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Analysis

# Zero discounting can compensate future generations for climate damage

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ABSTRACT

In cost–benefit analysis of climate policy there are two main approaches to discounting, each with implications conflicting with our moral intuitions. Thus, discounted utilitarianism implies that we hardly need to protect future generations against climate change, while classical utilitarianism implies that we should reduce our consumption across the board to benefit future generations. The insolubility of the debate derives from the fact that both classical and discounted utilitarianism permit only a single discount rate for all consequences occurring in the same future year, while our intuitions clearly do distinguish between consequences, depending on whether we cause adverse effects on other people's interests and violate their rights. Most people share the moral intuition that we ought to refrain from harming others, and ought to compensate them if we were unable to prevent harm. To regain a reflective equilibrium between such deontological intuitions and economic theory there is a need to accept different discount rates for different situations: a zero consumption discount rate in the case of cost–benefit analysis of measures to prevent wrongful harm to future generations, and standard discounting in all other cases. Applying a zero consumption discount rate means that future generations are automatically largely compensated for climate damage that remains unmitigated.



## 1. Introduction

Discounting is the procedure whereby a lower value is assigned to costs and benefits the farther in the future they occur.[1] Since the consequences of greenhouse gas emissions extend centuries to millennia into the future, the choice of discount rate in cost–benefit analysis of climate policy is of decisive importance (see e.g. Dasgupta, 2008; Nordhaus, 2007; Stern, 2006). Discounting at a typical constant rate of 6%, for example, means being willing to spend less than nine dollars today to prevent a million dollars of climate damage two hundred years hence. When standard discount rates are applied, therefore, there is hardly any climate change mitigation effort that passes a cost–benefit test. Many concur with the observation of Weitzman (1998: 201) that "to think about the distant future in terms of standard discounting is to have an uneasy intuitive feeling that something is wrong, somewhere". Unfortunately, economists have to date been unable to reconcile moral intuitions with economic theory. In September 2011 the US Environmental Protection Agency asked twelve economists central to the discounting debate[2] how the benefits and costs of regulations should be discounted for projects that affect future generations. In a recent Science article (Arrow et al., 2013) they recommend using declining discount rates as a means of accounting for the uncertainty concerning future discount rates (see e.g. Weitzman, 1998, 2001) and uncertainty in future consumption (see e.g. Gollier, 2012; Gollier et al., 2008). The proposed rates decline only slowly from around 3.5% to lower values, however. Consequently, the resultant damage estimates remain relatively low, in the order of $10–$17/tC (=$4–$5/tCO$_2$) in 1990 U.S. dollars (Freeman et al., 2013), still hardly a spur for stringent climate policy. Something remains wrong, somewhere.[3]

When theoretical considerations and moral intuitions conflict, neither is to be trusted. To restore a reflective equilibrium we need to enter into a dialectical process, as a result of which either our intuitions shift or we adapt our theory, or both (Rawls, 1971). The purpose of this article is to argue that a reflective equilibrium is restored by assuming that discount rates depend on our specific duties under the circumstances. In other words, it requires incorporating deontological elements in cost–benefit analysis (see also Caney, 2008; Davidson, 2006; Howarth, 1995; Padilla, 2002; Sen, 1982a; Spash, 1993, 1994). This shift is rather alien to mainstream economics, however, which is based on the view that normative properties depend solely on consequences. Moreover, our moral intuitions may require actual compensation for climate damage (Spash, 1994), while standard cost–benefit

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[1] Throughout this article the term discount rate will refer to the consumption discount rate unless mentioned otherwise.

[2] Kenneth J. Arrow, Christian Gollier, Ben Groom, Geoffrey M. Heal, Richard G. Newell, William D. Nordhaus, Robert S. Pindyck, William A. Pizer, Paul R. Portney, Thomas Sterner, Richard S. J. Tol, and Martin L. Weitzman. The workshop was chaired by Maureen L. Cropper.

[3] It has been suggested that present damage estimates may be too low given the uncertainty about damages and the possibility of a catastrophe (see e.g., Anthoff and Tol, 2013; Weitzman, 2009). Higher damage estimates may weaken some people's intuition that something is wrong with discounting. For others, however, the problem will remain to lie in the procedure of discounting itself.

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analysis requires only potential compensation (Hicks, 1939; Kaldor, 1939). It should be emphasized that there is no single 'right' reflective equilibrium. Reflective equilibrium is subjective and different people may therefore reach different equilibria.

The argument developed in this paper differs from earlier proposals for so-called dual-rate discounting. Earlier articles that advocate zero discounting in the case of wrongful harm to future generations (Caney, 2008; Davidson, 2006; Parfit, 1983: 36; Spash, 1993, 1994) have not discussed the relation between discounting and compensation. This article provides a discussion of how compensation can be offered in practice and an actual calculation of the results when applying alternative principles. Some have argued for different discount rates for environmental goods (or intangible effects) and other goods, to account for the expectation that the value or relative importance of the former will grow over time (see e.g. Almansa and Calatrava, 2007; Gollier, 2010; Hoel and Sterner, 2007; Krutilla and Fisher, 1975; Kula and Evans, 2011; Tol, 1994; Weikard and Zhu, 2005). However, this approach does not really apply different discount rates, but rather compensates for undervaluation of intangible effects. Hasselmann et al. (1997: 370-1) proposed a zero discount rate for climate damage costs, arguing that "future sustainable development is perceived as a non-time-degradable commitment to which one should assign a time-independent welfare value". Yang (2003) argued, however, that using different discount rates for mitigation and climate damage costs, i.e. in cost–benefit analysis of the same project, would lead to time-inconsistency. The issue of time-inconsistency would be resolved by using different discount rates for environmental impacts that are not (readily) substitutable by conventional private goods (see also Neumayer, 1999). According to Yang, dual-discounting would reflect people's willingness-to-pay for environmental projects that are only justified with very low discount rates, but he did not further investigate the scope and nature of such environmental projects.

