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“Once more on intergenerational discounting in climate-change analysis: Reply to Partha Dasgupta”

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0. In this comment, I will respond to Partha Dasgupta’s rejoinder (Dasgupta (2011)) to my article Roemer (2011), published in this journal, in which I used several quotes from his work to illustrate common, and I think misconceived views, about intergenerational welfare economics. My interest in the topic here is in its application to studying intergenerational equity in the presence of climate change. My work in this area has been conducted with a small team of three; the *ERE* article presented a summary of some of our views, which are used elsewhere alongside more technical work involving both economic theory (Llavador, Roemer, and Silvestre (2010)) and simulation of an intergenerational model of human welfare in the presence of climate change (Llavador, Roemer, and Silvestre (2011)). Here, I will limit myself to outlining what I think are the most important points of disagreement, while taking the opportunity to spell out as clearly as I can my critique of ‘discounted utilitarianism.’

1. There are, to my knowledge, four justifications for using the social welfare function $\sum_{t=1}^{\infty} \rho^{t-1} u(c_t)$ as a way of ordering consumption paths for a society with a sequence of representative agents who are (possibly) alive at dates from now and into the infinite future, where $0 < \rho < 1$ is the discount factor. These are: (A1) that the intergenerational problem is ethically isomorphic to that of an infinitely lived utility-maximizing consumer, who discounts her future utility at a discount rate δ defined by $1/(1+\delta) = \rho$; (A2) that the intergenerational problem is ethically isomorphic to that of an altruistic parent, whose overall utility is a sum of her own utility from consumption $u(c_t)$ plus a discount factor applied to her child’s *overall* utility (which is a function of *his* consumption plus his child’s overall utility, etc.); (B) that the intergenerational problem can be represented as the expected utility of a von Neuman-Morgenstern Ethical

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Observer (or social evaluator, to use Dasgupta's preferred term), who is a utilitarian, evaluating prospects in which the human species lasts for a finite but unknown number of dates; (C) axiomatic justifications, à la Koopmans (1960) and Diamond (1965). To be precise about justification (B): the Ethical Observer (EO) postulates that the probability that the T th human generation will be the final one, assuming that the species has survived until date T , is a fixed number π ; the vNM utility function of the EO on the prospect that the species lasts for exactly T dates if the infinite path being evaluated is

$\mathbf{u} = (u_1, u_2, \dots)$ is $W(u_1, \dots, u_T) = \sum_1^T u_t$; and so the EO evaluates the expected utility

$$\sum_{T=1}^{\infty} \pi(1-\pi)^{T-1} W(u_1, \dots, u_T) \quad (\&)$$

to determine its ranking of \mathbf{u} , using the fact that the probability that the T th generation is the last one is $\pi(1-\pi)^{T-1}$. A few lines of algebra show that the ranking on streams \mathbf{u}

given by (&) is identical to the ranking gotten by evaluating $\sum_{t=1}^{\infty} \rho^{t-1} u_t$ where $\rho = 1 - \pi$.

2. My argument was that the best justification for using the discounted utilitarian formula in the context of climate change is (B). I rejected (A1) because I do not endorse the view that the ethics of intertemporal distribution are isomorphic to the optimization problem of an infinitely lived consumer whose rate of discount δ is derived from observing market interest rates. I displayed the following quotation from Dasgupta (2005):

An individual's lifetime well-being is an aggregate of the flow of well-being she experiences, while intergenerational well-being is an aggregate of the lifetime well-beings of all who appear on the scene. It is doubtful that the two aggregates have the same functional form. On the other hand, I know of no evidence that suggests we would be way off the mark in assuming they do have the same form. As a matter of practical ethics, *it helps enormously* [my italics- JR] to approximate by not distinguishing the functional form of someone's well-being through time from that of intergenerational well-being.

The second sentence shows that Dasgupta agrees that the intergenerational problem and the utility maximization problem of an infinitely-lived consumer are, indeed, two distinct problems, but nevertheless, he thinks, pragmatically, that little harm is done by taking the distinction seriously (an assertion so bold that I described it as 'amazing'). The main

reason I object to (A1) is that the discount factor δ is (almost always) taken to reflect the rate of impatience of the long-lived consumer, and is calibrated using market interest rates: but it is ethically impermissible, so I maintain, to evaluate the attractiveness of an intergenerational utility stream according to the parochial interest of an impatient consumer living today.

