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How a Common Commitment Promotes International Agreement

For 20 years, climate negotiators have been stymied by the most challenging tragedy of the commons ever encountered. The central problem is well understood. All countries can use the atmospheric commons for free, but only a small fraction of the benefits of investing in CO_2 reductions accrue to the country that incurs the cost of such an investment. As a result, self-interested countries rationally invest too little in CO_2 abatement and instead attempt to free-ride on the hoped-for investments of others. Indeed, "climate change is a public good (bad) par excellence" (Arrow, 2007).

The Kyoto process started with a natural approach to breaking the free-rider deadlock: agree on a *common commitment*. A common commitment helps realign self-interest with the common good by assuring all parties that they will only be required to contribute to the common good if all are required to follow the same commitment rule. This "I will if you will" feature is critical for solving problems of the commons.[1]

A common commitment needs to be enforced like any other commitment. Yet the fairness that comes with protection from exploitation offered

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by a reciprocal common commitment removes one reason to defect. Also, because defecting will weaken the common commitment and hence jeopardize the contributions of others, a well-structured common commitment automatically embodies some enforcement.[2] Moreover, as we show later, a price commitment reduces risks compared with quantity commitments and thus reduces the needed size of the enforcement penalty.

In a nutshell, a common commitment facilitates the collective reciprocity that is the only known way of overcoming free-riding—the central problem of climate negotiations (Weitzman, chapter 8, this volume). Moreover, it is likely a necessary precursor to the implementation of effective enforcement. Yet Kyoto failed to find such a commitment. This failure was no accident. The quantity commitments needed for international cap-and-trade preclude a common commitment. This chapter suggests this is the foundation underlying the proposals for an international price commitment by Cooper (2004, chapter 5, this volume), Nordhaus (2013), Stiglitz (chapter 6, this volume), Weitzman (chapter 8, this volume), and ourselves.

Why Kyoto Failed

Initially, many countries supported a common commitment by all to reduce their emissions by an equal, agreed percentage below their 1990 emission levels. Such a general percentage-reduction rule—as opposed to individually pledged percentages—would constitute a common commitment. But many disagreed, and at least 10 other formulas were developed and considered. After many failed attempts, the resolve to forge a common commitment was broken and replaced with a resignation to accept *individual* commitments. Indeed, even before concluding the negotiations, Chairman Estrada allowed parties "to negotiate their own targets" and finally "invited Annex I Parties to submit their revised, final, numbers to the podium" without any restrictions (Depledge, 2000, p. 214).

The European Union (EU) offered a 15% emission cut with a common commitment but accepted only 8% when that failed.[3] Russia accepted 0%, Australia and Iceland accepted 8% and 10% increases, respectively, and the United States accepted a 7% cut, which was not serious. Of course the developing countries accepted nothing and with the EU masked cuts that ranged from 30% to an increase of 40%. The 95 to 0 rejection by the US Senate was explicitly linked to the fear of free-riding, although there were

other motives as well. The lack of an acceptable common commitment meant there was little check on free-riding, but if any common commitment had been forced on the parties, the outcome would have been worse, which is why none was agreed to. The Kyoto negotiations were right to focus on the search for a common commitment, but what they proved, after more than a year of searching, was that no common *quantity* commitment can be found. The result was a weak and fragile international cap and the mistaken conclusion that a common commitment is impossible. The mistake was accepting the international-cap-and-trade straight jacket as inevitable.

Interestingly, the Kyoto Protocol also failed to achieve its second goal: equalized prices. International permits were implemented in the form of Assigned Amount Units (AAUs). The Soviet Bloc's AAUs are referred to as "hot air" in the popular press, and, in fact, some AAU trades that took place simply enriched those in Eastern Europe who faced no burden from the Kyoto Protocol. Because trading was seen as inappropriately redistributional and evasive of climate commitments, AAU trading became so controversial that Japan had to publicly deny purchasing AAUs from countries previously in the Soviet Bloc.[4] Now the UN has restricted AAU trading.[5] As a result, and because of political uncertainties (Edenhofer et al., 2014) and various regulatory interventions (Marcantonini and Ellerman, 2014), quantity commitments did not lead to anything like the hoped-for equalization of carbon prices.

