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A Climate Club as a complementary design to the UN Paris agreement

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ABSTRACT

The global coverage and the need for consensus explain why the UN Paris agreement, in several critical dimensions, is characterized by low levels of commitment and reciprocity. Hence, complementary designs are needed. This paper analyzes the parameters of such designs. New agreements should cover only nations that are willing to high levels of commitments and reciprocity. They should use measures that governments can control and be made accountable for. Commitments should be short-term and few-dimensional and they should incentivize efficient reductions, prevent leakages to outside nations and provide sanctions for non-compliance. Further, they should provide incentives to outsiders to reduce emissions and encourage them to join the agreement. A *Climate Club* that harmonizes minimum national carbon prices (i.e. carbon taxes), introduces a common carbon tariff, and welcomes new members to meet these criteria. Such a complementary design also has the potential to expand and, with time, provide a global price on carbon.

POLICY RELEVANCE

The paper demonstrates the need to develop complementary international climate policies to the Paris agreement. It analyzes design flaws of the UN agreements and, as a complement, proposes a Climate Club among nations that are willing to introduce a price on carbon. By agreeing on a carbon tax and a carbon tariff, the club creates mechanisms that reduce emissions and enlarge the club, with the potential to provide a global price on carbon.

POLICY INSIGHT

- The Paris design includes all nations. Such a design will be insufficient. Nations with low ambitions are provided with a veto-right, which explains the flaws of the Paris agreements.
- A complementary design among nations with high ambitions is needed to compensate for the flaws of the Paris agreement.
- By agreeing to an internal minimum carbon price and an external carbon tariff, a Climate Club can create such a design.

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1. Introduction

Property rights and government regulations restrict the use of other resources, but the climate is a global common and free to change by emitting carbon dioxide and other greenhouse gases (Hardin 1968; Nowak and Highfield 2011). The lack of protective institutions, with reciprocity for the climate costs that emission causes, provides distortive incentives for consumers, producers, and whole nations, which explain why emissions increase. Time asymmetries (present costs for abatement, distant costs for climate change) and redistribution controversies (who shall pay for what) increase the complexities of the problem. A global solution is urgently needed, but how can institutions develop that cover all nations, encourage them to commit to appropriate climate actions and provides reciprocity so that they are strongly incentivized to do what they promise?

Climate change was addressed by the United Nations in the late 1980s, leading to the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and followed by annual meetings among the 197 nations behind the convention. The participants early committed to take steps to mitigate climate change. Different interests among low- and high-income nations resulted in the adoption of a *common but differentiated responsibilities principle*, allowing developing nations to increase their emissions while developed nations would reduce their emissions.

The members negotiated the first legally binding instrument, the Kyoto protocol, in 1997. The protocol covered two periods, 2008–2012 and 2013–2020, and participant nations committed to reduce their emissions by 18% below 1990 levels. Following the differentiated responsibility principle, only developed nations participated. Fast-growing developing nations, such as China and India, were exempted from responsibilities. The USA, therefore, refused to ratify the protocol in 2001. Later, also Canada left the agreement (2011).

The Kyoto protocol did not curb emissions; it did not provide participants with the global coverage, levels of commitments and reciprocity needed. Without mechanisms that provided reciprocity, more than possible reactions in media and environmental groups, nations were free to refuse participation, leave the agreement or give up on commitments. Early UN negotiations under the Kyoto Protocol had tried to solve the reciprocity-problem by common commitment, a mechanism where one participant commits to contributing to the common good if other participants also do so. With common commitment, free riders are sanctioned and the individual self-interest is better aligned with the common interest. However, the early UN attempt failed. It was not possible to reach a consensus, perhaps because negotiations also focused on quantitative reductions among participants, which was difficult to agree upon (Cramton, Ockenfels, and Stoft 2015). Instead, UN negotiations ended up in a design that only covered parts of global emissions and that lacked appropriate commitments and mechanisms for reciprocity. Global emissions continued to rise.

