

Research Articles

Implementing Long-Term Climate Policy: Time Inconsistency, Domestic Politics, International Anarchy

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Introduction

A long-term policy problem can be characterized as (a) lasting for at least a human generation, (b) deep uncertainty and (c) engendering substantial public good aspects. Because climate change shares all of these three characteristics and because it will be irreversible if present trends of emissions continue, it can be considered a quintessential long-term policy problem.¹

Climate change poses two major challenges.² One is to develop, under considerable uncertainty, an effective, long-term response strategy. Resources need to be allocated both for the purpose of mitigating climate change caused by anthropogenic emissions and for the purpose of adapting to climate change. The second challenge is to implement this plan, once arrived at, consistently over time.³ While these challenges also pertain to other long-term policy problems, climate change is particularly intriguing because it combines these challenges with several other demanding characteristics: it is basically about protecting a pure collective good, this good is truly global in scope, and time-lags between cause and effect are very long in some instances.

In this article we consider the second of these two challenges, i.e. the challenge of translating a long-term plan for climate policy into a consistent set of effective policy measures. We divide this challenge into three analytically distinct, yet tightly interrelated, commitment problems. First, we point out that even for a single unitary actor (such as a benevolent “world government”) it might well be tempting at any given point in time to devote fewer resources to

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1. Sprinz 2008 and Sprinz in this issue.

2. For an introduction to climate change and international climate policies, see *inter alia*, Luterbacher and Sprinz 2001.

3. This formulation is not intended to exclude *revision* of the plan in response to new information or developments which would make the original plan inadequate or inefficient.

mitigating climate change than required to meet its own long-term goal. This may be due to implementing agents doubting the credibility of the world government to enforce a policy of strong emission reductions. We refer to this as the *time inconsistency* problem. Second, a government eager to secure support for a broad range of policy programs—and to stay in power—may stall at the domestic political costs of implementing the mitigation measures required. Moreover, even if it were to put all its muscle behind the effort, it may very well fail. The dynamics of political processes are such that even broad support for a certain goal may be hard to translate into approval of the specified measures required to reach that goal. We refer to these hurdles as the *domestic politics* problem. Finally, international cooperation is largely confined to measures that can be established by consensus among the main actors. The logic of international negotiations thus makes it hard to design and enforce an international agreement that fully meets the requirements of an optimal long-term plan (the *anarchy* problem).

We examine each of these commitment problems in some detail, explore how they relate to a policy for mitigating the impact of human activities on the climate system, and suggest institutional designs that may help limit their adverse effects. Also a policy of *adaptation* will have to face the three problems, but all of them will be less severe. As far as we know, there has been no previous attempt at considering these three commitment problems jointly in the context of climate change.

The article is organized as follows. The following three sections consider the time inconsistency problem, the domestic politics problem, and the anarchy problem, respectively. Each of these sections first defines the problem under consideration, then provides illustrations drawn from the issue of climate change, and finally suggests some possible response options. Having considered each problem on its own, we point out that they are likely to interact, and consider briefly some implications of such interaction. In a brief concluding section we ask whether the conclusions obtained for mitigation apply also to climate policy focusing on adaptation measures.

The Time Inconsistency Problem

*Definition*⁴

In their Nobel-prize winning work on time inconsistency,⁵ Kydland and Prescott demonstrate that optimal choices at one point in time may be at odds with optimal choices at future points in time.⁶ Policies may be designed such that one policy rule is administered in the first period, e.g. to encourage low inflation by

4. This subsection builds, in part verbatim, on Sprinz forthcoming.

5. Kydland and Prescott 1977.

6. Time inconsistency, temporal inconsistency, or dynamic inconsistency “occurs when the policy currently planned for some future period is no longer the best when that period arrives.” See Cukiermann, cited in Elster 2000, 24.

way of wage restraint. However, at a later point in time, it may be the best policy to actually permit some degree of “surprise” inflation so as to reduce short-term unemployment. More generally, governments are tempted to renege on earlier promises given changes in circumstances. As Kyland and Prescott note, “The suboptimality arises because there is no mechanism to induce future policy-makers to take into consideration the effect of their policy, via the expectations mechanisms, upon *current* decisions of agents.”⁷ Any type of political system should be challenged by the possibility of time inconsistency due to the contemporaneous tradeoffs in spending scarce political and other resources.

Time inconsistency problems may arise even where all decisions are made by one single individual. Take, for example, a personal ambition to improve one’s health through an extended program of regular physical exercise. Even a person who firmly believes that the program as a whole will yield substantial net benefits need not arrive at the same conclusion for each training session in that program. One single defection would hardly reduce long-term health benefits but may well increase short-term well-being (e.g. by avoiding exposure to snow or wind, or free up time to attend a concert). Wherever the cost/benefit calculus for individual micro-decisions deviates significantly and systematically from that pertaining to the program as a whole, there is a real risk of defections, the aggregate effect of which may be a significant loss in goal achievement. The discussion about when to substantially reduce greenhouse gas emissions illustrates this point in the sphere of climate change.

