Is There a Sacrifice-Free Solution to Climate Change?[1]

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Ethics, Policy & Environment 18(1) (2015): 68–78

ABSTRACT: John Broome claims that there is a sacrifice-free solution to climate change. He says this is a consequence of elementary economics. After explaining the economic argument in somewhat more detail than Broome, I show that the argument is unsound. A main problem with it stems from Derek Parfit's "nonidentity effect." But there is hope, since the nonidentity effect underwrites a more philosophical yet more plausible route to a sacrifice-free solution. So in the end I join Broome in asking economists and policymakers to help make this a reality.

1.

According to John Broome, "the very most important thing about climate change" is "that the problem of climate change can be solved without anyone making a sacrifice" (Broome, 2010, p. 102).[2] Broome says this remarkable fact is a consequence of elementary economics and "is recognized among economists but has received little attention" (Broome, 2012, p. 44, p. 45). He credits the economist Duncan K. Foley with first formulating the point. Nicholas Stern—of the now-famous Stern Review of the Economics of Climate Change (2007)—has also recently highlighted this "basic lesson from standard welfare economics," adding that "It is surprising that it has been so under-emphasized in the economic discussion of climate change" (Stern, 2014, p. 425, p. 427). Broome in particular wants the point to gain more prominence, as he thinks—quite

[1] For comments and discussion on material included here, I would like to thank Jonny Anomaly, Marc Bellemare, Greg Bognar, Daniel Bromley, Bill Gardner, Dan Hausman, Nathaniel Jezzi, Christopher McKelvey, David Morrow, Greg Nemet, and two anonymous referees for this journal. Any remaining errors are entirely my own responsibility.

[2] Broome, a former economist turned leading moral philosopher, was involved with the Stern Review of the Economics of Climate Change (Stern et al., 2007; Miller, 2013), and was Lead Author for the "Social, Economic and Ethical Concepts and Methods" chapter of the Fifth Assessment Report of Intergovernmental Panel on Climate Change (Kolstad et al., 2014).

reasonably—that people will be more likely to address climate change if they believe doing so won't make them worse off.

I am sympathetic to the claim that there is a sacrifice-free solution to climate change. But I think the economic argument for this conclusion is flawed, and that the only successful argument is much more philosophical. To show this, I will have to explain the economic argument in somewhat more detail than Broome himself does, since Broome does not discuss a key assumption that ultimately limits the argument's force. That assumption, familiar from welfare economics, is that the costs of greenhouse gas emissions are to be measured by determining how much those who are harmed by them would be willing to pay to reduce them, while the benefits of greenhouse gas emissions are to be measured by determining how much current emitters would have to be paid before agreeing to abate. If costs and benefits are measured in this way—and they must be for the economic argument to work—then the economic argument cannot provide a solution to the climate change problem. The main reasons for this have to do with what Broome calls "the nonidentity effect," a phenomenon made famous by Derek Parfit. After explaining why the nonidentity effect undercuts the economic argument for a sacrifice-free solution to climate change, I will suggest that the nonidentity effect actually underwrites a philosophical argument for the same thesis. In the end, there does seem to be a sacrifice-free solution to climate change, and it is now up to economists and policymakers to make it a reality.

2.

In his recent book on the ethics of climate change, Broome explains the core of the economic argument thus:

> Greenhouse gas causes inefficiency, and the definition of efficiency tells us that it would be technically possible to make some people better off without making anyone worse off…As things stand, people—the "emitters"—emit greenhouse gas and benefit from doing so, while other people—the "receivers"—suffer harm from those emissions…Just because the emissions are inefficient, we know that a transfer is possible that is enough to compensate emitters fully and yet still leaves receivers better off than they were originally. That is a consequence of the elementary economics of externalities: it is possible to benefit some people without leaving anyone worse off… (pp. 43-44)[3]