Due to the problems with the Kyoto protocol, new initiatives were taken within the UNFCCC framework, with the priority to include all nations, also large emitters such as the USA, China, India, and others. After several rounds of negotiations (Copenhagen 2009, Cancun 2010, Durban 2011, Doha, 2012, Warsaw 2013, and Lima 2014), a new, universal, legally binding climate agreement was agreed upon in Paris

2015. The Paris Agreement included all UNFCCC Parties and was celebrated as a large step forward. But does the Paris agreement provide a strong enough design? As will be discussed below, there are reasons to be skeptical.

Compared to the Kyoto protocol the Paris agreement has a high level of global coverage. It included all nations of the UNFCCC, until the USA in 2017 announced that they would leave. However, it does not solve the problem of low commitments and weak reciprocity. Therefore, there is a significant risk that the design is insufficient, as is illustrated by the fact that emissions continue to rise. National pledges on future reductions under the agreement are insufficient and future plans for increasing the production of fossil fuels worldwide summarizes to levels far beyond what is sustainable (SEI et al. 2019).

The risk that the Paris agreement will be insufficient motivates new initiatives and complementary policy designs. The aim of this paper is to analyze what would make such complementary designs efficient. What design-characteristics can complement the Paris agreement and provide higher levels of commitments and reciprocity? In the following part, a set of design-characteristics is identified that would make a design complementary to the Paris agreement. In the final part, a Climate Club is analyzed as such a possible complementary design.

2. Design characteristics of the Paris agreement

In Paris, governments of all nations agreed to a long term goal of keeping the increase in global average temperature to well below 2 °C and to aim to limit the increase to 1.5 °C, to significantly reduce risks. Governments agreed on the need for global emissions to peak as soon as possible and to achieve a balance between emissions by sources and removals by sinks in the second half of the century. At the same time, the agreement recognized that this will take longer for developing countries.

To reach these common global goals, nations were asked to submit *nationally determined contributions*. In these statements, individual nations specified their ambitions and efforts to reduce emissions in the future. Commitments were formulated in various ways and summarized in quantitative terms, as a certain percentage of reductions in the future, normally in 2030. Developing nations often also specified the financial support they needed from others to reach their goals. The parties also agreed on future meetings, every five years, reporting on implementation, developing a transparent system for increased accountability and setting more ambitious targets if needed. The agreement also included common pledges to provide support to developing countries and to recognize the loss and damages associated with the adverse effects of climate change. Other parts of the agreement encouraged parties to provide sinks and reservoirs of greenhouse gases, to recognize the possibility of voluntary cooperation by market and non-market approaches, to enhance adaptive capacity and to promote education and public access to information (FCCC 2015).

On the positive side, the Paris design promotes a globally shared view on climate change and a normative basis for engagement. Leaders around the world agree that climate change is a threat and they commit to national pledges and reviews. It increases transparency and provides a public arena for communication. If the global reductions

are insufficient, there are future opportunities for nations to express more ambitious commitments. Nations can also experience indirect reciprocity if public reviews earn them reputation of being good (or bad) global citizens. There can also be increased opportunities for altruistic punishment (Fehr and Gächter 2002) if, for example, consumers boycott goods from nations that do not take responsibility.

However, it is uncertain if the Paris agreement will be sufficient for keeping climate change within sustainable levels. National commitments are, still, insufficient and the mechanisms for reciprocity are weak. How come the design does not provide higher levels of commitment and reciprocity? One answer is that UN negotiators emphasized the need for global coverage and that all significant nations have to participate in an agreement. The agreements were designed for reaching consensus, which affects the design (Victor 2011). Interests and climate ambitions vary among nations and consensus means that those with the lowest ambitions will be the ones with the strongest impact on the outcome (“Underdal’s law,” see Underdal 1980). If all participants are to agree, all participants have a veto-right to any suggestion. Participants with low ambitions that are against ambitious commitments and strong levels of reciprocity will thus determine the outcome. Such participants can motivate their positions by several types of rationalities: for example that they are strongly dependent on the production of fossil fuels; that they are situated in geographic locations that are less violated by climate change; that they emitted less greenhouse gases historically; that they have lower incomes and levels of development and so on. Hereby, an agreement that prioritizes high levels of coverage downplays the levels of commitments and reciprocity. This phenomenon explains important design characteristics of the Paris agreement.