Time Inconsistency and Climate Change

Given the inertia in the climate system and the corroborated effect of human emissions on the climate system, any strategy to realize the ultimate goal of the UNFCCC—to “prevent dangerous anthropogenic interference with the climate system”⁸—requires a long-term strategy. It has been estimated that by the end of the 21st century, global emissions of greenhouse gases should be reduced by 50–80 percent below 1990 levels if catastrophic climate change impacts are to be avoided. This is essentially equivalent to replacing a fossil fuel-based world economy with a low-greenhouse gas world economy, a strategy that will most likely take longer than half a century.⁹ Electoral cycles for legislative and executive positions are of a much shorter duration.

Imagine that, rather than about 200 national governments, we had *one* supranational world organization capable of governing as a unitary actor (this assumption will be relaxed in later sections). Even if such a world government

7. Kydland and Prescott 1977, 481; emphasis in the original. Optimality is a very demanding standard, and—like other ideal-type constructs—attractive for purposes of theory development. The basic argument developed in this article applies also if we adopt a somewhat less demanding (and precise) standard, such as that of effectiveness. Note that the less demanding the standard, the less severe will be the problems encountered.

8. United Nations 1992, Article 2.

9. European Environment Agency 2005.

were to decide that strong measures must be taken in line with Article 2 of the UNFCCC (above), the question would arise whether policies geared to such a transition are credible. Political and social revolutions are rarely successful precisely because many political actors doubt their chances of success and therefore opt for low or nil contributions. Any world government announcing a transition to a low-greenhouse gas economy during the 21st century would face a credibility problem precisely because this investment would not be profitable for several generations and a range of other problems are likely to arise over time (such as poverty reduction, financial crisis, financing social security, or fighting epidemics) that will make *ex post* adherence to the ambitious climate goal unlikely. Given that most drastic long-term climate policies are not credible—e.g. lack of an enforcement system for the UNFCCC and a very mild enforcement system for the Kyoto Protocol—moral hazard will entice present generations to under-invest. Moreover, the more lenient the interpretation of Article 2 of the UNFCCC, the more credible the world government may be. Paradoxically, due to lower ambitions in exchange for higher credibility, we are likely to induce dangerous anthropogenic interference with the climate system, which in hindsight we would have liked to avoid.¹⁰

Adding all this up, we can safely conclude that even if all decisions were to be made by a single unitary actor (a world government), we would have a time inconsistency problem.¹¹

Coping with Time Inconsistency

While a range of strategies might be used to tackle the time inconsistency problem, we shall concentrate on three mutually related strategies. The first is to *eliminate alternative options*. In his classical treatment on deterrence theory, Schelling explains how an army leader can eliminate the possibility of retreat by burning the bridges behind him.¹² A designer of climate policy can achieve a similar effect by prioritizing emissions reduction measures that are literally or practically irreversible. For example, once a new and emissions-reducing technology has been installed, it will usually be economically unattractive—at least in the short run—to revert to older and more emissions-intensive technology.

Second, Kydland and Prescott advocate the strategy of “*tying hands*,” i.e. requiring present and future decision-makers to abide by a fixed rule which is enforced over time and deprives the decision-maker of the option to use discretion (except during emergencies).¹³ Many governmental institutions for monetary policy use this option, such as the rule-based expansion of monetary aggregates

10. Grass and Stützel 1983.

11. If a technology were to be found that allows for emission reductions to be inexpensive and socially acceptable, then mitigating generations would be able to reap profits from investing in mitigation. Unfortunately, such a technological or social genie is not in sight. See also the Virgin Earth Challenge at <http://www.virginearth.com>.

12. Schelling 1966.

13. Kydland and Prescott 1977, 477, 487.

that many central banks have adhered to following the stagflation period in the 1970s. In the realm of climate policy, a long-term annual percentage mitigation rule has been proposed,¹⁴ yet was not favorably received by the parties to the UNFCCC. Even if such a plan were to be adopted, enforcement would be a problem. In fact, this would be the case even for a unitary actor (e.g. a world government), because such an actor would have to cope not only with climate policies but also with other environmental and social policies which command well-entrenched political support. In essence, one would need an Earth Alliance¹⁵ that is (a) authorized to decide long-term plans, (b) equipped with the means to implement such plans, and (c) deprived of easy ways to shirk its plan over time. Such institutional architectures are unlikely to materialize in the foreseeable future on a global scale.

