ENVIRONMENTAL RESEARCH
LETTERS

LETTER

Automaticity and delegation in climate targets

David Frame[1,*] and Jana von Stein[2]

[1] New Zealand Climate Change Research Institute, Victoria University of Wellington, Wellington 6012, New Zealand
[2] College of Arts and Social Sciences, Australian National University, Canberra, Australia
[*] Author to whom any correspondence should be addressed.

E-mail: david.frame@wgtn.ac.nz

Keywords: climate policy, political science, climate targets

OPEN ACCESS

RECEIVED
10 April 2020

REVISED
5 August 2020

ACCEPTED FOR PUBLICATION
15 October 2020

PUBLISHED
6 April 2021

Abstract

The problem of dynamically inconsistent preferences is common in domestic and international politics. A country's—or indeed the world's—future health (economic, social, environmental, etc.) often requires policy adjustments that are costly and unpopular. Governments face formidable pressures to underinvest today in policies whose consequences are optimal in the future. This challenge may be particularly acute when leaders face accountability mechanisms that induce frequent policy responsiveness such as elections. Policies that automatically adjust in response to other changes are a common proposed solution to these types of problems. To be successful, index-based approaches typically also require delegation to an independent authority. In the realm of climate mitigation, we argue that a combination of automaticity and delegation can provide a promising combination for policymakers to consider as they attempt to develop enduring solutions to climate change.

1. Introduction

It is well known that implementing strong, costly, climate change mitigation policies is one of this century's most pressing and challenging tasks (Poterba 1991, Schelling 1992, Barrett 1994, Victor *et al* 1998). These efforts can be particularly difficult if they potentially drive leakage and/or if the benefits are not strictly internalised across time or space. And yet, without decisive action, environmental risks accrue over time, becoming costlier to solve in the future than they would have been in the present. How, then, to navigate these challenges? How to induce governments to start—and stick with—costly climate action, despite the temptation to delay such policies (Hovi *et al* 2009)?

There are, of course, many reasons why governments avoid or delay climate action. Some, such as the Trump administration, place no value on emissions reductions as a valuable policy goal (Greshko *et al* 2019). Others face a different challenge: they would like to implement climate change policy, but face dynamic inconsistency problems (AKA time-inconsistent preferences) whereby optimal policy today may not be the same as optimal policy tomorrow. These make it difficult for governments that would like to implement costly mitigation strategies now to do so. We offer a potential solution for the second group of countries. We argue that policies that are automatic, and include some degree of delegation to an authority that is not heavily subject to political manipulation, offer a viable institutional solution when governments face dynamic inconsistency problems.

2. Dynamic inconsistency in climate change and beyond

For many countries, developing solutions to long-term challenges such as climate change involves solving a fundamental challenge of dynamic inconsistency. Put simply, optimal choices today may be at odds with optimal choices in the future[3]. Discounting and credible commitment problems are central features of dynamic inconsistency. A key component of the former is that peoples' willingness to substitute consumption of one good for another does not depend solely how much time has elapsed; rather, humans have 'present-biased' consumption preferences and discount the future non-exponentially. Put more simply, people are impatient: they prefer to experience rewards soon and to defer costs until

[3] Kydland and Prescott (1977).

later—even if the payoffs are lower in the future (O'Donaghue and Rabin 1999). Non-exponential discounting is also highly relevant to climate change: it explains why governments sometimes forgo action (i.e. consume) today even though efforts will be more onerous in the future. Particularly when future generations will bear the costs of future mitigation (Broome 1991, Beckerman and Hepburn 2007), the natural human tendency to value the present over the future can result in serious problems. Even governments that would like to take meaningful action today face incentives to defer doing so if they discount the future at a sufficiently high rate[4].

