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Analysis

A Global Survey and Review of the Determinants of Transaction Costs of Forestry Carbon Projects

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ABSTRACT

Reducing carbon emissions in the forestry sector by means of market-based schemes is considered a cost-effective measure for tackling climate change impacts. However, the transaction costs (TCs) involved are typically unknown or unquantified and therefore often neglected. In this study three types of TCs (search, design and negotiation costs) were measured in person-days and monetary terms based on a global survey of forestry carbon projects implemented across Latin-America, Asia and Africa. Cost estimates vary between zero and 1.201/tCO_2 for person-days and from zero to US$ 1.738/tCO_2 for monetary costs. Key drivers of TCs are identified based on the characteristics of the project in general, the transaction, the transactors involved and institutional design. The latter type of characteristic is shown to have a particularly large impact on TCs.

1. Introduction

Since the establishment of the Clean Development Mechanism (CDM) negotiated under the Kyoto Protocol, marketing carbon credits generated from forests has been considered a promising mechanism for mitigating the consequences of climate change. This is due to its assumed cost-effectiveness and potential scope for carbon emissions reduction (Eliasch, 2008; Houghton, 2005; IPCC, 2000; Nabuurs et al., 2007; Stern, 2006). The fundamental principle of marketing carbon credits is that since carbon is a uniformly mixed pollutant, carbon emitted by industrial countries can be offset by emission abatement activities carried out in developing countries, provided the reduction is additional and without leakage. Within the CDM, industrialized countries are allowed to implement emission reduction projects, including afforestation and reforestation, in developing countries as a way to offset their domestic emissions, hence meeting the Kyoto Protocol's targets. In parallel with an internationally regulated CDM market, a voluntary carbon market has been developed as well, where firms and other organizations can voluntarily compensate for their emissions by purchasing forestry carbon credits generated elsewhere (Bumpus and Liverman, 2008). Additional to A/R, the voluntary market also favours the trading of carbon credits generated from avoided deforestation and sustainable forest management. To ensure the quality of carbon credits (*i.e.* additionality, no leakage and permanence), credits obtained from both the compliance (CDM) and voluntary (non-CDM) markets are subject to a verification process in which specific standards are used. Being viewed as a new form of environmental governance, these two market-based mechanisms are anticipated not only to help contribute to combating the consequences of climate change, but also to act as a new source of funding from developed to developing countries (Lederer, 2011).

Although forestry carbon projects are expected to help reduce emissions at low cost, little is known about their transaction costs (TCs), *i.e.* the resources used to define, establish, maintain and transfer property rights between transactors (McCann et al., 2005). In fact, the TCs incurred by the various actors are typically neither known nor quantified and are therefore usually neglected in project design and evaluation (Challen, 2000; Falconer and Whitby, 1999; McCann et al., 2005). A number of studies have attempted to estimate the size of the TCs associated with forestry management (see the work so far by Adhikari and Lovett, 2006; Alston and Andersson, 2011; Cacho et al., 2013; Milne, 1999; Ray and Bhattacharya, 2011; Thompson et al., 2013; Wunder et al., 2008). However, studies attempting to identify the factors driving or determining these TCs are lacking. On the one hand, TCs are not transparent owing to their confidentiality and inherent political sensitivity, as they are often viewed as wasteful and inefficient. As McCann et al. note (2005, p. 536), "access to the necessary data is a major problem faced by researchers examining transaction costs". On the other hand, measurement of TCs is complicated as a result of divergent definitions.

The purpose of this study is to further develop existing analytical frameworks to assess factors influencing TCs incurred by project developers in forestry carbon projects and apply this framework to practical

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cases. The analytical framework developed here builds on the work by Antinori and Sathaye (2007), Coggan et al. (2010, 2013), McCann (2013), Mettepenningen and van Huylenbroeck (2009), and Williamson (1979, 1996). With respect to application of the framework, our objective is first to quantify the size of TCs and second to determine their main driving factors and how these impact the TCs of marketing forest carbon credits. Given the fact that heavily forested nations in developing countries can make a major contribution to reducing carbon emissions, this study analyses and evaluates carbon-credit-generating forestry projects implemented in Latin-America, Asia, and Africa.