A milder version of rule-based decision-making uses pre-commitment strategies,¹⁶ such as intermediate policy goals. For example, by increasing its renewable energy goal to 20 percent of total EU energy consumption by 2020, the EU set itself ambitious goals in the direction of an energy transition, although there is evidence that the less ambitious 2010 renewable goal as well as the goal for 2020 “will not be met without significant further efforts from Member States.”¹⁷ A second example is that the EU has committed itself to reduce GHG emissions by 20 percent below 1990 levels by 2020, declaring that it is willing to reduce them by 30 percent below 1990 levels if other developed countries commit to comparable emissions reductions.¹⁸ The unconditional 20 percent reduction goal can be interpreted as a costly signal that the EU is sincere about emissions reductions and that it is willing to stake its reputation on reaching this goal.¹⁹ It remains to be seen, however, to what extent this and other commitments will be successfully translated into substantial cuts in emissions as the EU uses iterative procedures to implement long-term environmental goals.

One positive sign is the creation of the UK Climate Change Committee in late 2008 with an independent mandate to ensure that the UK government goal of reducing carbon emissions by 80 percent until the year 2050 will be accomplished. This goal is to be pursued by multi-year carbon budgets to be proposed by the Climate Change Committee. The temptation to potentially leave some of the major cuts until the year 2050 remains.

Finally, a third option for tackling the time inconsistency problem is *rational ignorance*, i.e. to deliberately refrain from acquiring ever more information about options that are likely to be attractive in the short run, but might lead the decision-maker to deviate from the long-term plan for climate

14. Ott et al. 2004; and German Advisory Council on Global Change 1997.

15. German Advisory Council on Global Change 2001.

16. Elster 2000.

17. European Environment Agency 2008, 6.

18. See European Union 2009.

19. Similarly, Norway has announced a goal of carbon neutrality by 2050. See <http://www.norway.org.uk/policy/news/carbon-neutral.htm> (accessed 20 January 2009).

policy.²⁰ The more strongly committed a decision-maker is to a long-term plan, the easier it will be to refrain from exploring other options. For example, high audience costs may make it politically impossible or unlikely that the EU's unconditional commitment to reduce GHG gases by 20 percent below 1990 levels by 2020 can be revised downward.

The Domestic Politics Problem

Definition

We now abandon the assumption that decisions are made by a single unitary actor. Instead, we ask what happens when policies are the products of complex political systems and processes, involving multiple actors—each with its own preferences, beliefs, and political resources. We proceed in two steps. First, we explore the kinds of domestic political costs and benefits that a government is likely to take into account when considering whether and how far to pursue a particular policy. We argue that concern with domestic political costs and benefits will normally make a government (a) more preoccupied with short-term consequences, and (b) more cautious in adopting policies that are perceived to impose costs on, or run counter to the values of, its own core constituency. Our second step is to consider the policy-making system at large, more specifically the mechanisms by which it aggregates preferences into collective decisions and government policies. In such a system, decisions can be seen as a function of three principal determinants: the configuration of actor preferences, the distribution of power and influence, and the decision rules for policy-making and policy-implementation games. Our main proposition here is that—under certain circumstances, relevant to the climate change problem—the policies that come out of such processes will tend to suffer from a particular kind of vertical disintegration, where the aggregate thrust of micro-decisions falls short of delivering what professed policy goals and principles require.²¹

Domestic Politics and Climate Change

In all political systems there is competition over positions and influence. Any government will be constantly aware that its own efficacy—and, ultimately, its survival—will depend upon how well it succeeds in meeting the demands and expectations of influential domestic stakeholders and its broader constituency. Even a government strongly committed to its declared policy can therefore be expected to consider the likely effects of alternative moves on its own position. Moreover, all governments have multiple goals and programs to attend to, and

20. "Rational ignorance" is sometimes also used to denote the phenomenon where a decision-maker rationally chooses not to collect more information about options, expecting the costs to outweigh the benefits.

21. Underdal 1987.

with limited political capital they will sometimes have to modify or even give up one goal in order to secure sufficient support for another. Combining these two observations, we can easily see that governments sometimes will find themselves in a situation where they cannot afford to do what one of their own cherished goals or programs would require.²²

This is indeed likely to happen in the case of climate change policy. One reason is simply that we are dealing with a policy that will have to be sustained over a very long period of time. During that period there will be multiple shifts in government, with corresponding shifts in political concerns and priorities. Moreover, as argued by Downs, “. . . public attention rarely remains sharply focused upon any one domestic issue for very long.”²³ Downs goes on to suggest that a significant decline in interest (from a period of intense concern) is particularly likely where (a) most people are not continually reminded of the problem by their own suffering from it, (b) the problem calls for sustained effort and fundamental changes in social institutions or mass behavior, and (c) dramatic news and front page headlines in popular media are rare. Climate change seems to meet at least conditions (a) and (b) fairly well. Increased frequency of extreme weather events may well spur a growing concern over future consequences of human activities on the climate system in parts of the world. Yet, it seems prudent to heed Downs’ warning not to underestimate “. . . the [American] public’s capacity to become bored.”²⁴