The challenge of non-credible commitments is a second element of dynamic inconsistency. If policymakers or their successors have discretion to alter or eliminate targets, even governments that want to implement costly policy changes today will struggle to convince others that the commitments will 'stick' because informed observers will understand the incentive structure (Schelling 1960, North 1993). At the heart of this problem is a simple but important point: whereas current policymakers can, when designing today's policies, take into account future policymakers' likely choices, the converse is not possible. 'The suboptimality arises because there is no mechanism to induce future policymakers to take into consideration the effect of their policy … upon current decisions of agents' (Kydland and Prescott 1977, 481). This problem can compound when domestic and international politics intersect: government officials, observing the internal machinations of their potential cooperation partners, may struggle to trust that international promises will be implemented, even among parties with the best of intentions (Barrett 1994, Hovi *et al* 2009).

The above discussion briefly explains why humans' inherent tendency to delay costly action and the challenge of tying future governments' hands can create dynamic inconsistency problems even when expectations, beliefs, and preferences do not change over time. This becomes all the more complex when these do change over time. In uncertain systems, different assessments of the future costs of action (or of the future seriousness of inaction) can stymie climate action, particularly if current leaders assume that tomorrow's can develop cheaper solutions or adapt, but gamble wrong. What is more, generating credible commitments can be particularly challenging if policy implementation requires future adjustments in response to external stimuli such as economic growth or retraction (Blackburn and Christensen 1989), or because tomorrow's government simply has different policy preferences—for instance due to partisan change. As with monetary policy, then, future governments' need or desire to adjust can undermine the promises that today's government makes (Keefer and Stasavage 2003).

3. Automaticity

Individuals, firms, and governments have been developing solutions to the challenges of dynamic inconsistency for centuries. In climate change as in other arenas, implementing desirable policies sometimes requires (1) regular, sometimes even constant, adjustment in order to achieve those goals; and (2) setting objectives today that will not be realised until many years, or even decades, from now. For instance, pension plans and welfare benefits both take account of cost of living adjustments, central banks set monetary policy based on target inflation rates, and so on.

Consider the example of pension planning, a problem that has many similarities with climate change. Politicians have incentives (electoral and otherwise)[5] to hike today's pension rates and to put off much-needed reform for later. Yet such spending will have disastrous consequences, particularly in the long-term. Various countries have attempted to solve the pension problem via 'automatic stabilising mechanisms' (ASMs). ASMs have been successfully introduced in many jurisdictions, and some have endured. Their basic premise is to attempt to depoliticise the policy process and render it formulaic over time by having benefits adjust automatically to economic and demographic circumstances (essentially, an index) without direct policymaker manipulation (Weaver 2011)[6]. Automaticity is important: it eliminates the requirement of political assent, making adjustments depend on pre-established criteria rather than political whim. Adopting ASMs involve political hurdles, including interest group opposition, institutional barriers, and conflicts over the distribution of benefits and costs of the policies in question (Weaver 2011). Of course, it is important to get the index right (a process that, itself, can be fractious). But, in theory, a well-designed ASM can help mitigate the problem of adjustment, accomplishing goals that benefit the public writ large.

[4] See Karp (2005), who provides a hyperbolic model of global warming, for further discussion and nuance. Another reason for deferring action is that leaders believe the future costs of mitigation will be low. We discuss this below. There are also important disagreements regarding the interpretation of discounting—specifically whether it should be treated as a purely empirical parameter (observable in markets) or should be treated as a normative parameter (reflecting judgements regarding pure time preferences, risk aversion, and antipathy toward inequality of consumption). Both issues are significant in climate policy, involving as it does judgements regarding and segments of humanity in vastly different circumstances, as well as intergenerational welfare (Beckerman and Hepburn (2007), Broome (1991), Heilman (2017)).

[5] We briefly explore the relationship between democracy/autocracy and dynamic inconsistency on p. 12. For greater detail, see for example Minford (1995).

[6] As we discuss below, automaticity alone does not fully depoliticise, because governments can ultimately override it if they want. For this reason, we argue that it must be coupled with delegation.