Stiglitz (2006b, chapter 6, this volume) has explained why there is no reason to believe anyone will ever come up with a quantity-based emissions rule. The history of the Kyoto negotiations strongly confirms that requiring quantity targets will block any hope of a broad common commitment even without including the developing countries. The US government has now come to the same conclusion.[6] Without a common commitment, any agreement, if one could be reached, would again be weak and fragile. It would not produce anything like a uniform price on carbon. Kyoto was a useful experiment, but the world learned the wrong lesson.

Kyoto's Legacy for International Climate Negotiations

In response to Kyoto's dramatic failure and then Copenhagen's, the idea of striving for a common global commitment was abandoned on the way to Paris. Rather, it was hoped that individually selected quantity targets

will cover the bulk of global emissions with sufficient stringency. Indeed, the plan for Paris was to let every country simply pledge to do whatever it wants. There will be reviews without consequences for hundreds of incomparable proposals (Gollier and Tirole, chapter 10, this volume). If countries fall short of their pledges, then there still will be no consequences.

This pledge-and-review approach is unlikely to work (Cooper et al., chapter 1, this volume). As the Kyoto Protocol demonstrates, individually adopted targets do not change self-interest, at least not by enough to notice. The reason is that such agreements are not of the "I will if you will" type (MacKay et al., chapter 2, this volume; Cramton et al., chapter 4, this volume). In fact, under the Kyoto Protocol, several countries, including the United States, Canada, New Zealand, Japan, and Russian, have said "We won't" while the others continue to say "We will." So the Protocol is an "I will even if you won't" agreement. This is an agreement of nations acting altruistically—a coalition of the politically willing. But as explained by Gollier and Tirole (chapter 10, this volume), among others, there is no reason to suppose that altruism can solve the tragedy of the commons. Conditional cooperation in the vein of "I will if you will," in contrast, provides a strong source of cooperation, as explained by Weitzman (chapter 8, this volume). Indeed, conditional cooperation is the most robust pattern of cooperation seen in laboratory, field, and theoretical studies of free-rider situations and is—unlike unilateral altruism—consistently found to stabilize higher cooperation levels. Numerous studies show that conditionally cooperative strategies can promote cooperation levels well beyond what is theoretically sustainable among selfish players. One reason is that conditional cooperation—unlike unilateral altruism—is considered fair (see Hauser et al., 2014; Kraft-Todd et al., 2015; MacKay et al., 2015, and references therein).

This is why we advocate that negotiations again focus on a common commitment. Although a common *quantity* commitment proved infeasible, we argue that a common *price* commitment can substantially mitigate many of the problems associated with quantity commitments (see also Stiglitz, chapter 6, this volume; Weitzman, chapter 8, this volume). One reason is that there is near-unanimous agreement that each country should commit to the same price, which thus constitutes what Schelling (1960) calls a focal point. Such a common commitment makes possible the type of agreement that changes self-interests for the better: "I will commit to the common price if you will."

The difference between the two commitments—price and quantity—has been overlooked in part because the two can be economically equivalent in a world without uncertainty. A global cap induces a carbon price, and taxing carbon at that price would limit emissions to that cap. But for reaching agreements, the two targets are substantially different. Before exploring that in more depth, it is useful to review why international commitments do not automatically induce specific national policies.

International Commitments Are Not National Policies

Economists sometimes imagine that caps or taxes could be implemented by an international tax-collection agency or international cap-and-trade market covering a large majority of each country's carbon emissions. Such plans assume a dose of top-down regulation that is presently infeasible.

However, a different pair of alternatives requires no such top-down apparatus and would allow countries tremendous flexibility. Under these alternatives, countries simply commit to a set of quantity commitments (regarding carbon permits) or a price. Either type of commitment could be met by national or regional cap-and-trade markets, fossil-fuel taxes, or any mixture of these along with bonus-malus systems applied to, for example, auto emissions estimated at the time of sale. An example of a mixture is the EU's reliance on a weak cap-and-trade market and a strong tax on carbon in the form of an oil tax. Another possibility is cap-and-trade with a floor price. This flexibility should minimize the acrimonious debate over caps and taxes to the extent possible because all countries could adopt linked cap-and-trade markets under either a global price commitment or a set of global quantity commitments. Countries also comply with either commitment by using fossil-fuel taxes.

Defining a Global Price Commitment

A country that commits to the global price only needs to meet the commitment on average. The average carbon price is simply the country's carbon revenues divided by its emissions. The revenue can, of course, come from selling permits under cap-and-trade, fossil fuel taxes, or calculations on other pricing-compatible regulation.