Additional challenges emerge when we consider the policy-making system at large. The important point to be made here is that certain types of policies or options stand a better chance of being adopted and implemented than others. Thus, in many circumstances blocking a certain option will be easier than having it adopted and implemented. Admittedly, there are important exceptions to this rule. It does not usually apply to the default option of continuing current policy.²⁵ Other things being equal, it takes more political energy to change an established course than to continue it. Moreover, much may depend on the configuration of costs and benefits attributed to a particular option (see below). Finally, decision rules can make a substantial difference. The general pattern will be that the more demanding the decision rule, the more cards are stacked in favor of blocking change. However, even where decision rules are basically neutral in the choice between continuation and change (as is the case with the simple majority rule), there are certain mechanisms that tend to favor the former.

Experimental research has produced substantial evidence indicating that most people tend to react more strongly to the prospect of a certain loss than to

22. There may, of course, also be instances where a government will not be able to get their preferred policy accepted by Parliament (or some other veto player). President Clinton found himself in this situation when he acknowledged that the US Senate most likely would have declined to ratify the Kyoto Protocol had it been urged to vote on it.

23. Downs 1972, 38.

24. Downs 1972, 49.

25. For a general and sophisticated analysis of policy stability and its determinants, see Tsebelis 2002.

Benefits	Costs	
	<i>Concentrated</i>	<i>Dispersed (or indeterminate)</i>
<i>Dispersed (or indeterminate)</i>	1	2
<i>Concentrated</i>	3	4

Figure 1
Four Configurations of Consequences

Based on Wilson 1973.

the prospect of an equally large gain.²⁶ As a consequence, the losers' influence over the fate of that particular measure tends to be disproportionately large, other things being equal. The implications of this finding for climate change policy are not obvious; the costs of mitigation measures and the effects of climate change may both be seen as losses. Much of the current discussion on mitigation measures seems, however, to be framed in terms of short-term costs and long-term benefits.²⁷ Furthermore, there will often be broader support for an overall target—such as cutting greenhouse gas emissions by x percent over n years—than for at least some of the specific measures required to reach that goal. In such a situation, one or more of these measures may well be defeated or have to be sacrificed in order to save other components of the program. Because of the complex nature of the problem and the long time-lag between measures and effects, climate change policy seems highly vulnerable to the dynamics of vertical disintegration.

Additionally, in business-as-usual circumstances, the policy measures that are most easily adopted and implemented tend to be those that offer tangible benefits to certain sectors of the economy or segments of society while costs are either widely dispersed or indeterminate (cell 4 in Figure 1). Conversely, the measures that are hardest to adopt and implement tend to be those where costs are concentrated to specific sectors or segments while benefits are widely dispersed or indeterminate (cell 1). One reason for expecting this particular pattern is that the logic of collective action favors small and pre-organized groups responding to the prospect of significant costs over larger and more diffuse groups responding to the prospect of gains that are collective in nature or will be distributed in ways that cannot be predicted at the time of decision. Another is that in business-as-usual circumstances the involvement of sector agencies and organizations tend to increase as we move from policy at the level of goals and principles to policy as action. Moreover, since specific measures will in most cases affect particular activities, sectors, or groups more than others, the problem itself will to some extent be reframed along the way. Thus, what started out as climate change policy may increasingly come to be seen as matters of en-

26. Kahneman and Tversky 1979.

27. Some policy measures might produce significant short-term benefits as well.

ergy policy, industrial policy, or food policy. Evaluated in terms of such sectoral frameworks, at least some of the specific measures that could be important components of a comprehensive climate change policy are likely to be seen by many as less attractive.

The misfortune of environmental policy is that it is relatively poor in measures with concentrated benefits and dispersed costs, and relatively rich in measures producing the opposite configuration of effects. Environmental damage typically occurs as a side effect of otherwise legitimate activities such as industrial production or transportation of people and goods. Therefore, effective mitigation policies must somehow penetrate or regulate the activities that cause environmental damage. At least in the short run, such measures will most often impose costs on those whose behavior is to be changed, while benefits will be distributed more widely and perhaps in ways that cannot be predicted at the time of decision.

There are, however, fortunate circumstances in which a company or even an entire branch of industry can reap substantial gains from environmental regulation. For example, banning or taxing emissions of a certain substance puts a premium on more benign substitutes. A company that is well ahead of its competitors in developing such substitutes may see regulatory intervention as an effective device to strengthen its competitive edge. Regulations to phase out CFCs seem to be one case in point. In other instances, producers of new technologies may see environmental regulation as a vehicle for expanding their markets. And even when it is opposed to strict regulation, a company will often want to see its foreign competitors subject to equally strict measures, and hence urge its government to push for international standards. The toolbox of environmental policy contains multiple instruments—cap and trade systems being one—that can be used to reinforce and take advantage of such incentives. A government would be well advised to consider these tools.

