Ethics of the Discount Rate in the Stern Review on the Economics of Climate Change

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1. Introduction

The Stern Review on the Economics of Climate Change (Stern et al., 2006, referred to below as 'the Review') is probably the most comprehensive survey of the economics of climate change published so far. This was to be expected since its lead author, Sir Nicholas Stern, is not only a distinguished economist but has also made important contributions himself to areas of public and welfare economic theory (including discounting and the identification of 'shadow prices') that are particularly relevant to climate change economics.

It has long been generally recognised by many philosophers and economists that climate change policy raises several difficult ethical problems, of which intergenerational justice is perhaps the most important.[1] But, unfortunately, this is not one on which philosophers have been able to provide much guidance. Indeed, according to Rawls, the problem of intergenerational justice is one that subjects ethical theory to 'severe if not impossible tests' (Rawls, 1972, p. 284).

It was entirely appropriate, therefore, that ethics was given explicit and prominent treatment in the Review. After the first chapter's brief summary of the scientific evidence for climate change, the next chapter (chapter 2),

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[1] For example (in recent years only): Broome (1992), Arrow et al. (1996), Arrow (1999), Gardiner (2004), and Dasgupta (2005).

the technical annex (chapter 2a), the 'Postscript' and the Technical Annex to it, devoted considerable attention to the ethical issues involved in the choice of the discount rate. For this represents the economist's trade-off between the welfare of different generations and is hence the key to the way that different distributions of consumption over time can be ranked in terms of social welfare.

The Review correctly states that 'The ethical framework of standard welfare economics looks first only at the consequences of actions (an approach often described as 'consequentialism') and then assess consequences in terms of impacts on 'utility' (an approach often described as 'welfarism'). The standard welfare economic approach has no room, for example, for ethical dimensions concerning the processes by which outcomes are reached. Some different notions of ethics, including those based on concepts of rights, justice and freedoms, do consider process' (p. 29). Nevertheless, the Review takes a predominantly impersonal consequentialist approach, in line with standard welfare economics, and makes explicit or implicit ethical judgements concerning the distribution of welfare and of 'consumption' across generations.

In section 2 below, we note some of the peculiar difficulties that arise in applying cost–benefit analysis to climate change policy. This immediately focuses attention on the practice of discounting, so in section 3 we disaggregate the discount rate into its key parameters. Much of the criticism of the Review by economists has focussed on two particular parameters: the elasticity of marginal utility (section 4) and the pure rate of time preference, or 'utility discount rate' (section 5).[2] While the Review is to be commended for being explicit about its ethical assumptions, in our view it considers a narrow range of plausible ethical approaches.[3] In section 6, we compare the appeal and implications of adopting 'agent-relative' ethics as an alternative to the Review's impersonal, or cosmopolitan, consequentialism. In section 7, we consider the criticisms that the Review's discount rate is inconsistent with prevailing interest rates. We argue that while comparisons with market rates of return on investments are important, there are limitations on the normative significance of market interest rates.

[2] See comments by Dasgputa (2006), Gollier (2006), Mendelsohn (2006), Nordhaus (2006), Tol and Yohe (2006), and Weitzman (2007), among others.

[3] Dasgupta (2006) writes that the Review treats discounting 'cavalierly'. Nordhaus (2006, p. 9) provides a list of alternative ethical perspectives that ought to have been considered. The Review's postscript refers to a broader literature on sustainable development and to references in Dasgupta (2001) and Arrow et al. (2003).

2. Consequentialism and cost–benefit analysis

The standard micro-economic model of the economy, built on parsimonious assumptions, enables one to identify the conditions under which an economy will reach a Pareto optimal position, which is one where it is impossible to make anybody 'better off' without somebody being made worse off. On the face of it, this looks like a fairly compelling principle, although there are several well-known limitations that need not detain us here. Subject to these limitations, the scope for any project to help move the economy towards a Pareto optimum can be measured in a cost–benefit analysis (CBA). But a favourable CBA only tells one that there is scope for a *potential* Pareto optimising move, for it must be theoretically possible for the beneficiaries to compensate the losers and still remain better off.[4] It is generally accepted that although *actual* compensation is necessary, in principle, to ensure that any move is Pareto-optimising, this is invariably impossible in practice (and perhaps in theory as well), so that one must fall back on one or other of two defences of the procedure. The first is that in a large society with lots of projects carried out, it can be assumed that losers on some projects are likely to be gainers on others. The second defence is that, anyway, the socially desired distribution of income in any democratic society is in the hands of the government and if, for one reason or another (including a bias in the projects selected), it is desirable to change the distribution, this can always be done via appropriate taxes and benefits.