To get all on board, UN negotiations have also opened up for new re-distributional opportunities and financial transfers based on arguments of fairness and equity which increase the complexity and provide incentives to exploit the system. There are a number of questions to discuss. Should, for example, old and longtime emitters take more responsibility than those that started recently? Should large emitters take more responsibility than small emitters? Should rich emitters take more responsibility than poor? If so, what is the fair amount of responsibility for a nation that is old, large and poor or a nation that is new, large and rich, or old, small and poor? The compensation possibility further increases the complexity of the problem and provides incentives for rent-seeking.

Furthermore, different voluntary commitments, and variations in the choice of mechanisms used in national voluntary efforts, result in cost inefficiencies. Some nations will reduce emissions at higher costs than others, making global reductions more expensive than necessary. Different levels of ambitions will also cause trade distortions and leakage problems since carbon-intensive industries in nations with low climate ambitions gain competitive advantages. Carbon-intensive industries in high-ambition nations have incentives to relocate to low-ambition nations, or risk being replaced by imports from industries in low-ambition nations. Hereby, citizens in high-ambition nations continue to contribute to climate change when buying imported products. There are also second-order leakage problems. If ambitious nations reduce emissions and their demand for fossil fuels falls, prices on world

markets will fall which will make fossil fuels more affordable in other parts of the world (Tirole 2012).

Hence, the Paris agreement makes it unclear what the participants must do to reach the common goals. There is no reciprocity to low levels of national commitments and free rider incentives prevail. Issues of commitment and reciprocity are left for the future to solve in coming negotiation cycles, but recurrent pledges and reviews risk to push participants into a waiting game where they see what others do before they make their own commitments (Tirole 2012).

An agreement that is dependent on the acceptance of participants with low ambitions will be affected in several critical ways. From a perspective of commitments and reciprocity, this explains several critical aspects of the Paris agreement. In general, low-ambition participants can be expected to favor design choices that allow for low commitment and low reciprocity, with weak accountability and free rider opportunities. Low-ambition participants will prefer agreements with voluntary commitments over agreements that are coercive with sanctions for noncompliance. Further, low-ambition participants will prefer agreements that accept leakages from nations with high climate ambitions to nations with low ambitions (i.e. carbon-intensive production). Hereby, low-ambition nations gain benefits on behalf of high-ambition nations. Low-ambition participants can also be expected to prefer agreements that emphasize joint outcomes over individual outcomes. Joint outcomes leave the question of “who should do what” open and provides opportunities for low levels of commitment, and it allows free rider opportunities. For similar reasons, low-ambition participants can be expected to favor commitments that are complex and multidimensional, over commitments with low complexity and few dimensions. Low-ambition participants can, in general, be expected to prefer to commit to activities where the outcomes are difficult to measure and evaluate.

Further, low-ambition participants can be expected to prefer long term commitments over short term ones. Long term commitments weaken accountability, especially for governments that are accountable for results within the scope of their mandate periods, but not after. Low-ambition participants can also be expected to favor agreements that allow for a large variety of measures and variations in abatement costs. Such variances allow low-ambition nations to have relatively lower costs for fulfilling commitments, even if it is inefficient and increases uncertainties for future investments and innovations.

A consequence of the design-choices described above is also that high-ambition participants may be influenced. They will have incentives to reduce their levels of commitments, changing their position to low levels. Why keep a high level if others with lower ambitions gain advantages?

3. Characteristics of a complementary design

To include all nations in an agreement to solve a global problem might seem rational. However, as discussed above, it can result in a design with low levels of commitment and reciprocity. Why did climate negotiations focus on coverage rather than commitment and reciprocity? One reason is that the initial Kyoto agreement mainly failed

because it did not include important nations such as China, the USA, and other large emitters. Another explanation is that the UN climate negotiations were inspired by the success of the Montreal Protocol, a voluntary agreement to save the ozone layer. However, the ozone problem had a limited economic impact and involved relatively few producers in few nations. Measures to save climate, on the other hand, have a large economic impact, affect billions of producers and consumers globally and challenge important businesses and national interests (Victor 2011).

