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The effectiveness of climate clubs under Donald Trump

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ABSTRACT

On 1 June 2017, President Trump announced that the US intends to leave the Paris Agreement if no alternative terms acceptable to his administration can be agreed upon. In this article, an agent-based model of bottom-up climate mitigation clubs is used to derive the impact that lack of US participation may have on the membership of such clubs and their emissions coverage. We systematically analyse the prospects for climate mitigation clubs, depending on which of three conceivable roles the US takes on: as a leader (for benchmarking), as a follower (i.e. willing to join climate mitigation clubs initiated by others if this is in its best interest) or as an outsider (i.e. staying outside of any climate mitigation club no matter what). We investigate these prospects for three types of incentives for becoming a member: club goods, conditional commitments and side-payments. Our results show that lack of US leadership significantly constrains climate clubs' potential. Lack of US willingness to follow others' lead is an additional, but smaller constraint. Only in a few cases will US withdrawal entail widespread departures by other countries. We conclude that climate mitigation clubs can function without the participation of an important GHG emitter, given that other major emitters show leadership, although these clubs will rarely cover more than 50% of global emissions.

Key policy insights

- The US switching from being a leader to being a follower substantially reduces the emissions coverage of climate mitigation clubs.
- The US switching from being a follower to being an outsider sometimes reduces coverage further, but has a smaller impact than the switch from leader to follower.
- The switch from follower to outsider only occasionally results in widespread departures by other countries; in a few instances it even entices others to join.
- Climate mitigation clubs can function even without the participation of the US, provided that other major emitters show leadership; however, such clubs will typically be unable to cover more than 50% of global emissions.
- Climate mitigation clubs may complement the Paris Agreement and can also serve as an alternative in case Paris fails.

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Introduction

On 1 June 2017, President Trump announced that the US would leave the 2015 Paris Agreement.[1] Moreover, on 4 August 2017, he communicated to the UN the intent to follow through with withdrawal unless a suitable form of reengagement could be found.[2] Given that the US is the world's second largest emitter, US withdrawal from

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the Paris Agreement, or even delayed[3] or incomplete US compliance, might entail substantial detrimental effects on long-term GHG emission paths and thus on the probability of reaching the Paris Agreement's 1.5–2^0 C target (Climate Action Tracker, 2017; Sanderson & Knutti, 2017).

This article explores the potential for effective climate cooperation under different constraints on US participation. A formal model of climate clubs is employed. While focusing on this particular form of cooperation, the results are also relevant for understanding the impact of such constraints on international climate cooperation more generally.

The US and climate policy

International climate policy has always been controversial within the US (Bang, Hovi, & Sprinz, 2012; Hovi, Sprinz, & Bang, 2012; Kemp, 2016, 2017). For example, the George H.W. Bush Administration opposed inclusion of targets and timetables for limiting emissions from developed countries in the 1992 UN Framework Convention on Climate Change (Bodansky, 2001). Moreover, the 1997 Byrd–Hagel resolution passed by the US Senate opposed US participation in any protocol mandating targets and timetables that would not include substantive obligations for emerging economies as well as for developed countries. Nevertheless, finalized later in the same year, the Kyoto Protocol imposed targets and timetables only on developed countries. Despite being signed by the Clinton administration, the Kyoto Protocol was never submitted to the Senate for advice and consent; hence, the US never became a party. Because of the persistent reluctance in the US Senate, the Obama administration ensured that the 2015 Paris Agreement was designed to avoid the need for US Senate advice and consent (Rajamani, 2016). Public support for climate policy in the US has lagged behind other countries (Egan & Mullin, 2017; Stokes, Wike, & Carle, 2015).

The announcement by President Trump to withdraw from the Paris Agreement was greeted with determined opposition from other countries (especially China, whose cooperation with the US since 2014 was pivotal in the negotiations leading up to the Paris Agreement)[4] as well as from scientists,[5] larger US firms[6] and pro-climate action US governors.[7]

Climate mitigation clubs

The 2015 Paris Agreement has been widely celebrated as a diplomatic triumph; however, as a legal structure it can only encourage – not mandate – specific mitigation obligations for parties. Scholars therefore continue to consider alternative avenues for climate cooperation, such as the club approach proposed by Victor (2011).