However, these defences are not available for climate change, where policy creates winners and losers between generations and intergenerational compensation is not possible. First, future generations that may benefit from any current policies cannot compensate those today who may bear the costs of the policy. Second, the swings and roundabouts argument cannot apply intergenerationally. Losers in the present generation have no hope of being winners in any subsequent generation. Thirdly, there is not, and can never be, any inter-temporal government that can adjust the intergenerational income distribution in accordance with any trans-generational views on what would be an equitable intergenerational distribution of welfare.

[4] A change passes the Kaldor (1939) criterion if the gainers could compensate the losers, and the Hicks (1940) criterion if the losers could not pay the gainers to prevent the change.

So what can consequentialist maximisers do in such a situation? A common route is the classical utilitarian route followed by the Review, namely, adopt a totally *impersonal* consequentialist approach, which attaches equal value to an equal unit of welfare of any member of any generation. But, as we shall point out below, it is not the only approach, and adopting it raises some fundamental questions that have been hotly debated by philosophers since the foundations of Utilitarianism were set out in the 19th Century by Bentham and J. S. Mill.

3. Intergenerational justice and the discount rate

It is now well-known that the dominant ingredient in any cost–benefit calculation of climate change policy is the discount rate used in order to compare the costs of mitigating climate change with the expected benefits (i.e. the avoidance of the damage that climate change might otherwise do under what is known as a 'business as usual scenario').[5] For example, with a constant discount rate of only 4 per cent, the present value of benefits accruing in one hundred years' time is only one fiftieth of the value of those benefits today (all comparisons being in real terms—i.e. adjusted for inflation).[6] This ratio, which is one fiftieth in this instance, is what is known as the 'discount factor'.[7] Thus, one's natural reaction might be to say that economics tells us that we should not worry about climate change. For with such a discount factor, the benefits accruing in 100 years' time from the Review's proposed policies would have to be fifty times as great as the costs of mitigating climate change (assuming that most of the costs are incurred in the near future). It might seem very unlikely that the benefits will be fifty times the costs. From this perspective it could be concluded that unless the first two chapters or so of the Review justify the use of a relatively low discount rate, it is not worth reading the next 500-odd pages.

However, as the report emphasises again and again, a crucial ingredient in climate change policy is risk and uncertainty. And one cannot rule out the possibility—however small—that the consequences of a 'business as

[5] See Guo et al. (2006) for an analysis of the impact of different discounting schemes on the social cost of carbon.
[6] The current rate for use in cost–benefit analysis in the United Kingdom begins at 3.5 per cent and falls over time to reflect uncertainty in the macroeconomy (HM Treasury, 2002).
[7] The (discrete time) discount factor equals $1/(1 + r)^t$ where r = the discount rate, and t = time.

usual' (BAU) policy would be absolutely catastrophic in the very long run. In that case, not only could the benefits of a mitigation policy be at least fifty times as great as the costs, if not a lot more, but the applicability of standard, marginal cost–benefit analysis with conventional discounting would be questionable. This is partly a matter of the science, but it is even more a matter of the ethics, and, under some scientific assumptions, climate change policy must rest on considerations that—as John Broome has recognised from the outset—lie outside a simple application of a discount rate in a standard economic cost–benefit analysis.[8]

The analytical framework most commonly employed to examine questions of intertemporal resource allocation[9] is the tractable workhorse bequeathed to us by Ramsey (1928). In this model, there is a single, infinitely-lived agent, no taxes and no externalities, so the market interest rate, *r*, is also the discount rate for public projects, *s*, which we will refer to as the social rate of time preference. Future flows of *consumption* are discounted for two reasons. First, we might discount the utility experienced by future generations because we care less about them, or they may not be around. Second, if future generations have higher consumption than us we attribute less marginal utility to that consumption. Hence, Ramsey (1928) gives us the following equation:

$$r = s = \delta + \eta g$$

where

r = the market interest rate;
s = social rate of time preference (which is the rate for discounting public projects);
δ (delta) = the 'utility discount rate';
η (eta) = the 'elasticity of marginal utility' with respect to consumption; and
g = the expected future growth rate of consumption.

The utility discount rate, δ, is the proportional rate of decline in the weight placed on a unit of utility in the future compared with an equal unit

[8] For example, Broome (1992, p. 72). Broome did, however, recognise that economic analysis is relevant, if only to bring out more clearly some of the ethical choices that have to be made.
[9] The Review, Dasgupta (1994; 2001; 2006), and *The Economist* 13 Dec. 2006, 'Shots across the Stern'.

of utility experienced today. It is often referred to as 'pure time preference', and in the *individual* context is generally regarded as reflecting impatience (the desire for utility to be accrued sooner rather than later).

The second key term, η, which is the 'elasticity of marginal utility', determines how much weight should be given to the consumption of the poor relative to the rich. The value chosen in the Review, $\eta = 1$, implies that £1 is worth ten times more to someone with one-tenth of the income. By contrast, $\eta = 2$ would imply that £1 is worth one hundred times more to someone with one-tenth of the income.