Rather than following the traditions of environmental diplomacy, the design of international climate policy could have learnt from how international institutions were created when stakes were high and when there were conflicting interests among nations. Take the development of institutions such as the WTO, NATO, and the EU. These institutions emerged among a selected group of nations sharing a strong common interest. They were designed to coordinate internal activities, but also to influence outside parties, to attract new members and to grow. The constructs were based on the insights that all nations do not share the same interests and that nations with similar interests can benefit from collaborating with each other and put pressure on outsiders.

The WTO is probably the most successful example of such an emergent global institution in a world of diverging interests. All nations share a common interest in promoting free international trade. However, there are different interpretations of how this should be done and free rider incentives and social dilemmas lead individual nations into protectionist positions. The WTO's solution did not focus on voluntary UN negotiations among all nations, but started in a club of nations with similar high ambitions to reduce trade barriers. The club provided members with the benefits of access to a market with low barriers, noncompliance was sanctioned and a decision to leave the club meant that the benefits were lost. By allowing new members, if they accepted the same level of commitment and reciprocity, a mechanism was created that expanded the club to global coverage. The mechanism was self-enforcing; the more members, the more attractive it was to join the club.

The question is if a similar design could compensate for design-problems of the Paris agreement, and allow nations with high ambitions to set the standard? Based on the discussion above it is possible to identify a set of principles that would make such a design complementary to the Paris agreement.

1. The Paris agreement includes all nations, also those with low ambitions. Commitments are voluntary with a mechanism that can lead to more ambitious reductions in the future. *A complementary design should begin with a limited group of ambitious nations, and have a mechanism that can lead to more global coverage in the future.*
2. Beyond possible reputation effects, the Paris agreement does not provide reciprocity for nations that choose a low-ambition strategy, thus it does not provide incentives for low-ambition nations to change policy and become more ambitious. *A complementary design should implement measures that provide reciprocity to low-ambition nations outside the sphere and encourage low-ambition nations to change policy and join the efforts of high-ambition nations.*

3. The Paris agreement does not sanction lack of compliance; free rider incentives prevail also among high-ambition nations. *A complementary design should provide sanctions against noncompliance among its members.*
4. The Paris agreement does not provide solutions to the leakage problem. *A complementary design should prevent leakages of carbon-intensive activities from high-ambition members to low-ambition nations.*
5. The Paris agreement focuses on joint global objectives and leaves national objectives for the nations to decide. *A complementary design should agree on efforts pursued by each nation individually.*
6. The Paris agreement is complex and multidimensional. Quantitative allocations of emissions and redistribution of incomes provide a multitude of dimensions to commit to. *A complementary design should focus on activities with few dimensions to commit to.*
7. The Paris agreement builds on pledges that are difficult to measure and evaluate. *A complementary design should target activities that can be measured and that national leaders can be made accountable for.*
8. The Paris agreement encourages long term pledges that are outside the scope of control by today's decision-makers. *A complementary design should target short term activities that national leaders can control.*
9. The Paris agreement allows for a variety of measures used by nations which results in different abatement costs and uncertainties for innovation. *A complementary design should target measures that coordinate reductions among all nations in a cost-efficient way and clarify conditions for innovation.*

4. A Climate Club for a global carbon price

A policy design with characteristics as described above would be an important complement to the Paris agreement, but how could such a policy design be developed in practice?

The examples of the EU, NATO and, in particular, the WTO exemplify how groups of nations sharing similar interests can develop into larger, even global, institutions that address problems when efforts for a common good are hindered by social dilemmas, free rider incentives, and conflict of interest. Can similar arrangements be created for more efficient efforts to mitigate climate change, and how should such arrangements be designed? A possible solution is to develop Climate Clubs among likeminded nations. Such clubs can be developed among high-ambition nations or build on existing coalitions such as the European Union, and include also outside nations that share similar interests (Victor 2011).