Coping with Domestic Politics Hurdles

What might be done to overcome or at least reduce the domestic politics problems described above? Let us briefly consider two sets of strategies, one involving the design of policies, the other focusing on the design of institutions.

One important rule-of-thumb for policy design has already been formulated at the end of the preceding section. Moreover, some of the measures analyzed in the sections on time inconsistency and anarchy are relevant to the domestic politics problem as well. Suffice it here, then, to suggest only one extension. Since the climate change problem involves moral as well as material issues, actors are likely to frame policy choices differently. Some will evaluate alternative options primarily in terms of interests, other in terms of ethical principles or other norms, and people may disagree on whose interests or which norms are the most important. In such a setting, much can be said for trying to

design policy programs so that they respond to different interpretations of the problem. Political feasibility can be enhanced to the extent that such programs combine measures that (a) offer tangible benefits to specific sectors or segments while costs are widely distributed or indeterminate, and (b) conform to core values or ethical principles subscribed to by the attentive public. There is nothing as attractive as measures that combine private benefits with moral virtue. Moreover, we know that coalitions of “Baptists and Bootleggers” have been effective in other fields of environmental policy.²⁸ Admittedly, such composite programs may well appear clumsy.²⁹ If so, this merely reflects the complex configurations of preferences and political processes through which they will have to be developed and implemented.

Moving on to the design of institutions, we should first note that there are some trenchant analyses concluding that present-day combinations of democratic polities and market economies will not be capable of responding adequately to the profound and very complex challenges of ecological scarcity. The solutions prescribed include, as one important component, more centralized governance.³⁰ These contributions raise very important issues that we cannot pursue in depth in this article. Suffice it to point out that centralization of governance will not by itself be a sufficient measure. Moreover, it is a high-risk option with significant side effects, unlikely to be embraced by societies or governments accustomed to the privileges of liberty and democracy. Let us therefore briefly point to three lines of more incremental reform that may enhance response capacity even in the absence of centralization and would make sense also in a more centralized system.

One is to build or strengthen institutions that can provide early warning and help build a platform of consensual, state-of-the-art knowledge. The IPCC provides these kinds of services at the global level, but there are important roles for such institutions also at the national level. Another line of reform is to enhance the capacity of environmental ministries, agencies, and non-governmental organizations. This is partly a matter of resources (budgets, people etc.), but also of procedural rules and practices. Third, regular and open environmental performance reviews can be used systematically for keeping a problem on the agenda, and for forcing governments and parliaments to publicly confirm—or abandon—goals and programs they have committed themselves to pursue. Where public concern is high, naming and shaming may be an effective strategy.

Neither of these reforms can revolutionize earth system governance. They are, however, examples of the kind of measures that—taken together—can make a non-trivial difference while being politically feasible.

28. DeSombre 2000.

29. Verweij et al. 2006.

30. See Hardin 1968; and Ophuls 1977.

The Anarchy Problem

Definition

Mitigating climate change is a global public good. It is well known that the provision of such goods involves free-rider problems.³¹ Because the benefits of reduced global warming accrue to all countries, not only those that reduce their emissions of greenhouse gases, it will be tempting for each country to leave a disproportionate share of the mitigation burden to others. Although this problem is also central to international cooperation problems of a short-term nature, the long-term nature of climate change makes the temptation to free ride particularly strong. Hence, without effective international cooperation, mitigation of climate change will likely be provided only in suboptimal quantities.

Yet, the prospects for implementing an optimal long-term climate policy through an international treaty are not particularly promising either. Because of the free-rider problem, some countries might be tempted to decline to participate. Also, some of the countries that do participate might be tempted not to fulfill their commitments.³² Thus, most treaty designs require potent systems for enforcing compliance.³³ Such systems must usually be adopted by consensus. In some cases, they can be adopted by a qualified majority vote, but then there is typically an escape clause specifying that the system will apply only to countries that explicitly submit to its superiority.³⁴ In either case, the prospects for potent enforcement are dim.³⁵ Suppose that country A declines to consent to a proposed potent enforcement system for treaty T. There are then three possible scenarios. First, the enforcement system might be dropped. Second, other countries might adopt the enforcement system without country A. In this scenario, the enforcement system is probably not needed. If other participating countries were to have significant incentives for non-compliance, they would likely have followed A by declining to consent. Finally, the proposed enforcement system might be watered down, or loopholes added, until all countries (including A) consent. In this scenario, the enforcement system would likely be unable to

31. Olson 1971; and Barrett 2007.

32. The research community remains divided over the significance of enforcement for compliance with international agreements. Whereas some scholars see enforcement as a crucial determinant of compliance, others consider norms, facilitation, and capacity-building to be the main factors. See Barrett 2003; Brown Weiss and Jacobson 2000; Chayes and Chayes 1993; 1995; Downs et al. 1996; and Finus 2008.

