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Direct and market effects of enforcing emissions trading programs: An experimental analysis

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Abstract

Since firms in an emissions trading program are linked through the permit market, so too are their compliance choices. Thus, enforcement strategies for trading programs must account for the direct effects of enforcement on compliance and emissions decisions as well as the indirect effects that occur due to changes in permit prices. Our experimental results are consistent with theoretical predictions about both a negative direct effect of enforcement on individual violations and a countervailing market effect through the permit price. Furthermore, there is no direct effect of enforcement on the emissions choices of firms, only a negative price effect.

JEL classification: C91; L51; Q58

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1. Introduction

By exploiting the power of a market to allocate pollution control responsibilities, well-designed emissions trading programs promise to achieve environmental quality goals more cheaply than traditional command-and-control regulations. It is clear, however, that the potential of emissions trading is jeopardized if these programs are not enforced well. In recognition of this fact, there is

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now a significant literature on compliance and enforcement of emissions trading programs (e.g., Keeler, 1991; Malik, 1990, 1992, 2002; van Egteren and Weber, 1996; Stranlund and Dhanda, 1999; Stranlund and Chavez, 2000). In general, this literature suggests that compliance behavior in emissions trading programs is likely to be very different from behavior under command-and-control standards or fixed emissions taxes. One of the more important differences is that firms in an emissions trading program are linked together through the permit market while they operate largely independently under both command-and-control policies and emissions taxes. Thus, compliance and enforcement of emissions trading programs are inextricably linked to permit markets. Indeed, any factor that affects compliance decisions will in turn impact the permit market, which has its own indirect effect on compliance via the permit price.

For this study we have designed and conducted laboratory experiments to examine the direct and indirect market effects of enforcement on pollution and compliance decisions. Our hypotheses about these effects are derived from the simplest possible model of imperfect compliance in an emissions trading program. Our goal is to provide empirical tests of several fundamental results from the existing theory. A theoretically sound and empirically validated understanding of such fundamentals is critical for the appropriate design and implementation of enforcement strategies for market-based policies, and provides a baseline for theoretical and empirical extensions into more complicated environments.

Most of our hypotheses are supported by the experimental data. One of the most important of these is that there is a direct effect of enforcement on individual violations as well as a countervailing market effect through the permit price. Increased enforcement through increased monitoring or higher penalties motivates firms to reduce their violations by purchasing more permits. This puts upward pressure on the equilibrium permit price, but higher permit prices motivate firms toward greater violations. Our experimental data are consistent with the theoretical prediction that the direct effect is always larger so that increased enforcement results in lower violations. However, the basic conclusion in this regard should be clear: the productivity of enforcement pressure in reducing noncompliance in emissions trading programs is partially offset by a countervailing price effect. Regulators who ignore this price effect would over-estimate the effectiveness of any attempt to reduce violations.[1]

The experimental results also provide strong support for a somewhat surprising result about enforcement and emissions choices: there is no direct effect of enforcement on the emissions choices of firms; there is only a negative price effect.[2] That is, a firm's choice of emissions is independent of the enforcement strategy it faces, but this choice is not independent of the price of permits. An important implication of this conclusion is that the only way that increased enforcement can have an impact on environmental quality is if it is large enough and applied widely enough to lead to an increase in the equilibrium permit price. Increased enforcement pressure applied to a single firm or a small subset of firms will have *no* environmental impact.

[1] Another policy implication of this indirect price effect is that directing more enforcement pressure at a subset of firms, presumably to motivate them toward greater compliance, may involve a cost that regulators may not have recognized. The firms that are targeted with more enforcement pressure will purchase more permits to reduce their violations, thereby putting upward pressure on the equilibrium permit price. A higher permit price, however, motivates all the other firms in the program toward larger violations. Therefore, targeting groups of firms to increase their compliance may be accompanied by reduced compliance by other firms. This cannot happen under command-and-control regulation or a fixed emissions tax because firms under these regulations are not linked together through a permit market.

[2] Malik (1990) shows that this result obtains when audits of firms' emissions are random. Harford (1978) noted a similar result in the case of an emissions tax.