A question is how a Climate Club should be designed in order for it to be complementary to the general Paris agreement? Among policy makers and economists, there is a growing consensus that a global price on carbon is the most efficient solution to climate change (e.g. Mankiw 2009). Carbon taxes or tradable carbon markets, or hybrids of the two, can introduce such a price. There are several arguments that support a carbon price. The climate is a global common, an open access resource free for all to exploit and a price is an efficient mechanism to correct this distortion. A price

provides reciprocity and an incentive to reduce emissions. The result is globally cost-effective reductions of emissions and, as it gives rise to new markets; incentives for innovations and the required sustainable transformation. It also builds on existing institutions; tax bureaucracies exist in all nations and existing markets for resources can be extended to the trade of rights to carbon emissions. Pricing emissions provide governments with income and an opportunity to reduce other, distorting taxes. Several nations have also already introduced carbon pricing, and more plan to follow. Around the world, almost 60 carbon pricing initiatives had been implemented in 2018, or were scheduled for implementation, covering about 20% of global greenhouse gases (World Bank 2019).

In a context of climate negotiations, a carbon price also has the advantage that it is less complex and multidimensional to agree on, compared to a certain allocation of national quantities for reaching a total reduction (Weitzman 2015). When negotiating national quantitative reductions, many allocations are possible. When agreeing on a price, the participants have to agree on only one dimension: the level of the price. Compared to negotiating quantitative allocations of reductions, the negotiation of a price is also less exposed to the free rider problem; a negotiator has incentives to argue for a small quantity for himself and large for others, but arguing for a low price for oneself will also give a low price to others (*ibid*).

How can then a club of ambitious nations introduce a carbon price for its members, and how can that price become global? A Climate Club could be formed among today's nations that already have introduced carbon prices, or that are willing to do so, that is, nations that have carbon taxes or trading schemes, or hybrid measures, or are about to introduce such measures. The Climate Club should then agree on a minimum price, a price floor on carbon emissions. To simplify negotiations and allow for national varieties, each member could be allowed to reach the price with a measure of their own choice (carbon taxes, price floors in carbon markets, or hybrids) and be allowed to make upward adjustments. Damages caused by carbon emissions vary locally, which justify higher carbon prices, for example, health issues in urban areas (Gollier and Tirole 2015).

An internal price on carbon could also be complemented with a club-synchronized price on carbon emissions from goods imported from outside the club. Such a price requires the members of the club to synchronize carbon tariffs on goods from outside the club (a border tax adjustment, see, e.g. Tirole 2012).

There are several strong arguments for combining national carbon pricing with carbon tariffs. Governments should price *all* national activities that cause such emissions, including emissions from imported goods. A carbon tariff on imports, hereby, complements national carbon pricing so that emissions from imports are also priced, making carbon pricing symmetrical (see, e.g. Helm 2012). Further, governments that do not price carbon emissions provide a hidden subsidy to their industries since their producers do not need to pay for their climate costs, which cause leakage problems. A carbon tariff hinders the leakage of fossil-intensive production from nations that price carbon, and thereby increases the efficiency in international trade, which is in accordance with the intentions of WTO (Stiglitz 2006). A carbon tariff also makes national carbon pricing more politically acceptable, calming those that claim that a

price on carbon threatens jobs and growth. A tariff also provides revenues that, like carbon taxes, can be used for other purposes, for example, to lower other taxes or increase government expenditures.

Another argument for a carbon tariff is that free rider incentives threaten the stability of any club. Members need to know that they benefit from participation, that there are costs associated with leaving. Nordhaus (2015) argues that nations can share a flat tariff; it does not have to be linked to variations in carbon emissions, and he calculates that a tariff for creating a stable club can be rather small, of the magnitude of 2%.

