# Global Sharing of the Proceeds of Global Greenhouse Gas Taxes

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## Abstract

Efficient control of greenhouse gas emissions requires globally uniform taxes on emissions, but less developed countries tend to find such taxes unacceptably burdensome. If we regard the atmosphere as a global asset owned equally by all humanity, then, after relocation payments to those who must leave their homes because of rising seas and rising temperatures, the proceeds of globally uniform taxes on emissions of greenhouse gases should be used for a global basic income. Such a system can be expected to appeal to less developed as well as more developed nations.

The efficient levels of taxes are derived in two steps. In the first step, the current generation sets taxes that ensure that future generations have opportunities at least as valuable as their own. There is no discounting of the consequences for future generations. In the second step, the current generation asks themselves how much of their own consumption they are willing to sacrifice to improve the lives of future generations who will be richer than themselves. Benefits for future generations are discounted according to the preferences of the current generation. Different analyses lead to global sharing of the proceeds of taxes in both steps.

# Introduction

Any well-trained economist knows that, to motivate people to cut back efficiently on emissions of carbon dioxide, methane, and other greenhouse gases, there must be prices for emissions equal to the global marginal social costs of those emissions. In principle, these prices can be achieved either by taxes equal to the global marginal social costs or by tradable permits, with the quantities set to levels that achieve market prices for permits equal to the global marginal social costs. In practice, the desired result is much more feasible with taxes than with tradable permits.

# Why taxes and not tradable permits?

There are two reasons why taxes are better than tradable permits. The first is that, even though there is great uncertainty regarding the optimal rate of reduction in greenhouse gases, we have better information about the right prices than the right quantities. We know that if emissions of a greenhouse gas are controlled efficiently, the prices of emissions will rise over time, as population and average incomes rise. The efficient quantity, on the other hand, will fluctuate with fluctuations in the level of economic activity. An agency responsible for setting quantities of emission permits cannot reasonably be expected to predict accurately the fluctuations in the overall level of economic activity and adjust the quantities of permits accordingly. On the other hand, putting the price on a path of the proper shape is relatively straightforward.

The second reason for favoring taxes over tradable permits is related to politics and fairness. If permits are to be created, there may be a political scramble over who receives them, leading to arbitrary, unfair allocations of permits and decisions that some emitting activities (zookeeping, perhaps) do not need permits. There would be no reason for concern about the fairness of the outcome of a political scramble if all emitting activities that might be taxed required permits and the permits were simply auctioned to the highest bidders. However, when there are things that might be allocated, politicians are rarely able to resist the temptation to allocate those things to their friends.

One reason that tradable permits seem appealing is that they make it possible to create a plan with a goal and a date and know that if the plan is adhered to, the goal will be achieved. Just reduce the number of tradable permits at a constant rate until there are zero, and voilà, there will be no emissions. There are two issues with this reasoning.

The first issue is a practical one that is solvable in principle. To have such a system succeed, it must be global. Efficiency requires that if there are tradable permits, they must be globally tradable, with the same price everywhere at any given time since the global harm from emissions of greenhouse gasses is the same no matter where the gasses are emitted. It would be challenging to devise a system of globally tradable emission permits for greenhouse gases, though it is possible in principle.

The second issue with a fixed reduction schedule is that it relies on the fallacy that there is something wonderful about achieving the goal of net zero emissions of greenhouse gases by a particular date.It would be a bit better to achieve net zero emissions a bit sooner, a bit worse to achieve control a bit later. There is nothing economically heroic about continuing to seek to achieve net zero emissions by a pre-set date in the face of costly unforeseen consequences.

## Why not command and control?

Another way that greenhouse gas emissions might be managed is by a system that specified what emitting activities were permitted and what mechanisms to control emissions were required. There are two reasons why such a "command-and-control" mechanism is inappropriate.