The club approach resembles the process started by the Paris Agreement in that both try to build cooperation bottom up. However, an important difference is that – unlike the Paris Agreement – a climate change mitigation club would start small and try to spur club growth through the use of incentives. Examples include club goods (exclusive benefits for club members),[8] conditional commitments (promises to reduce one's own emissions more than one would otherwise do, provided that others join the club) and side-payments (monetary compensations for joining). If two or more similar-purpose clubs emerge, their leaders may find themselves competing over attractive followers, or initiate cooperation based on comparative advantages or some other criterion. The club approach we model could serve either as an alternative to the Paris process, or as a complementary process through which a subset of members of the Paris Agreement coalesce to increase the ambition of their nationally determined contributions (NDCs).

Using an agent-based model (ABM), we have shown elsewhere that these types of incentives can cause a climate club – even if initiated only by a few major economies – to grow and eventually develop into a very effective framework for reducing global emissions. A climate club instigated jointly by the US and one or more other major economies (e.g. China, the EU) would be particularly likely to attract new members (Hovi, Sprinz, Sælen, & Underdal, in press; Sælen, 2016).

This article considers how different options available to the Trump administration would influence the potential effectiveness of international climate clubs. Considerable uncertainty exists concerning the Trump administration's future climate policies. We consider three ways the Trump administration might relate to climate clubs. First, in a theoretical reference scenario, the US acts as a *leader* (an 'enthusiastic country' in Victor's (2011)

terminology). In a second scenario, the US acts as a *follower* (a 'reluctant country'). Finally, in a third scenario the US acts as an *outsider*, that is, as a country that will not join a climate club under any circumstances (i.e. it acts neither a leader *nor* as a follower but opts out of participating in any club).

We show below that this third option results in knock-on effects on other countries' participation in some scenarios, yet not in others. Overall, our results indicate that climate clubs can be reasonably successful even *without* US participation, yet in most scenarios, clubs can then at best grow to cover around half of global GHG emissions. Prospects for club growth are brightest if initiators use side-payments rather than club goods or conditional commitments as incentives.

Literature review[9]

The reliance of the United Nations Framework Convention on Climate Change (UNFCCC) on the consensus rule[10] enables determined countries to block collective decisions that they consider go against their interest. 'Starting small' might facilitate negotiations by enabling enthusiastic countries to bypass reluctant UNFCCC members in order to get effective cooperation started.[11] In addition, starting small might be helpful for creating incentives to participate and for giving major emitters a privileged position (Falkner, 2016). Thus, Victor (2011) suggests that cooperation should begin with small groups (clubs) of enthusiastic countries that then try to entice reluctant countries to follow by offering incentives such as conditional commitments and club goods. Similarly, Stewart, Oppenheimer, and Rudyk (2013a, 2013b) include clubs in their suggested strategy for global cooperation on mitigation.

Several actor groups – including the 2006 Asian Pacific Partnership on Clean Development and Climate Change, the 2009 Major Economies Forum on Energy and Climate, and the 2012 Climate and Clean Air Coalition – have attempted to address climate change outside the UNFCCC; however, these attempts have failed to reduce emissions significantly. Part of the explanation may be that these groups have not offered any incentives of the type proposed by Victor (2011). Rather, they have mostly served as 'discussion clubs' (Andresen, 2014) or 'forums for political dialogue' (Weischer, Morgan, & Patel, 2012).

Conditional commitments can under specific conditions boost other countries' willingness to contribute (Helland, Hovi, & Sælen, 2017; Holtsmark, 2013; Underdal, Hovi, Kallbekken, & Skodvin, 2012). Club goods, such as preferential terms of trade or investment, R&D programmes in renewable energy technology, or access to emissions trading schemes, can have similar effects. For reluctant actors to respond positively to the offer of a club good, this good must be significant enough to outweigh the temptation to continue to free ride as a non-member. It must also be credible that an actor can get access to the club good only by joining the club (Weischer et al., 2012).

