



Auction winning, social dynamics and non-compliance in a payment for ecosystem services scheme in Indonesia



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ABSTRACT

Conservation auctions for payment for ecosystem services (PES) are useful to identify the levels of incentives that will cover the opportunity costs of farmers supplying ecosystem services. Although auctions are increasingly used for allocation in PES schemes, the factors that lead to their successful implementation and eventual environmental outcomes are poorly understood in developing countries. We investigated the socio-economic and institutional contexts that led to smallholders' auction winning and eventual compliance using linear mixed-effects models, and post-auction and post-contract surveys. We employed a case study of a conservation contract preceded by a sealed-bid, multiple round, uniform price auction for watershed services from coffee farmers in Lampung, Indonesia. The auction participants presented low education levels, low asset endowments and small plot sizes. The study obtained evidence that farmers with larger plot areas were more likely to win the contracts, suggesting economies of scale. Most farmers considered the auction a fair self-selection mechanism to allocate contracts where allocation was not influenced by power or social rank. Non-compliance was associated with labor availability constraints, short duration of land ownership and existence of previous conservation applications, suggesting lax of capability to invest in applying conservation agriculture. Final bids were however not good predictors of compliance, among other factors, calling into question the potential of auctions to elicit the actual incentive from the farmers. Ensuring that farmers understand the purposes of auctions for effective contract allocation beyond a mere game and identifying farmers that might encounter difficulties fulfilling the contract could increase the likelihood that such a PES scheme would be successful.

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1. Introduction

Land degradation and, in particular, soil erosion in agricultural lands require urgent attention because they cause a loss of soil nutrients and, in the long run, a loss of production that further contributes to the vicious cycle of poverty and environmental degradation facing farmers in developing countries (Giller et al., 2009). Downstream, eroded soils cause significant problems, for example, hydroelectric projects and irrigation infrastructure lose productivity due to siltation, which are costly for the public and companies (Boardman et al., 2003; Pretty et al., 2000). Soil conservation programmes, legislation and regulations have been commonly employed in developing countries to reduce harmful onsite productivity and offsite impacts of erosion. While such government support programmes focus on the promotion of soil and water conservation through charges, subsidies, regulations

and extension programmes (Pagiola, 1998; Pannell, 2008; Whitten et al., 2013), the question of how to provide conditional incentives to farmers to practice conservation agriculture remains poorly understood.

Cases in developing countries have revealed that farmers' household incomes remain too low to make substantial investments in natural resource conservation. Moreover, on high-value agricultural land, farmers have little incentive to change practices that are clearly successful from a short-term economic perspective (Boardman et al., 2003). Incentive mechanisms, their payment level and individual farmers' decision-making to invest in soil and water conservation techniques need to be considered. A payment for ecosystem services (PES) is an alternative policy for conserving agricultural land by applying a conditional incentive-based approach. This policy instrument can encourage farmers to invest in soil conservation, which results in ecosystem service provision in the form of better water quality for downstream users. Nevertheless, lack of information on the incentive level necessary to motivate behavioral change in the absence of competitive markets for ecosystem services is one of the challenges that has prompted

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scepticism concerning the effectiveness of PES (Kosoy and Corbera, 2010).

A conservation auction is defined as “a process through which a buyer of ecosystem services invites bids (tenders) from suppliers of ecosystem services for a specified contract and then buys the contracts with the lowest bids” (Ferraro, 2008). An auction is a market-based instrument that is expected to reveal the incentive level required by farmers, which is typically private information, to indirectly change their behavior to enhance ecosystem services. Procurement auctions for conservation contracts involving farmers and their agricultural lands have been commonly implemented in the United States, Australia and Europe (Stoneham et al., 2003). The award of contracts on the basis of competitive bidding is frequently used in procuring commodities for which there are no well-established markets (Latacz-Lohmann and Van der Hamsvoort, 1997; Ferraro, 2008), such as markets for ecosystem services.

In the context of PES, auctions are closely related to the allocation of conservation contracts in which farmers or landholders are treated as agents. If they win the auction contracts, they will join a programme proposed by a government agency or other entity that serves as the principal. This principal may act as a public representative to support the provision of ecosystem services. Latacz-Lohmann and Schilizzi (2005) highlighted that auctions function as quasi-markets for public goods and, under the broad umbrella of incentive theory, auctions are a means of involving farmers in a self-selection mechanism to join the programme. An incentive policy is effective when its design can alleviate the problems of adverse selection and moral hazard. In theory, auctions partly reduce asymmetric information between the agents and the principal and thus can reveal hidden information.