Now one might respond: ‘impatience’ is a technical term that has unfortunate connotations; in reality, the model of the infinitely-lived consumer, as applied to the intergenerational problem, envisages that the discount rate δ reflects our ethical views about intergenerational equity. However, the claim that what I have just expressed is really the viewpoint of most writers who share this approach is belied by their method of *calibrating* δ and ρ . That method is to use the Ramsey equation, which is implied by the first-order conditions for solving the optimization problem of the infinitely lived consumer in the Ramsey growth model (see Program ILC, p. 371, Roemer (2011)), *and* by taking the datum of the interest rate from market observation. In other words, δ is calibrated as the deduced discount factor of *actual* consumers in real-life markets. If one believes, as I do, that the utility function actual consumers are using embodies a rate of time impatience, which in the main reflects their attitudes towards own consumption over time, and not their ethical views about how to treat future generations, then it is surely not an appropriate discount rate for evaluating the ethical attractiveness of utility streams of an intergenerational society.

The argument against (A2) could really be subsumed under the argument I just gave against (A1). For if the world actually consists of ‘altruistic parents,’ then the form of their utility function is indistinguishable from that of the infinitely-lived consumer, except that we should interpret ρ as a reflection of intergenerational concern (or at least concern for their own descendants), rather than time impatience. If one uses the Ramsey equation, and observed market interest rates, to calibrate ρ , one can still ask the question whether the discount factor in the consumer’s utility function reflects mainly her own impatience or her attitude towards her descendants’ welfare. This is an empirical issue: I have expressed above my conjecture as to the correct answer.

My point is that we should not use that utility function (in either the (A1) or (A2) variant) as the social-welfare function for adjudicating among paths of intergenerational

utility. This can be seen with a simple example. Suppose humans were entirely selfish: they cared about their children only as insurance policies for their own old age. Then the discount factor in their utility functions would reflect *only* their own self-interested views concerning intertemporal consumption. What I object to is this principle: that how we *should* treat our provision for future generations follows from how much *we* care about them. Of course I do not deny that how much we care about future generations may provide a reasonable *positive* theory of our investments on their behalf. I am objecting to the proposal that we base our *ethical* views on such considerations.

I advocate, in contrast, the view that, *ex ante*, every generation has an equal right to welfare, a right that does not depend upon how much we want to provide for them². The justification is that the date at which a person is born is arbitrary from the moral viewpoint, to use Rawlsian language. We do have the right also – in my view – not to bring future generations into being. Procreation is rightfully our decision: but once we do bring children into the world, they acquire rights to as much adult welfare as we have, and their descendants have, should they exist.

3. I rejected the usefulness of Koopmans's theorem, in the present context, because it is based on a fairly long list of postulates which are not self-evidently compelling, from an ethical viewpoint. Diamond's theorem, while simpler than Koopmans's, also depends upon a continuity axiom on the class of infinite utility streams, which I am reluctant to endorse. Indeed, even completeness of an order on sets of infinite utility streams is a demanding requirement, that perhaps one should not require. Perhaps as importantly, these theorems tell us nothing about what discount rate to use. Koopmans's theorem states that a set of postulates implies that the social preference order over infinite utility streams is given by the discounted-utilitarian formula for *some* choice of u and *some* discount factor ρ . In climate-change economics, the hot disagreements have concerned the size of the discount factor, and Koopmans's theorem does not help us here. Diamond's theorem does not even imply the discounted-utilitarian formula, but

² The 'ex ante' caveat is needed as it will become clear below that the uncertain existence of future generations provides a legitimate reason not to guarantee each generation as much (potential) welfare as every other generation.

something more general than this (so it includes the Koopmans - admissible social preferences, as well as others which exhibit impatience).

4. My view is that justification (B), which is the one implicitly used by Stern (2007), is consistent and ethically admissible. Notably, Stern takes $\pi = 0.001$ per annum, and thus uses a discount factor of $1 - \pi = \rho = 0.999$ per annum, while Nordhaus (2008), who calibrates his discount factor using the Ramsey equation and market interest rates, uses $\rho = 0.985$. The associated values of δ differ by an order of magnitude ($\delta^{Stern} = 0.001$, $\delta^{Nord} = 0.015$), so these are serious differences. The debate between Nordhaus and Stern, which I cited in Roemer (2011), has been mischaracterized, by them, as being *fundamentally* over the size of the discount factor. The deeper difference between these authors is that they endorse different justifications of discounted utilitarianism: Stern uses (B), and Nordhaus uses a version³ of (A1). The fact that they calibrate the discount factor so differently is corollary to their different underlying models.