Although previous research has focused on the conditions under which a climate club might grow and eventually become effective in reducing emissions (Hovi et al., in press; Nordhaus, 2015), very little attention has been paid to how a change in course by a major emitter, such as the US, influences the potential for creating a successful climate club. Our article aims to fill this void.

Methods

The ABM employed (Hovi et al., in press; Sælen, 2016) captures essential climate club features, while leaving out many complicating real-world factors. The basic decision is binary: Each actor must decide whether to join a climate club requiring each member to implement annual mitigation measures worth at least 1% of its gross domestic product (GDP). Hence, we model a particular form of club, with a clear membership criterion, and effort sharing regarding total abatement costs across members. The abatement measures produce a global public good (climate change mitigation), and we assume that the global benefits (avoided damages) of a global club would outweigh the costs by a factor of three.[12] Justifications for the 1% and factor three figures are provided in Hovi et al. (in press).

Like the extensive game-theoretic literature on stable coalitions, we focus on participation and assume full compliance. Cooperation based on club goods reduces non-compliance incentives because defectors can be excluded from access to the club good (Stewart et al., 2013a, 2013b). Cooperation based on side-payments

reduces the non-compliance incentive among recipient countries, but increases it among donor countries (Finus, 2003). Future work should model compliance behaviour explicitly.

The model includes three types of actors. *Followers* are rational and self-interested. They will join a climate club provided that they at least break even by doing so. *Leaders* are not purely self-interested, but intrinsically motivated to start a club and to remain a member unless – having negotiated with all potential followers – the club generates negative net private benefits relative to the no-club scenario. This assumption could be defended by arguing that state behaviour is influenced by norms, values and notions of collective identities that generate more cooperative behaviour than one would expect based solely on actors' material self-interest (Mayer, 1992; Underdal et al., 2012). Finally, a country might eschew self-interest by being an *outsider*, thereby completely distancing itself from climate clubs (i.e. serving neither as a leader nor as a follower).

Our ABM (Hovi et al., in press) includes 141 actors representing 168 countries (the EU28 countries are treated jointly as a single actor). In the model, actors are parameterized using current distributions of GHG emissions (see Table SM.1), GDP and vulnerability to climate change impacts.

We ran our ABM under various assumptions concerning which actors are leaders. In particular, we mapped the growth potential of clubs initiated by the US (for benchmarking), by the EU, by China, by the BRICS group (Brazil, Russia, India, China and South Africa), by the BASIC group (Brazil, South Africa, India and China), by a constellation of the world's 30 most vulnerable countries, and by some coalition of two or more actors/actor groups (select coalitions only).

We consider three mechanisms whereby leaders might induce followers to join the club. First, besides reducing climate-related damages through mitigation, the club may produce club-good benefits exclusively for members. Second, leaders may use conditional commitments (i.e. offer to increase their mitigation efforts conditional on new members joining). Finally, club members may offer side-payments to cover part of the followers' entry (abatement) costs.

The club expands through bilateral negotiations with every non-member. If at least one new entrant joins, a new round of negotiations will take place with *all* remaining non-members because their cost–benefit calculus will change as the club grows. Negotiations take place sequentially, starting with the candidate with the cost–benefit calculus most favourable to joining. The negotiations are assumed to take place based on countries' current attributes. If negotiations are delayed beyond the current configuration of input data, influence would shift among countries in response to differential GDP and emissions growth. Given current and expected growth rates, US influence relative to emerging economies is expected to fall over time, but such external dynamics are not included in the current model.

The club good in our ABM may be thought of as preferential market access for members. The benefit from such access is assumed to increase (at a decreasing rate) with club size. Specifically, the benefit equals the natural logarithm of other members' GDP, adjusted by a multiplier termed *Club-Good Benefit (CGB) scale*. We report results for CGB values from 0 (zero members-only benefits) to 0.25 (very high members-only benefits). For comparison, estimated benefits from the Transatlantic Trade and Investment Partnership would correspond to a CGB value around 0.1 (Francois, Manchin, Norberg, Pindyuk, & Tomberger, 2013).[13]

To consider the effect of conditional commitments, our ABM undertakes the following procedures. First, it calculates how much each non-member's entry would benefit each member. If a particular non-member's entry would benefit current members enough to enable them to increase their combined mitigation efforts to a level that makes entry beneficial for this non-member, a deal is struck so that the non-member joins. Second, the model repeats this procedure until no more mutually advantageous deals can be concluded.

