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The Use of Ambient Inspections in Environmental Monitoring and Enforcement When the Inspection Agency Cannot Commit Itself to Announced Inspection Probabilities

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We consider a game between two polluting firms and an inspection agency, which can inspect ambient pollution levels before inspecting individual firms, but without committing itself to announced inspection probabilities. Without ambient inspections, we have a unique equilibrium. With ambient inspections, we obtain several equilibria, depending on the relative values of the environmental cost of noncompliance and the cost of inspecting firms. In the most relevant equilibrium, the higher the fine for noncompliance and the lower the environmental cost of noncompliance by the firms, the more likely that expected costs for the inspection agency will be lower with ambient inspections. © 2001 Elsevier Science

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1. INTRODUCTION

Perfect observation of the emission levels of individual economic agents would be prohibitively costly for any environmental regulator. Thus, any environmental policy will be confronted with some uncertainty with respect to the compliance with regulations. This obviously provides incentives for reporting falsified data on actual emission levels.

In the vast and growing literature on monitoring and enforcement in environmental policy some problems do not seem to have been recognized yet.

In this paper, we shall tackle two new problems: the use of ambient pollution inspections to improve the efficiency of monitoring and the commitment problem in enforcement policy.

The probability of inspecting a firm is a crucial element in any enforcement problem; several approaches are possible to model this parameter.

For instance, in some approaches, the inspection probability depends on the relation between pollution and the standard.[1] This means that transgressors will be inspected more frequently and that the firm has to take the effect on the monitoring probability into account when it decides how much to pollute. However, none

[1]For instance, the absolute difference between effective pollution and the standard [11], the ratio between effective pollution and the standard [18], or simply the pollution level [7]. In Malik [17] it depends in a non-specified way on the level of pollution and the magnitude of the pollution permit.

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of these papers endogenizes the relationship between ambient pollution levels and inspection probabilities.

Also, several authors have proposed using ambient-based policies to regulate non-point pollution [3, 4, 25, 28–30]. The political feasibility of the proposed schemes can however be doubted: it is very unlikely that polluters will accept to pay for ambient pollution levels if their contribution can only be quantified approximately. Ambient levels could however be a useful source of prior information to guide the monitoring efforts of the monitoring agency.

Moreover, few authors have treated this inspection probability as an *equilibrium mixed strategy* in a game between the agency and the monitored firm. There is thus an implicit assumption in most models that an agency can announce an inspection probability and subsequently stick to it. Malik [17] and Stranlund and Dhanda [27] are, as far as we know, the only authors who have stated this assumption of full commitment explicitly; Grieson and Singh [9] seem to be the only authors who do not assume full commitment by the agency.

An important source for commitment power for government agencies is that they can be statutorily compelled to undertake certain actions. On the other hand, informational constraints compel governments to give some autonomy to agencies. The institutional context we shall be looking at here is one where the government sets the environmental standard and the fine for noncompliance, but where the agency is free to organize itself its inspection policy. Therefore, in the agency–firm interaction, the fine and environmental standards are exogenous, but the agency has no commitment power with respect to the decision variables that are in its own hand.[2]

The assumption of non-commitment is far from innocuous. To see this, consider the following very simple game *without* repeated interactions.

We shall assume that we have only one polluter, who can choose between two levels of abatement expenditure, α and 0. If it chooses α, the firm is in compliance. We assume that there is a one-to-one relationship between emissions and the chosen abatement technology, so that the environmental damage due to the choice of a particular abatement technology only depends on that technology. The monetary value of environmental damages related to the choice of the compliant abatement technology will be represented as D_c; the monetary value of environmental damages due to noncompliance will be represented as D_{nc}. We assume that $D_{nc} > D_c$.

Inspecting the firm costs b. If a firm is inspected and is found in noncompliance it will receive a fixed exogenous fine $\Psi > 0$ with certainty. All parameters of the model are common knowledge.

The firm can choose between complying and not complying, and the agency can choose between inspecting and not inspecting.

The inspection agency is assumed to minimize the sum of expected environmental and inspection costs. It does not care however about private compliance costs or fine collections, because these parameters have already been taken into account by the government in the determination of the optimal standards and fine structure. Our framework is normative, not positive, and we ignore any bureaucratic objective the agency may have. Finally, the firms minimize expected costs.

[2]The assumption that the fine is given in the agency–firm interaction is quite standard. It should however be noted that some authors [19] have considered institutional contexts where the same level of government determines the monitoring rates and the penalties.