There should be some restrictions on how unevenly a country prices its carbon. For example, exports should face a price rather close to the global

price. (The same is true under an international cap.) But we will not get into such details.

Also, our definition leaves a question of how to count preexisting taxes. There are at least two views on this. For accounting simplicity, all carbon charges would be counted toward compliance. We prefer this approach for pragmatic reasons. Another view is that this would be true after some base year, say 2015, and the fossil-fuel tax rate in that base year (excluding any taxes imposed for climate reasons) would be subtracted from all future carbon-price measurements. Both approaches are quite simple, and from an implementation point of view, the only difference is that the second approach requires a one-time accounting of fossil-fuel tax revenues at the start. There is no need to untangle taxes by purpose after the initial accounting, and even that may be unnecessary. So there is no possibility of gaming the commitment by saying a nonclimate tax is for the climate. Going forward, all taxes count.

Of course, it is inefficient to credit a new tax to pay for highways as if it were a carbon tax for the climate (Gollier and Tirole, chapter 10, this volume). But this is simply the minor inefficiency of not having a perfectly uniform tax, which seems even more out of reach with an international cap-and-trade scheme, as we will explain later.

Price versus Quantity Commitments: A Comparison

This chapter argues for correcting the flaw that derailed the Kyoto process and for returning to Kyoto's sound fundamental principle: agree on a common commitment that leads to (fairly) uniform carbon pricing. It proposes to do so in the most straightforward way—by using a global price commitment. Similar views have been expressed by Cooper (2004, 2008), Nordhaus (2013), Weitzman (2014), and Cramton and Stoft (2012a, 2012b), as well as throughout most of this book.

Although a single price commitment would be effective and is within reach, as we discuss throughout this chapter, it appears impossible to agree on n national quantity commitments. Stiglitz (chapter 6, this volume) has made the case that there is no way to achieve a compromise between rich and poor countries regarding quantity commitments, and Weitzman (chapter 8, this volume) argues that quantities cannot be successfully negotiated. We add that history confirms this. The hope of finding a common

quantity commitment was high at the start of the Kyoto treaty but has declined steadily ever since to the point where no one any longer mentions the possibility. Neither is there any discussion of how individual quantity commitments might be negotiated, even in this book, which raises this as the central topic for discussion. This explains why we will not attempt to refute any arguments that quantity commitments, common or individual, could be successfully negotiated. Rather, we will focus on comparing the two negotiation processes in terms of reciprocity and common commitments.

Importantly, cap-and-trade advocates and tax proponents nearly always agree that a uniform global price is the desired outcome. So unlike quantity, for which there is little if any agreement on the appropriate common commitment rule, there is nearly universal agreement that a common price commitment should be a uniform price commitment (or more precisely a uniform price floor). That is, a uniform price is a natural focal point. This facilitates negotiations about the price commitment (Schelling, 1960; Weitzman, chapter 8, this volume).

There is an apparent but not actual symmetry between the global cap of Gollier and Tirole (chapter 10, this volume) and the global price of our approach. Gollier and Tirole suggest a cap corresponding to 2°C, which is likely a focal point. Also, as they point out, negotiating a cap avoids the free-rider problem, much like negotiating a price. However, there is an important difference. Although a global price is a common commitment, a global quantity is only a common aspiration. Individual countries can implement the global price, and their commitment to the price is in principle enforceable. But no country can implement the global cap. An aspiration cannot be enforced.

The practical benefit of a price commitment is that it takes us most of the way to the set of final commitments. It resolves who will do how much for the climate, and of course it can also strive to reach the 2°C goal or any other focal climate goal. It leaves only the question of equity transfers to be resolved. This is still a crucial and difficult question (and we will get to it below), but focusing on price helps to disentangle it from the larger question of climate efforts.

Another advantage is that price is an inherently fairer measure of effort intensity than is a Kyoto-style quantity measure. The United States has tried to persuade India to commit to a cap in the vicinity of its emissions

level, which would have been lower than the per capita emission of the United States in 1880. Not surprisingly, India rejected this idea. Accepting a carbon price would not limit India to any lower emission rate or "intensity rate" than the United States, and it would even allow India to emit as much or even more per capita than the United States. A price treats India more equitably and is at least as efficient as a cap that induces the same carbon emissions.

