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# Environmental crises' regulations, tradable permits and the adoption of new technologies

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### ABSTRACT

There are many situations where environmental authorities use a mix of environmental policy instruments, rather than one single instrument, to address environmental concerns. For example, one instrument may be used to reduce overall emissions of a pollutant while another is used to address environmental crises that arise when meteorological conditions affect the capability of the environment to assimilate pollution. This paper looks at the effects of the interaction of a tradable permits scheme with environmental crises' regulations on the rate of adoption of advanced abatement technologies.

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## 1. Introduction

In some cases, the damages caused by emissions of pollutants depend almost exclusively on their magnitude and on the number of persons whose location makes them vulnerable to the effects. However, under many other circumstances, the effects of a given discharge depend on variables beyond the control of those directly involved. For example, amount of water and speed of flow are

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critical determinants of a river's assimilative capacity. Similarly, emission levels that are acceptable and rather harmless under usual conditions can become intolerable if temperature inversion prevent air pollution from leaving the atmosphere (Baumol and Oates, 1988, pp. 191–192).

Variability in the assimilate capabilities of the environment poses difficult problems for pollution control policies (Howe and Lee, 1983) since changes may cause occasional environmental crises that prompt the imposition of emergency measures to improve environmental quality to a satisfactory level. Typically, these crises cannot be predicted far in advance or with certainty – but we can be certain that at some unforeseen time they will recur.

The use of a single policy as the only means of control may be unacceptably costly to society since it would have to be set at a level that is high enough to maintain the pollution at acceptable levels during emergency periods. Instead, it may be less costly to employ a mixed policy in which one policy is used to control the long-run equilibrium level of pollution and another is used to maintain the pollution below some predetermined threshold during environmental crises (Bawa, 1975; Baumol and Oates, 1988, p. 200). In fact, several cities have already defined and formulated corresponding policies measures for periods of environmental distress. This is the case – for example – of the Hudson River on the east coast of Australia, where a system of tradable permits was introduced in 1995 to control the saline wastewater discharged by industrial activity. However, the trading scheme operates only during high flows. No discharge at all is allowed during low flows since the river cannot dilute emissions adequately (NSW EPA, 2003).

A similar mixed policy is applied in Santiago, Chile. A system of tradable permits was introduced during the early 1990s to reduce emissions of particulate matter coming from stationary sources of air pollution. Nevertheless – since during some winter days the stagnant air traps and collects atmospheric pollutants until they become a danger to health – the scheme was complemented with an “emergency emission standard” that further restricts emissions during declared states of “environmental emergencies” of bad air quality that occur when an environmental quality index reaches high values (Coria, 2009).

Finally, although the focus of this paper is pollution, the variability of water flows impose similar challenges for water management during droughts. Tradable water rights schemes are in place in several countries as a mechanism to efficiently allocate water resources (for example, Australia, United States and Chile; see Kraemer and Banholzer, 1999). Nevertheless, during droughts, conventional water-rationing schemes restrict each household or enterprise to water use below a given level.<sup>1</sup>

In spite of that these mixed systems of tradable permits and emission standards may induce with little uncertainty the prescribed alterations in pollution activities, the theory of environmental regulation suggests that market-based instruments create more effective technology adoption incentives than conventional regulatory standards.<sup>2</sup> Then, it is worth asking to what extent the interaction of policies preserves the economic incentives provided through tradable permits; especially if the incidence of environmental crises and the “relative use” of environmental crises' regulation within the mix vary. The present paper is an attempt to answer such question that seems very timely, given the growing interest in the use of tradable permits worldwide and the fact that in many cases, tradable permits might have to interact with complementary policies that affect the same industry.<sup>3</sup>

In line with previous studies (Milliman and Prince, 1989; Jung et al., 1996; Parry, 1998; Montero, 2002a; Requate and Unold, 2001, 2003; Coria, 2009b), I find that under a tradable permit scheme the adoption of advanced abatement technologies depreciates the emissions' permit price. Since firms with higher costs of adoption can free ride on the decreased permit price caused by other firms' adoption, the private gains from adopting the technology under permits are reduced and so the rate of adoption. However, I show that if the tradable permit scheme is complemented with an

<sup>1</sup> If households and other water consumers are heterogeneous in terms of how they value water use, simple rationing of water might not be economically efficient since water is not targeted for its best economic use (Lund and Reed, 1995).

<sup>2</sup> See Requate (2005) for a survey on the literature about the incentives provided by environmental policy instruments for both adoption and development of advanced abatement technology.

<sup>3</sup> See Johnstone (2003), Sorrell and Sijm (2003) and Smith (1999) for a discussion about the use of tradable permits in combination with other policy instruments; and Benneer and Stavins (2007) for a discussion about the use of multiple policy instruments in the context of second-best theory.

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