As per capita consumption is expected to continue growing in the future (so $g > 0$), it follows that if either of these two ethical parameters is increased, so, too, is the social rate of time preference, which reduces the present value attached to consumption of future generations. For a given scientific model of climate impacts, these two ethical parameters dominate the choice of climate change policy.[10] The expected growth rate of consumption will, of course, affect the appropriate discount rate, but consumption growth is not an ethical parameter. So we are not concerned with it here, where we are concerned only with the two ethical parameters — η and δ — which are arguably independent of the consumption growth rate.[11] In the next section we shall concentrate on η, namely the elasticity of marginal utility.

4. The elasticity of marginal utility with respect to consumption

In the standard model of welfare economics, individuals derive 'utility' from the consumption of goods and services.[12] The relationship between consumption and utility is described by a curved 'utility function'. Increases in consumption are considered to provide greater utility, but with diminishing returns. There are three important implications for climate policy.

[10] See Wahba and Hope (2006). Weitzman (2007) also provides a striking illustration of how the impact of the discount rate can swamp the uncertainty concerning the scientific and economic components of the calculations. Similarly, Nordhaus (2006) demonstrates how the Review's alarming estimates of the damage that might be done by climate change in the very long run are strongly dependent on its choice of a very low discount rate.
[11] It may be the case that η is a function of the level of consumption, as Atkinson and Brandolini (2006) suggest, but we ignore that interaction in the following analysis.
[12] For a clear summary of the different meanings ascribed to the term 'utility', see Broome (1999).

First, if individuals are assumed to maximise expected utility, then individuals with higher η are more risk averse than individuals with lower η (because a consumption loss reduces utility more than an equivalent consumption gain increases utility). Higher η not only implies higher individual risk aversion, but also more risk-averse climate policy, implying greater spending now to reduce the future risks of climate impacts.

Second, if social welfare is assumed to be the simple sum of agents' utilities, then η is also effectively a measure of *society's* aversion to inequality of consumption.[13] As noted above, $\eta = 1$ implies that £1 is valued ten times higher if it accrues to someone with one-tenth of the income. Or, equivalently, a given *per cent* increase in consumption is taken to generate the same utility for rich and poor people (because the absolute increase is much higher for the rich person). Employing higher η places much greater weight on the consumption of the poor, and effectively produces a higher social aversion to inequality in consumption.

Third, when utilities are additive over time periods, η also governs aversion to inequality in consumption over time, or between different generations. A low η implies that policy should not be particularly concerned with equalising consumption between generations. In contrast, a high η implies that policy should take account of relative wealth differences between generations. As future generations are expected to be wealthier than the current generation, in this context high η implies the current (poor) generation should not spend much on preventing climate impacts to the future (rich) generations.

Because η simultaneously affects aversion to risk, spatial inequality and intertemporal inequality, it is not immediately obvious whether increasing η produces an increase or decrease in the present value of climate impacts. On the one hand, higher η implies greater risk aversion, pointing to much greater concern about the climate change and the associated risk of impacts. On the other hand, higher η reduces the weight placed on the consumption of the (future) rich, and increases the weight placed on the consumption of (current) poor, pointing to a more relaxed approach to emission reductions.

[13] See Kaplow (2003) on the differential impact of curvature in the utility function and curvature in the social welfare function on our aversion to inequality.

What is a reasonable value for η? Descriptive or normative (i.e. prescriptive) approaches might be employed.[14] Descriptive approaches include inferring a value of η from data on individual behaviour derived from individual experiments or produced from aggregative macroeconomic data on savings or implicit risk aversion.[15] Normative approaches involve thought experiments about the implications of different values of η on egalitarian transfers. These approaches can be employed to justify a wide range of values from η. Cowell and Gardiner (1999) consider the range 0.5 to 4 to be reasonable, while Pearce (2003) rejects higher values as being inconsistent with observed social egalitarianism, instead proposing that values within the range 0.5 to 1.2 are reasonable.

The Review adopted the value $\eta = 1$, within the ranges suggested in previous literature, but this choice has been criticised on several grounds. In contrast to Pearce (2003), Dasgupta (2006) considers $\eta = 1$ to be inappropriate on the ethical grounds that it is insufficiently egalitarian. Gollier (2006) also argues that η should be higher, implicitly condoning the range 2–4 based upon revealed preferences over gambles. Weitzman (2007) adopts a value of $\eta = 2$ in his thought experiments. Nordhaus shows that, if $\delta = 0.1$, as in the Review, this is only consistent with observed rates of growth of consumption, rates of return on investment, and saving rates, if $\eta = 2.25$ (op. cit., p. 16).[16] Atkinson and Brandolini (2006) make the point that it is probably inappropriate to assume η to be constant. Rather, thought experiments suggest that we should expect η to first rise and then fall as income (and consumption) increases.