To unpack this argument, I need to explain what is meant by an externality and by (in)efficiency, and how they are connected. To begin, Broome describes a harmful externality—the only sort of externality he's concerned with here—as an "external cost" of an activity (p. 39). In the case of a productive entity like a firm, a harmful externality exists when some of the costs of the firm's activity are imposed upon third-parties, rather than internalized by the firm itself. Pollution is a standard example. When the firm's business model does not have to factor in the social costs associated with its pollution, it has no incentive to keep the net social costs of its activity in check. The business will care only about whether the benefits *it* receives from its activities are greater than the costs *it* is forced to bear. Broome explicitly refers to this misalignment of social costs and benefits and he says it is a form of waste (p. 39). Like most economists, however, Broome does not think that *all* of the potentially harmful external effects of a productive activity are economically problematic. Later he writes that "Some particular level of carbon emissions will be correct from the point of view of economic efficiency. This is the level where the benefit people can gain from emitting a bit more gas is exactly equal to the social costs of carbon

[3] All parenthetical citations that include only page numbers are to Broome, 2012.

[emissions]" (p. 42). This efficient level of emissions has been called the "equi-marginal" level, since it is the level at which the marginal social costs of an activity are exactly balanced by offsetting marginal social benefits (Endres, 2011, p. 11). Any unit of emissions beyond that equi-marginal point brings more costs than benefits, and that means waste and inefficiency. Hence Broome associates "fixing climate change" with "curing" the greenhouse gas externality (p. 47), which he in turn associates with eliminating "the inefficiency caused by emissions of greenhouse gas" (p. 42; see also p. 44ff.).

At this point, however, a natural question arises: If inefficient emissions involve marginal costs that outrun marginal benefits, why should it always be possible to eliminate the inefficiency without anyone's making a sacrifice? Why is *that* a "consequence of elementary economics"? Understanding the answer this question is the key to understanding Broome's economic argument. The answer comes in two steps. The first step is to understand the technical sense in which Broome is using the terms "efficiency" and "inefficiency". This is the sense that economists call Pareto (in)efficiency. A situation is Pareto inefficient when at least one person can be made better off without making anyone worse off, and it is Pareto efficient when no one can be made better off without making at least one person worse off (p. 40). When Broome says that a policy does not involve a sacrifice, he simply means that it makes no one worse off than they were prior to the policy. Thus on these definitions, it clearly follows that *if* the greenhouse gas externality is inefficient (in the Pareto sense of the term), then it must be possible to remove the inefficiency without anyone's making a sacrifice. That is just a matter of definitions. The next step is to understand why Broome (and welfare economists generally) think that unregulated externalities cause Pareto inefficiencies. In the previous paragraph we saw how unregulated externalities lead to emissions that go beyond the equi-marginal point, the point where marginal social costs are balanced by marginal social benefits. We now want to know why economists say

that emissions that go beyond the equi-marginal point will always be Pareto inefficient, and thus will always be eliminable without anyone's having to make a sacrifice.

Before proceeding, let us state Broome's Economic Argument in standard form, so that we can be clear about which part of the argument we are focusing on. Thus:

1. The problem of climate change is constituted by the Pareto inefficiency created by the unregulated greenhouse gas externality.
2. Any Pareto inefficiency can in principle be eliminated without anyone's having to make a sacrifice.
3. So the problem of climate change can in principle be eliminated without anyone's having to make a sacrifice.

This argument is clearly valid, and Premise 2 simply states the definition of *Pareto inefficiency*. So any problem with the argument must lie with Premise 1. And indeed that is the Premise we are now trying to understand. We already know that Broome thinks the problem of climate change is constituted by a Pareto inefficiency, as that is why he thinks the problem can be eliminated without making anyone worse off. But we still need to know why economists say that an unregulated externality causes Pareto inefficiency in the first place.