But we (not the royal, but the LRS team) nevertheless reject approach (B), because we do not agree that *utilitarianism* is the right intergenerational ethic in a world without uncertainty. That rejection is based upon utilitarianism's complete indifference to the distribution of a given total utility among the members of the (intergenerational) society, that is, its indifference to inequality. The anti-utilitarian viewpoint has been prominent since Rawls (1971). Despite our rejection of (B), we consider it to be superior to (A1) and (A2).

5. Our team has advocated using several intergenerational social-welfare functions, which we call *sustainabilitarian*, a locution we use in order to make the point that we think they are reasonable formalizations of 'sustainability' as that view is presented in the environmental literature. Suppose the world were to last exactly T generations. Let a feasible utility stream be $\mathbf{u} = (u_1, \dots, u_T)$. Then we evaluate finite utility streams of length T according to:

$$W^1(\mathbf{u}) = \min(u_1, u_2, \dots, u_T).$$

³ I say a version, because he imposes an ethical view on intergenerational inequality by postulating a particular utility function u , incorporated in the elasticity η .

If there is uncertainty as to the life-time of the human species, then we look at the expected utility

$$\sum_{T=1}^{\infty} \pi(1-\pi)^{T-1} W^1(u_1, \dots, u_T) \quad (+)$$

of a sustainabilitarian vNM Ethical Observer over finite-species-length prospects. Since the EO has vNM preferences over these prospects, and has the vNM utility function W^1 defined on finite-length streams, its ordering of infinite utility streams is give by (+), according to the vNM representation theorem. This is exactly analogous to the approach of (B), but replaces the utilitarian EO with a sustainabilitarian EO.

An unattractive feature of W^1 is that it assigns no value to the length of time the species survives. One way to incorporate such a concern is to use:

$$W^2(u_1, \dots, u_T) = T \min(u_1, \dots, u_T).$$

We have studied this social-welfare function as well, and its stochastic variant, in Llavador, Roemer and Silvestre (2010).

We believe that W^1 or W^2 models the view that ‘each generation has a right to as much utility as any other,’ enunciated above. For, in a world which lasts an infinite number of generations, the maximization of W^1 , defined on infinite streams, can be written:

$$\begin{aligned} & \max \Lambda \\ & \text{s.t. } u_t \geq \Lambda, \quad t = 1, 2, \dots \quad (\text{SUS}) \\ & \mathbf{u} \in U \end{aligned}$$

which can be phrased : choose that utility stream which maximizes the level of welfare that can be sustained forever. It is possible – depending on the specification of the set of possible utility streams U – that there is a solution of program SUS in which utilities are increasing over time. This turns out *not* to be the case for our calibration of U in the climate-change model of LRS (2011); the solution of (SUS) in that model engenders constant utility across generations.

Finally, we say that although each generation has a *right* to as much utility as all future generations – and those rights would be enforced for all generations by the path which solves (SUS) – people may value *human development*, in the sense of future

generations' having higher utility than they⁴. In this case, each generation would be willing to *not enforce* its putative right, and to allow future generations' welfare to grow at some positive rate g . This gives rise to the formulation:

$$W^3(u_1, \dots, u_T) = \min(u_1, \frac{u_2}{1+g}, \dots, \frac{u_T}{(1+g)^{T-1}}),$$

and the associated program:

$$\begin{aligned} & \max \Lambda \\ & \text{s.t. } u_t \geq \frac{\Lambda}{(1+g)^{t-1}}, \quad t = 1, 2, \dots \quad (g\text{-SUS}) \\ & \mathbf{u} \in U \end{aligned}$$

The verbal statement of (g -SUS) is to maximize the utility of the first generation, subject to guaranteeing a utility growth rate of g forever thereafter. On the set of paths U we have calibrated in LRS (2011), there is a solution to this program for $g = 0.28$ per generation, which corresponds to an annual growth rate of utility of 1%, subject to keeping biospheric carbon concentration below the level of 450 ppm (that restriction being one of the constraints defining U).