A striking feature of this debate is that the arguments advanced for different values of η are a mix of the normative and descriptive (more on this in section 7 below). One important reason for the debate is that η is being overworked. The standard model is parsimonious to a fault in simultaneously representing three different concepts (risk, inequality and allocation over time) by one parameter. Although Harsanyi (1955, 1976) claimed to show that in Rawls' 'original position', attitudes to risk can be married to attitudes to social inequality,[17] we do not live in the original position, and various evidence suggests that these concepts are distinct (see, e.g.,

[14] See section 7 below for a more detailed discussion of how economists can estimate ethical parameters.
[15] Stern (1977) conducted some important early research on the value of eta; Cowell and Gardiner (1999) and Pearce and Ulph (1999) provide surveys; and Pearce (2003) provides a more updated summary of the issue.
[16] See section 7, however, for a discussion of the use of market information to determine ethical parameters.
[17] However, there has been plenty of debate on the issue; see, for example, Sen (1976), and Broome (1991).

Carlsson et al., 2005). It is easy to imagine a person who is highly averse to risks (high η) and at the same time cares very little about equality (low η), or indeed a person who willingly accepts risk (low η) and at the same supports redistribution from rich to poor (high η). Similarly, risk-averse people (high η) may care a great deal about future generations even though they are wealthier (low η), and so on. These observations can be buttressed by the recent research into subjective reports of well-being which suggest that there is an important difference between inequality within a generation, and inequality between generations. In a careful review of happiness economics, Di Tella and MacCulloch (2006) conclude that the evidence is consistent with two assumptions. First, happiness is derived from *relative* levels of consumption, suggesting that inequality matters. Second, aggregate happiness remains relatively constant over time (Easterlin, 1974, 1995) which suggests that inequality in *consumption* over time is less important. Theoretical reasons why egalitarianism *between* generations is more difficult to justify than egalitarianism *within* generations are advanced by Beckerman and Pasek (2001, ch. 4).

These observations suggest that the standard model is not rich enough to separate the key ethical dimensions relevant to climate change. In particular, utility functions that separate risk from intertemporal substitution (Epstein and Zin, 1989) and risk from inequality (Kreps and Porteus, 1978) would be a preferable starting point. While it is difficult to determine the net effect of disentangling preferences for risk, spatial and temporal inequality, it is clear that so doing could have a very significant impact on the Review's estimate of the costs of climate change.

5. The utility discount rate

The second crucial ethical choice is the utility discount rate. The Review is quite categorical that one should attach as much value to a unit of welfare accruing to a future generation as to an equal unit of welfare accruing to the present generation. It states that 'We take a simple approach in this Review: if a future generation will be present, we suppose that it has (sic) the same claim on our ethical attention as the current one' (p. 31).[18] What

[18] The same sentiment is repeated on pages 45, 48 and 160. Readers may find it curious to attribute a claim in the present tense to an entity that does not actually exist, namely a future generation. The implications of this point for the possibilities of a theory of intergenerational justice are discussed in Beckerman and Pasek (2001, ch. 1–2).

sort of ethical principle can justify this equality of valuations of welfare among generations?

The principle would be an *impersonal* consequentialist principle, like most versions of Classical Utilitarianism. It is the principle adopted in the great paper by Ramsey (1928) on optimal growth and savings, where he adopted a frankly Utilitarian approach and counted a unit of utility accruing to a future generation as having the same value today as an equal unit of utility enjoyed by the present generation. In this approach, the goodness of any outcome is measured by the total utility resulting from the actions in question, irrespective of who gets the utility. Thus the recipients of utility are regarded simply as vessels into which one puts a certain amount of utility.

The utility discount rate, *delta* can be broken down into two components: the 'pure rate of time preference' and an allowance for the possibility of extinction of the human race. In fact, the only concession that the Review makes to the view that the value of *delta* ought, perhaps, be positive, is to take account of this extinction possibility. The Review proposes that the former component ought to be zero and the extinction component of *delta* should be 0.1, giving a total value of *delta* of 0.1 reflecting an assumed probability of the extinction of the human race over the next 100 years of almost 10%. Any such estimate is extraordinarily speculative, and is clearly a question upon which 'reasonable minds may differ'. Plausible arguments can be advanced for either a higher or a lower extinction risk.[19]

The Review acknowledges that 'It is, of course, possible that people actually do place less value on the welfare of future generations, simply on the grounds that they are more distant in time. But it is hard to see any ethical justification for this' (p. 31). Later the Review states that '…that is

