

Optimal environmental regulation of politically influential sectors with asymmetric information

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Received 8 March 2006

Available online 13 November 2007

Abstract

Politically motivated subsidies can have undesired environmental consequences. Asymmetric information regarding firm productivity constrains the government's ability both to redistribute income and control emissions. Taking political and information constraints as given, this article characterizes a social-welfare maximizing policy. The optimal policy uses a single instrument to achieve both goals, making income-support subsidies contingent upon pollution reduction. Price variation allows the government to design contracts with countervailing incentives, potentially eliminating some firms' information advantage.

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JEL classification: D82; H23; Q28

Keywords: Regulation; Income support; Mechanism design; Countervailing incentives

1. Introduction

This paper examines socially optimal policy for reducing emissions in politically influential sectors. Many industries contributing to environmental degradation also benefit from some form of government support. Examples include agricultural subsidies, below-market timber concessions, and subsidized credit to fishing fleets; see [8,18] for other examples. Such “perverse” subsidies compound the welfare loss from market distortions with increased negative externalities. Their continued existence in spite of the social cost is testament to the political influence of the beneficiaries.

Taking political constraints as given, I determine the optimal policy for reducing environmental damage. The model allows for both private information regarding individual firms' cost structure and a non-stationary price setting. The optimal mechanism in this relaxed framework violates two pieces of conventional wisdom that hold in more restrictive models. The first, dating at least to Tinbergen [22] and appearing throughout the literature,¹ is that two policy targets (e.g., correcting externalities and redistributing income) can be most

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¹See, for example, the discussion of market imperfections in [6].

efficiently attained by two independent policy instruments. The second is that in a mechanism design problem the principal can do no better than by using short-term or deterministic contracts [12].

The problem is motivated in part by stylized facts of U.S. agricultural policy. Currently, producers receive income support through direct payments varying inversely with output prices. In addition, the voluntary Conservation Reserve Program (CRP) pays farmers to remove environmentally sensitive land from production. Administration of the two programs is not coordinated. The combined cost has been about \$12 billion per year since 1996, indicating potentially significant savings from improved design [19].

Based on this experience, the model incorporates political influence of the polluting sector by imposing two policy constraints. First, the government must establish a safety net for the sector, ensuring that all producers exceed a minimum income threshold. Second, participation in an environmental program must be voluntary.

The model allows each individual producer to have private information regarding his *type* (a productivity parameter such as soil quality). A first result shows that the two-instrument, two-target strategy resembling current policy is only optimal if output price is sufficiently high relative to the income threshold. Otherwise, the optimal abatement allocation for the environmental policy alone is sub-optimal in the presence of the income constraint.

The second main result arises from extending the basic model to allow for multiple states of nature regarding output price. If contract payments are based only on the realized state of nature then all types, except the highest or lowest, have an incentive to misrepresent their type. If the output price is low enough, the minimum income constraint binds and all firms can benefit from under-stating type (so as to receive a larger income subsidy). Otherwise, the participation constraint binds and all firms can benefit from over-stating type (to receive larger compensation for abatement). By forcing firms to make one declaration of type that holds for both states, a contract can change the problem's incentive structure, allowing the opposing incentives to countervail each other.

This result applies regardless of whether variation in prices is deterministic or stochastic. In a deterministic setting where price varies predictably from one period to the next, a single long-term contract covering multiple periods can yield strictly higher social welfare than a series of single-period contracts. This result stands in sharp contrast to a standard result in the mechanism design literature (e.g., [1,7,12,16]). The standard result can break down if incentives operate in different directions depending on price.

Similarly, standard results suggest that there is no advantage to using contracts with stochastic payments [12]. The analysis here shows that this conclusion is not true if incentives depend on a stochastic price. As a result, an *ex ante* contract (committed to before uncertainty is resolved) with stochastic payments can yield strictly higher social surplus than a set of *ex post* contracts with deterministic payments.

Previous studies have characterized optimal income support or environmental policies under conditions of adverse selection by adapting the Baron and Myerson [2] (henceforth, BM) framework. This research models policy as a contract to which the government and the regulated firms commit. Private information can give firms an incentive to misrepresent type by choosing a contract intended for another firm. In order to overcome these incentives some firms must receive surplus payments.

Private information often gives firms an incentive to misrepresent type in one direction. In an income support program, firms have an incentive to claim they are relatively less profitable in order to receive a larger subsidy [4]. In voluntary environmental programs, incentives can operate in the opposite direction. If the opportunity cost of reducing emissions is increasing in profitability, firms have an incentive to claim they are more profitable in order to receive higher compensation [5,21].

In a seminal paper, Lewis and Sappington [14] (henceforth, LS) show that the principal to a contract benefits if it is able to create such countervailing incentives. This insight has led several authors to look for means of introducing countervailing incentives in regulatory policy. Bontems and Bourgeon [3], for example, examine a polluting industry in which the technology gives firms different incentives when faced with input versus output regulation. They show that a policy by which the government randomizes over the two kinds of regulations can generate countervailing incentives. The results depend, however, on restrictive technological assumptions.

Lewis and Sappington [15] incorporate political clout into a model of environmental regulation under asymmetric information. In their model, a small number of firms in a polluting sector have enough political influence to demand a minimum level of profit. The authors show that if privileged firms' private valuation of

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