

## **Free-Riding vs Free Trade:**

### *International Trade and the Effectiveness and Composition of an IEA*

International environmental issues such as global climate change, ozone depletion, and species extinction represent a new set of problems for environmental and resource economists. Traditionally economists have focused on domestic environmental problems, applying criteria such as efficiency or cost-effectiveness to the design of regulatory mechanisms. While this approach has been usefully and successfully applied to domestic problems, it cannot be applied as easily to international problems because of national sovereignty. That is, there is no supra-national authority that can impose and enforce a particular regulatory scheme. Any regulation in a particular country must be undertaken voluntarily, and thus any cooperative effort must be arrived at by mutual consent. We call a cooperative effort an international environmental agreement (IEA). Before we can think effectively about designing mechanisms to enhance the efficiency or cost-effectiveness of an IEA, we must first analyze the forces that determine the form and composition of such an agreement. I investigate these issues in my dissertation, focusing particularly on the role of international trade.

Previous work has investigated the composition of an IEA. A highly stylized model in which an IEA is formed as the subgame perfect equilibrium of a game played by identical countries was analyzed in order to compare global welfare under the IEA to global welfare if all countries were to cooperate in a socially optimal manner. It was demonstrated that when *individual* benefits are small relative to the cost of regulation, participation in an IEA is small, even if the *social* benefits are large relative to the social costs. Each country would prefer to benefit from other countries' regulatory efforts without incurring the costs of regulation themselves. That is, the impulse to free-ride undermines the effectiveness of the agreement, prohibiting a significantly global effort to regulate international environmental problems.

While this work represents an important first step toward understanding the forces at work, its scope is limited because it ignores the role of international trade. Trade relationships may effect the effectiveness and composition of an IEA in two ways, what I will call implicit effects and explicit effects. When a country chooses to impose domestic regulations, prices are changed. Price changes shift supply and demand curves, which in turn change the terms of international trade. Thus all of that country's trading partners are effected, regardless of whether they too have imposed domestic regulations. I refer to these changes as implicit effects. Evidence of these kinds of effects has been derived in analyzing large-scale, computational trade models. Trade and environmental regulation may also be explicitly linked. International trade policy may be employed strategically (via tariffs or embargoes, for example) with the goal of encouraging participation in an IEA. Such strategic links have been used in practice. For example, the Montreal Protocol prohibited trade of the regulated substances between signatory and nonsignatory countries. If we are to understand who will participate in an IEA and what form it will take, these effects must be taken into consideration.

My dissertation builds on previous work to explicitly analyze the role of international trade in determining the effectiveness and composition of an IEA. I build a simplified model of trade into the above game theoretic model of forming an agreement and address three questions: What determines which countries will participate in the agreement? When can international trade policy be strategically employed to induce participation in the agreement? and When does free (-er) trade enhance the effectiveness of the agreement? In a scenario with identical countries and firms I show that the success of strategic trade policy depends critically on the existence and structure of a general trade agreement. In a scenario with differentiated countries and firms I define to types of trade relationships that are fundamental in determining the composition of an IEA. Further it is possible to show that whether an IEA is enhanced or hurt by liberalizing trade depends critically on which of these types of relationships will predominate in the more liberal environment. I can also use this model to develop an economic explanation for the refusal of developing countries to commit to reduction targets under the Kyoto Protocol. These results provide the foundation for a better understanding of some issues that will be critical if global environmental challenges are to be adequately addressed.