[19] The Review suggests that the assumption of 10 per cent may be too high on the grounds that 'indeed if this were true, and had been true in the past, it would be remarkable that the human race had lasted this long' (p. 47). While this is clearly correct as a deductive statement, the premise is manifestly false, because for more than 99.9 per cent of the time that the human race has existed it did not possess the means of total self-destruction that it now has available. Lord Martin Rees, the Astronomer Royal, has recently written that 'I think the odds are no better than fifty-fifty that our present civilisation on Earth will survive to the end of the present century' (Rees, 2003). The title of his book—'Our final century'—suggests that Lord Rees is expressing a view on extinction risk. If all the extinction risks he considers were exogenous (which they are not, as climate change is itself one potential extinction risk), the appropriate component of *delta* to account for extinction risk would be 0.7% (because if P = the probability of survival, and $P = 1/(1 + \delta)^{100}$, then for P = 0.5, δ equals 0.7%). Clearly, such judgements are extraordinarily speculative.

not a position which has much foundation in ethics and which many would find acceptable'.[20]

The Review appeals to some rightly very eminent economists—from Ramsey and Pigou down to Sen and Solow—in support of the view that pure time preference is an irrational manifestation of 'impatience' or 'defective telescopic faculty', so that 'the only sound ethical basis for placing less value on the utility (as opposed to consumption) of future generations was the uncertainty over whether or not the world will exist, or whether those generations will be present' (i.e. the extinction possibility) (p. 45). This view has a respectable ancestry, since scholars who developed individual time preference believed it to be an irrationality (e.g. Fisher, 1930), although it could be argued that time preference is simply a preference like any other preference (von Mises, 1949). In fact, even Ramsey accepted a positive pure rate of time preference when his guard was down.[21] Moreover, one could equally well appeal to a list of eminent philosophers who have supported 'agent-relative' ethics (discussed below), starting with David Hume, one of the greatest moral philosophers of all time.[22] Agent-relative ethics have also been proposed in the present context by Ken Arrow (1999).

Furthermore, one must take great care to distinguish between the positive pure time preference of *individuals* and the weight placed on future *generations*. Schelling (1995, p. 396) points out that 'the alleged inborn preference for earlier rather than later consumption is exclusively concerned with the consumer's impatience with respect *to his or her own consumption*'. Schelling notes that while the Ramsey and Pigou references to 'impatience' or 'myopia' might accurately describe the virtually universal preference for consumption during one's lifetime by oneself, it is absurd to apply these adjectives to the consumption of somebody one will never know in 200 years' time. Harrod's frequently quoted assertion is that 'Time preference in this sense is a human infirmity…a polite expression for rapacity and the conquest of reason by passion'.[23] But Harrod seems to

[20] The Review, p. 48. The actual text says 'unacceptable', not 'acceptable', but we have used the latter, which was clearly what had been intended, and the use of 'unacceptable' suggests that the authors had confused themselves with their double negative.
[21] Ramsey (1931, p. 291) is reported to have said that 'In time the world will cool and everything will die; but that is a long way off still, and its present value at compound interest is almost nothing.'
[22] See, for example, the various contributions to Scheffler (1988), such as Williams, Nagel, Nozick, Scanlon, Sen and others, to make a rather random selection.
[23] The other two quotations routinely used in this context are from Ramsey and Pigou.

have forgotten Hume's even more famous statement to the effect that '[R]eason is, and ought only to be the slave of the passions, and can never pretend to any other office than to serve and obey them'.[24]

This is clearly an issue on which 'reasonable minds may differ'.[25] But two statements *can* be made with confidence. First, irrespective of the ethical appeal (or otherwise) of impersonal consequentialism, it is clear that it does not reflect actual human behaviour at the individual level (Pearce et al., 2003). At best, it might be said to underpin the ethical basis for national policy when it is adjudicating between competing claims of citizens within the one nation-state. However, it clearly fails to describe national decisions that have different impacts on different nation-states. Second, there *are*, in fact, plausible ethical justifications for attaching more importance to people alive today than to distant generations. Among the theories that stand in sharpest contrast to impersonal consequentialism are 'agent-relative' ethical theories, with a distinguished pedigree going back to David Hume.

6. Agent-relative ethics

Hume developed at some length his view that morality is firmly based in human behaviour and that this, in turn, is basically agent-relative (though he did not use this term). For example, he writes 'A man naturally loves his children better than his nephews, his nephews better than his cousins, his cousins better than strangers, where every thing else is equal. Hence arise our common measures of duty, in preferring the one to the other. Our sense of duty always follows the common and natural course of our passions' (loc. cit., Book III, sec. 1).[26]

But Hume was not suggesting that agent-relative ethics implied complete moral relativism. He was arguing that the moral codes that had evolved in society were based on a shared human nature and common codes of conduct. Furthermore, Hume provided a fully articulated theory of how this common sense of morality and justice has evolved. For example, he writes that '…we must allow, that the sense of justice and injustice

[24] Hume, 1740, reprinted 1969, Book II, Part III, section III, p. 462. Hume's defence of his theory of morality in general and of justice in particular is also presented, more briefly, just over ten years later in *An Enquiry Concerning the Principles of Morals*. Hume went on to say that 'As long as it is allow'd, that reason has no influence on our passions and actions, 'tis vain to pretend, that morality is discover'd only by a deduction of reason'.
[25] Compare Hepburn (2006) with Beckerman and Pasek (2001).
[26] He also gives a detailed account of why we tend to attach less value to distant benefits than to present benefits (loc. cit., Bk. II, sec. vii).