Monitoring and Corruption

For the two global commitments (as opposed to national policies), two main questions will determine which is best. The first concerns reaching an agreement (discussed earlier), and the second concerns whether compliance can be verified. Here we discuss verification.

Local monitoring and corruption. Under a commitment to either price or quantity, it is possible for emitters to bribe the carbon-tax collector or the carbon-permit collector (Tirole, 2012; Victor, 2001). Such corruption will impose inefficiency on the country but will not disrupt the enforcement of the international commitment, which only requires information of a more aggregate nature. If a power plant dodges its carbon charge, national carbon revenues are reduced. So the country must charge other emitters more to meet its average-price commitment, but the national commitment is still verifiable.

National monitoring and corruption. Emissions should be measured by monitoring the inflow of fossil fuel from extraction and net imports. Even so, with more than 500 coal mines in India and more than 18,000 in China, emissions monitoring could be poorly enforced or deliberately distorted. Similarly, under a price commitment, national carbon-pricing revenues could be falsely reported. Although this could be a serious problem in a number of countries, there are several ways to mitigate such problems. There could be monitoring by the International Monetary Fund, World Bank, International Energy Agency, or World Trade Organization, all of which do some similar monitoring already. Countries receiving green funds could be required to open their national accounting books to receive such funds.

Finally, most real carbon pricing will be reflected in visible prices at gas stations, in home heating bills, and in retail electricity prices. These prices could be easily monitored. So verification is possible under either commitment, but in a few countries, it may require a significant effort. Both commitments would include a requirement to allow verification, and any country that did not cooperate would be considered to be out of compliance and would be sanctioned as if it had not met its price or quantity commitment.

International monitoring and corruption. On a global level, the corruption problem is asymmetric. Suppose a local official, on behalf of a kleptocratic ruler, allows a company to underreport emission so that it needs fewer carbon permits. The kleptocrat then sells supposedly surplus international carbon permits to a perfectly honest country. As Nordhaus (2008) explained, both the government and private company benefit because this shifts money from honest to corrupt countries. It also crowds out the honest country's abatements.

Conclusion on monitoring. Proponents of international cap-and-trade claim a carbon price cannot be monitored. Yet they claim that cap-and-trade will solve the export-import problem that results from international carbon-price differentials. But as we saw earlier, equality of nationally traded permit prices says nothing about the price of carbon emissions from exporters or anyone else. So the export-import problem can only be solved by monitoring the carbon prices paid by exporters. In other words, a crucial claim of cap-and-trade proponents relies on the assumption that carbon prices can be monitored accurately under the worst of conditions—at the local level, in industries where (unlike at gas stations) the price can be camouflaged, and where there is perhaps the strongest incentive for corruption.

Overall, looking at the various arguments in favor and against each commitment type with respect to monitoring and corruption, we tend to agree with Nordhaus (2008), who concludes, "Quantity-type systems are much more susceptible to corruption than price-type regimes," and with Cooper (2008), who concludes that a global cap-and-trade system "will unavoidably foster rampant corruption."

Will Carbon Emission Actually Be Priced?

The point of international cap-and-trade is usually viewed *as imposing on* "all CO_2 emitters the cost of their damage to the climate."[7] The result of this would be an economically efficient reduction in emissions. This efficiency is a central goal of the policy partly because cost reduction is a great help in making a strong policy sustainable. Environmentalists, however, generally have quite a different goal for cap-and-trade. Their view is that the price doesn't matter but that the cap is a good old-fashioned command-and-control mechanism.

So the question is, will international cap-and-trade induce a uniform and an efficient carbon price as economists would like, or will it produce an inefficient mix of national command-and-control policies? Let us look at the Kyoto Protocol, which priced international permits and allowed any national policy. Gollier and Tirole (chapter 10, this volume) note that within the Organization for Economic Co-operation and Development countries, there were direct subsidies to green technologies, which resulted in implicit carbon prices that range from "less than 0" to "as large as 1,000 €." It is likely that most of this range was spanned within countries that were under the Kyoto Protocol. Gollier and Tirole conclude that such policies demonstrate "the inefficiency of this command-and-control approach."