Some perceive rules such as ASMs, inflation bands, and national constitutions as tantamount to binding contracts; they make commitments credible because they require policy to follow a prespecified plan (Kydland and Prescott 1977). We are more sceptical of rules' inherent bindingness. In the case of ASMs, for instance, politicians still maintain the authority to change or eliminate ASMs. They face pressures not to 'stand idly by' when unpopular automatic adjustments take effect. Hence, temptations to promise rates that are unrealistic in the future, and to renege on indices, are high. Establishing an index without also empowering someone or something (independent of government) to ensure its implementation is tantamount to choosing an inflation rate band without having an independent central banker, or creating a constitution without concurrently establishing an independent court.

4. Delegation

The problem with automaticity alone, then, is that it does not actually tie leaders' hands (Manjone 2001, Keefer and Stasavage 2003). Leaders can override targets if they so desire—and the pressures to do so may be particularly acute when elections are part of the equation (Minford 1995). In the absence of strong norms or precedent, leaders must instead devise ways of 'being constrained to obey a set of rules that do not permit leeway for violating commitment' (North and Weingast 1989: 804). But how? Solutions have to be designed carefully to match the anticipated incentive problems; they also must be self-enforcing, i.e. the parties to the bargain must have an incentive to respect it down the road (North and Weingast 1989). Delegation to an agency or body is a common solution to these sorts of collective action problems.

Governments choose to delegate for two main reasons: to reduce decision-making costs, or to enhance the credibility of policy commitments (Manjone 2001). The climate target case falls more readily into the latter category, as a key challenge is how to insulate policy from the whims of politicians. The establishment of independent courts (North and Weingast 1989) and central banks (Cukierman 1992) has a similar justification. Consider the latter. Today, few informed observers would question the idea that central bank independence is crucial to ensuring price stability by insulating monetary policy from political influence. As *The Economist* famously stated, 'The only good central bank is one that can say no to politicians' (Eijffinger and De Haan 1996). Truly independent central banks have a clear mandate, the ability to set interest rates without significant political backlash, and appointment processes not subject to undue political influence.

There are many other examples of delegation to independent bodies: courts, and, in some countries, clerical authorities. Ombudspeople can fulfil this role, but only if their decisions are binding and their mandate difficult to overturn (which is probably more the exception than the rule). Delegation to an independent body or agency has also proven a useful solution to similar challenges in the international arena, with governments sometimes turning over substantial authority to supranational bodies (Hawkins *et al* 2006).

In addition to monitoring and enforcing existing targets, an independent authority could potentially be charged with developing and authorising changes to the automaticity formula as science and technology evolve and as information (hopefully) improves. A prime example comes from changes in how mitigation goals are framed: the change from a focus on equilibrium climate conditions and emissions stabilization to a focus on the transient climate response to cumulative emissions and carbon budgets (e.g. Frame *et al* 2014) would have been difficult to incorporate into a purely automatic process. Governments may be wary of delegating such discretion to an independent body, but some or perhaps many are also likely to understand the benefits. Delegation carries risks—that the independent body will pursue its own objectives and/or that sticking to targets becomes economically and politically costly. But it also brings stability and helps render commitments stable. It is also generally accepted that experts, rather than politicians, do a better job of implementing mandates, whether they relate to inflation, pension rates, or how to hit emissions targets.

Why not simply have delegation without automaticity? The main reason is that governments must have *something* to delegate to the independent body. Of course, they could give the independent body complete discretion over implementation of climate policy without specifying how to achieve emissions reductions. It is highly unlikely that governments would issue carte blanche to an independent authority. A much narrower remit would be much more politically palatable. It is plausible that a government would give parameters but instruct the body to develop an automaticity formula—this is precisely how independent central banks work. However, we think it is more likely that governments will prefer to establish the initial index—in roughly the same way that national constitutions and independent courts function—because policymakers often want to set the 'rules of the game' before turning over authority for their implementation.