I am going to answer that question in Section 3, and I have already hinted that the answer hangs on the way welfare economics measures the costs and benefits associated with greenhouse gas emissions. Broome does not discuss that issue. He simply introduces the definitions I've discussed, notes that economics predicts that externalities cause Pareto inefficiency, and then draws the conclusion that: "Just because the emissions are inefficient, we know that a transfer is possible that is enough to compensate emitters fully [for restraining their emissions] and yet still

leaves receivers better off than they were originally" (p. 44). Now, before moving on to what I claim is the key issue of measurement, it is worth pausing to ask how these future receivers can compensate us for restraining our emissions, especially since "most of the bad effects of climate change will not be suffered for many decades from now, indeed not for more than a century from now" (p. 59). How can people who won't be born for decades compensate us here and now? Here is Broome's succinct description of the intergenerational transfer mechanism first described by Foley:

> But how is the transfer possible? Many receivers of harm have already been born, but most have not. How can resources be transferred to emitters from receivers who are not yet born? As things stand, the current generation will leave a lot of resources to people who are not yet born. We shall leave artificial resources in the form of economic capital: buildings, machinery, cultivated land, irrigation systems, and so on. We shall also leave natural resources…If we make a sacrifice by emitting less greenhouse gas, we can fully compensate ourselves by using more of those artificial and natural resources for ourselves. We can consume more, and invest less for the future. We shall leave less of these resources to future generations, but those generations will end up better off on balance because they will suffer less from the greenhouse gas we leave in the air (pp. 44-45).

In what follows, I will assume for the sake of argument that such a transfer is feasible. Others may think that the Economic Argument for a sacrifice-free solution to climate change falls down at precisely this step. But I think the problem runs deeper, and so I will not quibble with the assumed transfer mechanism in this article.

3.

As I have noted, Broome's presentation of the Economic Argument stresses the connection between an unregulated externality, on the one hand, and the Pareto inefficiency that results, on the other. I now want to explain this connection, and to show that it holds only when costs and benefits are measured in the specific way that welfare economics measures them. I will then go on (in Section 4) to suggest that we simply cannot measure costs and benefits in this way if we want to do justice to the full severity of the climate change problem.

To begin, recall that Broome said that some external effects—some amounts of pollution, greenhouse gas, etc.—are perfectly Pareto efficient. Broome gave us the welfare economist's standard view about when a certain amount of pollution is efficient: "Some particular level of carbon emissions will be correct from the point of view of economic efficiency. This is the level where the benefit people can gain from emitting a bit more gas is exactly equal to the social cost of carbon" (p. 42). To see how this works in practice, consider the following toy example that I have adopted from Goodstein (2011, p. 57) and modified slightly.[4] Suppose Brittany and Tyler are the lone workers in their office. There is no rule against smoking, and Tyler is a smoker. Specifically, he smokes five cigarettes a day. Brittany would like a break from this, and would be glad to pay Tyler to reduce the number of cigarettes he will smoke today. Tyler wants to smoke, but there are other things he wants as well, and so he is willing to consider a deal to put a little cash in his pocket. Table 1 shows the "marginal" amounts that Tyler would need to be paid to reduce his smoking from his status quo of five cigarettes. These are "marginal" amounts because they take each reduced cigarette one by one. For example, Tyler would be willing to go from five to four cigarettes for the price of $4.00. But since foregoing one of his daily cigarettes is

[4] Those familiar with the economics of externalities will see that this is just a (partial) illustration of the Coase Theorem. See Coase, 1960.

somewhat difficult for Tyler, and since going from four to three is even more difficult, a reduction from four to three will cost Brittany more than a reduction from five to four. And so on. Table 2, meanwhile, shows Brittany's marginal willingness-to-pay for each eliminated cigarette. On the basis of this, what will the bargain between Brittany and Tyler look like? Well, we know that Tyler would be willing to go from five to four cigarettes for $4.00, but Tyler knows that Brittany is willing to pay up to $10.00 for that same reduction. So let's assume that is the price he will charge. Still, this will be a "Pareto improvement," since at least one person is made better off and no one is made worse off.[5]

Table 1

Number of Cigarettes Reduced	Additional Payment Required per Reduced Cigarette	Total Payment Required
1	$4.00	$4.00
2	$5.00	$9.00
3	$6.00	$15.00
4	$7.00	$22.00
5	$8.00	$30.00