The setup of this article is as follows. In Section 2, I first discuss the Ramsey–Cass–Koopmans model as a description of household saving behavior. In Section 3, I discuss the debate between the so-called descriptive and prescriptive approaches to discounting climate damages. In Section 4, I argue that our moral intuitions in the discounting debate are largely deontological. In Section 5, I offer a simplified example to illustrate the consequences of a zero discount rate both for consumption and compensation. Section 6 concludes.

## 2. A Description of Discounting and Saving

Central to the discount debate is the Ramsey model, a neo-classical model of economic growth (Ramsey, 1928), later extended by Cass (1965) and Koopmans (1965). Ramsey originally intended his model to answer the question of how much of its income a nation *should* save. Later, the model was also used to *describe* the actual economy, particularly to describe household saving behavior, capital accumulation and economic growth. The model assumes that households face an intertemporal optimization problem: households can choose to consume or to save the returns to capital and labor, so as to optimize utility over their lifetime. Essential in the description of the actual economy is that households do not simply maximize intertemporal utility, but prefer present over future utility. The intertemporal welfare function ($W$) is thus given by

$$W = \int_{t=0}^{\infty} u(c(t))\mathrm{e}^{-\rho t}dt \tag{1}$$

where $u(c)$ is the utility accruing from consumption, $c(t)$ is the consumption at time $t$, and $\rho$ is the pure rate of time preference. This is also called the discounted utility model (Samuelson, 1937). Utility ($u$) is usually a concave function of consumption ($c$), for the higher the level of consumption, the less additional consumption offers people additional utility. Better an additional dollar as a poor student than as a well-paid doctor. Since people generally expect to become wealthier in the future, i.e. to have higher consumption levels, this gives people a second reason besides impatience to discount future consumption compared with present consumption. The consumption discount rate *CDR* thus reads:

$$CDR = \rho + \mu\, g \tag{2}$$

where $\mu$ is the absolute value of the elasticity of marginal utility (a measure of the relative effect of a change in consumption on welfare) and $g$ the expected growth rate of consumption. Note that this so-called Ramsey equation holds only under conditions of certainty. An uncertain future can give rise to precautionary savings and consequently a lower *CDR* (see e.g. Gollier, 2010; Kimball, 1990).

In optimizing utility over time, individuals choose how to divert the returns of capital ($K$) available at time $t$. These returns, $y(K(t))$, are divided over consumption, $c(t)$, and saving, $K'(t)$:

$$y(K(t)) = c(t) + K'(t) \tag{3}$$

Because of their positive *CDR*, consumers require a reward for postponing their consumption. Producers are willing to pay this reward because capital is productive, i.e. there is a positive marginal rate of return on investment (*MRRI*). The outcome of this supply and demand for capital is a market interest rate ($i$). In a world without market failure, taxes or risks, $i$ equals both *CDR* and *MRRI*.

$$i = MRRI = CDR = \rho + \mu\, g \tag{4}$$

*MRRI* and *CDR* also determine the saving rate or marginal propensity to save (*mps*): $K'(t)/y(K(t))$. If *MRRI* > *CDR*, people will increase their savings and vice versa. A typical *mps* is in the order of 20% (see e.g. Lind, 1982; Moore et al., 2004; Pearce and Ulph, 1999; Stern, 2006: 161).

There are various approaches to estimating practical values for $i$ and *MRRI* (see e.g. Nordhaus, 2007). For example, the real return on twenty-year U.S. Treasury securities in Autumn 2013 was about one percent per year, although the average of the real interest rate on long-term Treasury securities between 1870 and 2000 is about three percent (US Department of the Treasury, 2005). The U.S. Office of Management and Budget assumes a real, pretax average return on private investments of seven percent (OMB, 2003).

## 3. The 'Prescriptive'–'Descriptive' Debate

What are the implications of the Ramsey–Cass–Koopmans model as a description of the economy for discounting climate damage in cost–benefit analysis? According to Arrow et al. (1996), there is a general agreement that when evaluating alternative policy scenarios all present and future consequences, including consequences for spending and investments, are to be converted into consumption equivalents first, then discounted against the appropriate consumption discount rate (Arrow and Kurz, 1970; Lind et al., 1982). Calculation of these different consumption paths (from the present to the indefinite future) must be consistent with a description of the actual economy, in terms of actual household saving rates and marginal rates of return on investment, for example. There is a disagreement, however, as to what consumption discount rate is appropriate for comparing the resulting consumption paths. Arrow et al. (1996) classified the various approaches as either descriptive or prescriptive. The descriptive approach bases the *CDR* on rates of return on investment (see e.g. Manne, 1995; Nordhaus, 2007; Weitzman, 2007), while the prescriptive approach bases it on ethical principles (see e.g. Broome, 1992; Cline, 1992; Stern, 2006). In this section, I first argue that the descriptive approach is based on erroneous assumptions and is therefore to be rejected. And secondly, I argue that the prescriptive approaches followed to date have been based upon moral principles incapable of restoring a reflective equilibrium.