By adjusting the level of the carbon tariff to the level of emissions caused by the imported goods, producers in outside nations can also be provided with an incentive to reduce carbon emissions and, most important; a carbon tariff would provide leaders of nations outside the club with a financial incentive to change sides and join the club. With such a shift an outside nation would escape the cost of paying tariffs and, as a member of the club, instead become a recipient of revenues from tariffs paid by outside nations. Hence, tariffs provide outsiders with an incentive to join the club and to price carbon emissions whether they care about the climate or not. The more nations that join the club, the larger the market protected by a carbon tariff and the stronger the incentives for outsiders to join. This would start an escalating process, allowing a global carbon price to emerge.

There are, of course, also arguments against a climate tariff. Most important is the risk that outside nations retaliate and introduce trade barriers, with escalating trade wars and protectionism. However, the risk of protectionism has to be balanced against the risks of climate change, and one argument for tariffs is that climate change is more devastating (Helm 2012; Pindyck 2013). Besides, retaliation is not a certain reaction. Outside nations may suffer more from a trade conflict than members of a Climate Club. Arguments can also be made that a tariff is a legitimate mechanism to correct distorted trade relations. Nations subsidize their export by allowing emissions for free, which give them unfair competitive advantages. WTO can here play an important role by clarifying that climate tariffs are legitimate. A further argument for tariffs is that nations that increase their emissions without concern for climate change are a threat to the world. Carbon tariffs are sanctions against misconduct, comparable to how tariffs are used in other international disputes.

Another objection has to do with implementing a carbon tariff. It has never been done in practice. However, this does not mean that it cannot be done and there is an extensive literature on the topic (see, e.g. Condon and Ignaciuk 2013). A problem is that measuring fossil emissions from finished goods has to be based on estimates of carbon intensity (Hübler 2012) which is difficult to assess, especially if parts come from many nations (Tirole 2012). Therefore climate tariffs will be based on approximate measures of, for example, energy content or type of industry which will not be fully correct. However, allowing emissions for free can be argued to be worse and “It is better to be a bit right than exactly wrong” (Helm 2012, 191).

Finally, a carbon price causes competitive disadvantages for exporters within the Climate Club. Should exporters be exempted from a carbon price? Such an exemption could be beneficial for the climate if exporters cause lower carbon emissions than outside competitors. If exporters also supply goods within the club

they probably use cleaner technologies. On the other hand, all taxes influence competitive advantages. For example, in labor-intensive industries taxes on labor hurt exports. Should then all export be exempted from all national taxes that diverge from outside nations?

In sum, a Climate Club should build on the following cornerstones. It should:

- I. Synchronize domestic carbon pricing policies in the Climate Club (carbon taxes, trade schemes, etc.) by the introduction of a minimum carbon price.
- II. Synchronize trade policies and introduce a border tax adjustment among member nations. Introduce a carbon tariff on imports from nations outside the Climate Club.
- III. Welcome outside nations to join the Climate Club on the condition that they pursue the same policies (I, II, and III).

Designs similar to the one above have been suggested by Stiglitz (2006), Helm (2012), and Nordhaus (2015). For an overview of this discussion, see Bertram (2016).

A Climate Club, as described above, would adhere to the characteristics of a complementary design outlined earlier.

1. *A complementary design should begin with a limited group of ambitious nations, and have a mechanism that can lead to more global coverage in the future.* A Climate Club includes a limited group of ambitious nations. All nations do not participate and commitments are coercive, including a reciprocal mechanism that can lead to increased global coverage in the future.
2. *A complementary design should implement measures that provide reciprocity to low-ambition nations outside the sphere and encourage low-ambition nations to change policy and join the efforts of high-ambition nations.* The carbon tariff provides reciprocity to outside low-ambition nations and encourages them to change position and join the club. As the Climate Club becomes larger, it will provide outsiders with even stronger incentives to join.
3. *A complementary design should provide sanctions against noncompliance among its members.* The carbon tariff provides a sanction for those members of the Climate Club that fail to live up to their pledges as they lose their membership. Also, members that are tempted to free ride that way will be sanctioned by the carbon tariff they meet as outsiders.
4. *A complementary design should prevent leakages of carbon-intensive activities from high-ambition members to low-ambition nations.* The carbon tariff prevents leakage of carbon-intensive industries to outside nations. It hinders producers in outside nations to gain competitive advantages from lower relative prices due to the carbon tax in Climate Club-nations. The tariff also prevents producers within the Climate Club to gain advantages by relocating their activities to outside nations.
5. *A complementary design should agree on efforts pursued by each nation individually.* The introduction of carbon taxes, or trading schemes, and a carbon tariff are activities that are implemented on the national level. Rather than agreeing on the common results of joint efforts, it makes it clear what each nation should do.

