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International Environmental Agreements with reference points☆

Fuhai Hong*

Division of Economics, Nanyang Technological University, Singapore

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ABSTRACT

Whether or not the current climate talks achieve a meaningful treaty, the current negotiation forms important reference points for future negotiations. In this paper, we introduce reference points to a canonical model of International Environmental Agreements (IEAs). Countries have reference points on IEA membership. An IEA member that abates is aggrieved if there is a material loss relative to the case with the referenced membership. We find that reference points weakly reduce the abatement level for an IEA with given membership, while interestingly, reference points weakly increase the equilibrium membership and thus the equilibrium abatement level of the IEA. These results imply that effective management of reference points could be conducive to the resolution of the climate problem.

1. Introduction

In order to control climate change, concerted efforts in abating Greenhouse Gas (GHG) emissions should be made. However, GHG abatement is a global public good and the provision of this global public good suffers from the usual free riding problem, in the absence of a world government. An International Environmental Agreement (IEA) is a coalition mechanism that aims to resolve the free riding problem from transboundary pollutions. However, the literature on IEAs is generally pessimistic regarding the equilibrium participation level in an IEA (see, e.g., Barrett, 2005 for a survey). With insufficient participation, the IEA mechanism has little chance to resolve the climate problem.

Much of the IEA theory relies on a particular type of participation games in which countries decide on whether to participate in an IEA and the resulting IEA makes abatement decisions for its members. In the equilibrium, some countries choose to join the IEA and contribute to the public good while the others stay out. The asymmetry of the equilibrium raises an important but debatable concern revolving around the climate problem: equity (see, e.g. Cazorla and Toman, 2001). Countries exhibit a preference for equity in international environmental negotiations (Lange and Vogt, 2003). However, lacking a consensus on what is equity, countries' perception of an equitable way to address the climate problem critically depends on their *reference points* in viewing the climate issue.

The literature has shown that reference points play a crucial role in human decisions and interactions. Kahneman (1992) reviews the role of reference points in individual choices and interpersonal negotiations. Reference points are characterized by the abrupt changes in the valuation of gains and losses and of acceptable or reprehensible behavior. More recently, Brandts and Solà (2001) and Abeler et al. (2011) provide evidence on how reference points affect reciprocal behavior and effort provision. Hart and Moore (2008) and Fehr, Hart, and Zehnder (2011) introduce reference points to the negotiation between contracting parties: if a party does not get what he feels entitled to, he is aggrieved and provides perfunctory rather than consummate performance, causing deadweight losses. Kristensen and Gärling (1997) provide empirical evidence showing that reference points influence negotiation process and outcome.

Reference points not only affect behavior at the individual and interpersonal level, but could also make a difference at the international arena. Nations' behavior is not purely driven by materialistic interests.[1] In a country, if voters have certain preference with reference points, the government should take this into account and respond to the voters' reference points. In a recent study,

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* Tel. +65 67904496.
E-mail address: fhhong@ntu.edu.sg

[1] For instance, equity is an important issue in international negotiation of climate treaties. The principle of equity is articulated in Article 3 of the Convention on Climate Change and the decision approved by the COP 6 in Bonn. For another example, Kennan (1985) provides anecdotes and a critique on the moralistic judgments of American statesmen on foreign policies. Many papers, e.g. Lange and Vogt (2003), Eyckmans and Kverndokk (2010) and Kolstad (2014), consider countries' non-materialistic preferences in decision-makings regarding IEAs.

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Charite, Fisman, and Kuziemko (2015) show that social planners do respect people's reference points in decision-makings. Moreover, in international negotiations, the decisions of diplomats or national delegates may be influenced by their own reference points. Starkey, Boyer, and Wilkenfeld (2010) point out that "Diplomacy is not just about bargaining. There is a human dimension to the negotiation game that should not be ignored." Zartman (2007) discusses the role of reference points in international negotiations on the European Development Fund. Reference points can also be important in international negotiations on climate treaties. Countries are dissatisfied if other countries' participation level in climate treaties is below their referenced level and may thus be unwilling to make consummate efforts to address the transboundary pollutions. For instance, many members of the Kyoto Protocol, including Australia, Canada, Japan and New Zealand, harbored discontent towards the United States for not ratifying the Kyoto Protocol (see, e.g., Hara, 2005), although the U.S. was not pivotal for the enforcement of the Protocol. These countries were also aggrieved by the fact that developing countries were out of regulation under the Kyoto Protocol, and some expressed unwillingness to take part in the second phase of the Protocol.[2]

In this paper, we introduce reference points to a canonical IEA model. Countries have reference points regarding the membership of the IEA. If the actual membership falls short of the reference points, the IEA members may feel aggrieved by being free ridden, which results in perfunctory performance of the IEA. Interestingly, anticipating such responses of IEA members, in the equilibrium, more countries would participate in the IEA with high reference points. Therefore, if there is a way to "manage" countries' reference points, reference points could be used as an instrument to increase the membership and abatement level of the IEA. Our result thus provides a less pessimistic insight than the standard IEA literature.