In other words, in the only test case, the outcome was, by and large, not what economists hoped for but rather the inefficient command-and-control policies. Two conclusions seem evident. International cap-and-trade need not induce much if anything in the way of actual carbon pricing, and it may leave the current command-and-control approaches untouched. In other words, international cap-and-trade may not achieve the central objective of its proponents but rather the opposite.

Committing to a Price Is Less Risky

Quantity targets are favored because they supposedly remove the risk of emission and climate uncertainty and shift that risk to nations in the form of price and cost uncertainty. Although their success at limiting climate risk has been dismal, in part due to the uncertainty of the resulting quantity agreements and disagreements, quantity targets do impose risks on the countries that adopt them.

More specifically, accepting a quantity commitment entails risk because future business-as-usual (BAU) emissions and abatement costs are both highly uncertain. Suppose that a country expects BAU emissions of 100 Mt and considers two commitments: (1) a quantity reduction to 90 Mt, and (2) a price of $20/t. Assume these are equivalent (they both cause the same price and same emission quantity). Furthermore, assume that the global carbon price will be $20/t.

Now suppose that the country's BAU emissions turn out to be 110 Mt (10 Mt higher than expected). Under the quantity commitment, the $20/t global price will reduce emissions 10% to 99 Mt. But the country will only have been issued 90 Mt of permits, so it will need to buy 9 Mt of permits on the world market for a cost of $180 M. Under a price commitment, the country simply sets its carbon price to $20/t as if nothing had changed.

Although the price-commitment policy specifies that countries keep all of the carbon revenues from pricing carbon, there is still a social cost. To find that cost, note that the more that is abated, the greater the cost per ton is abated, with the per-unit cost starting at $0/ton and reaching a maximum of $P/ton. So the standard estimate of the cost of abatement, A, under carbon price, P, is $A \times P/2$, or in this case, 11 Mt × ($20/Mt)/2, which equals $110 M. This cost occurs under either policy because the global price of $20 causes 11 Mt of abatement in both cases.

Hence, the total cost under the quantity commitment is $180 M + $110 M = $290 M. That's 2.6 times as much as the $110 M cost under the price commitment. But some cost was expected to occur under the expected BAU emission of 100 Mt. That expected cost was 10M × $20/2, or $100 M. So the unexpected cost under the quantity policy is $290 M – $100 M = $190 M, whereas the unexpected cost under the price commitment is $110 M – $100 M = $10 M. The financial risk from a possible 10% shock to BAU emissions in this example is 19 times greater than under a price commitment.[8]

This example does not exaggerate the risks of quantity commitments. In 2000, the US Department of Energy's International Energy Outlook predicted China's 2010 emissions would be 1.5 Gt, but in the event, emissions were more than 7 Gt—nearly a 400% error rather than the 10% error assumed in the previous example. Quantity targets generally have been set 10 to 15 years in advance. Moreover, quantity errors can have high political sensitivity. If China had committed to a cap in 2000 equal to its expected

BAU emissions (not reduced by any cooperative climate efforts), it would have been purchasing more than 5 billion tons of permits annually by 2010 from perhaps the United States and the European Union. This would have likely caused a dramatic permit shortage and high carbon prices, but even at $20/ton, this comes to $100 billion per year in highly visible transfers to foreign countries. If China had made anything like the quantity commitments desired of it by cap-and-trade advocates at that time, quantity risks would have likely destroyed that international quantity commitment and any associated cap-and-trade treaty. China was right to reject such quantity commitments.

Enforcement

Measurement delays. A major advantage of monitoring and enforcement of a price commitment is that it is an annual rather than a once-in-15-year event, such as the Kyoto Protocol or China's recent commitment to cap emissions in 2030. This creates free-riding incentives and diffuses responsibilities among successive governments within countries and makes it difficult to repair noncompliance. Annual price commitments have the advantage that cheating can be quickly detected and quickly corrected because full compliance can be achieved simply by increasing the carbon charge. Indeed, frequent monitoring is known to be one of the most critical aspects of self-enforcing cooperation (Ostrom, 1990).