The first reason is that it results in inappropriate prices. A command-and-control system does not charge people for costs that are not subject to control. If there are cattle burps of methane that contribute to climate change but are regarded as not controllable, then no payment is required for those methane emissions. This leaves the costs of these methane emissions out of the selling prices of meat and milk, so that the quantities of meat and milk sold will be greater than they would be if the full social costs were reflected in their prices.

The second reason that a command-and-control mechanism is inappropriate is that no controlling agency can be expected to have the information needed to do the job well. Here is an example. It was reported in 2021 that the addition of seaweed (a source of tribromomethane) to cattle feed can reduce the amount of methane that cattle emit in their burps by up to 82%, without any harm to the cattle.[1] If the cost of carbon dioxide emissions is $100 per ton, then the cost of the methane emissions by cattle is about $1.00 per day. So, a technique for reducing these emissions substantially could be quite valuable. If there was a tax on cattle feed for the global harm from the emissions of methane caused by these methane emissions, with an 82% discount on the tax for feed with the right amount of seaweed added, the news of the impact of seaweed would have been followed by an explosion of economic adjustment. The price of seaweed would have gone through the roof. Abundant effort would have been put into expanding seaweed production. Emissions of methane by cattle would have been brought down with all deliberate, economically reasonable speed.

An agency with the power to command cattlemen to reduce emissions of methane would have a very difficult time replicating what the market could do. Such an agency would not know how to expand the production of seaweed. It would not know the rapidity with which expansions should be sought. When more seaweed was produced, it would not know to which cattle operations should be told that they must add seaweed, and which should be told to wait until later. We cannot expect an agency with command-and-control powers to replicate the market. For efficient control of greenhouse gases, we need prices of emissions equal to the global marginal social costs of emissions.

## Resistance to global uniformity

Efficiency requires that the prices of emissions of greenhouse gases be globally uniform. The consequences of emissions are the same no matter where on earth the emissions occur, so the prices of emissions should be the same everywhere.Less developed countries balk at this idea. Their argument against globally uniform prices for emissions has two strands. First, representatives of less developed countries say that they simply cannot afford to pay what the developed countries can. Second, they say that the world would not have the climate problems that it now has if the developed countries had not been so extravagant in their emissions of greenhouse gases for so many years.

These are not adequate reasons for not

[1] https://caes.ucdavis.edu/news/feeding-cattle-seaweed-reduces-their-greenhouse-gas-emissions-82-percent