The side-payment module is similar to the conditional commitment module, except that current members pay the potential entrant directly by a monetary transfer instead of by increasing their mitigation effort. Because such payments are targeted exclusively at the entrant, they are theoretically more effective than conditional mitigation commitment. Again, the process is iterated until the potential for mutually advantageous deals is exhausted.

The model was run in Netlogo. Further methodological details are provided in Sælen (2016) and Hovi et al. (in press), including pseudo-code that exactly specifies model sequences and links to executable code. These articles also include sensitivity analyses that help quantify the uncertainty in model outcomes.

Results

Club-good benefits

We first consider clubs that only use club goods to attract new members. Previous research has shown that clubs initiated by the US have the greatest potential for using club goods to induce others to join (Hovi et al., in press). Figure 1 (top row) shows that clubs initiated by the US jointly with the EU or China will persist even with a comparatively low level on the club-good scale. China would join as a follower when it is not a founding member. Those three actors alone account for half of global emissions. For moderate levels of the club-good scale, they will be joined by India and Indonesia (see Table SM.4), and for high levels, by all other counties. In these combinations, the US acts as a leader. The reasons why the US is particularly influential is that it controls a large share of global emissions and that its large GDP makes preferential access to US markets particularly attractive.

Figure 1 (rows 2–4) compares the equilibrium club size if the US acts as a follower to the equilibrium club size if the US acts as an outsider, depending on (1) which actors initiate the club and (2) the *CGB scale*. Solid lines