is not deriv'd from nature, but arises artificially, tho' necessarily from education, and human conventions'. He then sets out fully the way this has evolved—namely in a manner conducive to the peaceful and successful evolution of human society (loc. cit., sec. II). He presents this in a manner that has since been developed, of course, in various modern forms, including socio-biology and game theory. Indeed, one of the foremost contributors to game theory, Ken Binmore, goes as far as to say that '…a game theorist ought to have recognized from the start that Hume is the original inventor of reciprocal altruism—the first person to recognise that the equilibrium ideas now studied in game theory are vital to an understanding of how human societies work'.[27]

The Review defends its choice of a zero rate of pure time preference between generations by appealing frequently to our emotional attachment to our children and our grandchildren. Although it is true that many parents would weigh the interests of family members equally, they would nevertheless discount the interests of others, in accordance with agent-relative ethics. Similarly, nation states might weigh the interests of citizens equally, yet discount the interests of other nationals, according to agent-relative ethics. A global decision maker might weigh the interests of all (currently alive) humans equally, while applying a discount to animal species, and to humans not yet born, not to mention Martians. The argument made by the Review rests on an (implicit) analogy: if a parent should not discount the welfare of their children and grandchildren, nor should the global decision maker discount the welfare of future generations. Yet it is not necessarily unethical to place decreasing weight on the well-being of our increasingly distant descendants, corresponding to a positive utility discount rate.

Of course, the fact that our moral intuitions and our sense of justice reflect human nature as it has evolved though time in a way that prevents anarchy and promotes co-operative solutions to repeated 'games' does not necessarily give it irresistible normative value. Hume is famous for deploring the tendency of people to jump readily from 'is' propositions (such as comments on human nature) to 'ought' propositions (e.g., op. cit., Book III, Part I, sec. I). However, as some philosophers have argued, it would be wrong to interpret this as meaning that Hume did not attach normative

[27] Binmore (2005, p. ix).

significance to his description of the development of moral beliefs or that he failed to spell out the normative basis for a moral system anchored in human nature.[28] Nevertheless, one may well ask, as does John Roemer, 'Why should distributive justice be so intimately linked to the preferences of individuals?'[29] As he points out, linking justice to preference satisfaction could easily lead to a situation in which a majority treats a minority in a manner that we might regard as unjust. In the present context it is arguable that a future generation, being unrepresented, would be in a similar position as that of a minority at any point of time.

But it is not clear what sort of answer to Roemer's question can be given. The opening sentence in J. L. Mackie's *Ethics* is 'There are no objective values'.[30] By this he did not mean, like Camus's Caligula, that all actions are morally equivalent. The point is that moral values are not part of the fabric of the universe like the speed of light and that can, in principle, be empirically established. How far this is the case has, of course, also been the subject of extensive debate among philosophers for centuries.

Furthermore, even if one takes the view that there cannot be any cast-iron objective case for agent-relative morality, even an instrumental case for it deserves some respect. And along the Humean lines or modern game-theoretic lines, it is not difficult to see how anarchical society could be in the absence of the ties of trust, sentiment and obligation within units that have developed.[31] On the other hand, some extreme manifestations of prioritising duties to one's particular group—notably in the form of tribalism, racism or nationalism—can lead to terrible violations of our moral obligations to 'outsiders', as the world has witnessed throughout its history. But agent-relative ethics by no means excludes concern for those people outside the particular groups with which one identifies oneself. It is simply that our moral intuitions have evolved in a manner that leads to one having special obligations to one's own group—be it one's family, one's friends, one's nation, or one's generation.

Thus even if we did take an agent-relative view we might still want to make some sacrifice today in the interests of distant generations. But how heavy a sacrifice 'we' ought to make depends on who we mean by 'we'.

[28] See, for example, the contributions by A. C. MacIntyre, G. Hunter, and others in a valuable collection of contributions on this subject, to Hudson (1969).
[29] Roemer (1996, p. 37).
[30] Mackie (1977). But see also Wiggins (2006).
[31] See an eloquent exposition of this point in Railton's 'Alienation, Consequentialism, Morality', in Scheffler (1988).

Most of the people alive today live lives that are, at best, precarious and, at worst, verging on the intolerable. It would be clearly inappropriate to ask those currently living in destitution to make sacrifices for a future that is likely to be richer than the present.