Table 2

Number of Cigarettes Reduced	Additional Willingness to Pay per Cigarette Reduced	Total Willingness to Pay
1	$10.00	$10.00
2	$8.00	$18.00
3	$6.00	$24.00
4	$5.00	$29.00
5	$2.00	$31.00

[5] Strictly speaking, when Brittany pays $10.00, it is *Tyler* who is made better off without making Brittany worse off (since welfare economics treats one's maximum willingness-to-pay as the amount such that one is indifferent between the status quo and paying that amount). By contrast, the alternative scenario in which Tyler charges Brittany only $4.00 to reduce one cigarette is more analogous to the intergenerational climate change bargain that Broome is proposing. And in *that* scenario, Brittany is indeed the one who is made better off without making Tyler worse off.

Having bargained to achieve a reduction of one cigarette, what will happen next? Clearly, Brittany and Tyler will strike a deal to eliminate a second cigarette, and a third. But as soon as they get to Tyler's fourth cigarette, the bargaining will stop. For Tyler demands at least $7.00 to eliminate the fourth cigarette, but Brittany (having already improved her work environment considerably) is willing to pay only $5.00. So in the end, Brittany will pay Tyler a total of $24.00 to reduce his smoking from five cigarettes to two.

We can now connect this kind of "marginal analysis" to Broome's claim that the "correct" level of pollution reduction from the point of view of Pareto efficiency is the equi-marginal level at which the benefit people can gain from emitting one more unit is exactly equal to the social cost of that unit of emissions. Suppose, following standard welfare economics, that we measure the *benefits* of a unit of emissions by asking *how much the "emitter" would demand to be compensated for not emitting it*. And suppose that we measure the *costs* of a unit of emissions by asking *how much the "receiver(s)" would be willing to pay to eliminate it*. Thus, the middle column of Table 1 lists the benefits associated with the smoke from each cigarette, while the middle column of Table 2 lists the costs. (Notice that each of these concepts has a complementary flipside. That is, the benefits of emitting are just the flipside of the costs of abatement, while the costs of emitting are just the flipside of the benefits of abatement. To illustrate: if Tyler derives a benefit from smoking, then when he is forced to stop, the cost of abatement is just the benefit he is forced to give up plus any other cost of abatement, such as the costs for nicotine gum.) Now, before any deal is struck between Brittany and Tyler, the cost of the smoke from Tyler's fifth cigarette of the day is $10.00 (i.e. the amount Brittany is willing to pay to reduce that unit of smoke). But the benefit associated with that smoke is just $4.00 (i.e. Tyler's willingness-to-accept compensation for that unit of reduction). This is precisely the mismatch between marginal costs and benefits that Broome associated with Pareto inefficiency,

and we can now see why: in the presence of such a mismatch, it is possible to make at least one person better off without making anyone worse off. In other words, Pareto improvements are available whenever there is a mismatch between marginal costs and marginal benefits. These Pareto improvements will cease to be available at the equi-marginal level, the point where the marginal benefit of cigarette smoke is equal to its marginal cost. In our example, that is the point at which Tyler demands $6.00 in compensation and Brittany is willing to pay $6.00. At that point, Tyler and Brittany will strike their last deal, with the result that Tyler reduces his daily total from five to two. But no further deals will be made beyond that point, since the benefits of emitting the next unit of smoke ($7.00) are greater than its costs ($5.00). Hence Broome's claim: the correct level of pollution reduction from the point of view of Pareto efficiency is the level at which the benefits from emitting one more unit are exactly equal to its costs.

