Ecological Economics 88 (2013) 232–243

Contents lists available at SciVerse ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

Transaction costs of carbon offset projects: A comparative study

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ARTICLE INFO

Article history:
Received 21 May 2012
Received in revised form 6 December 2012
Accepted 6 December 2012
Available online 1 February 2013

Keywords:
Carbon markets
Climate policy
Transaction costs
Project feasibility
Smallholder agroforestry
Payment for environmental services

ABSTRACT

The land-use change and forestry sector can be a cost-effective contributor to climate mitigation in at least three ways: providing carbon offsets through carbon sequestration in biomass and soils, reducing emissions of methane and other greenhouse gases, and producing biofuels that replace fossil fuels. The presence of carbon markets should help encourage these activities; however, most carbon trades to date have occurred in the energy sector. A major obstacle to carbon trades from land-use systems is the presence of high transaction costs of converting a carbon offset into a tradable commodity, so the prevailing market carbon prices may not provide enough incentive for adoption. This paper presents a model of the exchange of carbon offsets between a project developer and a group of landholders. The model is solved to derive project feasibility frontiers that show the minimum number of contracts necessary to make a project feasible at any given carbon price. The model is applied to two case studies (smallholder agroforestry in Indonesia and partial reforestation of family farms in Australia) under two types of contract (purchase of carbon flows and rental of carbon stocks). The paper concludes by identifying possible strategies to reduce transaction costs while maintaining project integrity.

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1. Introduction

Globally, land management is one of the most important determinants of environmental outcomes, with impacts on global environmental goods such as climate mitigation, biodiversity conservation and watershed protection. Agriculture, including its impact on land use change accounts for approximately one third of global greenhouse gas emissions (FAO, 2011; Smith et al., 2007). Environmental policy makers thus face the challenge of providing incentives to landholders to take actions that are beneficial to the environment and which generally involve costs in the form of investment, operating, opportunity or transaction costs. There is a range of environmental policy instruments to promote incentives for change, from command and control regulations to market-based incentive schemes. The distribution of costs and who bears them varies by policy instrument and location (FAO, 2007). Since globally the majority of land managers are low-income, smallholder producers with limited capacity to bear the costs of environmental regulations, considerable interest in the use of payments for environmental services that reward land managers for the provision of positive externalities has arisen (Wunder et al., 2008; Zilberman et al., 2008). In such schemes, the costs of environmental regulation are principally borne by the consumers of the environmental service. Nonetheless participation in such schemes involves costs to land managers in the form of opportunity and transactions costs. The opportunity cost to landholders participating is normally the income foregone by adopting a particular land use that may be sustainable but less profitable, in present-value terms, than current land uses. Transactions costs associated with contracting, monitoring, reporting and verification of the environmental service provision can also be quite high—particularly the start-up costs of search and negotiation. Wunder et al. (2008) identified projects with start-up costs ranging from $76 to over $4000 per hectare, with strong economies of scale.

As stated by Garrick et al. (2013-this issue), transaction costs are becoming more prominent in the literature on environmental policy. McCann (2013-this issue) highlights the importance of considering both abatements costs and transaction costs, and their interactions, when designing environmental policies. Coggan et al. (2013-this issue) assess the costs of two Australian offset schemes and identify the importance of policy design as a determinant of transaction costs. Marshall (2013-this issue) presents useful definitions and an alternative framework for classifying transaction costs when collective action is the central focus of study.

Payment for environmental service programs tend to be associated with high transaction costs because the services being exchanged are difficult to measure and there is asymmetry of information between buyers and sellers regarding the true cost of producing the service. McCann et al. (2005, p.527) present a strong case for the need to measure transaction costs to help improve the efficiency of environmental policies. They develop a typology to help with cost measurement and

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http://dx.doi.org/10.1016/j.ecolecon.2012.12.008

Table 1
Activities associated with transaction costs of LUCF projects for carbon sequestration.

Cost	Buyer	Seller
Search and negotiation		
	• Find sites and contact potential participants • Establish baseline for region • Estimate project offsets • Design individual farm plans • Draft contracts • Provide training	• Attend information sessions • Undertake training • Design farm plan
Approval		
	• Validate the project proposal • Submit to relevant authority	• Obtain documentation required for participation
Project management		
	• Establish and run local office • Establish permanent sampling plots • Maintain database and administer payments to landholders • Arrange sale of carbon offsets	• Purchase equipment for measuring trees and sampling soil • Attend project meetings
Monitoring		
	• Monitor activities against contracts • Maintain carbon inventory • Verify and certify carbon offsets	• Measure carbon stocks • Deliver annual report to project office
Enforcement and insurance		
	• Maintain buffer of C • Purchase liability insurance • Settle disputes	• Protect plot from poachers and fire • Purchase insurance • Cover legal cost of disputes

emphasize the ex-ante costs to governments of designing and implementing policies, in addition to the standard costs of negotiation, monitoring and enforcement that are incurred once a policy is enacted.

