

Initial and Continuing Compliance and the Trade-Off between Monitoring and Control Cost¹

Jon D. Harford

Department of Economics, Cleveland State University, Cleveland, Ohio 44115

E-mail: j.harford@popmail.csuohio.edu

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The trade-off between firm abatement costs and regulatory monitoring costs modeled by Amacher and Malik [1, 2] (AM) is reinterpreted, extended, and critiqued in part. The notion of technology is replaced with the quantity of abatement capital, and a constant fine per unit is replaced with a “lump-sum” maximum total fine. Analysis of first- and second-best regulatory situations indicate that the first-best allocation involves a higher capital-to-labor ratio than that which would minimize the firm’s costs of meeting the standard. The relationship between initial and continuing compliance is analyzed, the curvature of isoabatement curves is related to the extent of net cost-saving possible from more capital-intensive abatement, and the effect of a delayed commitment to the pollution standard by the regulator is considered. AM’s comparison of pollution taxes versus pollution standards fails to hold up under the modified assumption on fines. © 2000 Academic Press

I. INTRODUCTION

One of the most fundamental sets of reasons for costly enforcement of pollution control laws is that maximum fines are finite and monitoring is costly. In response, economists have examined the potential for reducing social cost by the use of more elaborate monitoring approaches. One approach that was studied under various ancillary assumptions by Russell *et al.* [17], Russell [16], Harrington [10], Harford and Harrington [8], and Harford [6] is the use of state-dependent enforcement strategies whereby future monitoring and penalties facing a firm are made a function of past monitored compliance. It has been well documented by the aforementioned writings that state-dependent enforcement offers the possibility of lower expected steady-state enforcement costs, although the last two articles referred to indicate that there tends to be a partially offsetting increase in expected steady-state control costs, *ceteris paribus*. Taking a different approach, Kaplow and Shavell [12] and Malik [15] have shown that making the firm self-report its own wastes with monitoring performed probabilistically only on those firms claiming compliance leads to lower enforcement costs for a given level of pollution under at least some circumstances.

More recently, Amacher and Malik [1, 2], (AM) have presented papers which emphasize the possibility of lowering social cost through bargaining between the regulator and the polluting firm. Their papers use a static framework of costly but

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perfect enforcement of regulatory instruments. The regulator and firm bargain from a “second-best” allocation based on the regulator’s ability to pre-commit to only a pollution standard. The “first-best” allocation requires the regulator to pre-commit to both a “technology” (abatement capital) standard and a pollution standard. Bargaining can reduce social cost by offering a regulatory easing of the pollution standard in exchange for the firm using relatively more of the costlessly observable abatement capital.² The saving in pollution monitoring cost can more than compensate for the rise in the sum of pollution damage and control costs. The premise that performance standards are “second-best” is striking, given that economists have often argued that performance standards were superior to “technology”-based standards precisely because they ensured that firms eliminated pollution at the least cost (to the firm).

It is the intent of this article to restate the basis for the gains from adjusting the firm’s choices of abatement inputs and to offer additional analysis in order to clarify the nature of the trade-offs involved. To begin with, for a static model with end-of-pipe types of treatment, a change of terminology can be justified. In place of AM’s choice variables of technology and pollution, the firm’s choice variables are here assumed to be the inputs of capital and a short-run variable input labeled “labor.”³ This allows us to view the novel aspect of the regulatory issue as one involving the desire to induce the firm to choose a capital-intensive abatement process in order to reduce monitoring costs.

As part of this approach, the issue of initial compliance is examined so as to clarify the assumptions regarding the circumstances under which it is achieved and the implications of its achievement for the range of choices under continuing compliance. The idea of initial compliance has been mentioned and briefly discussed in a number of works, including Field [3] and Russell *et al.* [17], and by Harrington [11] nearly 20 years ago. However, it appears that no explicit theoretical analysis has been done on this matter, presumably because initial compliance has been seen as relatively easy to achieve. Nevertheless, even the relatively simple approach taken here indicates that consideration of initial compliance yields some additional insights into enforcement trade-offs.

Under assumptions similar to AM’s except that the (maximum) fine is a “lump-sum” total rather than a rate per unit of excess or untaxed pollution, it is shown that initial compliance requires that the fine per period must equal or exceed the sum of abatement capital and operating costs. This additional constraint has implications for the optimal pollution monitoring probability and the optimal combination of inputs in the first-best allocation (Case I). The “second-best” optimal pollution standard also satisfies a somewhat different marginal condition due to the modified assumption on the fine (Case II). It is also shown, intuitively

² The author’s limited attempt to find a number for the monitoring cost of initial compliance for any particular case was not successful. However, those authors that refer to the distinction between initial and continuing compliance all indicate that monitoring initial compliance is relatively less costly. For example, Goodstein [5, p. 279] refers to initial compliance as “easy to confirm.” Strong credence must be given to Russel *et al.* [17, p. 9] when they state that “initial compliance is relatively easy to monitor.”

³ The use of the word “technology” by AM appears to be at odds with the usual textbook use of the word; their use refers to the state of knowledge about all the different ways of producing things, rather than the choice of a particular combination of inputs. Stokey [19] uses the idea of technology in the discussion of different types of production techniques which can be indexed so that the higher the index the higher the ratio of pollution to output.

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