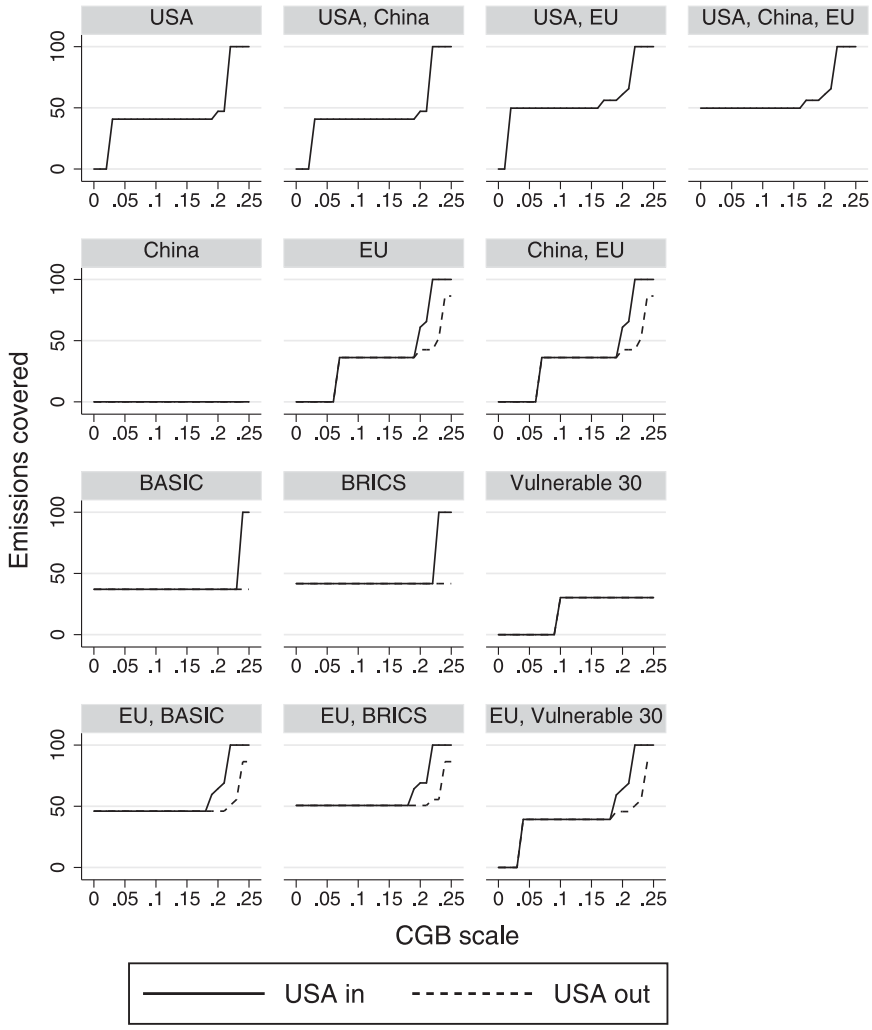

Figure 1. Climate-club participation (as a percentage of global emissions) by scenario, assuming no conditional commitments. In panel rows 2–4: solid lines: US as follower; dashed lines: US as outsider.

(labelled *US in*) represent scenarios where the US acts as a follower, whereas dashed lines (labelled *US out*) represent scenarios in which the US acts as an outsider. Hence, the vertical difference between the two lines represents the reduction in equilibrium club size (emissions coverage) resulting from the US switching from being a follower to being an outsider. Figure 2 shows this difference as a separate graph. When the difference is zero, the US declines to join the club also as a follower.

Perhaps surprisingly, the overall effect of the US acting as an outsider rather than as a follower is not dramatic: The overall mean reduction in the share of global emissions covered equals 5 percentage points. However, the effect varies considerably across coalitions (the standard deviation equals 13.5 percentage points). In some scenarios, the effect is zero because the US would not join even if it were to act as a potential follower. In a substantial share of scenarios, a switch by the US from being a follower to being an outsider has no effect on the other participants, i.e. the total reduction in the club's global emissions coverage equals the US share of global emissions (14 percentage points). Specific such instances are exemplified in Table SM.5.

In other cases, a US switch from follower to outsider causes one other major emitter – Indonesia – to drop out as well (Table SM.4). In rare instances, more dramatic cascade effects (up to around 60 percentage points) occur. For example, when the US acts as a follower, clubs instigated by the BASIC group or the BRICS group reach 100% coverage for high values of the CGB scale. In contrast, these clubs attract no additional members beyond the initiators if the US acts as an outsider.

In summary, a US switch from acting as a follower rather than as a leader would be more consequential than a US switch from acting as an outsider rather than as a follower. However, with the US as an outsider, only a few clubs grow to cover more than half of global emissions (Figure 1), and those that do rely on overly optimistic assumptions concerning club-good benefits.

Club-good benefits combined with conditional commitments

Figures 3 and 4 show the results with conditional commitments. This instrument offers the most leverage when in the hands of top emitters, because their mitigation has the largest impact on the welfare of other countries. When the US participates (as a leader *or* as a follower), conditional commitments enable clubs to reach more