Findings from developing countries indicate that several participant- and context-related conditions affect the effectiveness of auctions in improving PES contract allocation (Ajayi et al., 2012; Jindal et al., 2013). Participants may lack experience with a contract auction, while competitive markets for ecosystem services are relatively rare, if not absent. Participants may learn uncertain private values through experience with valuing unfamiliar goods or under the assumption of affiliated private values (Shogren et al., 2000). Land managers in developing countries may not have private information concerning the input requirements of the contract because the conservation contract is new or because of unfamiliarity with the auction mechanism. Jack (2009) concluded that, in practice, the conservation value determined by an auction can be a mix of private and common values delivered by the contract, as some conservation activities involve labour costs that are common to all auction participants, thereby resulting in homogenous cost information.

The literature also discusses the opportunity for the participants to gain experience in valuing unfamiliar goods before proceeding to the next round (Shogren et al., 2000), and auctions provide mechanisms to improve bidding behavior over time (List and Shogren, 1999). List and Shogren (1999) concluded that repeated second-price auctions provided bidders with the necessary experience to understand market mechanisms. This learning as part of decision-making process was reflected by the bidders adjusting their bids in early rounds and acquiring knowledge of the size of the budget in an auction with a budget cap for determining the cut-off price. Bidders adjusted their bids to extract almost all rent-related information, despite competitive bidding conditions, using only their own previous bidding result (Hailu and Schilizzi, 2004). Regarding learning from the bidding process, Jack (2010b) concluded that participants were “responsive to the market feedback offered in early bidding rounds” with a systematic incorporation of information in the bidding pattern, and revealed that the farmers did not submit their bids randomly, suggesting a promising potential of auction application.

Given the inherent socio-economic and institutional complexities in developing countries, it would be very useful to obtain the necessary implementation and predict the eventual effectiveness of conservation auctions. Here, we examine the application of incentive-based PES mechanisms in a rural area in Indonesia by conducting a sealed-bid, repetitive reverse auction to extract the information on the required level of incentives from farmers and contract performance implementation and monitoring to understand the effectiveness of the mechanism. We employ the case of a PES scheme from the Sumberjaya watershed, Indonesia that involved coffee farmers characterized by low educational levels, low asset endowments and small plot sizes (Ajayi et al., 2012; Jack et al., 2009; Leimona et al., 2009). These farmers grow coffee, which results in high levels of soil erosion that reduces the productivity of a downstream hydropower company (Verbist, 2008). We assess whether the bidding process effectively targets farmers likely to comply with the PES programme, as the bidding process reflected the private value of the farmer, and we hypothesize that this value could be used as an indirect predictor of contract performance. Specifically, we conducted the following three exercises: (i) explored the level of understanding and perceived fairness of the bidding process by participating farmers; (ii) analyzed the bidding behavior of the farmers in each bidding round as a function of their socio-economic factors; and (iii) examined the factors affecting the eventual compliance of the farmers with the conservation contract, including estimating the actual cost of implementing the contract.

1.1. Correlations of farmers' decisions regarding agricultural conservation measures with socio-economic traits

Farmers' decisions concerning agricultural conservation measures are likely influenced by several factors, including socio-economic, psychological and farming variables. Econometric analyses have been conducted to identify these factors and their relative importance (Pagiola et al., 2010; Zbiden and Lee, 2005), suggesting that observable characteristics, such as farm size, household assets, and other economic factors, are relevant to participation decisions, as well as transaction costs and procedural aspects. Previous studies have summarized the factors that are associated with farmers adopting soil and water conservation practices in their farmlands, namely, steep slopes, sandy/loamy soils, abundant biomass, few livestock, wealthier farmers who can afford inputs, secure land tenure, market accessibility, and an enabling institutional environment (Corbeels et al., 2010; Giller et al., 2009). The conditions typically associated with farmers who are not likely to adopt conservation agriculture are flat land, clayey soils, poor productivity, high livestock density, little capacity to invest, insecure access to land, poor markets and a poor institutional environment (Corbeels et al., 2010). The psychological aspects involved in farmers' decision-making have been regarded as further factors related to adoption (Willock et al., 1999).

As comparative cases in developed countries, analyses of European farmers have shown that the adoption of conservation agriculture to mitigate soil erosion was seemingly driven by the cost reduction due to machinery, fuel and labor savings, as the practice significantly reduced their production costs (Lahmar, 2010). Further, soil and water conservation concerns did not appear to be the main drivers of the European farmers' decision of whether to shift to conservation agriculture. Instead, most adopters of conservation agriculture were large-scale farmers (Chambers and Foster, 1983; Kwayu et al., 2014; Zbiden and Lee, 2005). A lack of knowledge on conservation agriculture systems and their management and the absence of dynamic and effective innovation systems made it difficult and economically risky for European farmers to practice new conservation agriculture techniques.

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