Gollier and Tirole (chapter 10, this volume) propose a fix for this problem: "Countries will have to match pollution and permits at the end of the year to avoid creating unfulfilled climatic debt." Unfortunately, this proposal blocks banking and borrowing of permits, the standard method of mitigating the volatility of permit prices. Such price volatility is likely to be unpopular with investors and the public.[9]

Successful enforcement is one key to successful cooperation (Nordhaus, 2015 and chapter 7, this volume). We have argued before that cooperation based on a common commitment is relatively easy to enforce because the common commitment enables a reciprocal relationship, which is known to promote cooperation. Here we argue that a common price commitment facilitates enforcement compared with a quantity commitment. One reason is that a price commitment is continuously monitored and thus more easily. Another reason is that it reduces risks. Risks can produce strong

incentives to leave or avoid a quantity commitment. Without such strong negative incentives, the needed size of the enforcement penalty is reduced. Finally, price commitments reduce the required size of equity transfers (as we describe later), which also reduces the needed size of the enforcement penalty.

Various complementary mechanisms can further ease the enforcement of price commitments (e.g., efficient performance, which we borrow from modern electricity markets, where deviations from plans are settled at the market price for carbon revenues). In other words, a country that exceeds its commitment can sell its excess performance to a country that falls short. This guarantees that plans are met in aggregate and yet gives countries the flexibility to easily and efficiently react in an uncertain environment. Efficient resolution of deviations from plans greatly reduces risks, facilitates performance, and encourages participation.

The Waiting Game

Gollier and Tirole (chapter 10, this volume) explain that negotiations which are currently ineffective but are likely to eventually result in individual pledges contribute to what they call the "waiting game." The result of this game is that present behavior, while waiting for an agreement on individual commitments, can be even worse than the outcome of the noncooperative Nash equilibrium of the public goods game—worse than without any thought of cooperation.

The problem does not arise if a *common* commitment is expected to be the eventual outcome. Yet if individual climate commitments are expected, then it pays countries to jockey now for position in the final round of commitments. For example, if it is expected that commitments will be made relative to 2020 emissions or some future BAU emissions, then it pays to not take easy actions to reduce emissions before 2020.

But if the eventual commitment will be a common price, then having higher emissions in 2020 will simply mean more emissions will be taxed at the global price. This confers no advantage on the recalcitrant country. That is, deciding now to agree on a common price ends the waiting game now, although there is still a wait for the actual agreement.

The Role of the Green Fund and Equity Transfers

Equity Transfers Are Less Expensive With Price Commitments

Agreeing on price as the indicator of global action opens the door to a common commitment. However, poorer countries, such as India, will feel that they should receive significant help with it. Fortunately, this is relatively inexpensive. Because India's carbon-pricing revenues would stay in India, pricing India's two billion tons of emissions at $20 per ton will have a *net* cost to India of only about $2 billion if emissions were reduced 10%—far less than the planned $100 billion per year Green Climate Fund. This is not to suggest that India should be given an exception to the common commitment. Rather, the common commitment should include a Green Fund formula for providing assistance from richer, high-emission countries to poorer, low-emission countries. In this way, the common pricing commitment would respect the UN's principle of "common but differentiated responsibilities."

Equity transfers need not be as high with price commitments because risk is lower. As seen in the previous example of price and quantity risk, if a country expects a $100 million cost of abatement, but there is a risk that its BAU emissions will be unexpectedly high by 10%, then this would add $190 million in the case of a quantity commitment and only $10 million in the case of a price commitment. If the country demands that this risk be covered by equity transfers, then these will need to be $180 million larger in the case of a quantity commitment. Politically, it seems difficult for a poor country to risk having its equity transfer obliterated by a miscalculation of future BAU emissions.

Choosing a Green Fund Formula

By committing to a uniform global price, we have confined the differentiated-responsibilities problem to the Green Fund formula. This makes possible a natural and less-divisive principle for national differentiation. The new design principle is to choose the Green Fund formula that maximizes global emissions abatement.

This suggests a two-step design: select the Green Fund formula and then choose the common price. This is similar to many political processes in which it is common to specify the payment and benefit structure before deciding how much to spend on a program, say a school system. When

voters are pleased with the payment-benefit structure, they will be generous in voting for a strong program. If they are displeased, then they will be less generous. This arrangement gives those designing the payment-benefit structure, in this case, the Green Fund structure, a strong incentive to design the structure to please all of those whose support is needed. It also allows the funders to have peace of mind when the funders delegate authority to those negotiating the structure—first because they know that they can reject or minimize the proposed structure if it is not to their liking, and second because they know the negotiator/designers will be well aware of this.

