the discount factor. As Sen (1982) comments:

> I do not doubt that different compromises can be reached about the relative importance attached to various considerations. But the least we should require is that attention be paid to the competing claims of these different influences and that the process of choosing discount rates... be made more reasoned and more explicit. The search has to be more than an intellectual blindman's buff (pp. 350–351).

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