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ANALYSIS

Market power in tradable emission markets: a laboratory testbed for emission trading in Port Phillip Bay, Victoria☆

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Abstract

In theory, competitive emission permit markets minimize total abatement costs. Permit markets are often imperfectly competitive, however, and may be thin and dominated by large firms. The dominant firm(s) could exercise market power and increase other firms' costs of pollution control, while reducing their own emission control costs. This paper reports a testbed laboratory experiment to examine whether a dominant firm can exercise market power in a permit market organized using the double auction trading institution. Our parameters approximate the abatement costs of sources in a proposed tradable emissions market for the reduction of nitrogen in the Port Phillip Watershed in Victoria, Australia. We vary across treatments the initial allocation of permits to sources, so that in one treatment the seller of permits is a monopolist and in another treatment the market is duopolistic. We also vary the information that subjects have about the number and abatement costs of their competitors. We find that prices and seller profits are higher and efficiency is lower on average in the monopoly sessions compared with the duopoly sessions, but the differences are not substantial and are not statistically significant due to pronounced variation across sessions. Moreover, prices, profits and transaction volumes are usually much closer to the competitive equilibrium (CE) than the monopoly equilibrium.

Keywords: Market power; Emission permits; Experiments; Environmental regulation

JEL classification: C91; Q25; Q28

☆ Views Expressed in this paper are those of the authors and not necessarily the Department of Natural Resources and Environment Victoria. Use of any results from this paper should be clearly attributed to the authors and not the Department.

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1. Introduction

For almost four decades economists have argued that tradable emissions permits can allocate emissions control responsibility, under conditions of asymmetric information and heterogeneous abatement costs, at least cost, for any given emissions ceiling (Dales, 1968; Montgomery, 1972; Tietenberg, 1985; Baumol and Oates, 1988).

Policy makers have slowly begun employing trading schemes for environmental management, predominantly for point source pollution. One of the first and most ambitious schemes was the United States Federal SO_2 Trading Program, (Title IV 1990 Clean Air Act Amendments), which regulates sulfur dioxide emissions that cause acid rain from electricity utilities across the US. Another example is the Regional Clean Air Incentives Market, established by the South Coast Air Quality Management District in Southern California, which regulates nitrogen and sulfur oxide emissions from 400 industrial sources in the South Coast air basin. Examples of point source water quality trading schemes include the Cherry Creek Basin Trading Program for phosphorous in Colorado (USA), and the Hunter River Salinity Trading Scheme in Australia, which regulates saline water exports from point sources in the Hunter River New South Wales, Australia. These programs have reported considerable cost savings. For example, Schmalensee et al. (1998) estimate that the US Federal SO_2 Trading Program reduced abatement cost by 25–34% as compared with a scheme with the same allocations of allowances but no ability to transfer allowances.

Theoretical models of allowance trading often assume some level of competition (often perfect), such that no firm(s) can exercise power on the selling or buying side of the market. This may be appropriate for large markets like the US SO_2 market, but other permit markets are often concentrated, and therefore, only imperfectly competitive. The dominant firm(s) could exercise market power and increase other firms' cost of pollution control, while reducing their own emission control costs (Hahn and Noll, 1982; Hahn, 1984; Newberry, 1990; Vickers and Yarrow, 1991). Some empirical studies, however, find that the extent of market power would need to be great (up to 90% of the potential trading volume) for a firm or group of colluding firms to manipulate control costs and even then, the savings from the permit market are not eroded to a significant extent (Maloney and Yandle, 1984).

Port Phillip Bay in southern Victoria, Australia is one such case where an emissions permit market would be dominated by one large firm. In 1996 the Port Phillip Bay Environmental study was conducted to investigate sustainable use and management of the Bay (CSIRO, 1996). This study identified nitrogen as the nutrient that limits algal growth in the Bay. It recommended that nitrogen emissions to the Bay should be reduced, with a specific target set for 2006. The Department of Natural Resources and Environment Victoria undertook a feasibility study into nitrogen emissions trading in Port Phillip Bay to reduce and maintain emissions from point sources (DNRE, 2002). One of the issues that needed to be explored was the likelihood of the dominant firm exercising market power. The testbed laboratory permit market reported in this paper was conducted to specifically test if the dominant firm could exercise power in this type of market.

In Port Phillip Bay there is one large emitter of nitrogen—a sewerage treatment plant managed by the Melbourne Water Corporation; three small sewerage treatment plants—City West Water Authority, Western Water Authority, Yarra Valley Water Authority; and two land based fish farms. The Melbourne Water Corporation's emissions account for approximately 94% of nitrogen emissions from point sources to the Bay. City West Water accounts for approximately 2%, Western Water 0.95%, Yarra Valley Water 1.9% and the two fish farms 0.4% each (Argent and Mitchell, 1998).

In order to testbed the permit market, abatement cost and scope for each firm in the Bay was estimated in consultation with the Melbourne Water Corporation, the Environmental Protection Authority Victoria, fish farmers and the Marine and Freshwater Research Institute Victoria (see Table 2 below). The firms differ in their cost and potential quantity of abatement. The Water Authorities have high fixed costs for the first