Nevertheless, if, with due respect to agent-relative ethics, most of us still wanted to make some sacrifices for the sake of future generations, it is quite likely that the best way to represent individual attitudes to discounting over very long periods is in a step function in the discount factor that we apply to the welfare of future generations, along the lines set out by Rothenberg (1993). That is to say, we may apply a discount factor to the next generation's welfare lower than that of our own, but hold it constant over the life of that generation—i.e. time may not enter into it. We may then value the welfare of the succeeding generation below that of the next generation, but, again, by the same discount factor irrespective of the particular year in which it is experienced. And we might then apply a very small, constant—but non-zero—discount factor to an equal unit of welfare accruing to all further generations down the line, to eternity (or whatever arbitrary cut-off point one prefers). However, since there are overlapping generations, and we have children and grandchildren of vastly different ages and hence expectations of life, aggregating such a step-function over all members of the current generation would produce a smooth exponential discount factor for society as a whole though it may flatten out before it falls to zero. In short, we would be back to a discount rate.

Thus the reasons for giving serious consideration to agent-relative ethics include (i) a long philosophical tradition stretching back at least to Hume; (ii) probably universally held public preferences; and (iii) within limits, its instrumental value. It is, at the very least, a respectable and traditional ethical structure that contrasts with the Review's impersonal consequentialism.[32] We do not presume here to adjudicate between various ethical systems. The point is that, whatever the 'right' answer, climate policy cannot properly be conducted without considering a range of ethical perspectives, including those that attach a lower value to a unit of welfare accruing to a distant generation as to one accruing today. Since the Review does not address the implications of alternative ethical assumptions, it

[32] This is notwithstanding the gallant and ingenious attempts that have been made to reconcile consequentialism with agent-relative ethics or with other constraints or moral intuitions. See, in particular, the contributions by Scheffler, Sen and Foot to Scheffler (1988).

brushes under the carpet the most crucial ethical questions underlying the economics of climate change.

7. The moral significance of the market rate of interest

Many critics of the Review's consumption discount rate have emphasised that it falls well below observed market rates of interest, or that its parameter values are less than those estimated on the basis of independent empirical observations or experiments designed to estimate the public's preferences concerning the two ethical parameters discussed above.[33] For instance, Nordhaus (2006) attacks the Review's parameter choices for failing to be 'consistent with today's market place' and Dasgupta (2006) and Weitzman (2007) make equivalent points.

The basis for these criticisms is not hard to understand. The mean discount rate over the next century implied in the Review is 2.1% p.a.[34] There is no doubt that much higher rates of return could be earned on investments, especially in poorer countries. Arrow et al. (1996), for example, state that 'A review of World Bank projects estimated a real rate of return of 16% at project completion; one study found returns of 26% for primary education in developing countries. Even in the OECD countries, equities have yielded over 5% (after corporate and other taxes) for many decades, which is comparable to a pre-tax rate of at least 7%'.[35] To the extent that investment in climate change mitigation crowds out private investment, the opportunity cost of capital needs to be incorporated into the cost–benefit analysis, and the market rate of interest is relevant here (op. cit., p. 139). If these crowding out effects are not accounted for, the use of a low consumption discount rate for an international policy on climate change will produce a much lower consumption stream over the foreseeable future than might otherwise have been available, both to

[33] The Review's actual discount rates are not easy to track down, since the modelling (correctly) accounts for the non-marginal nature of climate policy through Monte Carlo risk-based analysis. The discount rate involves the multiplication of the eta parameter by its estimated growth rate of per capita consumption, which varies across regions and model runs. The mean consumption discount rate happens to be 2.0% p.a. over the course of the next century, 1.4% p.a. over the next century, and 1.3% p.a. thereafter. An argument could easily be made for higher growth projections, which would imply that even the Review's low values of the two ethical parameters would not prevent distant consumption levels having totally negligible present values.

[34] This corresponds to values of 0.1 for delta, 1.0 for eta, and 2.0% p.a. growth rate over the course of this century. This is a mean value, because different discount rates are applied in different regions of the world, and across different model runs.

[35] Arrow et al. (1996, p. 133).

present and to future generations. And this may well reduce the ability of future generations to deal with the possible consequences of climate change.

Some of the comparisons of the Review's preferred discount rate and actual market rates are, however, misplaced as far as the ethical parameters are concerned. For actual market rates will reflect—in addition to the ethical parameters—assumed growth rates of consumption. Hence, if one is interested only in the ethical parameters, comparison with the market rates of interest can be misleading if market rates reflect much higher expected growth rates of consumption.

Furthermore, there are well-known reasons why one must be cautious in attaching normative significance to market prices in project evaluation. They include the usual market distortions, notably taxes, imperfect competition, externalities, and sub-optimal income distribution. For these reasons the market interest rate—like other prices—may not correspond to what would be society's 'shadow price' (Drèze and Stern, 1990).

Moreover, ethical decisions are not appropriately decided in the market place. One would not, for example, want to allow policy concerning the death penalty or abortion to be influenced by the *incomes* of voters. In the same way, decisions concerning the ethical parameters entering into the discount rate should, in principle, be made on a one-person-one-vote basis. Qualifications to the normative significance of market prices also include well-known distinctions that are a mixture of value judgements and empirical evidence between individuals 'manifest' preferences (Harsanyi, 1982), ideal preferences, real preferences, informed preferences, and so on.