33. An enforcement system is potent if authorized to impose credible and sufficiently severe punitive consequences on a noncompliant country. Multilateral environmental regimes also require potent systems for enforcing participation. However, because of space constraints we focus on systems for enforcing compliance.

34. Breitmeier et al. 2006, 114–118.

35. On the other hand, long-term problems typically involve repeated interaction. It is well known that this could entail opportunities for sustaining cooperation through tit-for-tat-like enforcement.

curb significant incentives for noncompliance. In either scenario, the final treaty would leave little room for potent enforcement.

This logic is particularly relevant to regimes aiming to tackle global environmental problems like climate change.³⁶ First, such regimes regulate multilateral rather than bilateral interaction. This makes them different from trade regimes, for instance. Consistent with the above logic, WTO institutions lack centralized means of enforcement. But this is not crucial as a non-compliant WTO member can be effectively punished by another member. Moreover, because the threat of such decentralized enforcement is often credible, the WTO's Dispute Settlement Body can concentrate on ensuring that the enforcement adheres to the requirements of due process.³⁷ In multilateral environmental regimes, punishing non-compliance is a public good for compliant countries. The incentive to punish is thus weaker, and the need for centralized enforcement correspondingly stronger.

Second, global environmental regimes typically focus on a single issue such as climate change. Hence, they differ from complex international organizations which regulate a large number of issues (e.g. the EU). If the members of a complex organization have incentives for non-compliance in different issue areas, every member might consent to a potent enforcement system covering several issue areas. This is true even if each member sees potent enforcement as undesirable for those issue areas where it has strong incentives for noncompliance. For most environmental regimes the potential for such linkage is limited.³⁸

The argument in this subsection suggests that, as far as environmental regimes are concerned, potent enforcement systems are compatible with full participation only for treaties in which compliance costs are low for all significant countries. Of course, if compliance costs are low, compliance rates may be high regardless of whether the agreement has a potent enforcement system.³⁹ The dismal conclusion is that potent enforcement systems are unlikely to be politically feasible precisely when they are most needed. Conversely, whenever a potent enforcement system is politically feasible, there is likely little need for it.

Anarchy and Climate Change

The argument in the previous subsection suggests that a regime design that would not require enforcement might be preferable to one that would. Clearly,

36. Hovi and Holtmark 2006, 145–147.

37. For example, a member cannot legitimately withdraw a concession previously made under a WTO agreement unless this is authorized by the Dispute Settlement Body.

38. One might object that climate change consists of a range of issues, including climate protection and sustainable development, and that linkage might thus be possible even in the context of climate change. Yet this does not change the overall conclusion that adopting a potent enforcement system is more likely in a complex organization such as the EU which handles climate change as well as a number of other issues.

39. Downs et al. 1996.

this holds only assuming that other things are equal. It is easy enough to design a regime that does not require enforcement, simply by choosing behavioral standards that do not require member countries to change their policies. The challenge is to design an effective regime that does not require enforcement.

Kyoto fails to satisfy this criterion. First, the Kyoto Protocol is not an effective regime. 165 countries have ratified the Kyoto Protocol, but only 37 have emissions limitation targets, and for countries such as Russia and Ukraine those targets do not in practice constrain emissions. Countries with targets that do constrain emissions are responsible for only about 20 percent of global emissions. And those countries need reduce their net emissions by only 5.2 percent on average compared to 1990 levels.⁴⁰

Second, for several countries, fulfilling their targets will entail significant costs. Indeed, the expected damage to its economy was one of two major reasons why the United States declined to ratify.⁴¹ Moreover, although some countries are well underway to fulfilling their targets for the first commitment period (Germany, Sweden, the UK), other countries are struggling (Greece, Japan, Portugal, Spain) or not even trying (Canada). Although in a cap-and-trade system it is only to be expected that some countries' emissions will exceed their targets, it is far from obvious that all these countries will eventually buy enough permits to fully comply with their targets. Foreseeing this possibility, the member countries have established a compliance system⁴² which includes a set of punitive consequences for excess emissions. The most important consequences are (a) that in the next commitment period the non-compliant country must cover the deficit, plus an extra 30 percent, and (b) that the eligibility of the non-compliant country to sell emissions permits is suspended.