5. Policy roles for indices, international and domestic

Other scholars have highlighted the potential for delegation to independent institutions to play important roles in bolstering credible climate change policy, particularly in the context of dynamic inconsistency

(Helm *et al* 2003). However, the combination of automaticity and delegation has gained less attention. Particularly in the context of domestic climate change policy, we argue that this combination—akin to what is found in the context of independent central banks—holds great promise.

To consider the possible roles of indices in climate policy, we draw on a long-standing distinction between descriptive, normative, and prescriptive models of decision-making, in which 'Descriptive models are evaluated by their empirical validity […], normative models are evaluated by their theoretical adequacy […], and prescriptive models are evaluated by their pragmatic value' (Bell *et al* 1988, p17–18). Environmental indicators can, in principle, have any combination of these roles (Ott 1979, Kravchuk and Schack 1996). In environmental affairs, the North Pacific Fur Seal Treaty, which sets a moratorium on killing fur seals if the number frequenting certain islands falls below a certain level, provides an interesting example of a prescriptive index. Similarly, arms control treaties such as the Strategic Arms Limitation Treaties (SALT) and the Chemical Weapons Treaty almost always set numerical limits on munitions and (when allowed) defined 'new' weapons as a percentage of that base. The majority of multilateral arms agreements also involve delegation to an existing or freshly-created international organisation (Koplow 2017), some of which have struggled to ensure compliance in large part because they lack sufficient enforcement authority.

For the foreseeable future, we believe the prospect of widespread consensus around a prescriptive index at the international level to be remote. It may be difficult to get states to agree on the specifics of the index, leading to a 'lowest common denominator' agreement or none at all. Furthermore, delegation to a sufficiently independent international body may, despite its benefits (Abbott and Snidal 1998), seem risky to governments so early-on in the process of getting an index up and running. (Recall, after all, that it took decades and even centuries for independent central banks to be accepted). Instead, weakly normative roles for indices are, perhaps, to some extent necessary at the global level, given Article 2(a) of the Paris Agreement's aim of 'Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels.' Taken seriously, this implies the development of a reference point, some measure of global warming, an understanding of the transient climate response to cumulative emissions, and a resulting remaining carbon budget (Millar *et al* 2017, Matthews *et al* 2017). Any conceivable alternative framing of the problem would also involve some sort of implicitly normative environmental index: had the world adopted a 450ppm (Stern 2008) or 350ppm (Hansen *et al* 2008) target instead of a 2 °C target, the conceptual challenges would have been much the same.

The prospects for practical guidance from indices combined with delegation are quite different in the domestic arena. We believe there is clear scope for prescriptive indices in domestic policy in many (though certainly not all) countries, because domestic institutions make indexed-based policy adjustment far more plausible than what can typically be accomplished internationally. Automatic climate change policies could be constructed around climate change targets, such as Nationally-Determined Contributions (NDCs), or around other mitigation indicators, such as prices on carbon or carbon budgets. In any of these three cases, countries could choose their own mitigation efforts directly from a comparison with their neighbours, trading partners or main climate change negotiation partners.

An index incorporating the observed behaviour of other countries ought, in principle, to be palatable both to climate change policy optimists and pessimists. From an optimist's perspective, domestic climate policies will automatically reflect and reinforce the progressive changes undertaken elsewhere. For a pessimist, the index provides assurance that his/her country will not be expected to do radically more than other, similar, countries. This does not fully eliminate the incentive to free-ride or renege, which is why independence is also crucial. But it does resolve another typical problem in international cooperation: disagreement over standards (Abbott *et al* 2001).

6. Worked example

Imagine a country wants to benchmark its climate efforts against N other countries. Then it could set an indexed target, either an NDC or a policy instrument such as a price on carbon, according to a formula such as

$$A = \sum_{i=1}^{i=N} w_i B_i + \varepsilon$$

where, for some number i of variables (B) around which the index is constructed, each of which has some relative weight w. B could include variables such as NDCs or the carbon prices of the countries in a basket, and ε is a leadership parameter indicating that country intends to lead ($\varepsilon > 0$) or lag ($\varepsilon < 0$) behind the countries in question. ε could be decomposed into further terms, based on income per capita considerations, historical responsibility or other considerations reflecting the country's interpretation of 'common but differentiated responsibilities and respective capabilities'.