We now arrive at the key point: *it is only when costs and benefits are measured in this way that a mismatch between marginal costs and benefits entails Pareto inefficiency, and thus the availability of Pareto improvements*. To see this, consider an example in which benefits and costs are *not* measured using willingness-to-accept and willingness-to-pay. Suppose we measure the benefits of your homemade vitamin-making operation simply in terms of the extra years of life you'll live by consuming the vitamins, whereas we measure the costs in terms of the years of life I lose by breathing the toxic pollution your operation generates. When measured in this way, there is no guarantee that when the marginal costs of emitting are greater than the benefits there is a sacrifice-free way to bring them into alignment. After all, the only way to reduce the years of life that I lose to pollution might be place hard limits on the amount of pollution you can emit. But if the harms to me are not "backed by money" in the form of my willingness-to-pay, then there is no guarantee that I am willing or able to fully compensate you for reducing your emissions. In contrast, if the harms *are* measured using my willingness-to-pay, and if costs *are*

measured by your willingness-to-accept, then it does follow that Pareto improvements will be available whenever marginal costs exceed marginal benefits. Eventually our bargaining will bring us to the equi-marginal point, and at that point the Pareto inefficiency will have been eliminated, and it will have been eliminated without anyone's having to make a sacrifice.

Although Broome does not mention that the Economic Argument requires costs and benefits to be measured in these ways, Foley is quite explicit about it:

> What is economically relevant is the question of what price…future generations would pay for any degree of abatement of global warming, because that price determines the correct price at which current investments in greenhouse gas abatement should be valued. (Foley, 2009, p. 116)

Here Foley identifies the benefits of greenhouse gas abatement with the price that future generations would be willing to pay to achieve it. (Recall that the *benefits of abatement* are just the flipside of the *costs of emissions*). And just as in our example involving Brittany and Tyler, if future "receivers" are willing to pay more than we "emitters" demand to agree to reduce a marginal unit of our greenhouse gas emissions, then the reduction need not involve a sacrifice. Moreover, such sacrifice-free reductions will be available right up to the point at which receivers' willingness-to-pay equals emitters' willingness-to-accept. This of course does not mean that emissions will have been eliminated at that equi-marginal point. Rather, it means that the externality will have been "cured" of its inefficiency (p. 45, p. 47, p. 48). And at that point, according to Broome, the problem of climate change will have been "fixed" and "solved" (p. 47; Broome 2010, pp. 102-103).

4.

Now that I have explained the workings of the Economic Argument more fully, what should we make of it? Perhaps the first thing to note is that Broome himself is very skeptical that the full costs of climate change can be measured in terms of receivers' willingness-to-pay:

> [G]lobal warming will do great damage to the beauty of the Earth, thereby impoverishing people's lives. This is a great harm it will inflict on future generations. When we assess the benefits of slowing global warming, the benefit of reducing this harm should be included. Some economists do try to include benefits of this sort, on the basis of what people would be willing to pay to possess them. But their attempts are unconvincing. It is much more plausible that goods of this sort simply cannot be put on the same scale as commodities. It is now accepted that economists' material measures of value miss a great deal of what makes life good. This is a very serious gap in cost-benefit analysis as economists do it. (p. 137)

Broome does not say more about why it is problematic to use willingness-to-pay to identify and measure certain climate-related harms. But he is not alone in his skepticism. For example, in specific reference to environmental goods, Daniel M. Hausman has recently argued that, in contrast to daily decision-making that is well-informed by prior consumer experiences, people's willingness-to-pay for environmental improvements will often be insufficiently informed and too unreflective to provide a cogent basis for highly consequential public policy. "When asked about their willingness-to-pay, they will answer, but those answers will not reflect settled valuations" (Hausman, 2012, p. 97). This is one reason (and perhaps it is one of Broome's reasons) to doubt

that the full scale of climate harms can be accurately measured by asking what receivers are willing to pay to prevent them.[6]

Although I am sympathetic to the worry that individuals are not good at assessing their "true" willingness-to-pay, I want to set that issue aside and focus on a second serious problem for the Economic Argument. So let us assume for the sake of argument that individuals are very good at coming to what Hausman calls "settled valuations" about their willingness-to-pay, where these valuations are sufficiently reflective and informed. Suppose further that independent observers (e.g. economists) are also very good at predicting individuals' settled willingness-to-pay. Even so, a significant problem remains with the willingness-to-pay measure when it is used to assess inter-generational costs. This problem stems from a philosophical observation that Broome discusses extensively in another context. The observation highlights what Broome calls "the nonidentity effect," a phenomenon made famous by Derek Parfit (1984, ch. 16). "Nonidentity" here refers to the fact that the set of people who will live in the further future *if we stick with business-as-usual* is completely different from the set of people who will live in the future *if we pursue greenhouse gas abatement* instead. This is because the policy we choose will affect many of the choices people make, and over time this will affect which people end up having children together. Since a person's identity is determined by the specific sperm and egg that conjoin to create that person, vastly different energy policies will eventually lead to different groups of people being alive in the further future.