Unfortunately, this system is consistent with the logic outlined in the previous subsection in that it suffers from a number of serious flaws.⁴³ It is characteristic that the countries least eager to accept potent enforcement were those foreseeing that they might be noncompliant themselves, such as Australia, Japan and Russia. Also, the developing countries were initially opposed to potent enforcement, but changed their minds when it became clear that this system would apply only to developed countries. Conversely, countries supporting the system seemed to assume that it would only be other countries that would have to face punitive consequences. For example, the US delegation "consistently sent the message that once the US commits to a target, the robustness of its domestic legal and regulatory system, in combination with the market mechanisms, would deliver the results."⁴⁴

40. Barrett 2002.

41. The Kyoto Protocol does not impose emissions limitation targets for developing countries.

42. See the Marrakesh Accords in UNFCCC 2002.

43. Barrett 2003, 386; and Hovi 2009.

44. Werksman 2005, 25.

Coping with Anarchy

Recognizing Kyoto's weaknesses, several scholars have proposed alternative conceptions for a climate agreement.⁴⁵ In this subsection we examine whether three such conceptions might help solve the anarchy problem.⁴⁶

First, consider a regime based on intensity targets, linking actual emissions to an output measure such as GDP. Intensity targets could lead to emissions growth being slowed down, stopped, or reversed, depending on the speed of economic growth. Intensity targets lower the risk of high abatement costs, an attractive characteristic both for developing countries and for the United States. A downside is that absolute emissions might increase. Moreover, whereas intensity targets aim to reduce compliance costs, significant incentives for non-compliance could remain. An intensity-target regime would thus require enforcement, albeit possibly to a lesser degree than an absolute-target regime.

Second, suppose countries agree to penalize emissions domestically via an internationally harmonized carbon tax. Such a tax imposes a cost on CO₂ emissions, thereby creating a monetary incentive to reduce emissions.⁴⁷ Economic theory suggests that if cost and benefit functions are known with certainty, then a tax regime and a cap-and-trade regime are equivalent in terms of efficiency. But if cost or benefit functions are not known with certainty, a tax regime is preferable on efficiency grounds. Also, a tax regime avoids problems with grandfathering and baselines, making the economic costs transparent. Furthermore, it might reduce the risk that new administrations cancel their predecessors' commitments.⁴⁸ Again, the downside is that a tax regime might be difficult to enforce.⁴⁹ Countries that seemingly maintain their existing energy taxes might in practice offset the impact of the new carbon tax through other changes in tax or subsidy policies, such as rebates on certain taxes or increased public funding of highway construction.⁵⁰

Finally, a climate regime that at least partially meets the criterion of being effective without requiring enforcement is a regime that imposes emission-reducing technology standards on participating countries.⁵¹ Consider two types of technology, one emission-intensive and one emission-reducing. Assume that these technologies exhibit network externalities, meaning that the net benefit of using a particular technology increases with the number of other countries using that technology, so that countries prefer to use the same technology as other

45. Aldy et al. 2003; Barrett and Stavins 2003; and Aldy and Stavins 2007.

46. We assume throughout that a new climate regime will have to be consensus-based. Hence, we ignore the possibility of a power-based regime.

47. Pizer 1999, 2.

48. Hoel and Karp 2001; Nordhaus 2006; and Pizer 1999. See also our section on time inconsistency.

49. Victor 2001, 86.

50. Eizenstat 1998, 120.

51. Barrett 2003.

countries. There are then two stable situations—one in which all countries use emission-intensive technology and one in which all countries use emission-reducing technology. If countries also care about climate change, they will likely prefer the latter situation to the former. Because it is costly for a single country to switch to emission-reducing technology on its own, an agreement is needed to ensure that enough countries make the switch simultaneously. Signing such an agreement is risk-free provided the agreement does not enter into force until an agreed-upon number of countries have ratified. Once enough countries have switched to emissions-reducing technology, there is nothing to be gained by switching back to emissions-intensive technology. Hence, there is no need for enforcement.

The obvious catch is that emissions-reducing technologies which allow radical transitions only partially exist. For example, hydrogen-driven engines⁵² do exist and there is good reason to believe that this technology exhibits network externalities.⁵³ But emissions-reducing technology for the production of hydrogen does not exist, meaning that this or other emissions-reducing technologies must be developed before a regime based on technology standards is feasible. International cooperation could also play a role in developing emissions-reducing technologies—e.g. by establishing an international fund to finance technology research and development and pay for royalties. However, such cooperation would likely suffer from free-rider incentives and thus require enforcement.⁵⁴ Hence, a regime based on technology agreements may not avoid enforcement altogether. But whereas other types of regime would grow more dependent on enforcement as cooperation widens or deepens, the opposite is true for a regime based on technology standards.

Interaction Effects

Each of the three commitment problems considered in previous sections represent considerable challenges by themselves. What makes climate change policy so hard to develop and implement is that it requires us to deal with all of these problems at once. Moreover, the three commitment problems are likely to interact. This is essentially bad news, since in most cases one problem will serve to reinforce another.

Consider, first, how the domestic politics problem may further compound the challenge of anarchy. Domestic political constraints can reduce or even eliminate the overlap between the “win-sets” of different parties, thereby making it difficult or even impossible to reach agreement.⁵⁵ Moreover, even if an

52. Using fuel cells, hydrogen engines combine hydrogen and oxygen to produce electricity, with water and heat as the only by-products.

