Paul Bowman¹

On the Alleged Insufficiency of the Polluter Pays Principle

Several theorists of climate change justice have argued that the polluter-pays principle fails to assign duties that, if fulfilled, would be sufficient to prevent or compensate for all climate change-induced harm to persons. This paper contends that their argument for this claim rests on a faulty account of how the costs of rectifying a collectively-caused harm or threat of harm should be allocated among agents who have incurred duties of corrective justice to bear these costs. Given a more plausible account of how these costs should be allocated, it is likely that the polluter-pays principle does in fact assign duties that, if fulfilled, would be sufficient to prevent or compensate for all climate change-induced harm to persons.

¹ Institute for Futures Studies, paul.bowman@iffs.se. Financial support by Riksbankens Jubileumsfond (the Swedish Foundation for Humanities and Social Sciences) is gratefully acknowledged.

I. Introduction

The polluter pays principle holds, roughly, that those who have produced excessive amounts of greenhouse gas emissions have duties to bear the costs of addressing harmful climate change. These costs include the costs required to prevent further anthropogenic changes to the climate system (mitigation costs), the costs required to prevent climate change impacts from harming persons (adaptation costs), and the costs required to compensate persons who have been harmed by climate change impacts (compensation costs).

The polluter pays principle, as it is typically understood by theorists of climate change justice, is based on a widely-endorsed principle of corrective justice: roughly, the principle that agents who wrongfully contribute to a harm or threat of harm incur a duty of corrective justice to bear the costs of rectifying the harm or threat (by preventing, mitigating, or compensating for it). Because climate change has resulted in harm and threatens significant future harm, and because it is plausible that many agents have wrongfully contributed to climate change by producing excessive amounts of greenhouse gas emissions, many theorists have found the polluter pays principle to be an attractive principle for assigning duties to bear the costs of addressing harmful climate change.²

While many theorists accept some version of the polluter pays principle, there appears to be widespread agreement among theorists of climate change justice that the principle is inherently limited or incomplete in one particular respect. Specifically, these theorists accept:

² Theorists who endorse the polluter pays principle include, e.g., Shue (1999), Caney (2005; 2010), Vanderheiden (2008), Bell (2010), Roser and Meyer (2010), Cripps (2013), and Zelletin (2014). Different theorists endorse different versions of the principle. Versions of the principle tend to differ according to the kinds of greenhouse gas emissions the production of which triggers a duty to bear costs. For example, some theorists have defended versions of the principle according to which an agent only incurs a duty to bear costs by producing emissions that exceed the agent's fair share of global 'safe' emissions (e.g., Bell, 2010; Cripps, 2013). Others have defended versions of the principle according to which an agent only incurs a duty to bear costs by producing emissions after the date at which the existence of human-caused climate change became reasonably well-established (e.g., Caney, 2005; Bell, 2010).

Some theorists hold that the polluter pays principle only assigns duties to bear adaptation and compensation costs, whereas different principles are needed to assign duties to bear mitigation costs (e.g., Vanderheiden, 2008; Roser and Meyer, 2010). Although I cannot here explain why, I do not find it plausible to restrict the principle in this way. I assume that the polluter pays principle assigns duties to bear mitigation costs as well as adaptation and compensation costs. My argument in what follows is aimed primarily at the views of those who share this assumption, though my argument could be suitably reformulated to address defenders of the more restricted version of the principle.

The Insufficiency Claim: the total costs that the polluter pays principle assigns agents duties to bear are not sufficient to cover the costs required to prevent or compensate for all climate change-induced harm to persons.

In other words, the Insufficiency Claim holds that if we were to add up all the costs that the polluter pays principle assigns agents duties to bear, these costs would be less than the total costs needed to prevent or compensate for all climate change-induced harm to persons that has occurred and that is threatened to occur. According to the Insufficiency Claim, then, even if all agents fulfill their duties assigned by the polluter pays principle, and if no agents bear additional preventative or compensatory costs, then some people will suffer uncompensated climate change-induced harm.

The Insufficiency Claim is significant because it is widely-accepted that a morally satisfactory response to climate change requires that persons are protected from all climate change-induced harm, or if protection is not possible or morally feasible, then those persons who have been harmed (or will be harmed) by climate change are compensated (e.g., Caney, 2010; Baatz, 2013). Thus, it is widely-accepted that a complete account of climate change justice must include principles that together assign duties that, if fulfilled, would be sufficient to cover the costs required to prevent or compensate for all climate change-induced harm to persons. So, if the Insufficiency Claim is true, then principles in addition to the polluter pays principle are needed to assign duties to bear the remaining costs required to prevent or compensate for all climate change-induced harm to persons. Theorists have typically identified these principles as those that assign duties to bear costs on the basis of agents' ability to pay (e.g., Caney, 2005; 2010) or on the basis of the benefits that agents have received from activities that produced greenhouse gas emissions (e.g., Baatz, 2013; Duus-Otterström, 2014).

In what follows, I will evaluate the Insufficiency Claim. I will contend that the primary argument that theorists have advanced in support of the claim rests on a faulty account of how the costs of fully rectifying a collectively-caused harm or threat should be allocated among those who incur duties of corrective justice to bear at least some of these costs. Moreover, I will argue that given a more plausible account of how these costs should be allocated, it is likely that the Insufficiency Claim is false. At the very least, I hope to show that the question is more complicated than theorists have hitherto assumed.

The basic plan for the paper is this. In section II, I will present what I take to be the main argument for the Insufficiency Claim. In sections III through V, I will evaluate the account that underlies the central premise in that argument. I will argue that this account is false, and I will defend a competing account. In Section VI,

I will consider the implications of my account for the Insufficiency Claim. I will argue that the Insufficiency Claim is likely false. I will conclude briefly in Section VII.

II. The main argument for the Insufficiency Claim

As I have said, the Insufficiency Claim has received widespread support among theorists of climate change justice. What arguments, then, do defenders of the Insufficiency Claim provide in support of it?

According to its defenders, the Insufficiency Claim is supported, first, by the fact that the polluter pays principle does not, for obvious reasons, assign duties to agents who have emitted greenhouse gases but who are now dead. In one of his several articles that discusses the problem that dead emitters pose for the polluter pays principle, Simon Caney (2005) writes that:

One problem with applying the ‘polluter pays’ principle to climate change is that much of the damage to the climate was caused by the policies of earlier generations. It is, for example, widely recognized that there have been high levels of carbon dioxide emissions for the last two hundred years, dating back to the Industrial Revolution in western Europe. This poses a simple, if also difficult, problem for the ‘polluter pays’ principle: who pays when the polluter is no longer alive? (p. 756)

Caney argues, ultimately, that the polluter pays principle, “cannot say who should bear the costs of climate change caused by past generations,” and so a different principle is needed to assign duties to bear these costs (2005: 761).³

Similarly, Göran Duus-Otterström (2014) writes:

[The polluter pays principle], however, cannot handle emissions that were emitted by agents who are no longer in existence—what I will call *past emissions*. Even though such emissions may continue to force the climate, there is no way of making the polluters responsible for them to ‘pay.’ Only the living—by definition not responsible for having caused past emissions—can shoulder duties. Thus, if we now want to handle or compensate for past emissions, some will have to bear *extra burdens*. (p. 449, his emphasis)

³ See Caney’s 2010 for a similar argument. In both his 2005 and his 2010, Caney argues that the polluter pays principle should be supplemented with a version of the ability to pay principle.