Broome invokes the nonidentity effect to argue that our profligate greenhouse gas emissions do not in fact harm future generations (p. 61ff.). To see this, suppose we continue with business-as-usual and thereby make it the case that those who live in 200 years suffer many bads related to the impacts of climate change. Still, we cannot be said to have harmed those

[6] Further relevant reservations about willingness-to-pay, which Broome may well share, are discussed in Spash, 2008.

individuals, for if we had pursued abatement instead, *those* individuals would never have existed in the first place. If we assume that climate change will not make life so bad for future people that they will wish they had never been born, it seems that no future person can claim to have been harmed by our emissions. Our emissions were a necessary condition of their very existence. According to Broome, this shows that a good deal of our climate change-related duties are not duties of justice (which are duties owed to specific individuals), but rather duties of goodness (which are duties simply to make the world a better place than it would otherwise be). As he puts it, "Emissions of greenhouse gas...make the lives of future people much worse than the lives of future people could have been. This truth is independent of the origins and the identities of those future people, so it is not subject to the nonidentity problem" (p. 68).

As it happens, the nonidentity effect is not just a problem for the view that our emissions harm future people; it is also a problem for Broome's view that the problem of climate change can be solved without anyone's making a sacrifice. This is because the first premise of Broome's Economic Argument identifies "the problem of climate change" with the Pareto inefficiency caused by unregulated greenhouse gas emissions. But as we have seen, the size or extent of this Pareto inefficiency depends on the amount that future generations would be willing to pay to induce us to curb our emissions. And as Broome's discussion of the nonidentity effect makes clear, the set of future people who will be born under business-as-usual would certainly *not* be willing to pay us to meaningfully curb our emissions, since a major change in our energy policy would make it the case that they never exist. This suggests that it would be a mistake to identify "the problem of climate change" with the Pareto inefficiency that our current emissions engender. Indeed, if the amount that future generations would be willing to pay is *equal to or less than* the amount that we would demand under a policy of abate-and-compensate (as is quite possible), then there would be no Pareto inefficiency and thus no problematic externality and

thus (according to the Economic Argument) no problem of climate change. But intuitively, this observation about future generations' willingness to pay should not lead us to think that the problem of climate change has dissolved. Instead, we should simply say that "the problem of climate change" outstrips the extent of the Pareto inefficiency generated by greenhouse gas emissions, in much the way that Broome said our climate change-related duties outstrip our justice-based duties. But to admit this is to admit that the first premise in the Economic Argument is false, and that the argument itself is unsound. There is simply more to the problem of climate change than the externality-caused Pareto inefficiency, but it is only the Pareto inefficiency that economics guarantees can be eliminated without sacrifice.

It is worth noting a further problem for the Economic Argument that is raised by the nonidentity effect.[7] Broome's discussion highlights the intergenerational bargaining that would take place between our current generation and those who will be alive if we keep on our course of business-as-usual. But since those future people are still merely possible people, perhaps we should not focus exclusively on them; perhaps we should consider the (hypothetical) preferences of all the possible people our choices could bring about. Consider, for example, the distinct set of future people who would result under a policy of abate-and-compensate. Since that set of people will not exist unless we change course away from business-as-usual, it seems likely that they would be willing to pay us a good deal to have us curb our emissions. But if we then agreed to pursue abate-and-compensate, that would change the willingness-to-pay of the set of people who would result under business-as-usual. They would now want us to change back! Thus, if we are allowing ourselves to talk about the preferences of different groups of currently nonexistent but possible future people, we must admit that any choice we make will have winners and losers. And when this is the case, standard welfare economics is not able to say (as Broome

[7] I am grateful to David Morrow for drawing this issue to my attention. However, he is in no way responsible for how I have chosen to present or develop it here.

wants to say) that business-as-usual is Pareto inefficient and that abate-and-compensate is Pareto efficient. Since each option involves winners and losers, standard welfare economics deems them "Pareto noncomparable," which means that neither can be said to be better or worse than the other. This is a well-known limitation of the standard welfare economic framework, and it poses a serious problem for Broome's attempt to establish a sacrifice-free solution to climate change using just the concepts and techniques of welfare economics.