53. Choosing a hydrogen-driven car is more attractive if it can be easily refueled in other countries as well as at home.

54. This is true unless cooperation can be organized so that only countries which participate (and pay their fair share) are able to benefit from the technology R&D.

55. See Putnam 1988.

agreement is reached, domestic constraints can make it hard to obtain ratification by some countries. For example, the Byrd-Hagel resolution⁵⁶ all but barred US ratification of the Kyoto Protocol.

Second, the domestic politics problem might impact the time inconsistency problem. While short-term policy goals could easily take dominance over long-term concerns even for a benevolent world government, this problem is likely to be reinforced in a system where politicians invariably need to consider their own (and their own party's) chances of winning the next election, which will never be more than a few years ahead.

Third, the time inconsistency problem could buttress the anarchy problem. Whereas non-compliance with international climate commitments might entail immediate economic and political gains, any adverse effects on the climate will materialize only after several decades. Moreover, with commitment periods lasting several years (as for the Kyoto Protocol), any punishment for non-compliance will materialize only with considerable delay, at best. Thus, even with a credible enforcement system in place, dominance of short-term goals over long-term concerns might make it tempting for a member country to postpone or cancel at least some of the measures required to meet its international commitments.

Fourth, solving the anarchy problem might entail a time inconsistency problem. We mentioned previously that the anarchy problem might be solved through an agreement based on technology standards and technology R&D. While such an agreement would not enter into force until the participation threshold (the tipping point) is passed, actually implementing such an agreement (say, by providing additional funds to an international pool for R&D funding) might engender time inconsistency problems. For example, it might be tempting for a country to hold back on fulfilling its commitments until others are able to demonstrate some progress for a particular line of research.⁵⁷

There is some good news as well! Precisely *because* the three commitment problems are interconnected, solving one may go some way towards alleviating another. For example, some of the design strategies identified in the analysis of domestic politics may help alleviate the anarchy problem. In particular, framing domestic policy in terms of core values and/or measures providing tangible short-term benefits for specific sectors of the economy may facilitate international negotiations. Thus, an agreement focusing on cutting-edge technology is likely to be particularly attractive to the United States and Japan, because these countries pride themselves as technology hubs—a value the European Union also wishes to subscribe to under its Lisbon strategy.

Conversely, an ambitious international climate agreement with an effective enforcement system might enable a member government to resist domestic

56. US Senate 1997.

57. This temptation is different from the incentives a country has once a group of countries have already implemented a line of research and this country makes a profitable payment to gain access to the new standard technologies (i.e. royalty payment).

pressure to pursue a less ambitious policy. Once bound by an international climate agreement, a government can more credibly claim to its critics that failure to deliver on its international commitments might damage its reputation and thus constrain its capacity for pursuing other policy goals of interest. Equally important, if any successor government would also be bound by the same international agreement, the electorate cannot realistically expect to escape international commitments by replacing the incumbent government.⁵⁸ In other words, solving the anarchy problem could take us some way towards alleviating also the domestic politics problem.⁵⁹

Despite some possibilities that progress made in overcoming one of the three commitment problems may facilitate efforts to cope with one or both of the others, the net effect of interaction will most likely be negative. This conclusion corroborates our main message: an effective climate change policy will have to cope with all three problems at once.

Concluding Remarks

As noted in the introduction, the analysis has so far focused primarily on policies of mitigation. Governments and societies may, of course, respond to climate change also by adapting. We conclude by briefly considering to what extent the somber conclusions we have reported for mitigation apply also to policies of adaptation.

Overall, adaptation is a more benign policy challenge in at least three important respects. First, for a wide range of measures (though not for all) the time span between action (cost) and effect (benefit) will be shorter. Second, a policy of adaptation can to a larger extent rely on measures providing tangible benefits for specific sectors or groups (thus belonging to cell 4 in Figure 1). Third, for most adaptation measures externalities will be local, national, or regional rather than global in scope.⁶⁰ The first of these features shortens the time inconsistency problem, the second ameliorates the domestic politics problem, and the third implies that the disabling impact of the anarchical structure of the international system will be less severe.

For the pessimist, the upshot of this analysis is that a policy of adaptation stands a better chance of effective implementation than a policy of mitigation. For the concerned and constructive optimist, one important implication is that mitigation can be enhanced by including measures that serve to ameliorate one or more of the commitment problems analyzed in this article.

58. This requires that the international agreement entails long-term commitments by member countries. The current climate regime hardly satisfies this requirement, given the emphasis on relatively short commitment periods.

59. This logic does not apply only to climate policy. For an application to trade policy, see Hudec et al. 1993, 8–9.

60. Sprinz 2001, 272–276.

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