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Credit-Based Payments for Ecosystem Services: Evidence from a Choice Experiment in Ecuador

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Summary. — The original conceptualization of payments for ecosystem services (PES) promoted direct payments to motivate the provision of environmental public goods, but market imperfections and behavioral considerations can mean that PES that reduce market constraints are preferred. The main issue with the latter is how to include conditionality. We propose credit-based PES (CB-PES) as an incentive that links an environmental condition with the reduction of a key market constraint. Through a choice experiment in Ecuador, CB-PES was found to be a promising form of PES, with multiple desirable qualities of an incentive as cited in the behavioral economics and PES literatures.

Key words — payments for ecosystem services, credit, agroforestry, choice experiment, Ecuador, Latin America

1. INTRODUCTION

There are various definitions of payments for ecosystem services (PES) (Muradian, Corbera, Pascual, Kosoy, & May, 2010; Sommerville, Jones, & Milner-Gulland, 2009; Tacconi, 2012; Wunder, 2005), but all generally describe PES as positive and (at least somewhat) conditional incentives provided to induce a socially preferred environmental behavior. Over the past two decades, the use of PES to incentivize the provision of regulating and cultural ecosystem services (ES) has become increasingly popular around the world, including in developing regions. [1] It was initially argued that direct performance-based payments are the most cost-effective form of incentive to induce the provision of ES and conservation of biodiversity (Ferraro & Kiss, 2002; Ferraro & Simpson, 2002). Where market constraints exist, however, indirect interventions that reduce them may be preferred by both the agent and the principal (Groom & Palmer, 2010). In addition to economic constraints, current PES discourse references behavioral research exploring the efficacy of direct incentives, raising concern for the potential crowding-out of intrinsic motivation to provide ES (Farley & Costanza, 2010; Muradian *et al.*, 2010; Sommerville *et al.*, 2009; Vatn, 2010). The key issue with alternative interventions, such as those that relieve market constraints, is that historically most have not been conditional and so do not ensure that conservation will occur (Wunder, 2005). Thus the key innovation that is required is to incorporate an environmental conditionality into the reduction of market constraints.

Discrete choice analysis (DCA) was originally developed to predict demand by consumers in traditional markets (Train, 2009). It is now also popular among environmental economists as a tool for understanding individuals' preferences for environmental attributes through stated preference (SP) studies (Hoyos, 2010). DCA has been used to evaluate preferences for forests (Brey, Riera, & Mogas, 2007), wetlands (Carlsson, Frykblom, & Liljenstolpe, 2003), beaches (Beharry-Borg & Scarpa, 2010), landscape beauty (Dachary-Bernard & Rambonilaza, 2012), fish (Agimass & Mekonnen, 2011), and cultural heritage (Choi, Ritchie, Papandrea, & Bennett, 2010), among many other environs and ES (see Atkinson, Bateman, & Mourato, 2012 for a recent review of valuation of ES and biodiversity). Most applications are to understand preferences related to demand for ES, but DCA can also be used to understand preferences related to the supply of ES. It has begun to be used to *ex-ante* assess land or resource users' preferences for the attributes of incentive-based policies, such as agri-environmental schemes in Europe (Christensen, Pedersen, Nielsen, Mørkbak, Hasler, & Denver, 2011; Espinosa-Goded, Barreiro-Hurlé, & Ruto, 2010; Ruto & Garrod, 2009), reforestation incentives in China (Grosjean & Kontoleon, 2009), and marine PES (Barr & Mourato, 2012).

The research presented here uses DCA to explore incorporating an environmental condition into what would previously be considered an indirect intervention for conservation that reduces market constraints. A choice experiment (CE) was carried out in Ecuador to estimate demand for credit that includes an environmental condition. The condition is such that if the borrower carries out the required environmentally friendly behavior, the cost of credit is reduced. That is a novel incentive called credit-based PES (CB-PES). Importantly, by estimating demand for such credit, observations can be made about the quality of CB-PES as an incentive in light of behavioral research that is cited in the PES literature. In doing so, this study adds to the literature in two ways. First, it adds to the few studies that empirically explore interventions to

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induce land use change through reducing market constraints in a PES context, and provides the first empirical research of incorporating strong conditionality into the provision of credit. Second, it also adds to the few studies that have used CE to explore policy design from the perspective of the agent supplying the desired policy outcome.

Following this introduction, section two reviews the relevant literature on PES and market constraints; motivation theory; and credit and environmental outcomes. Section three describes the case study and analysis carried out, section four explains the results of that study, and section five discusses the broader implications of those results. Section six concludes.