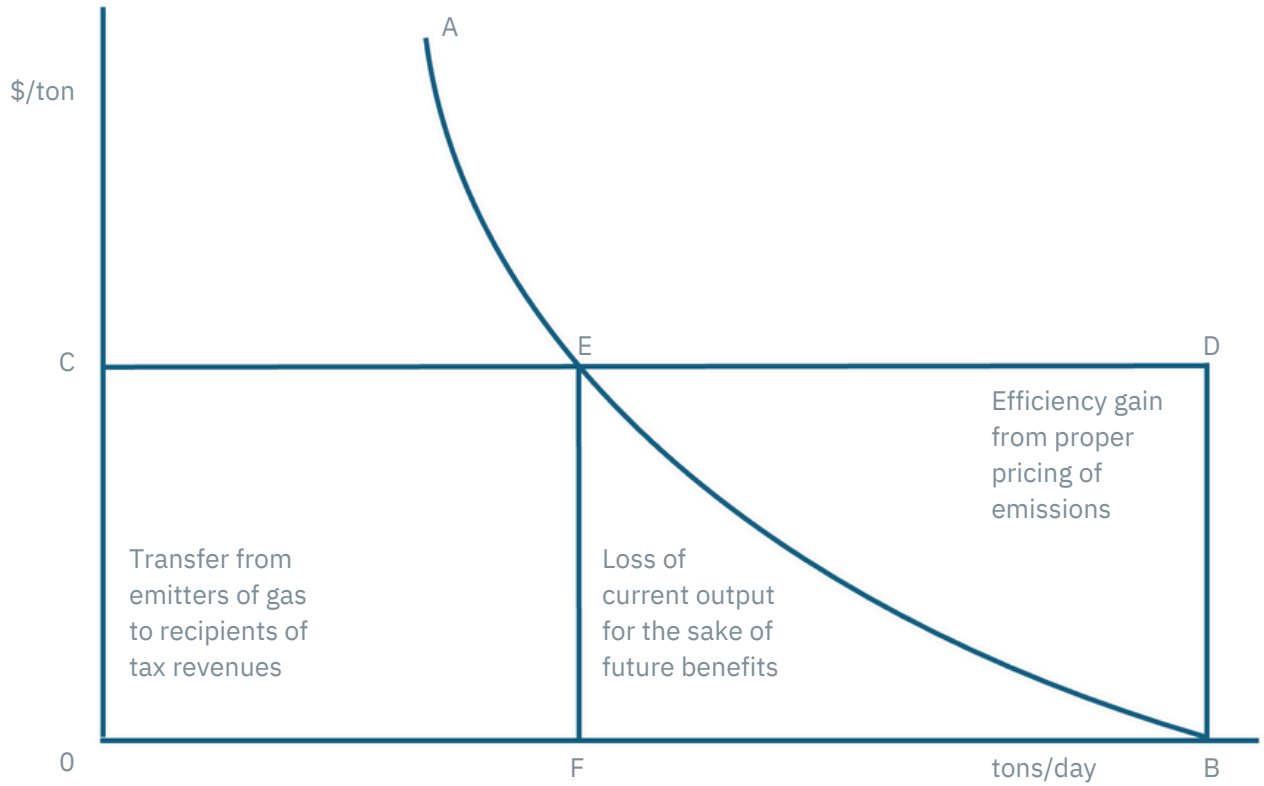
applying greenhouse gas taxes in less developed nations. The low incomes of less developed nations are indeed a serious problem, a problem that ought to be addressed by policies that raise the productivity of these nations. It is not good policy to maintain an artificially low price of any one item, including emissions of greenhouse gases. An artificially low price of greenhouse gas emissions for some economies will distort those economies in favor of the production, and especially the export, of goods that are high in greenhouse gas emissions.

Furthermore, while it is true that past emissions have not been taxed in the way that efficiency would have required, leaving future emissions in less developed countries untaxed does not correct this error; it adds an additional error.

## The distributive analytics of a greenhouse gas tax

Figure 1 shows the distributive analytics of a greenhouse gas tax. Line AB represents the rate of emissions of a greenhouse gas (say carbon dioxide, on the horizontal axis) as a function of the price that is charged for emissions (on the vertical axis). It is equivalent to a demand curve. Line CD is set at the level of the tax on carbon dioxide. The level of the tax can be chosen, and as the tax varies, the quantity of emissions varies, as specified by line AB. Line CD can be considered a horizontal supply schedule, chosen by the world community, for the right to emit carbon dioxide. For the level of the tax on carbon dioxide that is chosen, the