6. Dasgupta (2011, p.487) makes an apparently valid criticism of my exposition in Roemer (2011) when he writes, "Having trashed the model of the 'altruistic parent' as a basis for thinking about intergenerational welfare it could seem curious that Roemer should adopt the position described [that the subjective view each generation holds about human development in the future could justify replacing W^1 with W^3]." Sounds right. But there is a key asymmetry between the argument I gave against (A2) and the argument I gave for (g -SUS). No generation has an ethical license to violate the rights of future generations by choosing to discount their utility at a low rate, if doing so would render them worse off than their right grants them; but each generation *does* have the ethical permit *not to enforce its own right* to enjoy as much welfare as future generations. A person can voluntarily abstain for enforcing a right that applies to him, but he is not entitled to abrogate the rights of others. Thus, the subjective attitudes of a generation may serve to *improve* the welfare of future generations over what their right requires (as

⁴ We use 'human development' as the expression of growth in utility, because, in our model, utility is a function of education and knowledge as well as consumption and leisure. This was discussed in Roemer (2011, section 5).

determined by program (SUS)); what it cannot do is to render future generations *less* well off than their right to welfare requires. If each generation desires human development, then we think that program (*g*-SUS), of ‘sustaining growth,’ is an attractive approach.

In LRS (2011), we finally incorporate the uncertainty about the length of life of the human species, but reviewing that here would be tangential.

7. Dasgupta charges me with ‘moral fundamentalism,’ which I take to be my insistence on the principle that each generation has a right to as much welfare as any future generation. The ‘fundamentalist’ aspect is perhaps an apparently unbending insistence on this principle. There are some who may find the principle in question to be unbending for two reasons, and may thus agree with Dasgupta: first, that for many formulations of the set of feasible utility paths U , the solution to (SUS) entails constant utility for the rest of our time on Earth; second, because allowing growth (as in (*g*-SUS)) enables future generations to be fantastically better off than earlier ones, at a relatively small price in utility foregone to the earlier ones, it therefore seems unconscionable not to permit growth. Indeed, it is because that price is small, for small rates of growth (like $g = 0.28$ per generation), based upon our calculation (see LRS (2011)), that we do advocate using (*g*-SUS) with a positive growth rate. However, the move from W^1 to W^3 is what philosophers call supererogatory (more than required by rights or ethics); it is justified by a hypothetical agreement by each generation not to enforce its right.

Nevertheless, we do not agree with the inference expressed by Dasgupta when he writes:

...So, if future generations are likely to be richer than us [sic], there is a case for valuing an extra unit of their consumption less than an extra unit of our consumption, other things being equal. Rising consumption provides a second justification for discounting future consumption costs and benefits at a positive rate. (Dasgupta (2008, p.145))

Indeed, we agree with the first sentence in this quotation: our maximin-sustainabilitarian ethic as expressed in W^1 gives *zero* social value to any generation’s consumption above that level that generates the minimal value Λ in program (SUS)! What we *disagree* with is the inference to incorporate a discount factor, which is based on subjective views of the current generation, into the utilitarian formulation. For whether or not the future will be characterized by ‘rising consumption’ is due to choices *we make*, it is not exogenous to

the problem⁵. The proper way to equalize welfares across generations is to use a formulation like (SUS), not to arbitrarily discount future welfare as an *ethical principle*. If Dasgupta objects to the radical, maximin nature of (SUS), then a better proposal than discounting future utilities would be to use a CES social welfare function

$$W^{4,r}(u_1, \dots, u_T) = \left(\sum_{t=1}^T u_t^r \right)^{1/r}, \text{ for some } r < 1. \text{ This would generate more equality among}$$

generations than utilitarianism, without the objectionable approach of *ex ante* discounting future utilities because we want to hold down, due to the marvel of technological progress, the consumption of future generations. (Of course, as r approaches negative infinity, $W^{4,r}$ approaches the ‘min’ function W^1 .) The CES social welfare function just defined reflects the philosophical view known as prioritarianism (giving priority to the worse off).

For technological progress is, indeed, a marvel, and it is this fact that may give those with an egalitarian impulse a desire to moderate future utilities by discounting them. We believe that the fallacy in this move is in taking the utilitarian form (i.e., $r = 1$ in the W^4) as god-given: if that form were indeed immutable, then discounting at a rate above that determined by the stochastic character of human existence would be, perhaps, the most attractive alternative. Fortunately, we have better ways of expressing an ethical desire for inter-generational equality than this one, because the utilitarian form is not immutable.

Dasgupta writes that he is a pluralist. Indeed, I attempted to portray that fact in the quotation from Dasgupta (2008) reproduced at Roemer (2011, p. 176), where he writes that he finds it ‘hard to rebut’ the view of certain philosophers that one should not ‘favour policies that discriminate against the well-being of future generations merely on the grounds that they are not present today.’ In view of that pluralism, methinks he doth protest too much.

References

⁵ Nordhaus (2008) does model technical progress as exogenous. That, however, is for simplicity. LRS(2011) models technical progress endogenously, as determined by decisions concerning how much to invest in knowledge creation at each generation.

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