2. TOWARD CREDIT-BASED PAYMENTS FOR ECOSYSTEM SERVICES

The proposal of CB-PES is motivated by two considerations. The first is that market constraints can influence land-use decisions. Where conventional land-use is environmentally degrading, a transition to less damaging practices usually requires capital inputs. If capital constraints exist, it is arguably harder for a transition to the less degrading practices to occur, even in the presence of direct, demand-side incentives. The second consideration is motivation crowding. There is broad concern that direct payments can crowd out intrinsic motivations of the agent to provide positive environmental externalities, and thus reduce the effectiveness of those incentives. A credit-based intervention may be easier to align with the intrinsic motivations of the agent, and so be viewed as supportive, rather than coercive, which according to behavioral research would reduce the risk of crowding-out. The remainder of this section discusses both issues in more depth, and then reviews the literature on credit and environmental outcomes, leading to a conceptualization of CB-PES.

(a) *Incentives that overcome market constraints*

Payments for ecosystem services were originally conceptualized as direct payments for the output of ES or a land use that would generate that output (Wunder, 2005), and were believed to be an improvement over previous indirect approaches used in community conservation (Cranford & Mourato, 2011). Community conservation comprises various indirect approaches (McNeely, Faith, & Albers, 2005), but in the context of PES, indirect payments are often considered interventions that reduce the cost of inputs to activities that jointly produce private and public goods, or increase the price of the private good output (Ferraro & Simpson, 2002; Groom & Palmer, 2010). An example is providing the plants needed to establish a shade-grown coffee system, or ensuring there is a good price for the coffee produced.

Ferraro and Kiss (2002) argue that using direct payments for the public good output is the first-best incentive-based policy primarily because it is the most cost-effective. Based on an economic model comparing direct payments and the indirect approach of reducing the cost of capital to a joint production activity, Ferraro and Simpson (2002) conclude the same, and also show that the ES buyer and provider have opposing preferences, with the former preferring direct PES and the latter preferring indirect PES. In the context of developing countries, that result can be interpreted as a tension between environment and development outcomes (Groom & Palmer, 2010) because direct payments will be more cost-effective for achieving environmental objectives, while indirect PES will be less cost-effective for environmental outcomes, but more profitable for the presumably less-well-off ES provider.

A key assumption of Ferraro and Simpson (2002) was perfectly elastic markets for the inputs and outputs of the joint production activity. In a series of papers, Groom and Palmer (2009), Groom and Palmer (2010), and Groom and Palmer (2012) remove that assumption and compare direct PES to the indirect approach of reducing capital constraints of a joint production activity. Where quantity constraints exist, there are situations where relaxing them can be more cost-effective than direct PES and preferred by both the ES buyer and provider (Groom & Palmer, 2010). The chance of these results increases as (1) the return to scale of the productive activity increases toward constant (assuming diminishing returns to scale), and (2) there is input complementarity between the conservation action and capital used in the production process (Groom & Palmer, 2012). At intermediate levels of returns to scale and complementarity, use of an indirect intervention may not be strictly cost-effective for environmental outcomes, but can still lead to an overall increase in welfare (Groom & Palmer, 2012). Thus if the principal were concerned with improving welfare alongside environmental objectives, there is a greater chance they would prefer the indirect approach.

Supporting complementarity between household livelihoods and environmental outcomes, some PES programs incentivize agroforestry activities, including in Latin America (Corbera, Soberanis, & Brown, 2009; Pagiola, 2008; Pagiola, Rios, & Arcenas, 2010; Pagiola *et al.*, 2007). That highlights a key overlap between the literature on PES and agricultural technology adoption. The most direct form of PES—to pay for quantified ES outputs—is a demand-side intervention that can be used to induce the adoption of particular agricultural practices. Many studies indicate that costly credit or lack of access to credit hinders the adoption and persistence of sustainable agriculture and agroforestry practices in the tropics (Blackman, Albers, Ávalos-Sartorio, & Crooks, 2005; Mercer, 2004; Pagiola *et al.*, 2007; Pattanayak, Mercer, Sills, & Yang, 2003; Shively, 2001; Smith, Dubois, Current, Lutz, & Clement, 1998) and credit constraints are a widely recognized constraint to the adoption of agricultural technologies generally (Feder & Umali, 1993; Sunding & Zilberman, 2001). Researching capital constraints broadly, Groom and Palmer (2009), Groom and Palmer (2010), and Groom and Palmer (2012) focused on quantity constraints and illustrated that relieving them could be a preferred form of PES. Similarly in their review of the adoption of agricultural technologies, Sunding and Zilberman (2001, p. 248) explain in relation to price constraints for financial capital that "One approach to overcoming this obstacle is by credit subsidies for a new technology, which may be appropriate in situations when investments generate positive externalities." Relieving credit constraints, whether quantity or price, is thus a viable option for PES design from the perspective of agricultural technology adoption.

Previous studies have compared a direct, conditional incentive with relieving market. The debate about which is better, hinged on how strong the conditionality of the incentive is, and the degree to which local markets were elastic in relation to the inputs and outputs of the eco-production process. That included an inherent assumption that an incentive could not both be conditional and relieve market constraints. The current paper is unique, and advances that debate, because it focuses on an incentive designed to relieve market constraints, but that includes a strict environmental conditionality.

(b) *Incentives that account for motivation crowding*

Motivation crowding theory posits that the increase in supply of pro-social behavior induced by providing an external