Like Caney, Duus-Otterström argues that duties to bear the burdens not assigned by the polluter pays principle must be assigned according to a different principle.⁴

Here, finally, is Moellendorf (2014):

[A] serious practical problem of insufficient collection exists [. . .] because many of the damage-causing stock of atmospheric CO₂ was produced by people who are now long dead. Despite the remarkable advances of modern medicine, there is little prospect of recouping costs from them. So, any assignment of responsibility on the basis of [the polluter pays principle] necessarily ensures that full costs will not be recouped. (p. 166)

According to Caney, Duus-Otterström, and Moellendorf, although many agents who are now dead produced greenhouse gas emissions, the polluter pays principle does not assign duties to bear the costs of addressing harmful climate change on the basis of these emissions. Therefore, duties to bear the costs attributable to these emissions must be allocated according to some other principle or principles (or left unaddressed).⁵

In addition to not assigning duties on the basis of emissions of those who are now dead, some versions of the polluter pays principle do not assign duties on the basis of some currently living agents' greenhouse gas emissions. Some theorists who endorse one of these versions of the polluter pays principle have pointed to this fact as further evidence for the Insufficiency Claim.

For example, Baatz (2013) argues for a version of the polluter pays principle that does not assign duties on the basis of emissions agents produced prior to 1990, given that prior to 1990, agents were non-culpably ignorant that their emissions were

⁴ According to Duus-Otterström (2014), this principle is what he calls the "inherited debt principle," which holds, roughly, that extra burdens should be borne by those who have inherited holdings that resulted from uncompensated overuse of the atmosphere.

⁵ Also see Page (2008), who states that "the 'contribution to problem' approach cannot deal well with the fact that many of the individual citizens and policymakers responsible for their countries' historical emissions are now dead" (p. 559).

It is important to note that, according to supporters of the Insufficiency Claim, expanding the *kind* of agent to which the polluter pays principle assigns duties to include collective entities like states and corporations does not eliminate the problem of dead emitters, for three reasons. First, with respect to states, Caney (2010) argues that it would be unfair for the current citizens of a state to bear the costs attributable to emissions generated long before these citizens were alive. If this is correct, then it appears that states can incur duties only on the basis of emissions they produced in the more recent past. Second, Caney (2010) notes that some of the states and corporations that produced emissions no longer exist. Therefore, the polluter pays principle does not assign duties to these "dead" states and corporations. And third, even if states and corporations can be held liable on the basis of the emissions they produced in the distant past, many now dead individual persons *also* produced emissions. Thus, the problem remains: many dead agents emitted greenhouse gases, but the polluter pays principle does not assign duties to bear costs on the basis of their emissions.

contributing to harmful climate change. Baatz states that an implication of the principle is that the principle cannot address “who has to pay for damages caused by pre-1990 emissions” (p. 96).⁶ Similarly, Caney (2010) argues for a version of the polluter pays principle that does not assign duties on the basis of emissions produced by activities that are necessary for one’s “fundamental survival” (p. 213). According to Caney, such emissions are legitimate, or morally justified, and thus do not trigger duties of corrective justice. Consequently, Caney argues that the polluter pays principle must be supplemented with principles needed to “deal with [. . .] harmful climate changes that stems from [. . .] the (legitimate) emissions of the disadvantaged” (p. 213).⁷

We can, I believe, capture the basic form of the argument for the Insufficiency Claim as follows:

(P1) The polluter pays principle does not assign duties to bear costs on the basis of a significant portion of greenhouse gas emissions.

(P2) If the polluter pays principle does not assign duties to bear costs on the basis of a significant portion of greenhouse gas emissions, then the total costs that the polluter pays principle assigns agents duties to bear are less than the total costs required to prevent or compensate for all climate change-induced harm to persons.

Insufficiency Claim: The total costs that the polluter pays principle assigns agents duties to bear are less than the total costs required to prevent or compensate for all climate change-induced harm to persons.

Call this the “Main Argument.”

The Main Argument appears to be valid. Moreover, (P1) is clearly true. Defenders of the Insufficiency Claim have identified three kinds of emission on the basis of which at least some versions of the polluter pays principle do not assign duties to bear costs:

⁶ See Caney (2005) and Bell (2010) for similar arguments.

⁷ Caney (2010) claims that, in addition to the emissions of those now dead and emissions that are morally justified, the polluter pays principle cannot deal with climate change that stems from natural factors. Given space constraints, I have chosen not to address this argument here. I plan to address the topic elsewhere. In short, I think that we should treat natural factors as background conditions for the purposes of determining the magnitude of anthropogenic climate change-induced harms that the polluter pays principle assigns duties to address. Since non-anthropogenic climate change accounts for only a very small amount of observed warming, it is unlikely that non-anthropogenic climate change would, in the absence of anthropogenic activities, result in any serious harm. Therefore, the existence of natural climate change provides little or no support for the Insufficiency Claim.

- (a) Emissions produced by those who are now dead (“*past emissions*”)
- (b) Emissions produced by activities that are morally justified, including activities required for survival (“*justified emissions*”), and
- (c) Emissions produced by agents who have a full excuse for producing them, including agents who were non-culpably ignorant that their emissions were contributing to harmful climate change (“*excused emissions*”).

Note that no version of the polluter pays principle assigns duties on the basis of past emissions, whereas some, but not all, versions of the principle assign duties on the basis of agents’ justified emissions or excused emissions. Going forward, I shall assume that the correct version of the polluter pays principle does not assign duties on the basis of emissions from any of the above categories. Henceforth (and for lack of a better term), I shall refer to the emissions from any of these categories as *non-liable emissions*, or NLEs.

So (P1) is true. What about (P2)? (P2) states that an implication of (P1) is the Insufficiency Claim: that the total costs that the polluter pays principle assigns agents duties to bear are less than the total costs that are required to prevent or compensate for all climate change-induced harm. Specifically, defenders of the Insufficiency Claim hold that the polluter pays principle fails to assign duties to bear the costs of preventing or compensating for climate change-induced harm that “stems from” or is in some way attributable to NLEs.

Although (P2) is the crux of the Main Argument, proponents of the Insufficiency Claim have not, to my knowledge, explicitly defended it. As the passages I quoted above indicate, these theorists proceed directly from the fact that NLEs exist to the Insufficiency Claim. In the remainder of the paper, I shall attempt to determine whether the existence of NLEs implies or in any way supports the Insufficiency Claim. My strategy will be to investigate different accounts of how the principle of corrective justice on which the polluter pays principle is based should assign agents duties to bear the costs of rectifying a collectively-caused harm or threat when the actions of those who are now dead, as well as justified actions and excused actions, have contributed to the harm or threat. I will argue that the account that underlies (P2) is false. I will also argue for a competing account, which neither implies nor supports the Insufficiency Claim.