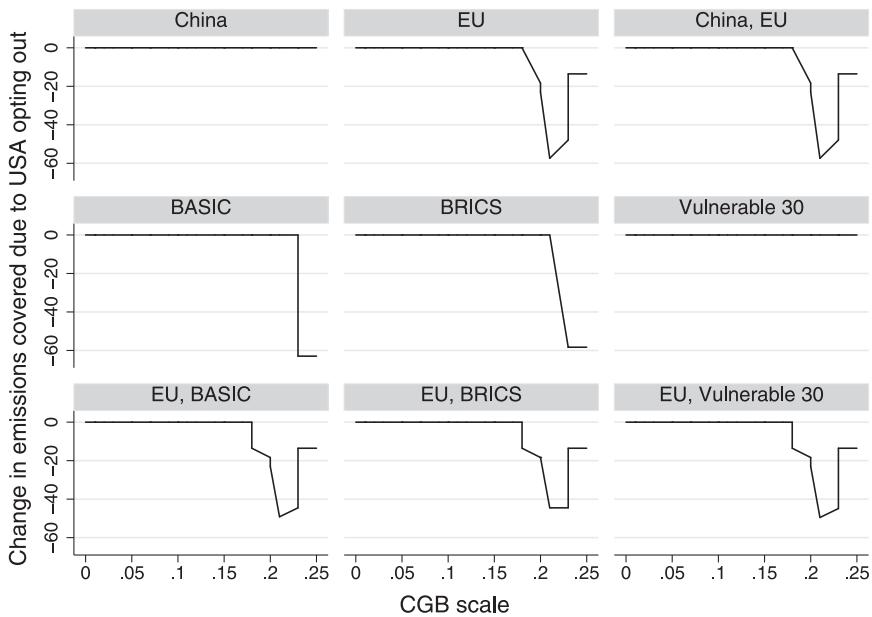

Figure 2. Change in climate-club participation (as a percentage of global emissions) if the US acts as an outsider rather than as a follower, assuming no conditional commitments.

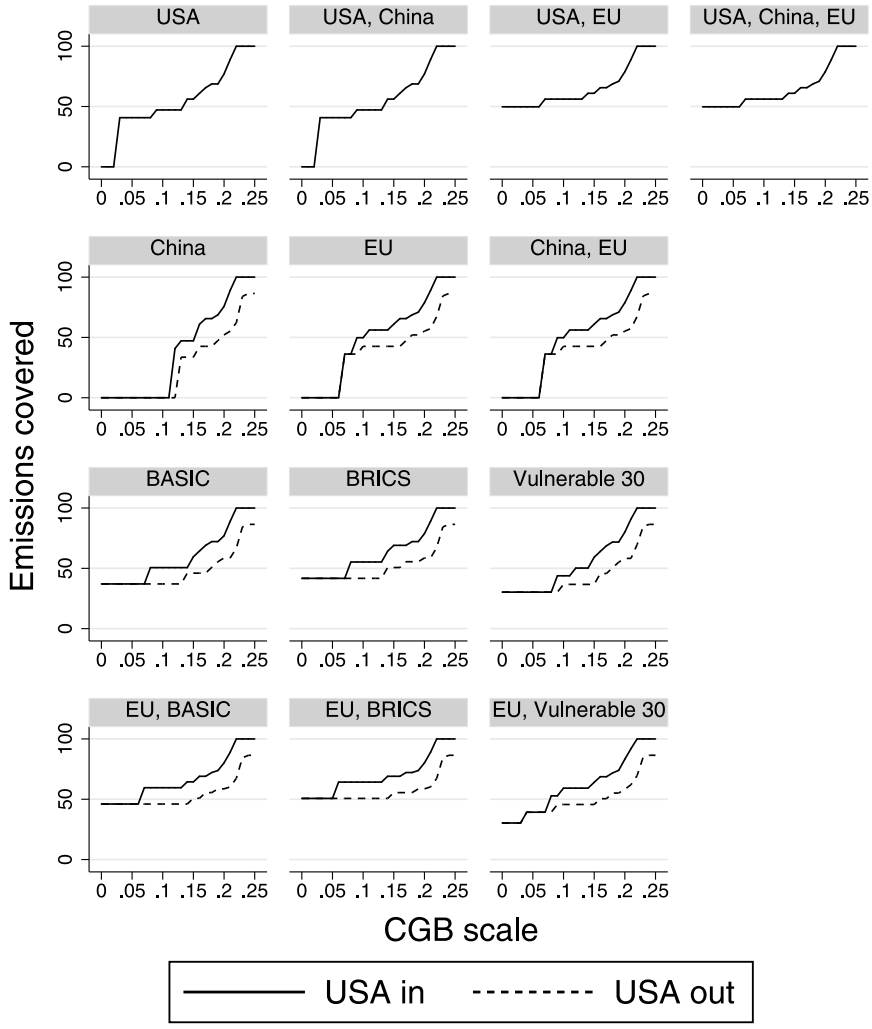

Figure 3. Climate-club participation (as a percentage of global emissions) by scenario, assuming conditional commitments are possible. In panel rows 2–4: solid lines: US as follower; dashed lines: US as outsider.

than 50% emissions coverage with considerably lower CGB-scale levels than above. The average effect of the US switching to act as an outsider (12 percentage points) is also larger than under the 'no conditional commitments' assumption because a US switch now has a greater effect on the behaviour of other countries. For example, if the CGB scale equals 0.2, a US switch causes 4–9 other large – yet not top – emitters (e.g. Brazil, Canada, South Korea, South Africa) to drop out as well (Table SM.8). However, both the *maximum* changes caused by a US switch and the variance across scenarios are smaller with than without conditional commitments (maximum: 41, standard deviation: 10). The reason is that conditional commitments tend to generate smoother graphs.