I therefore conclude that the Economic Argument fails, either because assessing harms using willingness-to-pay significantly downplays the true size of the climate change problem, or because the notion of Pareto (in)efficiency cannot be used to explain why climate change is a problem in the first place (given that business-as-usual and abate-and-compensate are Pareto noncomparable). Each of these problems stems in part from the nonidentity effect that Broome draws on elsewhere to argue that climate change-related duties outstrip duties of justice.

Is there, then, a sacrifice-free solution to climate change that is not scuttled by the nonidentity effect? I think there might be. Suppose we hold that if one does not yet exist, one cannot be made worse off by a policy that guarantees one's continued nonexistence. I think many will find this thesis plausible. Consider, for example, Sarah and Bob. Sarah and Bob are contemplating having a baby together. Before they conceive, the child they could have does not yet exist. Now suppose they decide not to conceive. Have they made anyone worse off? I suspect many would say they have not. Perhaps we are willing to say that Sarah and Bob have failed to confer a benefit, but it seems incorrect to say they have harmed someone. If this is right, then there may be a new route to a sacrifice-free solution to climate change. Like the economic route, this new route would involve (1) preventing the bads of climate change by significantly reducing our emissions here and now, and (2) borrowing from the further future to compensate ourselves for doing so. But where the Economic Argument says that future generations are made better off

because they get what they are willing to pay for (hence no sacrifice), the new argument ignores willingness-to-pay and says instead that our borrowing makes no one worse off (hence no sacrifice). If continued non-existence is not a harm, and if those who end up living in the further future are benefited just by being brought into existence, then a policy of abate-and-compensate addresses the bads of climate change without making anyone worse off.

The main problem with this new sacrifice-free solution is that it too leaves open why climate change is a major problem in the first place. The policy of abate-and-compensate will have the consequence that life in the further future will be less good than it would have been if we had abated *without* compensating ourselves. But then if it is permissible to refrain from making the further future as good as possible, why is a careless attitude towards climate change so wrong? In my view, Broome is correct that our climate change obligations stem (at least) from the terrible suffering that will otherwise occur in the future. He is right that this threat to goodness is of grave moral concern even if the nonidentity effect entails that no one who suffers is thereby harmed or wronged. If business-as-usual will be as bad as many scientists predict, then a policy of abate-and-compensate may well be justified as the only way to leave the future in decent shape, especially given current hostilities toward solutions that require current sacrifice. While it is true that business-as-usual and abate-and-compensate each leave the future worse off than is otherwise possible, the latter is more firmly in step with our duties of goodness than is the former. This helps explain why climate change is a problem and why a sacrifice-free policy of abate-and-compensate is a permissible solution.

5.

My main goal has been to show that "the problem of climate change" cannot plausibly be identified with "the Pareto inefficiency created by the unregulated greenhouse gas externality."

The economic concept of an externality-caused Pareto inefficiency simply does not capture the full scope of the climate change problem. This is either because the metric of willingness-to-pay significantly downplays the size of the climate change problem when applied in the inter-generational context, or because business-as-usual and abate-and-compensate are Pareto noncomparable, or both. Hence the first premise of Broome's Economic Argument is false, and the argument fails. However, a main reason for this—i.e. the nonidentity effect—also opens the door to a new, more philosophical sacrifice-free solution to climate change. If that new argument works (as I think it does), the argument now turns on the feasibility of the intergenerational transfer mechanism. So I will join Broome in asking economists to please help us tackle that problem.

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