III. Corrective Justice and the share of the total account

The moral principle that underlies the polluter pays principle is roughly the following:

Principle of Corrective Justice–Multiple Agents (CJ-MA): If several agents' actions contribute to some harm or threat of harm h , then an agent A incurs a duty of corrective justice to bear some of the costs of rectifying h (preventing, mitigating, or compensating for h) just in case A makes an unjustified and unexcused contribution to h .

Although (CJ-MA) specifies the conditions under which an agent incurs a duty of corrective justice, the principle does not address the extent of an agent's duty, or the costs that the agent incurs a duty to bear in service of rectifying the harm or threat.

Theorists who have discussed the polluter pays principle have typically stated or suggested that the extent of an agent's duty assigned by the principle must reflect, or be in proportion to, the amount of (unjustified and unexcused) emissions that the agent produced. Caney (2005), for example, states that the polluter pays principle is based on the principle that "if actors X , Y , and Z perform actions which together cause pollution, then they should pay for the cost of the ensuing pollution in proportion to the amount of pollution that they have caused" (p. 754).

Therefore, I will assume that (CJ-MA) also includes what I will call the *proportionality constraint*:

the extent of the costs of rectifying h that A incurs a duty to bear must be in proportion to the extent of A 's unjustified and unexcused contributions to h .

There are different ways in which one might interpret the proportionality constraint. Moreover, the correct interpretation of the constraint is relevant to whether the Insufficiency Claim is true. As I explain below, theorists have tended to assume (unjustifiably, in my view) an interpretation of the proportionality constraint that has led these theorists to accept (P2) and thus the Insufficiency Claim. For now, it is enough to note that the proportionality constraint implies that the extent of an agent's unjustified and unexcused contributions to a harm or threat is one factor that determines the extent of the costs that the agent incurs a duty of corrective justice to bear. This leaves open whether there are other factors that determine the extent of an agent's duty.

The following example will help illustrate (CJ-MA). I will use this example (as well as several variations) in my subsequent discussion of the principle:

Waste: Each of four agents—A, B, C, and D—independently dumps ten gallons of the same kind of industrial waste into a creek that feeds into a victim V's water supply. Each agent dumps her waste to avoid a moderate yet affordable disposal fee. V drinks the waste-laced water and goes blind. At the time of action, each agent knows for certain that the other agents either have dumped or will dump their waste. Each agent also knows for certain that her waste, combined with the others' waste, will result in V's going blind, and that V would not go blind (or be harmed at all) if no agent dumps her waste. The total cost of restoring V's eyesight is \$1,200, and there are no additional, compensatory costs. A, B, C and D are each capable of fulfilling whatever duty is assigned to her.

I assume that the cost of fully rectifying the harm to V is \$1,200. (Henceforth, I will sometimes refer to the cost of fully rectifying some harm or threat as the *magnitude* of that harm or threat.)

Additionally, I assume that none of the agents' contributions are either justified or excused. I assume also that nothing morally differentiates the agents' actions from one another. I assume, finally, that (CJ-MA) implies that each A, B, C, and D incurs a duty to bear one-fourth of the \$1,200 cost, or \$300. In this case, the total cost that (CJ-MA) assigns agents duties to bear is equal to the total cost of fully rectifying the harm to V.

The implications of (CJ-MA) appear to be relatively straightforward in cases like *Waste* in which all of the contributions to the harm or threat are those on the basis of which the principle assigns duties.⁸ However, (CJ-MA) does not, by itself, tell us how the costs of rectifying a collectively-caused harm or threat should be allocated among agents when one or more contributions are *not* those on the basis of which (CJ-MA) assigns duties—i.e., the contributions of those who are now dead, or justified or excused contributions. (I will henceforth refer to such contributions as non-liable *contributions*, or NLCs.)

Let's therefore consider how (CJ-MA) should handle NLCs. Consider the following variation of *Waste*:

⁸ This is not to say that there may not be other problems with (CJ-MA) or applying (CJ-MA) to particular cases (e.g., cases in which assessing the extent of an agent's contribution is not straightforward).

Dead Polluter: Same as *Waste*, but A dies before she fulfills her duty to contribute \$300. A leaves no estate from which her duty can be fulfilled.

Notice that once A dies, (CJ-MA) does not assign a duty on the basis of A's contribution to the harm, given that A, the would-be duty-bearer, is dead. A's contribution is an NLC.

As before, the magnitude of the harm is \$1,200. What, then, is the cost that each of the three remaining agents—B, C, and D—has a duty to bear, given that A's contribution is an NLC? Does each simply have a duty to bear the cost that she would have had to bear had A *not* died (i.e., \$300)? This would mean that (CJ-MA) does not assign a duty to bear the remaining \$300 of the \$1,200 cost. Or does each of the remaining agents incur an additional duty to bear a portion of the cost that A had a duty to bear while she was alive, perhaps in proportion to the extent to which each remaining agent contributes to the harm (i.e., \$1,200 divided by three, or \$400 each)? Or is there perhaps another way of allocating the costs?

Proponents of the Insufficiency Claim have not, to my knowledge, explicitly argued for an answer to this question.⁹ It is highly plausible, however, that they have simply presupposed the truth of what I will call the *Share of the Total Account*.¹⁰ roughly, the view that the cost that an agent P has a duty to bear in service of rectifying a collectively-caused harm or threat h is *n*, where:

$$\frac{n}{\text{total costs of rectifying } h} = \frac{\text{the extent of P's unjustified and unexcused contributions to } h}{\text{the extent of all contributions to } h \text{ (including NLCs)}}$$

Consider again *Dead Polluter*. Because B, C, and D each contributes one-fourth of the total waste that results in the harm to V, according to the Share of the Total Account, each must bear one-fourth of the total costs of rectifying the harm to V (one-fourth of \$1,200, or \$300 each). Thus, (CJ-MA) assigns duties to bear costs totaling \$900 of the \$1,200 total cost of rectifying the harm. If the Share of the Total Account is correct, then (CJ-MA) does not assign duties to bear the remaining \$300 cost.

Notice that if the Share of the Total Account is correct, then (P2) is true: the existence of NLEs implies that the total costs that the polluter pays principle assigns

⁹ Though as I shall discuss in section V, Caney (2005) does briefly argue against one answer to this question.

¹⁰ I borrow this name from Parfit (1984). The Share of the Total Account that Parfit discusses resembles but is not identical to the account I discuss here.

duties to bear is less than the total costs required to prevent or compensate for all climate change-induced harm. Therefore, the Share of the Total Account supports the Insufficiency Claim.

I suspect that theorists who endorse the Insufficiency Claim simply presuppose the truth of the Share of the Total Account. There are three reasons for my suspicion. First, the Share of the Total Account provides a straightforward and intuitive way to understand the proportionality constraint. Second, the Share of the Total Account provides unambiguous support for (P2). As I mentioned above, theorists who endorse the Insufficiency Claim do not explicitly defend (P2). If these theorists simply presuppose the truth of the Share of the Total Account, it is understandable why they do not think it is necessary to defend (P2). And third, the Share of the Total Account makes some sense of the idea the polluter pays principle does not assign duties to bear costs that “stem from” NLEs. In *Dead Polluter*, for example, the Share of the Total Account makes sense of the idea that the remaining \$300 of the \$1,200 total cost stems from A’s contribution—namely, the cost stems from A’s contribution in the sense that the extent of the cost is strictly proportional to the extent of A’s contribution.