Figure 1: The Distributive Analytics of a Greenhouse Gas Tax

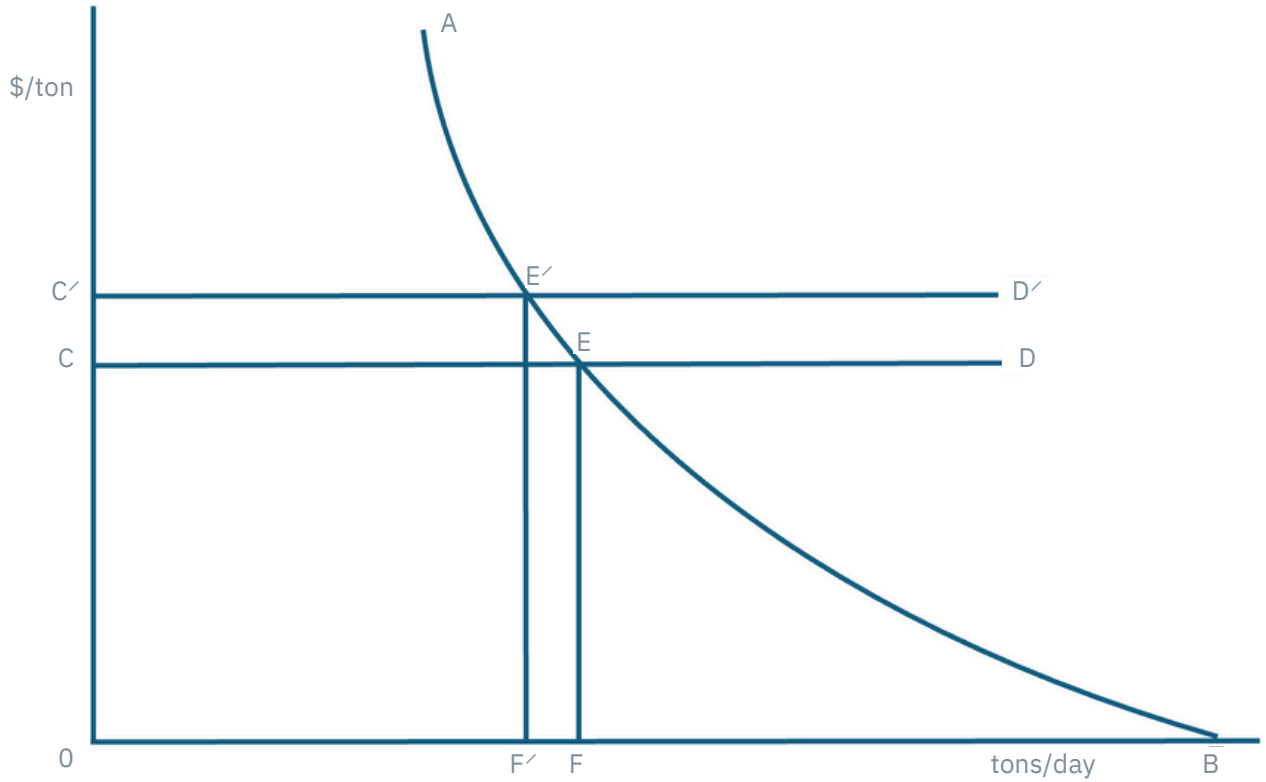


level of emissions is given by line EF. The revenue per day generated by the tax is the rectangle 0CEF. Area BEF is the loss of output per day from actions taken to reduce carbon dioxide emissions. Area BED is the estimated efficiency gain from eliminating emissions that are not worth what they cost. Rectangle BDEF is the estimated reduction in environmental harm that results from reduced emissions.

Now consider Figure 2, which shows the consequences of a small change in the price of emissions. When the tax on emissions rises to the level represented by line C′D′, the quantity of emissions falls to the level represented by line E′F′. Area EE′F′F represents resources that had previously been received as revenue from the greenhouse gas tax but are now allocated to reducing emissions, because of the higher price of emissions. The restriction in emissions represents a loss of current well-being for consumers of goods and services that cause emissions and for owners of factors of production that are specialised in the production of goods and services that cause emissions. It also represents a gain of well-being now and into the future for people who would have been affected by the emissions that were avoided. The reduction in emissions tax revenue is an off-setting gain for those who lose from the added control and a loss for the recipients of the tax revenues.

Area CEE′C′ represents money that had previously been kept by emitters but is now paid as additional greenhouse gas taxes. It is a gain for the recipients of greenhouse gas taxes and a loss for the producers and consumers of goods and services that cause emissions. Whether the total amount paid in greenhouse

Figure 2: The Consequences of an Increase in a Greenhouse Gas Tax



gas taxes rises or falls (combining the addition from CEE′C′ and the subtraction from EE′F′F) depends on the elasticity of the demand for being allowed to emit greenhouse gases. If the elasticity is less than 1, then tax revenues increase as the tax rate increases. If the elasticity is greater than 1, then tax revenues fall as the tax rate increases.