Policy would adjust automatically to changes in policy elsewhere. Domestic political arguments could centre on the value of ε, the extent to which the country ought to seek to lead or shadow its peers. Importantly, the development and adoption of an automatic policy is a domestic concern; it does not require agreement or consensus from the

international community. The implementation of such index-based policies could, however, support the development of climate clubs (Nordhaus 2015), by sending a signal to other countries about how one's own behaviour will change, especially if there are political costs associated with deviating from the policy. This approach has several attractive features.

It starts from realistic initial conditions, and it limits first-movers' exposure to leakage. The country does not begin by taking on Herculean commitments, but by offering an ante. But the country also promises to up its commitment as others join, so in ideal endgame in which everyone in the world shares a price on carbon, the country is imposing the full global social cost of carbon (GSCC) on its citizens, because everyone else is doing likewise. If it did not do so, it would be free-riding on the efforts of others.

It arrives at the right end-point of a full GSCC, even if the path involves under-pricing carbon over the period of increasing participation. It specifies policies, which are under government control, rather than outcomes, which are not. Scientific revisions to the GSCC can be incorporated automatically with each Intergovernmental Panel on Climate Change (IPCC) report or other information stream. This is just an example. Alternative algorithms might have further, or other, desirable properties.

A variation on the above approach could be to have a series of bi- or multi-laterally negotiated clubs, with membership perhaps reflecting 'common but differentiated responsibilities and respective capabilities', in which members promise to index to each other: e.g. a $10/tC club, and a $20/tC club, and so on, each of which contains members indexing to each other, and each of which could set out, announce, and negotiate over plans for future development that are contingent on members behaviour (and potentially on the efforts of other clubs, too). But even in the absence of negotiated clubs reinforcing each other's automatic commitments, countries that can announce automatic commitments which politicians find hard to unpick could still be a promising avenue to explore.

One potential challenge this model faces is the potential for backsliding: just as the model would imply that the country follows others into stronger mitigation, so it might also imply that the country weakens its mitigation efforts in response to a weakening of efforts by others. The Paris Agreement and subsequent negotiations have attempted to forestall forms of weakening through the (on-going) development of a 'ratchet mechanism' (Falkner 2016), which includes a schedule of regular updates and stocktakes, backed up by 'naming and shaming'; though many of the details of what comprises 'weakening' need further debate and development. The sorts of automatic policy discussed here could, in fact, be used exclusively to push efforts forward beyond some initial forward trajectory, such that it would apply only to taking mitigation efforts beyond those already committed to unilaterally. So, for instance, if a country had an NDC implying (say) −30% emissions on 2005 levels, then it could promise to increase this by a specific amount if others also did more. In this way, an automatic policy, if underpinned by an appropriate degree of institutional independence, could fit well with the spirit of the Paris Agreement and its provisions around using revisions to enhance rather than reduce ambition (Rajmani and Brunnée 2017).

7. Discussion

Indexing and bench-marking are far from flawless. Broome *et al* (2018), for instance, assert that benchmarks oversimplify the comparative evaluation of national performance, reductively collapsing a complex mix of political values and empirical variables into a paradigm-specific index that masquerades as something less value-laden than it really is. In this view, the creation and normalisation of indices and bench-marks creates arbitrary divisions between 'ideal' and 'pathological' types of performance which (re)cement international social hierarchies. These concerns are arguably most acute where international organisations—such as the UNFCCC or the IPCC—are both setting the benchmarks and measuring progress. We agree that an approach that centres on international organisations can be problematic, though for different reasons: we simply do not believe that most states would be willing to adopt meaningful indices while delegating significant authority to an international institution. Instead, the main function of our approach is to allow rational, foreseeable domestic policy responses which reflect changing social and economic contexts. This emphasis on national action is highly visible in the Paris Agreement. It reflects a political reality that we must leverage.