Gerber, Neitzel, and Wichardt (2013) consider minimum participation rules for coalitions providing public goods. These rules increase the level of participation above which the coalition is successfully implemented and could thus increase the equilibrium level of participation. In their model, the minimum participation rules are exogenous. Carraro, Marchiori, and Oreffice (2009) consider endogenous determination of minimum participation constraints by a prior stage of unanimity. In both models, the size of the minimally successful coalition increases because of the participation rules which were legally imposed. In our paper, we show that a sort of psychological trait with reference points is able to increase the size of the minimally successful IEA and thus the equilibrium membership, in the absence of explicitly imposed participation constraints on the agreement.

A few studies have investigated the role of social preferences in IEA negotiation and institution formation in public good games. Eyckmans and Kverndokk (2010) and Kolstad (2014) consider moral concerns and (impure) altruism in IEAs. Lange and Vogt (2003) and Kosfeld, Okada, and Riedl (2009) incorporate equity preference and inequality aversion into models of coalition formation. In particular, Kosfeld, Okada, and Riedl (2009) show that inequality aversion in the sense of Fehr and Schmidt (1999) can increase the size of a sanctioning organization. Although equity is undoubtedly important in climate negotiations, what is equitable allocation is controversial, and people "appear to desire equality relative to some reference point" (Alesina and Angeletos, 2005).[3] In this paper, we follow the tradition of Kahneman (1992) and Hart and Moore (2008) by incorporating reference points to an IEA model. While the inequality-averse preference is exogenous in Kosfeld, Okada, and Riedl (2009), reference points are endogenous and can be affected by pre-play communication in our extended model in Section 2.3. With this model, we show that effective management of countries' reference points, and more broadly their perception towards the climate problem, could increase the chance of achieving a successful IEA.

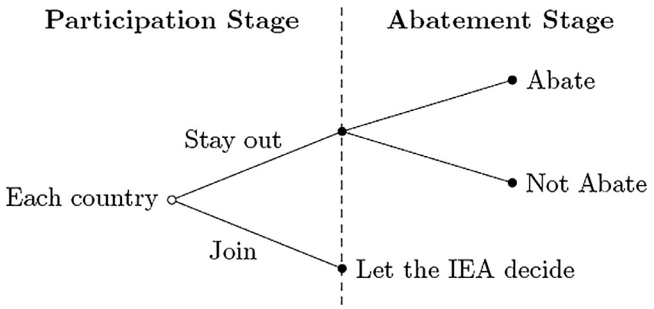

Fig. 1. The game.

The rest of this paper is organized as follows. Sections 2.1 and 2.2 present the IEA model, with and without reference points, respectively, while Section 2.3 considers an extended model with pre-play communication and endogenous reference points. Section 3 concludes with a discussion on the implications of our results.

2. Model

The first subsection below presents the canonical IEA model as a benchmark case, the second subsection introduces reference points to the model, while the last subsection discusses the choice of reference points by including a prior stage of communication in which countries announce the intention of participation in the IEA.

2.1. The canonical IEA model

Barrett (1999) firstly proposed the following "canonical" IEA model. This model is also used in, e.g., Barrett (2003, Chap. 7) and Kolstad (2011, Chap. 19). There are N identical countries. Each country has two binary decisions: participation in an IEA and abatement. If we assume linear costs and benefits of abatement, then a country will either abate at capacity or does not abate at all. So there is no additional loss of generality in assuming binary abatement. Abatement is a global public good. We normalize the benefit of one unit of abatement, to each country, to one. The country that abates incurs an abatement cost, c. We assume that $1 < c < N$, where the first inequality implies that it is a dominant strategy for a country acting alone to choose not to abate, while the second inequality means that the world is better off from any country's abatement. The game consists of two stages: in stage 1, each country decides on whether to participate in the IEA; in stage 2, members of the IEA let the IEA decide on abatement, while the outsiders make their own abatement decisions. Fig. 1 summarizes the game. The IEA is assumed to maximize the total welfare of its members.

The game can be solved backward. In stage 2, outsiders choose not to abate, following their individually rational decisions. Let the membership of the IEA be m. The IEA will instruct its members to abate if and only if $m \geq c$, where m is the coalition's benefit from one unit of abatement and c is the cost. Let $f(x)$ be the smallest integer no less than x, for any x. Then $f(c)$ is the membership of the "minimally successful IEA" given the IEA's decision rule. We say that a country is pivotal if exactly $f(c) - 1$ other countries join the IEA, because the country's participation will affect the IEA's decision. A pivotal country has an incentive to join the IEA because by doing so, the country obtains a payoff of $f - c \geq 0$. A country's additional membership is superfluous from its own viewpoint if at least $f(c)$ other countries

[2] See, e.g. the entry of "Canada and the Kyoto Protocol" in the *Wikipedia*, "Australia rejects Kyoto pact," in *BBC News*, June 5, 2002, and "NZ 'ahead of the curve' in quitting Kyoto Protocol", in *3 News*, 3 December 2012.

[3] Cazorla and Toman (2001) review the alternative equity criteria for climate change policy. Depending on different reference points, the equity arguments include equal burden shares, equal percentage reduction of pollutants, and reducing differences between developed and developing countries (see e.g. Lange and Vogt, 2003).