Compare this to the cap-and-trade alternative, which is also a two-step approach. First, the global cap Q is selected and then the permit allocations $\{A_i\}$ are negotiated. But, as noted earlier, Q is an aspiration and not a commitment, so all of the work of solving the climate-effort and equity-transfer problems is bundled into the single step of negotiating $\{A_i\}$. In contrast, the two-step approach of pricing breaks the problem in two—choosing climate effort (P) and negotiating equity transfers $\{G_i\}$—this simplifies both negotiations. Then it links the two halves so that the availability of the step-two price decision provides good incentives for, and confidence in, the Green Fund design process, and the Green Fund design is properly focused on making the price negotiation successful. This is why the "$\{G_i\}$ then P" negotiation process can outperform the "Q then $\{A_i\}$" process.

We now describe, for the sake of concreteness, a possible pair of negotiating procedures, beginning with the step-two price negotiation. To set the price, countries pledge their highest acceptable global price target, taking the step-one Green Fund formula into account. Then the highest price target acceptable to, say, 70% of the countries (population-weighted) determines the global price commitment.[10] Only countries that have pledged at least that price would sign the global-pricing agreement and participate in the green fund.[11] (This "club" could then implement enforcement that could induce additional members to join; see Stiglitz, chapter 6, this volume.)

Before describing step one, the Green Fund negotiation, we note that, as pointed out by Gollier and Tirole (chapter 10, this volume), it is an n-dimensional negotiation and hence difficult. As with the climate-effort negotiations, a common formula is needed, but here we are not lucky enough to have something as simple and well-agreed-on as a

uniform price. Nonetheless, it pays to look for an equity formula that is focal and has a single parameter that can differentiate responsibilities to the extent required. Of course, in reality, no simple formula will be sufficient. However, this example will serve to illustrate the value of looking for a common-commitment formula, even if the actual one needs to weight multiple relevant variables.

The formula that we propose as simplest and most focal for Green Fund transfers is to make transfers proportional to a country's excess emissions. These are defined as emissions that are in excess of what the country would emit if it had world-average per capita emissions. Countries pay into the green fund in proportion to their excess emissions and receive payments from the green fund in proportion to their negative excess emissions.

There seems little doubt that this formula would work if accepted because perfection is not required. But it would likely not achieve as high a price as a more detailed and thoughtfully designed formula. The formula should be judged by how high a price results from its use in the stage-two voting process.

The excess-emissions formula must also include a generosity parameter, G, that determines its strength—how many dollars per ton of excess emissions will be transferred. If the Green Fund formula is too generous, rich countries will hold down the global price to reduce Green Fund payments. If the formula is too miserly, then poor countries will hold down the carbon price to reduce the burden of carbon pricing. Only a compromise on generosity will lead to the highest agreed global carbon price and maximize abatement ambition. Hence, the objective of maximizing ambition leads naturally to a reasonably fair compromise on differentiation of responsibilities.

To ensure that the generosity of the Green Fund formula is set objectively to maximize climate ambition, it will be best to rely on countries that have the least stake in Green Fund payments. Such countries will base their recommendations on climate rather than Green Fund considerations. Within such a group, the median (not the average) opinion should determine the outcome. This prevents any one country from having too much influence (Cramton and Stoft, 2012a, 2012b).

When proposing individual commitments, the United States (2013) argues that it is "hard to imagine that Parties would be willing to have other Parties dictate their contributions." But the prior illustrative agreement shows the U.S. argument is irrelevant. Under such an agreement, no

country will ever be asked to commit to a price higher than it nominates voluntarily with full knowledge of the generosity of the green fund. Nothing is "dictated" by other parties. Despite the completely voluntary nature of this treaty, the resulting agreement captures the "I will if you will" effect of a common commitment that modifies self-interest within the agreeing group. Hence, each country's self-interest in naming a high price will be increased dramatically relative to the individual commitments the United States is proposing.

Why Opaqueness Is Not an Argument for Quantity Commitments

Some observers argue that a green fund is too transparent to be politically acceptable and that a supposed lack of transparency is a major advantage of cap-and-trade. However, the cap-and-trade programs often referred to are domestic and are opaque for a different reason. Their transfers are not in the form of traceable money. Companies get paid mainly by raising commodity prices by an amount that is hard to measure and that most people cannot comprehend. In contrast, international purchases of AAUs—the real standard of comparison—have been extremely controversial, as we described in our introduction. Indeed, we find it difficult to believe that large cross-border money transfers through perfectly transparent markets would not catch the public's attention. It seems even more likely that the transfer will become obvious at an earlier stage. To give India a large transfer, India must receive a cap that is far above its BAU emissions level. This part of the transfer will be highly visible, and past comments have shown that environmentalists will find this highly objectionable. It will also make it impossible to explain to the US public why the United States is giving a multibillion dollar climate transfer to a country that is required to do less than nothing.