Given that our approach is most likely to get traction domestically, it is natural to wonder whether it is most likely to 'stick' in the presence of particular domestic political arrangements. Arguably the most pressing is whether automaticity combined with domestic delegation would falter in cases where leaders face limited constraints on their ability to change policy (also known as veto players). In the monetary policy arena, scholars have shown that veto players make it more difficult to reverse a decision to delegate, therefore giving independent central banks greater scope to reduce inflation (Keefer and Stasavage 2003). Von Stein (2020) explores a similar question in the realm of environmental outcomes, arguing that constraints can 'lock in' existing policy, whether good or bad for the planet. This suggests that our proposed combination of automaticity and delegation is indeed more likely to 'stick' in countries with

greater institutional constraints, but that these very constraints may also stymie the adoption of such policies in the first place.

8. Conclusion

Index-based approaches have been prominent as proposed recipes for international burden-sharing, but the nature of the international system makes them poorly suited to this role. At the international level, indicative and weakly normative roles for indicators of planetary health are the more promising approach. In contrast, at the national level, we see greater potential for more prescriptive models. Index-based approaches, if coupled with sufficient institutional independence, can enable leaders to commit to a sequence of actions that would otherwise be difficult to roll out. Besides a lack of will, the biggest challenge to this approach is backsliding. Such action would become (politically) easier to implement if other countries were doing the same.

Data availability statement

No new data were created or analysed in this study.