The choice of a tax rate represents a social equilibrium, balancing these consequences. If the greenhouse gas tax rate is socially satisfactory, then the combination of the loss of current output and the need to make greater payments per unit of emissions because of an incrementally greater tax rate is just compensated by the combination of the future benefits from reduced emissions and the change in tax payments, which could be positive or negative, depending on the elasticity of the demand for the opportunity to emit the greenhouse gas.

## Globally uniform distribution of the revenues of greenhouse gas taxes

### A. ENSURING THAT FUTURE GENERATIONS ARE NOT WORSE OFF

Instead of fighting against globally uniform greenhouse gas taxes, less developed nations should embrace them and argue for shares of revenues proportional to their populations. That is they should argue as follows: “You are right that those who emit greenhouse gases need to be incentivised to economise on those emissions by being charged for them. At a bare minimum, the charge should be enough to achieve a reduction in emissions that will ensure that future generations have lives that are no worse than our own. And we should all recognise that everyone on earth has a right to an equal share of the emissions that this standard allows. The fact that we are not developed enough to use our shares should not keep us from benefitting as much as anyone else from the emissions that are allowed within the standard. We have rights to equal shares of the revenue that is raised by charging for the emissions of greenhouse gases.”

While it is likely to be in the interest of every less developed nation to participate, the possibility that some nation would decline to participate cannot be precluded. The exports of any such nation should have equalising tariffs applied to them to charge for the greenhouse gas emissions in their production.This condition should induce all or nearly all nations to participate.

Developed nations should recognise that less developed nations have a claim to the revenue from greenhouse gas taxes that is as good as their own claim. However, there is a prior claim on such revenue. The expectable rise in sea level will submerge some islands completely and inundate coastal areas everywhere. Some equatorial regions may become so hot as to become useless for agriculture. When, as with these effects, the negative consequences of emissions are concentrated on a few people and insurance is not feasible because the consequences are certain, it is appropriate to compensate those who are harmed from the greenhouse gas tax revenue. For harm such as storm damage, harm that is widely dispersed, uncertain, and subject to insurance, the argument for compensation does not apply. Thus, the argument so far is for equal global sharing of the net proceeds of globally uniform taxes on emissions of greenhouse gases, after compensation for those on whom costs of climate change induced by greenhouse gas emissions are concentrated and so certain as to be uninsurable. The magnitude of the tax justified so far is is the greater of what is needed to ensure that future generations have life opportunities no worse than our own and

what is needed to compensate those whose damages are uninsurable.