Over the next two sections, I will argue that the Share of the Total Account is false. I will also argue for an alternative account of how (CJ-MA) should assign duties to bear the costs of rectifying a collectively-caused harm or threat when some of the factors that contributed to it are NLCs.

IV. Two bad arguments for the Share of the Total Account

There are two arguments for the Share of the Total Account that are worth considering but that can be dispensed with relatively quickly. The first argument seeks to establish the Share of the Total Account on the basis of a metaphysical claim concerning the attribution of certain consequences to a person’s action. Perhaps it is *prima facie* plausible that, as a purely metaphysical claim, if an agent contributes $n\%$ of all contributions that result in a harm or threat, then the agent individually causes $n\%$ of that harm or threat. If this claim is true, and if we also assume that an agent incurs a duty of corrective justice to bear only the cost of rectifying a harm or threat she individually causes, then an agent who contributes $n\%$ of all contributions that result in a harm or threat incurs a duty to bear, at most, $n\%$ of the cost of rectifying the harm or threat, as the Share of the Total Account states.

However, it is false that if an agent contributes $n\%$ of all contributions that result in a harm or threat, then the agent individually causes $n\%$ of that harm or threat. To see why, consider two versions of *Waste*. In the first version, suppose that V would

have gone blind if at least thirty-five gallons of waste were dumped in the creek, such that agent A's contribution is necessary, but not sufficient, for V's blindness. In the second version, suppose that V would have gone blind if only twenty-five gallons of waste were dumped in the creek, such that A's contribution is neither necessary nor sufficient for V's blindness. In neither version of the case does it seem that we can, in any meaningful, metaphysical sense, attribute one-fourth of the harm V suffers to A's contribution. In the first version, given that A's contribution is necessary for the harm, it seems that A individually causes the entire harm.¹¹ In the second version, A's contribution is one of several factors that together cause the entire harm, though the contribution does not seem individually to cause any harm.

There may be some circumstances where by contributing $n\%$ of all contributions that result in a harm, the agent individually causes $n\%$ of that harm. Suppose, for example, that in *Waste*, the agents dump their ten gallons sequentially, and V's vision gets incrementally worse by an equally bad amount for each ten gallons of waste that is dumped until V is completely blind after the last agent dumps her waste. In this version, perhaps it makes sense to say that A individually causes one-fourth of the harm to V, given that A's contribution is both necessary and sufficient for a loss that is a component of an overall much greater loss. But importantly, most of the harms that have resulted and will result from climate change are not like this. One person's emissions are not, nor will they ever be, necessary and sufficient for a part of any person's climate change-induced loss of life, health, or property in the way that A's dumping her waste is necessary and sufficient for part of V's blindness. Rather, one person's emissions are more like A's contributions in the variations of *Waste* discussed in the previous paragraph. Either a person's emissions are necessary but not sufficient for some climate change-induced harms, or (far more commonly) the emissions are neither necessary nor sufficient for the climate change-induced harms to which the emissions contribute.

Let's turn to the second argument for the Share of the Total Account. Several theorists have argued that an agent's emitting greenhouse gases individually increases *expected* climate change-induced harm by increasing the probability that additional or worse climate change impacts will occur.¹² Moreover, given that there is a roughly linear relationship between total global emissions and total expected climate change-induced harm, these theorists argue that it is possible to approximate the extent to which an agent's emissions individually increase expected harm by dividing her emissions by total global emissions and then by multiplying this

¹¹ Of course, each of B, C, and D also individually causes the harm. I do not think it is implausible that more than one agent can individually cause some harm.

¹² See, e.g., Hiller (2011), Broome (2012), and Morgan-Knapp and Goodman (2015).

number by the total harm expected to result from total global emissions.¹³ If we suppose that each agent incurs a duty to bear only the costs that correspond to the extent to which the agent's unjustified and unexcused contributions individually increase expected harm, then perhaps the Share of the Total Account is correct in virtue of best approximating these costs.

In response, it is false that each agent incurs a duty to bear only the costs that correspond to the extent to which the agent's unjustified and unexcused contributions individually increase expected harm. Consider:

Overdetermined Threat: Same as *Waste*, but at the time of acting, each agent knows for certain that (a) if twenty-five or fewer total gallons of waste are dumped, V will not suffer any harm at all, but (b) if greater than twenty-five total gallons of waste are dumped, V will go blind in the near future, unless significant preventative action is taken (e.g., draining and replenishing the water supply). Each agent also knows for certain that V is not at risk of suffering any harm worse than blindness regardless of how much total waste is dumped (and that no other person is at risk of suffering harm). Finally, each agent knows for certain that the other agents have dumped or will dump their waste, and each agent knows that she cannot prevent any other agent from dumping her waste.

None of the agent's contributions individually increase expected harm. Yet it is highly plausible both that each agent lacks either justification or excuse for her contribution, and that each agent incurs a duty of corrective justice to bear one-fourth of the costs of preventing the harm they together threaten. Therefore, if the Share of the Total Account is correct, it is not correct because it best approximates the costs that correspond to the extent to which an agent's unjustified and unexcused contributions individually increase expected harm.

The Share of the Total Account is not supported, then, by either of the two arguments discussed in this section. This does not mean, of course, that the account is false. Over the next two sections, I will argue that the Share of the Total Account is false.

¹³ Note that the relationship between total greenhouse gas emissions and total actual harm is a nonlinear threshold function. Yet because the precise location of the relevant threshold-levels is unknown, the relationship between emissions and *expected* harm is roughly linear.

V. The Share of the Total Account and the Joint Liability Account

To better evaluate the Share of the Total Account, it will be helpful to introduce a competing account: what I will call the *Joint Liability Account*. The Joint Liability Account holds that (CJ-MA) allocates the total costs of rectifying a collectively-caused harm or threat among current duty-bearers in proportion to the extent of each agent's unjustified and unexcused contributions to the harm or threat. Therefore, the Joint Liability Account implies that in *Dead Polluter*, each B, C, and D has a duty to bear one-third of the \$1,200 magnitude harm that results from the actions of A, B, C, and D (or \$400 each). If B were to die, each C and D would have a duty to bear one-half of \$1,200, or \$600 each.

Let's consider the merits and deficiencies of the Joint Liability Account and the Share of the Total Account. Interestingly, Caney (2005) briefly considers but quickly rejects something like the Joint Liability Account, at least as it applies to dead emitters. He writes:

The suggestion, then, is that current polluters should pay the costs of their pollution and that of previous generations. In this way, it might be said, the mitigation and adaptation costs of climate change are shouldered by the polluters (and not by non-polluters). But this seems unfair: they are paying more than their due [...] It is alien to the spirit of the [polluter pays] principle to make people pay for pollution which is not theirs. (2005, p. 760)

I understand Caney to be arguing that it would be unfair for the (currently living) duty-bearers identified by the polluter pays principle to bear the entire cost of preventing or compensating for climate change-induced harm, given that their emissions compose only a portion of the total emissions causing harmful climate change. If we generalize away from the circumstances of climate change, Caney's argument suggests that the Joint Liability Account unfairly burdens some agents by requiring them to bear all the costs of rectifying a harm or threat when these agents only contribute a portion of the total contributions that cause the harm or threat.