6. *A complementary design should focus on activities with few dimensions to commit to.* Pricing carbon is a measure with few dimensions. To reach an agreement on a minimum price among nations therefore is a less complex decision problem than to reach an agreement on commitments on quantitative allocations of emission reductions among many nations.
7. *A complementary design should target activities that can be measured and that national leaders can be made accountable for.* The implementation of carbon taxes (or a trade scheme) and carbon tariffs are measures that can easily be evaluated. It is possible to observe if a nation has a carbon tax and a carbon tariff or not. Leaders can be held accountable for living up to their pledges.
8. *A complementary design should target short term activities that national leaders can control.* Introducing a carbon tax (or a trade scheme) and a carbon tariff are measures that governments can implement in the short term. These are measures within the scope of control of governments.
9. *A complementary design should target measures that coordinate reductions among all nations in a cost-efficient way and clarify conditions for innovation.* A synchronized price on emissions is an efficient measure to reduce emissions at the lowest cost for society and an efficient measure to clarifying conditions for innovations, encouraging alternatives and new technologies.

The design characteristics above relate to levels of international coverage, levels of commitment and levels of reciprocity. These three aspects are crucial for the efficiency of a policy design. There are of course other important questions to address related to moral obligation, fairness and income distribution, as well as how popular and politically acceptable a Climate Club will be. Will carbon taxes hurt low-income members of society with unwanted effects on income distribution? Will carbon taxes cause political disruption and protests that hinder implementation? Should rich nations, rather than introducing tariffs, support poor nations in their efforts to adapt to climate change and to mitigate emissions? Will tariffs on export from developing nations endanger future collaborations and mutual trustful relations?

These issues bring us to the question of how the revenues from taxes and tariffs are to be used. From the point of mitigating emissions, the important aspects of taxes and tariffs are that they provide strong reciprocity. The emitter has to pay for pollution, which provides efficient incentives for reductions and the development of alternatives. How the revenues are used matter less from the point of view of efficiency. The revenues, however, provide members of a Climate Club with financial opportunities to cope with other issues connected to what is acceptable from a social and political view.

Members of a Climate Club can redistribute revenues from carbon taxes and tariffs to groups that need support. Such measures would increase the popularity of carbon taxes among tax-payers and increase the political acceptability in a national context (Klenert et al. 2017). Revenues from taxes and tariffs could, also or alternatively, be distributed to outside developing nations, supporting climate adaption and climate transformation processes. Such efforts would make a Climate Club more legitimate in an international context, which could further increase the willingness among outsiders to enter and reduce the risk of retaliation among trade partners. To the extent that such

measures also would increase the efforts in developing nations to reduce emissions, it would add to the effect on climate change.

5. Conclusion

International agreements are important policy designs for preventing mismanagement of global commons such as the climate. In a world with autonomous nations, the design of agreements with global coverage, such as the Paris climate agreement, has to build on consensus. If nations have different agendas and ambitions, such designs will gravitate toward what is acceptable for low-ambition nations rather than what is efficient. Agreements with a high level of global coverage will, therefore, result in low levels of commitments and reciprocity. Even if mechanisms are created that allow for future increases in commitment and reciprocity, there is a substantial risk that such designs will provide insufficient results.

Complementary designs are required that compensate for the shortcomings of designs with global coverage. Complementary designs should build on agreements among limited groups of nations with similar high-level ambitions; they should have less coverage but high levels of commitment and reciprocity, and allow for increased future coverage. Such a complementary design should build on efficient, short term measures; measures that national leaders can control and can be held accountable for. A Climate Club, with an internal carbon tax (or trading scheme) and an external carbon tariff, illustrates such a complementary design.

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