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Optimal design of a phase-in emissions trading program

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Abstract

This paper studies a phase-in emissions trading program with voluntary opt-in possibilities for non-affected firms and derives optimal permits allocations to affected and opt-in firms when the environmental regulator has incomplete information on individual unrestricted emissions and control costs. The regulator faces a trade-off between production efficiency (minimization of control costs) and information rent extraction (reduction of excess permits allocated to opt-in firms). The first-best equilibrium can be attained if the regulator can freely allocate permits to affected and opt-in firms; otherwise a second-best equilibrium is implemented. The latter is sensitive to uncertainty in control costs and benefits.

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1. Introduction

In recent years we have witnessed a significant increase in the attention given by environmental policy makers to market-based instruments, particularly tradeable

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emissions permits.[1] The sulfur dioxide (SO_2) emissions trading program under Title IV of the 1990 Clean Air Act Amendments is the largest experience with the use of tradeable permits ever implemented. Furthermore, it is the first emissions trading program to include a voluntary participation provision — the Substitution provision — in its first phase of implementation.[2] Electric utility units not affected by the emissions limits of Phase 1 can voluntarily *opt-in* and receive tradeable permits.[3]

Although the Substitution provision was primarily designed to allow those *non-affected* electric units with low control cost to opt in, Montero (1999) explains that a large number of non-affected units opted in because their unrestricted or counterfactual emissions (i.e. emissions that would have been observed in the absence of regulation) were below their permit allocation. In other words, they had received *excess permits*. While shifting reduction from high-cost *affected* units to low-cost non-affected units reduces aggregate compliance costs, excess permits may lead to social losses from higher emissions than had the voluntary provision not been implemented.

As with any other regulatory practice, the optimal design of a phase-in emissions trading program with opt-in possibilities for non-affected firms is subject to an asymmetric information problem in that the regulator has imperfect information on individual unrestricted emissions and control costs. Furthermore, if we believe that either for practical or political reasons, phase-in or less than fully comprehensive trading systems are likely to be the rule rather than the exception in future environmental policy, the same sort of issues observed in the SO_2 emissions trading program are likely to arise in attempts to implement tradeable permit schemes in practice. In fact, a salient example is provided by current emissions trading proposals in dealing with global warming that call for early carbon dioxide restrictions on OECD and few other countries with voluntarily opt-in possibilities with the rest of the world (see Tietenberg and Victor (1994), and The Kyoto Protocol to the Convention on Climate Change).[4] In this paper I study the welfare implications and implications for instrument design of this particular asymmetric information problem.

As shown below, in a world with perfect information and no transaction costs, a

[1]For the theory and practice of tradeable permits see Tietenberg (1985) and Hahn and Hester (1989).

[2]In Phase 1 (1995 through 1999), the 'dirtiest' 263 electric utility units are mandatorily affected, while in Phase 2 (2000 and beyond), more than 2000 additional units become affected. For more details, see Joskow and Schmalensee (1998).

[3]Tradeable permits are called *allowances* in this particular trading program. In this paper, however, I will use the term *permits* throughout.

[4]As mentioned by a referee, another interesting example in the context of global warming might be the possibility of 'early voluntary reduction credits' in the US prior to the binding target on carbon dioxide emissions in 2008. Although the pre-2008 and post-2008 agents may appear to be the same, if the 'voluntary credits' are used to increase the binding target, the same sort of problems discussed in this paper will be present.