It is helpful, I believe, to point out that Caney's criticism of the Joint Liability Account appears to presuppose a particular interpretation of (CJ-MA)'s proportionality constraint. The proportionality constraint, recall, states that the costs that each agent incurs a duty to bear in service of rectifying a harm or threat must be proportionate to the extent of the agent's unjustified and unexcused contributions to the harm or threat. Caney suggests that if an agent bears a greater share of the costs than her share of contributions, as the Joint Liability Account prescribes she

must, then the costs that the agent bears is not proportionate to the extent of the agent's contribution to the harm or threat—it is to make them “pay for pollution that is not theirs.” Caney's argument suggests, then, that the proportionality constraint should be interpreted in a way that implies the Share of the Total Account.

But we need not endorse Caney's interpretation of the proportionality constraint. We are ultimately concerned with the question of whether some cost is proportionate to the extent of the agent's unjustified and unexcused contributions to a harm or threat in the sense that it would be *fair* for the agent to bear that cost, given the extent of the agent's unjustified and unexcused contributions to the harm or threat. Therefore, we should investigate the ways in which it might be fair (or unfair) for an agent to bear some cost, particularly when the fairness (or unfairness) is explained by the extent of the agent's unjustified and unexcused contributions to a harm or threat.

With respect to collectively-caused harms and threats, there are two ways in which it might be fair (or unfair) for an agent to bear some cost. First, an agent's bearing some cost might be fair (or unfair) to the agent in comparison to the costs borne by the other duty-bearers. For example, in *Waste*, suppose that A bears half the costs of rectifying V's harm, while B, C, and D together bear the other half (such that each B, C, and D bears one-sixth of the total cost). It would be unfair for A to bear this cost, given that each B, C, and D contributes to the harm to the same extent as A (and given that there are no other morally relevant differences among their actions).

Notice, however, that both the Share of the Total Account and the Joint Liability Account imply that the costs that agents incur duties to bear are fair in this way. For instance, in *Dead Polluter*, both the Share of the Total Account and the Joint Liability Account imply that B, C, and D should each bear the *same* costs as one another, given that each contributes to the harm to the same extent (and given that there are no other morally relevant differences among their actions). Whichever account is correct, there is no difference in the fairness of the allocation of costs *among* the agents who incur duties to bear costs on the basis of (CJ-MA).¹⁴¹³

Let's consider, then, the second way in which it might be fair (or unfair) for an agent to bear some cost. It might be unfair for an agent to bear a cost *independently* of the costs that other agents have duties to bear on the basis of (CJ-MA). Consider:

¹⁴ Might it be unfair that, according to the Joint Liability Account, B, C, and D must bear the cost of rectifying the harm rather than A? Perhaps there is something unfair about A's having avoided paying her fair share of the costs—that through death, A somehow “escaped” justice. However, even if it is unfair that A does not pay her fair share before her death, notice that this unfairness does not go away were the costs previously assigned to A borne by someone *other* than B, C, or D. That is, these costs must be borne by someone, whether by V, by the other contributors to the harm, or by third parties on the basis of some other allocative principle. So this kind of unfairness (if it even exists) can't support an objection to the Joint Liability Account that doesn't also apply to the Share of the Total Account.

Mostly Dead Polluters: Each of one million agents negligently discharges a drop of industrial waste into the creek. The one million drops together result in one million dollars of damage, though no one agent's contribution is necessary or sufficient for the harm. None of the agents has either an excuse or a justification for her action. All but one of the agents die before discharging their duties. Gert is the only living contributor.

Although Gert surely has a duty of corrective justice to bear a portion of the million-dollar cost, it seems unfair for Gert to bear the entire cost. It seems particularly unfair if Gert were not very rich and would take her the rest of her life to raise the million dollars. The unfairness is not explained by the costs that other liable agents bear, given that there are no other liable agents still alive. Rather, the million-dollar cost exceeds some upper limit on what it is fair for Gert to bear in service of rectifying the harm, independently of the costs that other liable agents bear. I will call the maximum cost that it is fair for a liable agent to bear independently of the costs that other liable agents bear the agent's *maximum cost threshold*.¹⁵

Mostly Dead Polluters gives us good reason to reject the Joint Liability Account. The Joint Liability Account implies that Gert has a duty to bear the entire million-dollar cost. I have said that it is implausible that Gert has a duty to bear this cost. The cost exceeds Gert's maximum cost threshold.

Notice that the reason the cost exceeds Gert's maximum cost threshold is that the large cost does not seem to be in proportion to the extent of Gert's minimal contribution to the harm. However, accepting the judgment that the million-dollar cost is not in proportion to the extent of Gert's contribution to the harm does not commit us to accepting the conception of the proportionality constraint that implies the Share of the Total Account. It may be that the extent of an agent's unjustified and unexcused contributions to a harm or threat is one of *several* factors that determine the agent's maximum cost threshold, and hence whether it would be fair for the agent to bear some cost. If so, then perhaps an agent's maximum cost threshold can be greater than the one set by the Share of the Total Account.

VI. Rejecting the Share of the Total Account

An agent's maximum cost threshold can indeed be greater than the one set by the Share of the Total Account. It can fair for an agent to bear a cost that is greater—

¹⁵ For the notion of a maximum cost threshold, I credit Tadros (2013; 2017: Ch. 4), who uses a similar concept (what he calls a "maximum *harm* threshold") in his account of liability to punishment. According to Tadros, an agent's maximum harm threshold is the maximum amount of harm the agent is liable to suffer as punishment.

sometimes significantly greater—than the cost that the Share of the Total Account implies that would be fair for the agent to bear.

Before I argue for that claim, notice that even in circumstances in which only one agent causes a harm, the cost that the agent has a duty of corrective justice to bear can be limited by her maximum cost threshold. Suppose, for example, that while walking on a busy street, I carelessly bump into you, causing you to sprain your ankle. Suppose that for whatever reason, it would cost one million dollars to restore your ankle to full strength and to compensate you for your pain. Suppose also that I am not very rich, and that it would take me the rest of my life to work off the debt. Although I clearly owe you *something*, it seems unfair that I must bear the entire million-dollar cost. My behavior, though careless, does not make me liable to bear such a large cost.¹⁶ This suggests, then, that an agent's maximum cost threshold is not determined solely by the extent of an agent's unjustified and unexcused contributions to a harm or threat. In the above case, the fact that my action is negligent, rather than malicious, seems to be relevant to my maximum cost threshold. If I had maliciously caused you to sprain ankle, then it seems that I would have a duty of corrective justice to bear a much greater portion of the million-dollar cost, perhaps even all of it. This suggests that the degree of an agent's *culpability* for causing or contributing to a harm or threat is relevant to the agent's maximum cost threshold, and not just the extent of the agent's unjustified and unexcused contributions. I will return to this idea below.

Perhaps when a harm or threat is collectively-caused, the cost that it would be fair for an agent to bear is *limited* by the extent of the agent's unjustified and unexcused contributions in the sense described by the Share of the Total Account. Perhaps other factors (like an agent's diminished culpability) can only reduce the agent's maximum cost threshold below the agent's share of total costs.