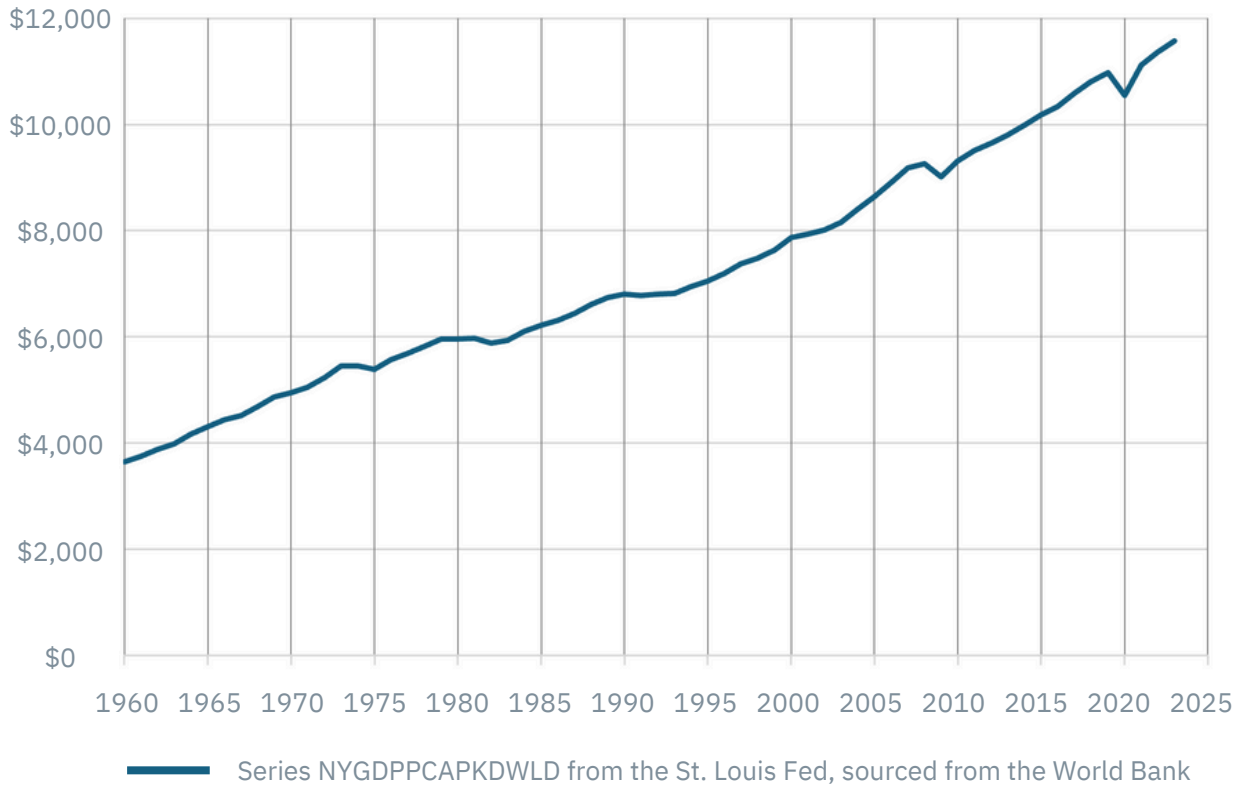
Considerable effort is needed to determine what taxes on emissions are needed, in practice, to ensure that future generations have opportunities no worse than our own. It is challenging even to specify what this idea means. As a first cut, one can look at the history of global real per capita GDP. This is shown in Figure 3.

The following things might be noted with respect to Figure 3. First, global real per capita GDP roughly tripled between 1960 and 2023. Second, line is more linear than exponential, implying that the annual percentage rate of growth has been declining over time. For the 10 years beginning in 1960, real per capita GDP grew at an average annual rate of 3.0, while for the 10 years ending in 2023 it grew at an average annual rate of 1.7%. Third, the growth of real per capita GDP has been rather steady, with just a few slips for economic difficulties.

It is reasonable to expect global real per capita GDP to continue to grow at a declining rate. Technology continues to improve. Capital continues to accumulate. Children receive more and more education. Birth control is available to more and more women, permitting them to have no more children than they want and spend more time in the workforce.For all these reasons, global real per capita GDP can be expected to continue to grow.

However, for several reasons, global real per capita GDP is not the right measure of whether future generations have life prospects as good as our own. First, just as a measure of economic

Figure 3: Global per Capita GDP in 2010 U.S. Dollars



income, one would want to use net domestic product (NDP) rather than GDP. NDP subtracts the value of the capital that is used up in the production process. But that depreciation is hard to measure, so people are often content to act as if GDP measures income.

Second NDP leaves out many things that affect well-being.Unpaid household production is left out.The quantity of desired leisure that people have is left out. (Undesired leisure from involuntary unemployment should count in a negative way.)A measure of health is relevant. Furthermore, climate change can be expected to have a whole list of effects on well-being:

- Atmospheric temperatures will rise
- Ocean temperatures will rise
- Storms will become more frequent and more severe
- Ice caps will melt
- Sea levels will rise, and shorelines will contract
- The pH of the oceans will fall, coral reefs will die, and various sea creatures will have difficulty making their shells
- Some cold areas will become more habitable by humans
- The plants and animals that thrive in various places will change; some species will become extinct.