However, transaction costs are also important in designing efficient contracts once a policy has been enacted. In this paper we study the case of transaction costs in carbon offset projects where carbon markets and policies already exist and thus political transactions costs of establishment are considered sunk costs and not included in the analysis.

The establishment of cap and trade schemes, involving carbon market offset exchanges, is a widely used environmental policy instrument for climate change mitigation. Several carbon markets exist, reaching a value of over $141 billion in 2010 (Linacre et al., 2011). About 84% of exchanges have occurred within the European Union Emission Trading Scheme (EU-ETS) and the majority of the remaining transactions (about 13%) have occurred within the Clean Development Mechanism of the Kyoto Protocol (CDM). In addition to these regulatory schemes, there is a small voluntary carbon market, representing less than 0.3% of total carbon market values (Linacre et al., 2011). Each scheme has developed rules and methodologies for crediting offset reductions and their treatment of Land use, land-use change and forestry (LULUCF) based credit varies. Credits from this source are not allowed under the EU-ETS scheme, while under the CDM only afforestation and reforestation are eligible activities for certified emissions reductions (Liniger et al., 2011). Emission reductions from LULUCF are more prominent in the voluntary market, including the development of credits from Reduced Emissions from Deforestation and Forest Degradation (REDD) and REDD+, which includes conservation, sustainable management of forests and enhancement of forest carbon stocks (Liniger et al., 2011). A more recent development is the recognition of “Nationally Appropriate Mitigation Actions” (NAMAs) for developing countries at the Cancun UNFCCC[1] Conference of Parties in 2011. Under these schemes developing countries propose a set of actions to reduce emissions relative to 2020 baselines, contingent upon receipt of financing, technology transfer and capacity building. Forty five developing countries, including Indonesia, have submitted NAMA proposals and in many cases LULUCF activities feature prominently (Campbell et al., 2011).

Although there is evidence that LULUCF has the potential to contribute considerably to reducing net emissions by sequestering carbon dioxide (CO_2) from the atmosphere (Kauppi and Sedjo, 2001; Plantinga et al., 1999; Rahlao et al., 2012; Rose et al., 2012) uptake of these opportunities has been slow, particularly in regulatory carbon markets. High transaction costs are normally blamed for the slow growth in LULUCF projects (Tietenberg et al., 1998; van Kooten et al., 2002). Stavins (1995, p.134) states that transaction costs “are ubiquitous in market economies and can arise from the transfer of any property right because parties to an exchange must find one another, communicate, and exchange information”. In the case of LULUCF, carbon transaction costs are high because the property right to be exchanged is difficult to measure and its exact size is subject to uncertainty. In carbon offset projects that pay for CO_2 sequestered in biomass and soils, it can be expensive to predict outcomes and monitor compliance with contract terms over large and heterogeneous geographical areas. Transaction costs also arise from the difficulty in setting baseline emissions pathways, as well as uncertainty regarding the permanence of carbon stocks contained in biomass and soils. The risk of reversal of a land use after payment has been received increases the costs of monitoring and enforcement and may lead to litigation costs.

The presence of ex-ante costs to develop baselines and predict outcomes of alternative land uses, as well as the fixed and annual costs of certifying carbon offsets, means that landholders, particularly smallholders, are unlikely to participate in the carbon market directly as individuals. Their participation needs to be mediated by aggregators that pool a number of individual farmer contracts into a “carbon project”. Pooling a large number of contracts allows aggregators to gain economies of scale and manage risk (Henry et al., 2009; Mattsson et al., 2009).

In the absence of transaction costs, the feasibility of a carbon project will ultimately depend on the opportunity costs experienced by landholders switching land uses to supply carbon offsets. Land productivity, alternative land uses, wage rates, resource endowments and other location-specific factors affect these opportunity costs. Many carbon sequestration options with low opportunity cost have been reported in the literature (de Jong et al., 2000; FAO, 2009, 2010; Parks and Hardie, 1995; Wright et al., 2000), representing a

[1] United Nations Framework Convention on Climate Change.

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