Asymmetric information and contract design for payments for environmental services

Paul J. Ferraro*

Department of Economics, Andrew Young School of Policy Studies, Georgia State University, P.O. Box 3992, Atlanta, GA 30302-3992, United States

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ABSTRACT

In contractual relationships involving payments for environmental services, conservation buyers know less than landowners know about the costs of contractual compliance. Landowners in such circumstances use their private information as a source of market power to extract informational rents from conservation agents. Reducing informational rents is an important task for buyers of environmental services who wish to maximize the services obtained from their limited budgets. Reducing informational rents also mitigates concerns about the "additionality" of PES contracts because low-cost landowners are least likely to provide different levels of services in the absence of a contract. Paying low-cost landowners less thus makes resources available for contracts with higher opportunity cost landowners, who are more likely to provide substantially different levels of services in the absence of a contract. To reduce informational rents to landowners, conservation agents can take three approaches: (1) acquire information on observable landowner attributes that are correlated with compliance costs; (2) offer landowners a menu of screening contracts; and (3) allocate contracts through procurement auctions. Each approach differs in terms of its institutional, informational and technical complexity, as well as in its ability to reduce informational rents without distorting the level of environmental services provided. No single approach dominates in all environments. Current theory and empirical work provides practitioners with insights into the relative merits of each approach. However, more theoretical work and experimentation in the laboratory and the field are necessary before definitive conclusions about the superiority of one or more of these approaches can be drawn.

1. Introduction

Payment schemes for environmental services (PES) generally have two common features. First, they are voluntary. Second, participation involves a contract between the conservation agent and the landowner. The landowner agrees to manage an ecosystem according to agreed-upon rules and receives a payment (in-kind or cash) conditional on compliance with the contract. In this paper, the word "landowner" denotes any entity that is in the position (de jure or de facto) to supply environmental services through its influence on an ecosystem. "Conservation agent" denotes any entity that wishes to encourage landowners to supply environmental services.

PES contractual relationships are subject to asymmetric information between landowners and conservation agents. Information asymmetries can limit the effectiveness of PES schemes and make them expensive to implement. There is a well developed literature in "contract theory" that can provide abundant insights into the design of PES contracts (see, for example, Bolton and Dewatripont (2005) and references therein). In this article, I highlight some of these insights.

There are two important information asymmetries in the design of contracts: hidden information and hidden action. Hidden information (adverse selection) arises when negotiating the contract. Landowners have better information than the conservation agent about the opportunity costs of supplying environmental services. Landowners can thus secure higher payments by claiming their costs are higher than they are. More precisely, landowners use their private information as a source of market power to extract informational rents from conservation agents. These rents are payments above the minimum payment necessary to induce landowner participation in the PES program. Hidden information has been the subject of theoretical analyses in the context of agri-environmental payment schemes, which have much in common with PES schemes (Spulber, 1988; Chambers, 1992; Bourgeon et al., 1995; Fraser, 1995; Wu and Babcock, 1996; Latacz-Lohmann and Van der Hamsvoort, 1997; Moxey et al., 1999; Ozanne et al., 2001; Peterson and Boisvert, 2004).

Why should we care about these informational rents? When conservation agents pay informational rents, they obtain fewer environmental services per dollar spent than they could obtain in a world in which the opportunity costs of supplying environmental services are observable. Furthermore, PES programs are often funded by taxes, which involve inefficiencies (deadweight losses from the market distortions associated with taxation), and are often subject to free riding, which implies suboptimal funding levels. Thus society benefits more if the payments just compensate the landowners' opportunity costs of contract compliance. However, PES programs may also serve as an instrument for income redistribution and thus reducing informational rents to landowners may have implications for other goals associated with PES programs (see Section 6).

In contrast to hidden information, hidden action (moral hazard) arises after a contract has been negotiated. The conservation agent may find monitoring contract compliance costly and thus will be unwilling to verify compliance with certainty. Thus the landowner has an incentive to avoid fulfilling his or her contractual responsibilities. Hidden action in agri-environmental payment schemes has also been the subject of theoretical analyses (Choe and Fraser, 1998, 1999; Ozanne et al., 2001; Fraser, 2002; Hart and Latacz-Lohmann, 2004). A few authors have attempted to model hidden action and hidden information simultaneously (e.g., White, 2002). Because of space constraints, I focus only on PES contract issues related to hidden information.

2. Hidden information

Consider a simple example. A conservation agent is interested in contracting with landowners for habitat quality, h, which can be represented by numbers ranging from 0 (completely converted) to 100 (pristine). Participation is voluntary and thus contract payments must at least cover the landowner's opportunity costs (in the theoretical jargon, the "participation constraints" are satisfied). There are two types of landowners: those with high-opportunity costs (H) and those with low-opportunity costs (L). A type H landowner has the cost function $2h^2$ and a type L landowner has the cost function $2h$.

The conservation agent would like to contract with type L landowners first, and only contract with type H landowners if the agent's demand for habitat quality was not satisfied by type L landowners. All landowners, however, would like to be paid as if they were type H landowners. Consider a specific parcel of land and assume that the conservation agent wishes to contract with a landowner to keep the landowner's habitat pristine, $h=100$. In a perfect information world, the agent would offer $200 if the landowner were type L and $20,000 if the landowner were type H. However, if the conservation agent could not determine if a landowner is H or L, all landowners would claim they were type H in order to receive the larger payment.

As long as there is substantial heterogeneity in opportunity costs of supplying environmental services, hidden information will be a problem. Indirect evidence of informational rents going to landowners in conservation payment initiatives has been observed in the United States, Europe and Central America. For example, Shoemaker (1989) analysis of the early U.S. Conservation Reserve Program found that land values increased substantially for contracted lands, which could only occur if substantial rents were accruing to owners. These rents accrue to owners of acres with below-average returns, who receive payments based on average county returns. Similarly, Osterberg (1999), in an analysis of a German agri-environmental payment program, found that the flat rate payments led to a concentration of contracts on unproductive lands run by farmers with the lowest land use intensities (in other words, farmers with the lowest opportunity costs). In a review of Costa Rica's Programa de Pagos de Servicios Ambientales (PSA), Hartshorn et al. (2005, p.12) found that 71% of PSA forest protection contracts were on land designated for the lowest-value uses, while the payment rates were set to be above average returns from cattle pasture. Commenting on the same program, Ortíz et al. (2003, p. 64) report average returns to land classes for a variety of activities and find that forest protection contracts compete favorably on only one type of land-marginal lands with zero opportunity cost of conservation (for another example, see The Economist (1999) report on the California Headwater Forest purchase).

Policy mechanisms that reduce informational rents can be broadly classified into three categories: (1) gathering more information on landowners in the form of costly-to-fake signals; (2) relying on screening contracts (self-selection mechanisms); or (3) harnessing competitive forces through procurement auctions. The basic idea of the latter two approaches is to design the contracting system to induce landowners to reveal their hidden information (called revelation mechanisms).

3. Gathering information from costly-to-fake signals

The simplest, and coarsest, approach to address the hidden information of landowners is to gather information on observable landowner attributes that are correlated with opportunity