That said, even if the supposed opaqueness of permit transfers is something worth taking advantage of, this might be possible under a price commitment without incurring the political risk premiums associated with quantity commitments. For example, instead of the US government paying India $100 million, it could allow US businesses to purchase offsets from the Indian government at the global price of carbon, and India could be issued a package of say 5 million one-ton permits. Although these would be just as visible as permits under cap-and-trade, they would not cause the financial risks of cap-and-trade.

Conclusions

Despite much rhetoric, there is almost no hope that the Paris pledge-and-review approach, if based on individual pledges, can solve the climate dilemma. Rather, to address the dilemma, we agree with all experts in this book that a common commitment is necessary. In this chapter, we reiterate Weitzman's plea that price and quantity commitments be compared on a level playing field. This seems eminently reasonable because quantity commitments have had the field to themselves for more than 20 years and failed repeatedly. Quantity commitments have been favored partly because of the misperception that caps provide stronger incentives and more certainty than a price, together with an incorrect analogy between an easily enforced domestic cap and unenforced international caps. Yet for reasons that we and other contributors to this book explain, a price commitment is likely a much more promising basis for a common commitment; it is a fair focal point, reduces risks, is easier to enforce, and is consistent with climate policies already in place. Indeed, one beauty of a carbon-price commitment is that it will not interfere with the current, dispersed cap-and-trade experiments, thereby leaving the door open to a future rehabilitation of caps and keeping alive the fundamental idea of using price.

Promoting cooperation in international climate negotiations is *the* crux of the climate problem. We hope that our chapter, along with the other contributions in this book, will provide guidance to those shaping international climate policy after Paris. After more than 20 years of failure, surely it is worth attempting a fresh approach, one that is guided by insights from the science of cooperation.

Notes

1. We will return to this later. For the moment, observe that democracies habitually solve national public-goods problems by voting on a common commitment. Usually this is a commitment to pay a uniform tax with revenues used for public goods, such as parks, highways, education, defense, or cleaning up toxic waste. Voting for a tax is an organized approach to saying, "I will adhere to the common commitment if you will."

2. In other words, a treaty based on a common commitment is a partially self-enforcing treaty.

3. Kyoto Chairman Estrada personally suggested the target of "8% below 1990 emissions" for many countries, and many countries adopted his suggestion when submitting their final pledges.

4. "Japan is defending itself against criticism that it's exploiting a surplus of Kyoto assigned credits and using 'hot air' to meet emission targets." Bloomberg, July 23, 2009. The importance of high-profile political ramifications caused by unpredictable public transfers between rival countries was anticipated by Cooper (2004): "What US Senator, once s/he understands the full implications of a trading regime, can vote for a procedure which could result in the unconditional transfer of billions of dollars, even tens of billions, to the government of communist China, or to Castro's Cuba, or even to Putin's Russia?"

5. See carbonmarketwatch.org/doha-on-aaus-the-future-of-the-phantom-menace.

6. In its March 11, 2013, submission, the United States stated, "It is hard to imagine agreement on any formula or criteria for imposition of contributions, as this would get into the most controversial issues."

7. From https://sites.google.com/a/chaireeconomieduclimat.org/tse-cec-joint-initiative/some-economic-perspectives, accessed July 14, 2015.

8. Based on our example, Weitzman (2015) has recently shown in a rigorous and general model that under uncertainty, internationally tradable permits expose a country to unambiguously greater risk than the imposition of a uniform carbon price whose tax proceeds are domestically retained.

9. In that respect, the first trading period in the context of the EU ETS provides a good lesson of undesired price effects when banking and borrowing are not allowed.

10. The higher the coverage of global emissions, the lower the price that will be agreed to by all the countries that must be included to achieve that coverage.

11. Countries may also agree on a price path. In any case, this initial agreement would be updated periodically with the intention of increasing its coverage and strength, and of reflecting the improving estimates of costs and benefits of climate change.

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