In a few scenarios, remarkably, India now steps in when the US becomes an outsider (see Table SM.7). The explanation is that with the US out, China and the EU offer India conditional commitments that they would otherwise offer to the US.

In summary, while climate clubs can reach significant coverage even in the event of a complete US opt-out, a combination of conditional commitments and relatively large club-good benefits would be required for clubs to be able to grow to cover 50% or more of global emissions.

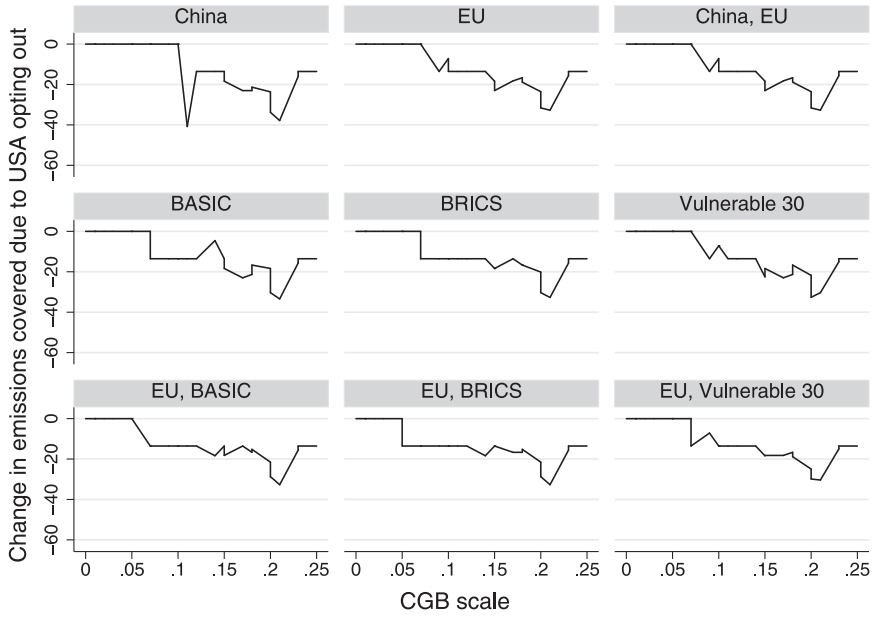

Figure 4. Change in climate-club participation (as a percentage of global emissions) if the US acts as an outsider rather than as a follower, assuming conditional commitments.

Side-payments

Side-payments constitute a third instrument for club growth (besides club goods and conditional commitments). Previous research has found that (1) side-payments facilitate club growth very effectively and that (2) the US will rarely be at the receiving end of such side payments because its high abatement costs and large GDP imply that very large payments are needed (Sælen, 2016). These two findings imply that side-payments can cause climate clubs to reach a substantial size even without the US as a member. For example, a club where the EU acts as sole initiator and provider of total side-payments worth US$ 66 billion can grow to include 51 actors responsible for 63% of emissions (see Table SM.10). In the scenarios presented in Table SM.10, changing the US status from follower to outsider produces no change in participation. However, enthusiasm by the US would make a difference because its large GDP means it can afford to fund large side-payments. The US could singlehandedly fund a club covering 67% of emissions, and jointly with the EU fund a club covering 87%.

Among the three instruments, side-payments yield the most optimistic results, both regarding the general potential for climate clubs and in the sense that the US opting out has relatively modest effects. However, side-payments are politically more difficult than the other two instruments, both in the US as well as in other potential donor countries (Sælen, 2016). Combining side-payments with either or both of the other instruments would be more effective than either in isolation, but these combinations have not yet been modelled. Using a combination of policy instruments is probably also more politically feasible than using a single instrument at high levels.