It is highly doubtful that this is the case, however. An agent's maximum cost threshold can exceed the maximum cost that the Share of the Total Account implies that it would be fair for the agent to bear.

To see why, consider first the following case:

Field Clearing 1: Anton wants to clear his yard of a large boulder. The most convenient way for him to do so is to push the boulder off a nearby cliff. Unfortunately, V is unwittingly sitting in his car just below the cliff. Anton knows this but doesn't care. He pushes the boulder off the cliff, and it lands on V's car, gravely injuring V.

¹⁶ For a discussion of this kind of case, see Waldron 1995. See also Tadros (2013: 302) for a similar case.

Anton, we can agree, incurs a duty of corrective justice to compensate V. Moreover, it is difficult to imagine a monetary cost that would be unfair for Anton to bear, if Anton's bearing that cost were necessary to compensate V fully for his injury. So although the cost that Anton has a duty to bear may be limited by *necessity* (by the cost required to fully compensate V for the injury) or by Anton's capacity to bear the cost, any monetary cost that is needed to rectify the harm to V would not exceed Anton's maximum cost threshold.¹⁷

Here is a brief argument for this claim. Any cost needed to rectify V's harm that is not borne by Anton must be borne by someone else, either by V himself or by third parties (perhaps on the basis of a different principle). Anton could have avoided bearing any rectificatory costs by fulfilling his moral obligation to refrain from rolling the boulder off the cliff. Because Anton culpably failed to fulfill his moral obligation, Anton has only a weak objection to bearing even extremely significant costs if his bearing that cost were necessary to compensate V for the harm. On the other hand, both V and third parties have strong objections to bearing any portion of the cost, given that there was very little that they could have done to avoid bearing it. So it is fair for A to bear even very significant costs to compensate V, rather than for V or third parties to bear any portion of the cost themselves.¹⁸

Yet now consider:

Field Clearing 2: Same as *Field Clearing 1*, but Beth knows that Anton is going to push the boulder over the cliff. Hoping to get revenge on V, Beth coaxes V to park his car just below the cliff. Anton knows that Beth does this, but Anton pushes the boulder anyway (solely to remove the boulder from his yard). The boulder lands on V's car, gravely injuring V.

It seems that Anton's maximum cost threshold in *Field Clearing 2* is the same as in *Field Clearing 1*. In *Field Clearing 2*, Anton performs the same action, which results in the same foreseeable consequences as in *Field Clearing 1*. The fact that Beth contributes to the harm V suffers in *Field Clearing 2* does not seem to reduce the maximum cost that it is fair for Anton to bear. Again, perhaps the cost that Anton has a duty to bear is limited by Anton's capacity to bear it. It may also be limited by necessity, especially since the cost that Anton must bear to ensure that V is fully

¹⁷ Perhaps we could imagine a non-monetary cost that exceeds Anton's maximum cost threshold. Suppose, for example, that the only way to restore fully V's abilities would be to kill Anton and harvest his organs. It is plausible that this cost would exceed Anton's maximum cost threshold. If that example doesn't convince you, imagine that for whatever reason Anton must first be tortured.

¹⁸ For a discussion of the relevance of culpability to liability in the manner sketched here, see Scanlon (1998: Ch. 6) and Tadros (2011).

compensated may be only a portion—perhaps half—of the total cost needed to fully compensate V, given the existence of a second liable agent in *Field Clearing 2*. However, the cost does not seem to be limited by Anton's maximum cost threshold.

The conclusion reached here is already strong evidence against the Share of the Total Account. Suppose that in *Field Clearing 2*, (CJ-MA) implies that Anton and Beth each incur a duty to bear one-half of the cost needed to fully compensate V. Suppose, however, that Beth dies before she can contribute her share. Given that the cost of fully compensating V does not exceed Anton's maximum cost threshold, it seems that Anton should bear the entire cost himself.

The argument for this conclusion is similar to my previous argument for why it is fair for Anton to bear the entire rectificatory cost in *Field Clearing 1*. In *Field Clearing 2*, when Beth dies, Beth's share of the cost must be borne either by Anton, by V, or by third parties. Anton has only a weak objection to bearing the additional cost, given that he could have easily avoided bearing this cost by fulfilling his moral obligation to refrain from rolling the boulder off the cliff. Yet V and third parties have strong objections to bearing the cost; they could not reasonably have done anything to avoid bearing it. So it is fair for Anton to bear the entire cost of fully compensating V (including Beth's share), rather than for V or any third party bear any portion of the cost themselves.

Perhaps a proponent of the Share of the Total Account could respond by pointing out that in *Field Clearing 2*, both Anton and Beth are causally necessary for V's injury, whereas in the case of climate change, it is unlikely that any individual's action is causally necessary for any climate change-induced harm. Perhaps, then, the reason that the maximum cost threshold is the same in *Field Clearing 1* and *Field Clearing 2* is that, in both cases, Anton's action is causally necessary for V's harm, but in cases in which no agent's action is causally necessary for the harm, an agent's maximum cost threshold is limited by the extent of the agent's unjustified and unexcused contributions, in the sense implied by the Share of the Total Account.

We can investigate this possibility. Consider first:

Field Clearing 3: Both Anton and Beth want to clear their respective yards of a medium-sized boulder. The quickest way for each to do so is to push his or her boulder off the same nearby cliff. Unfortunately, V is unwittingly sitting in his car just below the cliff. Anton knows that if he (and he alone) pushes his boulder off the cliff, it will not harm V. However, he knows that if both he and Beth push their respective boulders off the cliff, the combined weight of their boulders will land on V's car, gravely injuring V. Anton knows that Beth will push her boulder. Both Anton and Beth push their boulders, which land on V's car, gravely injuring V.

Anton and Beth do not intentionally coordinate their actions, and each is motivated solely to clear his or her boulder.

The only difference between *Field Clearing 2* and *Field Clearing 3* is how each Anton and Beth make a causally necessary contribution to the harm that V suffers (Beth by pushing a boulder, Anton by pushing a medium-sized boulder rather than a large one). It is hard to see why this difference should matter to Anton's maximum cost threshold. If Anton's maximum cost threshold is the same in *Field Clearing 3* as in *Field Clearing 2*, then by transitivity, Anton's maximum cost threshold is the same in *Field Clearing 3* as in *Field Clearing 1*.

Now consider:

Field Clearing 4: Same as in *Field Clearing 3*, but there are *three* agents—Anton, Beth, and Clarice—who wish to clear their respective yards of a medium-sized boulder. If any two of the three agents push their boulders off the cliff, V will (foreseeably) be gravely injured. Anton knows for certain that Beth and Clarice will push their boulders. All three agents push their boulders, which land on V's car, gravely injuring V. None of the agents coordinate their actions, and each is motivated solely to clear their respective boulders, such that each would have pushed his or her boulder had the others refrained from doing so.

