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International emissions trading with endogenous allowance choices

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Abstract

This paper compares endogenous choices of tradable and non-tradable emission allowances by non-cooperative countries. I find that the cost savings of trading do not necessarily lead to less pollution. In particular, environmentally more concerned countries usually choose less allowances if these are tradable, but this may be offset by the choice of more allowances on the side of environmentally less concerned countries. Moreover, if the establishment of a trading system requires the unanimous approval of all countries, there may be no agreement on trading even if it were to lead to less pollution overall. Conversely, a trading system may find unanimous approval even if it induces more pollution.

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1. Introduction

The principal idea of emissions trading is simple and intuitively appealing (Montgomery, 1972; Tietenberg, 1985). The number of pollution allowances (or permits) determines the emission target. Their subsequent trading on competitive markets assures that this target is met to the minimum social cost. It is widely accepted that the cost-saving argument applies equally for national and international emissions trading (Chichilnisky and Heal, 1995). However, at the international level there is no central authority with the power to determine the initial allocation of tradable allowances. Instead, this allocation is

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chosen by interdependent yet sovereign states, and the possibility of trading will affect their allowance choices.

For example, scholars argued that some countries have accepted less emission allowances because the Kyoto Protocol allows their trading. In contrast, however, the prospect of selling permits may have led other countries to demand more allowances than they would have done in the absence of a trading system. Russia and Ukraine in particular received allowances which exceed their projected emissions in the business-as-usual scenario without abatement. Estimations indicate that the difference between the two, often referred to as ‘hot air’, may be substantial (e.g. Victor et al., 1998).

To analyze these issues, I model the choice of emissions in a regime without permit trading, and the choice of permits in a regime with trading. Countries can choose between the two regimes. The outcomes under the two regimes are compared and the outcome of the overall game is determined.

In the regime without trading, countries choose emissions so as to equalize marginal environmental damages and marginal benefits of emissions. With trading, the rationale is more complex because marginal benefits of emission allowances are now given by the international permit price. Choosing more allowances reduces this price, but to a lesser extent than choosing more emissions reduces marginal benefits in the regime without trading.

As a consequence, I will show that environmentally less concerned countries tend to choose more allowances if these are tradable, while environmentally more concerned countries choose less allowances. The overall effect on emissions is ambiguous. Moreover, as countries are affected differently by a trading system, there may be no unanimous agreement on trading even if it were to lead to less pollution. Conversely, even if overall emissions are higher with trading, the welfare of each individual country may improve due to the efficiency gains on the permit market; hence a trading system would be unanimously approved.

That allowance trading may lead to higher emissions has already been hinted at by Bohm (1992), but his analysis is restricted to a diagrammatic approach. In Eyckmans and Proost (1996), countries choose emission reductions that can be traded. However, the authors assume that choices of emission reductions have no influence on the price at which they are traded. As a consequence, Eyckmans and Proost got the (curious) result that usually all countries but one will choose zero emission reductions. Finally, Krishna and Tan (1999) also compare transferable versus nontransferable licenses, but they focus on the effects of uncertainty about licence values.

The paper proceeds as follows. Section 2 introduces the basic model. Section 3 analyzes overall and country-specific environmental effects of allowance trading. In Section 4, welfare effects and the decision about establishing a trading system are considered. Section 5 concludes.

2. A model with multilateral externalities

Consider a standard partial equilibrium model with multilateral nondepletable externalities. There are I countries, indexed $i = 1, \dots, I$, that generate pollutive emissions $e_i \in \mathbb{R}_+$. Benefits of emissions are denoted $\pi_i(e_i)$, with $\pi_i'(e_i) > 0$, $\pi_i''(e_i) < 0$. Furthermore,

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