To address the question of whether future generations have prospects of well-being as good as our own, we need a measure of global real well-being that incorporates all these things. Economists know this, and they have begun working on it. Call a statistical measure of global real well-being GRW. We can hope that someday economists will have a measure of GRW that we can use.

Even if there is such a statistical product as GRW, that is not quite enough, for two reasons. First, assume that like GDP, GRW is reported in 2010 U.S. dollars. The number would represent a simple arithmetic average over all people.

Because there is such great inequality, and because the marginal utility of income decreases as income increases, a simple arithmetic average is not the best way to aggregate the disparate values. To measure the average value of well-being, one should translate the individual dollar measures into well-being units and average these. If well-being in cardinal terms is proportional to the logarithm of well-being in dollar terms, then the appropriate way to aggregate is to average the logarithms of individual well-being in dollar terms and then take the anti-logarithm of this number to have something reported in dollars. Call such a number logarithmically averaged GRW, or LAGRW.

LAGRW would be a reasonable overall measure of the well-being of the world's population, but it still is not quite enough, because of inequality. If the distribution of LAGRW changes over time in such a way that, while the average increases, the poor get poorer while the rich get richer faster, we ought to say that we have not provided future generations opportunities as good as our own. To be able to say that future generations have life prospects as good as our own, it is reasonable to require that the cumulative distribution of GRW be everywhere non-worsening. That is, for every level of well-being (measured in 2010 U.S. dollars), the fraction of the global population who have that level of well-being or less should be no greater for every future generation than it is today. Then we could say that we expect that future generations will be at least as well off as ourselves.

Thus, the goal of the first step in identifying the proper levels of greenhouse gas taxes is to identify the levels that are the greater of:

A) The levels needed to raise the revenue needed to pay the relocation costs of the people who will need to relocate because of rising seal levels and hotter temperatures, and

B) The levels needed to ensure that future generations will have distributions of well-being that are uniformly at least as good as our own.

If B is greater than A, then the difference between B and A serves as the basis for a global basic income.

Note that in this analysis, all generations are treated equally. No discounting is involved.

### B. CLIMATE IMPROVEMENT AS INFRASTRUCTURE INVESTMENT

The analysis in this section is undertaken so that the idea it develops can be rejected.

Making current sacrifices for the sake of future climate benefits has an analog with infrastructure investments. When we build a bridge or make some other infrastructure investment, we sacrifice current consumption for the sake of future benefits. Such projects are often financed by borrowing. Future people need to pay the debt that was incurred to undertake the project, and we justify this by the fact that they also get benefits from the project. If the project is worthwhile, then there is a structure of repayments on the debt such that people in every period are better off.

Similarly, after we have ensured that future generations will be no worse off than ourselves, we have opportunities to sacrifice current consumption for future climate improvements. If instead of sacrificing current consumption we borrow and assign the repayment of our debt to the future generations who receive the climate benefits, we have a possibility of making all generations better off.

We should reject such an idea because requiring future generations to pay the debts we incurred infringes improperly on their liberty. What, then, of the justification of infrastructure investments? If an infrastructure investment is worthwhile, then it can be financed by the combination of charges equal to the marginal cost of use plus public collection of the increase in the rental value of the land in the vicinity of the infrastructure. When infrastructure is financed justly, there is no use of sales taxes or income taxes to pay for it, no need for infringements on the liberty of future generations.

The analogy between climate investment and infrastructure fails, and borrowing should not be used to offset the reduction in consumption that is needed to deal with climate change.

### C. CLIMATE MANAGEMENT AS A GIFT TO FUTURE GENERATIONS

After we have provided for paying the relocation expenses of those who need to move because of the climate change that we allow to occur, and after we have ensured that future generations will have distributions of well-being that are at least as good as our own, and we have rejected the possibility of borrowing to finance climate management, there is a further reason to limit climate change by raising greenhouse gas taxes: We may care enough about future generations.