Notice that the only difference between *Field Clearing 3* and *Field Clearing 4* is the addition of Clarice's contribution. Yet it is hard to see why the mere addition of Clarice's contribution should make a difference to Anton's maximum cost threshold, especially given that Anton would not have changed his behavior even had his action been causally necessary for the harm. Yet if I am correct that the maximum cost threshold for Anton is the same in *Field Clearing 4* as it is *Field Clearing 3*, then again by transitivity, Anton's maximum cost threshold in *Field Clearing 4* is the same as in *Field Clearing 1*. This is so even though in *Field Clearing 4*, A's contribution to the harm to V is not causally necessary for the harm.

In *Field Clearing 4*, (CJ-MA) implies that Anton, Beth, and Clarice should split evenly the costs of fully compensating V. (assuming that each is able to do so). Yet, suppose that Beth and Clarice die before contributing their share of the costs. Because Anton's maximum cost threshold is the same in *Field Clearing 4* as in *Field Clearing 1*, then it is fair for Anton to bear the entire cost of rectifying the harm to V, including Beth and Clarice's shares. Once again, Anton's objection to bearing this cost is weak, given that he could have easily avoided bearing the cost simply by refraining from pushing his boulder. On the other hand, V and third parties could

not have reasonably avoided bearing the cost. Because it is fair for Anton to bear the entire cost, rather than V or any third party to bear even a portion of the cost, Anton has a duty of corrective justice to bear the entire cost.

My argument does not imply that the extent of an agent's contribution to a harm is never relevant to the agent's maximum cost threshold. We saw in *Mostly Dead Polluters* that the extent of Gert's contribution to a harm is relevant to her maximum cost threshold. Yet as *Field Clearing 4* suggests, the extent of an agent's contribution does not limit the agent's maximum cost threshold in the sense implied by the Share of the Total Account. It is plausible, then, that in *Mostly Dead Polluters*, although Gert does not have a duty to bear the entire million-dollar cost of rectifying the harm she contributed to causing, her maximum cost threshold is significantly greater than cost she would have a duty to bear according to the Share of the Total Account. Consider again that whatever cost Gert does not bear will have to be borne by someone else—someone who is not responsible for helping create the harm. Accordingly, it seems fair that Gert should bear a significant cost to rectify the harm—significantly more, at least, than the \$1 prescribed by the Share of the Total Account—even if it would be unfair for her to bear the entire cost herself.

The Share of the Total Account is false because it implausibly limits an agent's maximum cost threshold to the cost that is strictly proportional to the extent of the agent's contributions to a harm or threat. I have also argued that the Joint Liability Account is false because it implies that there is no maximum cost threshold. Yet we can easily modify the Joint Liability Account in light of my discussion above. According to what I will call the *Modified Joint Liability Account*, (CJ-MA) allocates the total costs of rectifying a collectively-caused harm or threat among all current duty-bearers; however, the cost that any agent has a duty to bear cannot exceed the agent's maximum cost threshold. An agent's maximum cost threshold is determined partly by the extent of the agent's unjustified and unexcused contributions to the harm or threat, but other factors, like an agent's culpability, are relevant as well.¹⁹

VII. Evaluating the Insufficiency Claim

Let's now return to the Insufficiency Claim. In the previous section, I argued that the Modified Joint Liability Account is correct: (CJ-MA) allocates the total costs of rectifying a collectively-caused harm or threat among all current duty-bearers, but

¹⁹ Note that my arguments for the Modified Joint Liability Account have implications for the fairness of the distribution of costs *among* duty-bearers. If factors other than the extent of an agent's unjustified and unexcused contributions are relevant to determining the agent's maximum cost threshold, these other factors would also seem to be relevant to the cost that it is fair for an agent to bear in comparison to other duty-bearers.

the cost that any agent has a duty to bear cannot exceed the agent's maximum cost threshold. Because an agent's maximum cost threshold can be greater than an agent's capacity to bear that cost, the cost that (CJ-MA) assigns an agent a duty to bear is also limited by the agent's capacity to bear that cost.²⁰ Therefore, for a collectively-caused harm or threat, if the sum of every current duty-bearer's (capacity-limited) maximum cost threshold is less than the total costs of rectifying the harm or threat, then (CJ-MA) does not assign duties to bear all of the rectificatory costs.

With respect to the circumstances of climate change, then, if the sum of every current duty-bearer's (capacity-limited) maximum cost threshold is less than the total cost required to prevent or compensate for all climate change-induced harm, then the polluter pays principle does not assign duties to bear all of these costs, i.e., the Insufficiency Claim is true.

How, then, should we evaluate whether the sum of every current duty-bearer's (capacity-limited) maximum cost threshold is less than the total costs needed to prevent or compensate for all climate change-induced harm? One method is to estimate the *average* cost that current duty-bearers would have a duty to bear were the polluter pays principle to assign duties to bear the total costs needed to prevent or compensate for all climate change-induced harm. We can then judge whether it would be fair for an average current duty-bearer to bear this cost, given factors like the magnitude of the climate threat, the extent an average duty-bearer's unjustified and unexcused emissions, and the degree of culpability an average duty-bearer has for producing these emissions. If it seems like the average cost would be fair for an average current duty-bearer to bear, then this is good evidence that the Insufficiency Claim is false.

To employ this method, we first we need to estimate the total costs needed to prevent or compensate for all climate change-induced harm. Any estimate of these costs undoubtedly makes several controversial empirical and normative assumptions. I avoid addressing these assumptions directly by simply appealing to estimates provided by others. There are two kinds of preventative costs for which there are reasonably reliable estimates: mitigation costs (the costs of preventing further changes to the global climate system) and adaptation costs (the costs of protecting persons against potentially harmful climate change impacts). I shall ignore compensation costs, which at this time are comparatively small (but will become larger as climate change worsens).

²⁰ I assume that an agent's capacity to bear a cost can be limited both by physical and moral considerations. Regarding the latter, if bearing a cost would drop an agent below a certain level of well-being, it may be wrong to require the agent to bear the cost, even if the cost is below the agent's maximum cost threshold.

According to a 2014 report published by the International Energy Agency, the costs of preventing increases in global temperatures from exceeding two degrees Celsius by decarbonizing the global economy would be approximately 44 trillion dollars through 2050 (IEA, 2014).²¹ In addition, the United Nations Environmental Programme estimates that developing countries will require approximately 500 billion dollars per year in adaptation financing by 2050 to protect against the worst impacts from climate change (UNEP, 2016).²² So, that's nearly 61 trillion dollars over the next 33 years or so. Let's round these costs up to 99 trillion dollars to account for the large degree of uncertainty in these estimates (and to make the math easy). So 99 trillion dollars over 33 years is approximately three trillion dollars per year until 2050. For context, global GDP in 2016 alone is approximately 75 trillion dollars (World Bank, 2016).

Suppose that around one billion currently living individuals both (a) have made significant unjustified and unexcused contributions to global climate change, and (b) have the capacity to bear reasonably significant rectificatory costs. There are approximately one billion people living in all OECD Annex I countries.²³ If the polluter pays principle were to assign duties to bear the entire 99 trillion dollar cost among these one billion persons, the average cost that each person would have a duty to bear is 99,000 dollars over the next 33 years, or about 3,000 dollars per year per person until 2050.

