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Permit markets, market power, and the trade-off between efficiency and revenue raising[☆]

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ABSTRACT

This paper focuses on an emissions permit market dominated by one firm and with a government concerned about social efficiency and permits revenue. In this setting, it is shown that the dominant firm's market power reduces the opportunities for the government to raise non-distortionary revenue from permits without loss of consumer surplus. Since the government's objectives are thus hampered in auctioning permits, the dominant firm should be excluded from the auction. Specifically, the regulator should sell permits directly, through bilateral negotiation, to the dominant firm, and auction off the remaining permits to the fringe firms.

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1. Introduction

Pollution is a standard example of an externality that prevents market efficiency, and therefore requires government intervention. One intervention that has been largely implemented is the cap-and-trade system; the U.S. program for reducing emissions of sulfur dioxide (SO₂) and the E.U. scheme for reducing carbon dioxide (CO₂) and other pollutants are two examples.¹

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¹ In the U.S., the cap-and-trade program for SO₂ emissions was created in 1990 under the U.S. Acid Rain Program, thus implementing the guidance of Title IV of the 1990 Clean Air Act Amendments. In 1993, the U.S. Environmental Protection Agency inaugurated the auction of tradable permits to emit SO₂. In July 2003, Member States of the E.U. agreed to establish a CO₂ cap-and-trade scheme within the E.U. as of 2005 for greenhouse gas emissions (see the 2003/87/EC Directive), which constitutes the legal basis for the world's largest multi-country cap-and-trade scheme.

The cap-and-trade system consists of a first stage where firms are granted permits and a second stage where a secondary market allows firms to exchange them. In the literature, two ways to allocate firms' initial endowment of permits are usually considered. In the first, the government hands out permits to firms ('grandfathering'); in the second, the government sells permits in an auction, collecting revenues. Although the primary objective of a government in allocating permits should be to achieve a socially efficient outcome within the constraints set by the desired cap, auctioning permits has been vindicated in the literature as a source of revenue that would allow reductions on other more distortionary income.²

When the permit market is competitive,³ the government can easily achieve both social efficiency and maximum revenue by simply auctioning all permits. Then, such an auction provides a distortion-free revenue stream. There are, however, situations in which market power in permit markets does exist, and hence there is potential for price manipulation. This is the case in small regional markets, where firms must buy permits from other firms in a geographically small and limited area. Two examples are permits for emissions of nitrogen oxide (NO_x) and sulfur oxide (SO_x) in the Canadian region of Ontario (the case explored in Muller et al., 2002), and nitrogen emissions in Port Phillip Bay, Victoria, in Australia (discussed in Cason et al., 2003). In both cases, dominant firms could exercise market power in the emissions permit trading market that the regional authorities envisioned.⁴

Surprisingly, the presence of market power in the permit market does not necessarily prevent a government from achieving social efficiency. As Hahn (1984) showed, grandfathering the efficient number of permits to the dominant firm effectively eliminates its market power in the permit market and thus its incentives to manipulate permit prices. Hahn's (1984) analysis is not, however, truly exhaustive because grandfathering implies that the government relinquishes permit revenue. The first result of the analysis developed in our paper is that, in the presence of market power, both objectives—social efficiency and permit revenue—necessarily conflict. Different procedures for the initial government distribution of permits to solve this conflict are then examined. Compared to grandfathering and auctioning permits, bilateral negotiation between the government and the dominant firm is shown to be a better procedure for achieving the government's objectives. In the final outcome of such a bargaining process, the government does sacrifice some market efficiency in order to improve revenue; but on balance these two objectives are better achieved with this procedure than with either grandfathering or auctioning.

Hahn (1984) is the seminal paper in the literature on market power in permit markets. He shows that, in the presence of market power, the initial allocation of permits has an impact on both the final allocation of permits and the permit price. Muller et al. (2002) and Cason et al. (2003) find experimental evidence that firms exercise market power in a permit market organized using the double auction. Liski and Montero (2005, 2006) analyse the effect of market power when firms can bank permits for later use. Finally, other papers examine how oligopolistic competition in final markets translates into strategic behaviour in permit markets (Misiolek and Elder, 1989; Montero, 2002; Sartzetakis, 1997).

In this paper, we deviate from the Hahn's (1984) set up, by examining the regulator's optimal policy in the presence of market power, when achieving efficiency is not its unique objective but also generation of revenue from permits allocation. To this end, the remainder of paper is organized as follows. In Section 2, a partial equilibrium model is developed where total emissions are capped and the government looks for both efficiency and revenue. In Section 3 the performance of a cap-and-trade system in the presence of a dominant firm is analysed. It is shown that, when the initial allocation of permits is through an auction, the dominant firm stays out of the auction and then buys only in the secondary permit market. As a result, the auction leads to an inefficient final allocation of permits. When some permits are handed out to the dominant firm, the behaviour of this firm in the secondary market is a function of the number of permits it is grandfathered. In Section 4, the behaviour of a government that cares both about consumer surplus and revenue is explored. It is shown that the

² See for instance the discussion in Ellerman et al. (2000), Cramton (2000), and Cramton and Kerr (2002).

³ This seems to be the case, for example, of the SO₂ permit market in the U.S.

⁴ See also 'Welcome to Kyoto-land' in *The Economist*, October 7, 2004, for a report on countries that could have market power in the framework of an international market for tradable greenhouse gas permits.

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