ORCID iD

David Frame https://orcid.org/0000-0002-0949-3994

References

Abbott K and Snidal D 1998 Why states act through formal international organizations *J. Conflict Resolut.* **42** 3–32
Abbott K and Snidal D 2001 International 'standards' and international governance.' *J. Eur. Public Policy* **8** 345–70
Barrett S 1994 Self-enforcing international environmental agreements *Oxford Econ. Pap.* **46** 878–94
Beckerman W and Hepburn C 2007 Ethics of the discount rate in the Stern review on the economics of climate change *World Econ.-Henley Thames* **8** 187–210
Bell D E *et al* 1988 editors *Descriptive, Normative, and Prescriptive Interactions* (Cambridge: Cambridge University Press)
Blackburn K and Christensen M 1989 Monetary policy and policy credibility: Theories and evidence *J. Econ. Lit.* **2** 1–45
Broome A, Homolar A and Kranke M 2018 Bad science: International organizations and the indirect power of global benchmarking *Eur. J. Int. Relat.* **24** 514–39
Broome J 1991 *Weighing Goods: Equality, Uncertainty, and Time* (Oxford: Blackwell)
Cukierman A 1992 *Central Bank Strategy, Credibility, and Independence* (Cambridge, MA: MIT Press)
Eijffinger S and De Haan J 1996 The political economy of central-bank independence (www.princeton.edu/~ies/IES_Special_Papers/SP19.pdf)
Falkner R 2016 The Paris agreement and the new logic of international climate politics *Int. Aff.* **92** 1107–25
Frame D J, Macey A H and Allen M R 2014 Cumulative emissions and climate policy *Nat. Geosci.* **7** 692–3
Greshko M, Parker L, Howard B, Stone D, Borunda A and Gibbens S 2019 A running list of how President Trump is changing environmental policy *National Georgraphic* (www.nationalgeographic.com/science/article/how-trump-is-changing-science-environment)
Hansen J, Sato M, Kharecha P, Beerling D, Berner R, Masson-Delmotte V, Pagani M, Raymo M, Royer D L and Zachos J C 2008 Target atmospheric CO2: Where should humanity aim? *Open Atmos. Sci. J.* **2** 217–31
Hawkins D, Lake D, Nielson D and Tierney M 2006 *Delegation under Anarchy: States, International Organizations, and Principal-Agent Theory* (Cambridge: Cambridge University Press)
Heilmann C 2017 Values in time discounting *Sci. Eng. Ethics* **23** 1333–49
Helm D *et al* 2003 Credible carbon policy *Oxford Rev. Econ. Policy* **19** 438–50
Hovi J, Sprinz D and Underdal A 2009 Implementing long-term climate policy: Time inconsistency, domestic politics, international anarchy *Glob. Environ. Politics* **9** 20–39
Karp L 2005 Global warming and hyperbolic discounting *J. Public Econ.* **89** 261–82
Keefer P and Stasavage D 2003 The limits of delegation: Veto players, central bank independence, and the credibility of monetary policy *Am. Polit. Sci. Rev.* **97** 407–23
Koplow D 2017 Eve of destruction: Implementing arms control treaty obligations to dismantle weaponry *Harvard National Secur. J.* **8** 158–238
Kravchuk R S and Schack R W 1996 Designing effective performance-measurement systems under the Government Performance and Results Act of 1993 *Public Administration Rev.* **56** 348
Kydland F and Prescott E 1977 Rules rather than discretion: The inconsistency of optimal plans *J. Polit. Econ.* **95** 473–91
Manjone G 2001 Two logics of delegation: Agency and fiduciary relations in EU governance *Eur. Union Politics* **2** 103–22
Matthews D H , Landry J, Partanen A, Allen M, Eby M, Forster P M, Friedlingstein P and Zickfeld K 2017 Estimating carbon budgets for ambitious climate targets *Curr. Clim. Change. Rep.* **3** 69–77
Millar R J, Fuglestvedt J S, Friedlingstein P, Rogelj J, Grubb M J, Matthews H, Skeie R B, Forster P M, Frame D J and Allen M R 2017 Emission budgets and pathways consistent with limiting warming to 1.5 °C *Nature Geosci.* **10** 741–7
Minford P 1995 Time-inconsistency, democracy, and optimal contingent rules *Oxford Econ. Pap.* **47** 195–210
Nordhaus W 2015 Climate clubs: Overcoming free-riding in international climate policy *Am. Econ. Rev.* **105** 1339–70
North D 1993 Institutions and credible commitment *Zeitschrift Für Die Gasamte Staatswissenscharft* **149** 11–23
North D and Weingast B 1989 Constitutions and commitment: Evolution of institutions governing public choice *J. Econ. Hist.* **49** 803–32
O'Donaghue T and Rabin M 1999 Doing it now or later *Am. Econ. Rev.* **89** 103–24
Ott W 1979 *Environmental Indices: Theory and Practice* (Ann Arbor, MI: Ann Arbor Science Publishers, Inc.)
Poterba J M 1991 Tax policy to combat global warming: on designing a carbon tax *National Bureau of Economic Research Working Paper Series* No. 3649 (https://doi.org/10.3386/w3649)
Rajamani L and Brunnée J 2017 The legality of downgrading nationally determined contributions under the Paris Agreement: lessons from the US disengagement *J. Environ. Law* **29** 537–51
Schelling T C 1960 *The Strategy of Conflict* (Oxford: Harvard University Press)
Schelling T C 1992 Some economics of global warming *Am. Econ. Rev.* **82** 1–14
Stern N 2008 *Key Elements of a Global Deal on Climate Change* (London: London School of Economics)
Victor D *et al* 1998 *The Implementation and Effectiveness of International Environmental Commitments* (Cambridge, MA: MIT Press)

Von Stein J 2020 Democracy, autocracy, and everything in between: How domestic institutions affect environmental protection *Br. J. Polit. Sci.* 1–19

Weaver K 2011 The politics of automatic stabilization mechanisms in public pension programs *WZB Discussion Paper* No. SP I 2011–201 (Berlin: Wissenschaftszentrum Berlin für Sozialforschung (WZB))

Weaver R K 2016 Privileging policy change? Sustaining automatic stabilizing mechanisms in public pensions *Soc. Policy Adm.* **50** 148–64