While 3,000 dollars per person per year is not insignificant, I do not think that it would be unfair for an average person living in a wealthy country to bear this cost, such that the cost exceeds the person's maximum cost threshold. Consider, first, that unless prompt and significant preventative action is taken, climate change threatens to cause the deaths and suffering of hundreds of millions of people over the next century (IPCC, 2014).²⁴ The extent of the harm that is threatened by the unjustified and unexcused contributions of the one billion liable agents is therefore extremely large, and is probably the greatest current foreseeable threat to fundamental human interests.

²¹ Importantly, this estimate does not include the vast economic benefits that will be gained by avoiding dangerous climate change. Although most of these benefits will accrue to future generations, some of them will accrue to members of the current generation.

²² There is likely some overlap in these estimates. To wit, the more we mitigate climate change, the less adaptation we will need (and vice-versa). The estimate of the adaptation costs assumes that we will exceed the two degree threshold.

²³ Of course, many of the one billion persons living in Annex I countries are children. However, there are also many persons living in non-Annex I countries who are reasonably wealthy and who have made unjustified and unexcused causal contributions to harmful climate change. I will assume the two groups cancel each other out.

²⁴ This may underestimate the extent to which people will suffer and die from climate change. See, e.g., Nolt (2011).

Second, even if the one billion liable agents' emissions constitute only a portion of the total emissions that have resulted in harmful climate change, this portion is not insignificant. Consider that nearly half of all greenhouse gas emissions generated between 1850 and 2012 were generated between 1990 and 2012—that is, *after* agents knew, or ought to have known, that greenhouse gas emissions were causing harmful climate change (WRI, 2014). Moreover, approximately half of these post-1990 emissions come from the United States, the Russian Federation, European Union countries, Canada, and Japan, whose citizens compose the majority of the one billion liable agents (WRI, 2014). So about twenty-five percent of cumulative greenhouse gas emissions were generated by citizens of these countries, after 1990.

Third, given how wealthy many of the citizens of these countries are (and have been since at least 1990), many of the greenhouse gas emissions produced by these citizens after 1990 were likely neither justified nor excused. This means, then, that many of the citizens of these countries had excellent opportunities to reduce their post-1990 emissions, but chose not to do so. These individuals, it seems to me, are highly culpable. It seems fair, then, that many of these individuals should bear considerable costs to rectify the climate change-induced harms and threats that they have made significant unjustified and unexcused contributions to causing.

Fourth, had wealthy countries and their citizens acted to mitigate climate change when they first learned that climate change was occurring, the costs of mitigating and adapting to climate change would have been *considerably* less than current costs. For example, in just two years (between 2012 and 2014), the International Energy Agency estimates that the cost of decarbonizing the global economy (to keep climate change under two degrees Celsius) increased by eight trillion dollars, or 25% over that time (IEA, 2014). Surely the maximum cost thresholds of the one billion current duty-bearers must reflect the fact that, collectively, they had an opportunity to bear much smaller costs to rectify harmful climate change but chose not to do so.

Given these considerations, it seems to me that, on average, 3,000 dollars per year per person does not even come close to exceeding the cost that it is fair for the average current duty-bearer to bear in service of rectifying harmful climate change. In other words, it does not exceed the average current duty-bearer's maximum cost threshold. It is likely, then, that the Insufficiency Claim is false.

IX. Conclusion

In this paper, I argued that the Insufficiency Claim is likely false. The total costs that the polluter pays principle assigns agents duties to bear are likely sufficient to cover

the total costs that are required to prevent or compensate for all climate change-induced harm.

In closing, it is important to note that even though the Insufficiency Claim is false, this does not mean that the only duties that agents have are those assigned by the polluter pays principle. In addition to having duties of corrective justice, it is plausible that many agents also have duties of distributive justice and duties of beneficence to bear costs. But the costs that agents have these duties to bear are not necessarily separate from, or in addition to, the costs that agents have duties of corrective justice to bear. Rather these duties overlap, giving agents powerful, all-things-considered moral obligations to bear significant costs to address climate change.

References

- Baatz, C. (2013). Responsibility for the past? Some thoughts on compensating those vulnerable to climate change in developing countries. *Ethics, Policy & Environment*, 16 (1), 2013, 94–110.
- Bell, D. (2010). Justice and the politics of climate change. In C. Lever-Tracy (Ed.), *Routledge Handbook of Climate Change and Society* (pp. 424–441). New York, NY: Routledge.
- Broome, J. (2012). *Climate matters: Ethics in a warming world*. New York, NY: W.W. Norton.
- Caney, S. (2005). Cosmopolitan justice, responsibility, and global climate change. *Leiden Journal of International Law*, 18(4), 747–775.
- Caney, S. (2010). Climate change and the duties of the advantaged. *Critical Review of International Social and Political Philosophy*, 13(1), 203–28.
- Cripps, E. (2013). *Climate change and the moral agent: Individual duties in an interdependent world*. Oxford: Oxford University Press.
- Duus-Otterström, G. (2014). The problem of past emissions and intergenerational debts. *Critical Review of International Social and Political Philosophy*, 17(4), 448–469.
- Hiller, A. (2011). Climate change and individual responsibility. *The Monist*, 94(3), 349–368.
- IEA. (2014). *Energy technology perspectives: Executive summary*. International Energy Agency, Paris: IEA Publications.
- Morgan-Knapp, C., & Goodman, C. (2015). Consequentialism, climate harm and individual obligations. *Ethical Theory and Moral Practice*, 18, 177–190.

- Meyer, L. & Roser, D. (2010) Climate justice and historical emissions. *Critical Review of International Social and Political Philosophy*, 13(1), 229–253.
- Moellendorf, D. (2014). *The moral challenge of dangerous climate change: Values, poverty, and policy*. Cambridge: Cambridge University Press.
- Page, E.A. (2008). Distributing the burdens of climate change. *Environmental Politics*, 17(4), 556–575.
- Parfit, D. (1984). *Reasons and persons*. Oxford: Clarendon Press.
- Scanlon, T.M. (1998). *What we owe to each other*. Cambridge: Harvard University Press.
- Shue, H., 1999. Global environment and international inequality. *International Affairs*, 75 (3), 533–537.
- Tadros, V. (2011). *The ends of harm*. Oxford: Oxford University Press.
- Tadros, V. (2013). Responses. *Law and Philosophy* 32, 241–325
- Tadros, V. (2017). *Wrongs and Crimes*. Oxford: Oxford University Press.
- UNEP. (2016). *The adaptation gap: Finance report*. United Nations Environment Programme (UNEP), Nairobi, Kenya.
- Vanderheiden, S. (2008). *Atmospheric justice: A political theory of climate change*. Oxford: Oxford University Press.
- Waldron, J. (1995). Moments of carelessness and massive loss, in D. Owen (Ed.), *Philosophical Foundations of Tort Law* (pp. 387–408) Oxford: Clarendon Press.
- WRI. (2014). *Climate analysis indicators tool: WRI's climate data explorer*. World Resources Institute. Retrieved from <http://cait2.wri.org>.
- WHO. (2017). Climate change and health. World Health Organization. Retrieved from <http://www.who.int/mediacentre/factsheets/fs266/en/>
- Zelletin, A. (2014). Compensation for historical emissions and excusable ignorance. *Journal of Applied Philosophy* 32(3), 258–274.