

A Unit-by-Unit Solution for Global Externalities with Voluntary Participation

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Abstract

When the mechanism of international environment agreements (IEAs) must take account of participation decisions as agents' choice variable, Barrett (1994, *Oxford Economic Papers*) and Saijo and Yamato (1999, *Journal of Economic Theory*) showed that (i) the participation of all agents is not an equilibrium and (ii) the final allocation is inefficient. These features illustrate various economic situations including the withdrawal of the United States from the Kyoto Protocol. This paper considers a gradual reduction of environmental pollutions where the unit of pollution reductions is discrete (lumpy), and examines a unit-by-unit participation game. Namely, countries are asked to participate in each unit of pollution reduction, and those who chose to participate share the cost of the unit abatement. In this game, there are subgame-perfect equilibria that are Pareto efficient. The proposed mechanism sheds lights on the possibility of the political agreements towards increasing efficiency in the post-Kyoto regime that is compatible with voluntary participations.

Key Words: Global externality; International Environmental Agreements; Participation; Mechanism Design

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