When we have done enough to ensure that future generations will be at least as well-off as we are, we may want to do more for them because we value the benefits for them more than the costs to ourselves. Parents often sacrifice so that their children can have lives that are better than their own. Similarly, a whole generation may want to sacrifice some consumption that they could have, to make life better for future generations, even though those future generations who will benefit will be richer than themselves.

Such a desire to sacrifice for future generations is likely to be more prevalent as incomes

increase. So, for analytical purposes, divide the world into developed and less developed nations, and consider the calculation of the developed nations. Since they will be providing a gift to future generations, the gift can be whatever size they choose. Since they have the possibility of making different kinds of gifts, they would reasonably want a systematic process for comparing the value of different gifts.Such a process could be expected to involve a kind of discounting that would have a different foundation than the interest-based discounting that is customary in economics. Instead of asking about the rate of return on investments or the relative value of one's own consumption at different times, one would ask how much this generation values an increase in the consumption of those who will be alive in 2040, or 2060, or 2080.

There are two reasons why we are likely to value benefits for future generations less and less as time extends into the future 1) we identify less with them, and 2) they are likely to be richer and richer as time goes on.Thus, to set the right price on emissions of greenhouse gases, we need to ask, for each increase in the tax (as from C to C′ in Figure 2), involving the loss of current consumption of EE′F′F and the extra taxes CEE′C′ that need to be paid, do we find these costs adequately compensated by the combination of the benefits to future generations (valued as we choose to value them) plus the extra income for the recipients of the tax revenue represented by CEE′C′ minus EE′F′F. We want to continue raising the greenhouse gas tax until the additional benefits of a further rise are no longer greater than the additional costs.

Now consider the less developed nations. We might expect them to say, "These gifts are your idea.We do not value the opportunity to make future generations even richer than they will already be. Count us out."

The first reply of the developed nations should be, "Yes, we have no right to make you participate, but you should understand that, since efficiency requires globally uniform taxes on greenhouse gases, we will need to apply equalising tariffs on your exports for the greenhouse gas emissions in their production if you do not participate."

The second reply of the developed nations should be, "Equalising tariffs are a pain, and we really don't like the idea of impoverishing you to make a gift to future generations, so how about agreeing that you and we will have the same greenhouse gas taxes, and we will share all the revenue globally equally?" It is likely to be economically advantageous for every nation to agree.

## How much money will there be for each person?

Suppose that the equilibrating price for emissions of carbon dioxide is $100 per ton. And suppose, for the sake of discussion, that charging $100 per ton for emissions of carbon dioxide causes emissions to fall by one-half. Global emissions of greenhouse gases in 2023 were estimated to be an average of 6.76 tons of carbon dioxide equivalent per person.[2] If this falls by one-half because taxes motivate control, it becomes 3.38 tons per person per year. At $100 per ton, this is $338 dollars per person per year, or 92.6 cents per person per day. For purposes of discussion, call it $1 per person per day. This amount would not mean much to most citizens in developed countries, but for the one billion people on earth with incomes of less than $1 per day,[3] it would more than double their incomes.It could make a huge difference in the lives of the poorest people on earth.

[2] https://edgar.jrc.ec.europa.eu/report_2023
[3] https://www.un.org/en/chronicle/article/surviving-pennies-we-must-help-worlds-most-deprived

# Summary

Efficient control of greenhouse gas emissions requires globally uniform emission taxes, not tradable permits and not a system of command and control. Less developed countries have tended to regard globally uniform taxes as unacceptable. That resistance is likely to fade if the preponderance of the revenues from such taxes are used to provide a globally uniform basic income. Under such a system, less developed countries will receive much more in basic income payments than they pay in emissions taxes.

If, as seems likely, people in the future will be better off than people today, then contributing to their well being by reining in greenhouse gas emissions is something we do because we care for them, and not something that we owe them. In deciding the levels of greenhouse gas taxes and by implication the levels of emissions, we are free to discount benefits for our richer progeny as we choose.

Taxes should be at a level that is approved by a consensus of all nations.

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