There are some features of people's preferences that imply that the social discount rate, in particular, would be below the market rate. For example, (i) social risk is invariably much less than individual's risk; (ii) many people may prefer, in their capacity as citizens, to discount the future less than they would do in making choices that affect only their personal allocation of resources (Sen, 1961, 1982); and (iii) at best, markets only reflect individual preferences and growth expectations over relatively short periods of time. They provide little information about people's preferences over generations; (iv) in any case, empirical studies of people's discount rates whether by 'revealed preferences' or 'contingent valuation' studies show such monumental inconsistencies in individual rates of time

preference that it is virtually impossible to base any policy-relevant estimate on these preferences.[36]

On the other hand, there are reasons why the appropriate consumption discount rate for *global* climate change policy might be higher than the interest rate in rich countries. For one thing, interest rates in the developing world are substantially higher than in rich countries. But more importantly, on a one-person-one-vote basis, there are grounds for supposing that the majority of the world's population would attach higher priority to the welfare of the current generation than to that of future unborn generations.

And in terms of agent-relative ethics, there are reasons not to rely on people's preferences as a safe guide to society's discount rate for intergenerational projects. First, although the evolutionary game-theoretic explanation of how moral systems have emerged may be accurate, they have emerged before humans had the capacity to influence the future that it possesses today. In particular, as Jamieson (1992) has pointed out, an important ingredient of mutually advantageous strategies leading to current moral conventions has been an ability to identify responsibility for actions and events. But this is not the case across generations. As has often been remarked, we have no incentive to behave decently towards future generations in case they retaliate against us if we do not (Jamieson, 1992, p. 148). On the other hand, an evolutionary/game-theoretic model does not seem to provide any guidance as to how we ought to treat future generations.

Second, a casual glance round the world shows that generations are hardly homogeneous. At any one point of time, people's views on distributive justice and related issues, such as risk and uncertainty—whether intergenerational or intragenerational—will reflect a variety of factors. There is abundant evidence from surveys that these views will vary according to race, religion, income level, and whether the society in which they live is primarily competitive or solidaristic.[37]

However, while the 'revealed ethics' of market behaviour is flawed, one could equally well ask why the ethical parameters should be linked to the judgements of the authors of the Stern Review, or scientists, or any politician making decisions about such ethically contentious issues. The views

[36] See the exhaustive survey in Frederick et al. (2002).
[37] See Miller (1992), Frederick et al. (2002), and Sunstein (2005, ch. 4).

of the Stern Review team or the scientists, economists, and politicians who pronounce on intergenerational justice (including the authors of this paper) will not necessarily be shared by the vast majority of the world's population.

8. Conclusions

It is widely known that any analysis of the economics of climate policy is extremely sensitive to the assumed discount rate and that this is essentially an ethical question. The Review's answer to this question is encapsulated in its choice of values for the two ethical parameters, *delta*, and *eta*. Leaving aside the possibility of extinction of the human race, the former represents pure time preference and the latter simultaneously effectively reflects our risk aversion, aversion to inequality, and the aversion to inequality through time.

As regards *delta*, the Review adopts the impersonal consequentialist view that the welfare of future generations ought to be valued equally with the welfare of people alive today—i.e. zero pure time preference—and dismisses other ethical perspectives . We argue that 'agent-relative' ethics, which has a respectable pedigree going back to David Hume, ought to have been considered for the discussion of this crucial ethical parameter to have been more balanced.

The Review's choice of *eta* is based on previous estimates derived partly from thought experiments and partly from empirical estimates of people's inequality and risk aversion. Some critics have challenged the Review's empirical estimates. However, both the Review's and the critics' reliance on such evidence raises the question of the moral significance of people's preferences as expressed in market prices such as the interest rate. Moreover, the standard model employed by the Review implies that *eta* has to reflect three different concepts simultaneously. Disentangling these concepts might reduce the domain of disagreement.

While we argue that the 'revealed ethics' of the marketplace have limited applicability to climate policy, leaving climate ethics up to elites and philosopher-kings is similarly inappropriate. As the late Isaiah Berlin went to great trouble to emphasise, disregard—sometimes to the point of contempt—for the preferences and interests of individuals alive today in order to pursue some distant social goal that their rulers have claimed is

their duty to promote has been a common cause of misery for millions of people throughout the ages (Berlin, 1997).

So how should we proceed? We do not need to choose between the dictates of philosopher kings and the 'revealed ethics' of the market place. There are a range of intermediate approaches including the use of stated preference surveys, behavioural experiments, and methods to reveal the social preferences inherent in our social institutions. Investigating these alternatives seems more promising than continuing endless debates about which of the extreme positions is correct, when actually both are wrong.

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