Conclusions

In this article, we have used agent-based modelling to explore how a complete US opt-out might influence the effectiveness of climate clubs. Compared to scenarios where the US acts as a leader, its absence significantly constrains the potential of climate clubs. Compared to scenarios where the US acts as a follower, its complete opt-out has more nuanced effects, sometimes – but not always – producing knock-on effects on other countries' participation. Climate clubs seem viable even without the US, provided that other major emitters – China and the EU being prominent candidates – actively engage in leadership roles. They would, however, struggle to achieve global emissions coverage beyond 50% and struggle even more to achieve truly substantial cuts in global GHG emissions.

Throughout this analysis we have treated climate clubs essentially as stand-alone arrangements. In fact, they would co-exist and in some respects (tacitly) interact with the UNFCCC and its Paris Agreement. The results are therefore relevant for understanding the effects of constrained US participation on international climate cooperation more generally. The critical test for the Paris Agreement will be implementation performance. Should the first 'global stocktake', scheduled for 2023, show that actual achievements lag far behind the corresponding NDCs announced in 2015, the demand for strong and constructive leadership will likely increase. In such a scenario, a climate club involving the world's most powerful states may be able to make a significant difference. US participation and leadership would considerably strengthen such a club but would not be strictly necessary.

Notes

1. https://www.whitehouse.gov/the-press-office/2017/06/01/statement-president-trump-paris-climate-accord, https://youtu.be/z99y6bUgJqI (accessed: 17 November 2017).
2. https://treaties.un.org/doc/Publication/CN/2017/CN.464.2017-Eng.pdf (accessed: 17 Nov. 2017).
3. The emissions gap between projections under Trump and the mid-century strategy released under Obama is analysed by Galik, DeCarolis, and Fell (2017). Given that the 2050 target set out in Obama's strategy is to be achieved, delayed action due to one (two) period(s) with Trump, implies that annual reductions thereafter must be 20% (40%) greater than if the strategy had been implemented immediately. The delay would also mean higher cumulative emissions before 2050 equivalent to 0.3 (0.6) years of global emissions.
4. https://nyti.ms/2rAvpOR, https://nyti.ms/2sqAM0j, https://nyti.ms/2rBkvsq (accessed: 17 November 2017).
5. https://www.nature.com/news/how-scientists-reacted-to-the-us-leaving-the-paris-climate-agreement-1.22098 (accessed: 17 November 2017).
6. https://nyti.ms/2stXOUf (accessed: 17 November 2017).
7. http://jackson.yale.edu/kerry-initiative/yale-climate-conference, http://environment.yale.edu/news/article/yale-professor-danesty-panel-kicks-off-climate-week-nyc/ (accessed: 17 November 2017).
8. In Buchanan's (1965) terminology, a 'club good' is an excludable good that exhibits little (if any) rivalness for moderate consumption levels yet significant rivalness for higher consumption levels (because of congestion effects). By contrast, as used in the climate club literature, a 'club good' is an excludable good that may or may not entail a congestion effect; indeed, it may even become gradually more beneficial with increasing participation.
9. For a more extensive review of the climate club literature, see Hovi, Sprinz, Sælen, and Underdal (2016).
10. In the absence of rules of procedure, the consensus rule in the climate regime, de facto, requires that no (major) country actively opposes a decision. See Vogel (2014) for further elaboration.
11. The advantage of starting small would exist even if the smaller group would base its decision-making on consensus amongst its own members.
12. As one reviewer pointed out, the assumption of fixed and commonly known costs of avoided climate impacts constitutes a particularly unrealistic feature of the model. A more realistic assumption might be that emissions reductions today must be made without full information concerning the avoided costs due to reduced climate change and that latecomers will face less uncertainty than the founding generation. However, this would require a major methodological advance, which is beyond the scope of the current article.
13. The resulting benefit functions are displayed in Figure 1 in Hovi et al. (forthcoming).

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