The article is structured as follows. Section 2 explains the analytical framework of TCs in forestry carbon projects. In Section 3 we describe in more detail the data set employed in this study. The main results from applying the analytical framework to selected projects and their economic implications are discussed in Section 4. Finally, Section 5 concludes.

2. Analytical Framework

2.1. Definition of Transaction Costs

Although there is a growing body of literature examining TCs, a universally agreed and fit-for-all definition for this type of cost is lacking (Chadwick, 2006; Falconer and Whitby, 1999; Garrick et al., 2013; Mettepenningen et al., 2009; Meshack et al., 2006; Mundaca et al., 2013; Wang, 2007). In practice, TCs are usually defined based on the activities that generate the costs (see for different definitions: Dahlman, 1979; Matthews, 1986; Woerdman, 2004). McCann et al. (2005) classify the TCs associated with public policies into seven subgroups, namely research and information; enactment; design and implementation; support and administration; contracting; monitoring; and enforcement. Grieg-Gran and Bann (2003: 36) describe the TCs of payments for ecosystem service (PES) schemes as the costs of "seeking, negotiating, agreeing, implementing, monitoring and certifying deals". In a similar manner, Wertz-Kanounnikoff (2006) describes the component elements of PES TCs as the costs of (i) identifying an ecosystem service's sellers and buyers, (ii) quantifying the services and the opportunity costs of conservation, (iii) negotiating and structuring deals, and (iv) implementing accountability and transparency mechanisms within the existing political and legal framework (*i.e.* monitoring and enforcement). Variations in the definitions of TCs imply that this concept can be operationalized in a variety of ways and also depends on "the influence of multiple theoretical traditions and analytical frameworks in transaction costs analysis" (Garrick et al., 2013: 182).

Given the fact that some of the selected projects are still in the pipeline, in this paper we only examine TCs associated with activities undertaken prior to implementation of forest carbon projects, *i.e. ex ante* TCs[1]: search for relevant information, project design, and negotiations of contractual agreements. Moreover, our study only focuses on the private TCs incurred by project developers. An investigation of public TCs borne by the government such as costs relating to the approval of project design or any public administrative costs emerging during project operation (Mettepenningen et al., 2009; Milne, 1999) is beyond the scope of this study. The definitions of TCs employed in this paper are based partly on the categorization used for CDM projects developed by Milne (1999). *Search costs* are defined as the costs incurred in obtaining information about the project area, project participants and other legal issues. *Design costs* are the costs incurred in designing the project, including development of (i) an implementation plan, (ii) the methods used for carbon quantification, monitoring, credit verification and certification, and (iii) an assessment of the potential environmental and socio-economic impacts of the proposed project. *Negotiation costs* are the costs incurred for reaching agreements between the project participants on their rights and responsibilities, and any enforcement rules once they participate in the project. Negotiations are needed in order to make sure all parties agree with the contract terms and conditions. Negotiations can take place *via* a series of face-to-face meetings or through telecommunication, as also reported by the contacted project developers in our study. All three of these TCs are measured on a per tonne of carbon basis, and hence the impacts of factors presented later on in this study are related to TCs per tCO_2 rather than total project TCs.

2.2. Driving Factors of Transaction Costs and Expected Directions of Influence

To facilitate our analysis and capture the particular nature of forestry carbon transactions, we employ a combination of analytical frameworks developed by Antinori and Sathaye (2007), Coggan et al. (2010, 2013), McCann (2013), Mettepenningen and van Huylenbroeck (2009), and Williamson (1979, 1996). Among these, the standard framework introduced by Williamson (1979) is most frequently referenced in all other subsequent work. According to Williamson (1979, 1996), the size of TCs depends on the transaction's characteristics, the transactors' characteristics, the governance structure (or institutional arrangement), and the institutional environment in which the transaction takes place. Coggan et al. (2010, 2013) utilize most of Williamson's work, with more details being incorporated to better fit the context of environmental policies. Adopting a slightly different approach, McCann (2013) classifies the determinants into physical (*e.g.* asset specificity, uncertainty, scale of intervention, heterogeneity, public *versus* private goods), cultural (*e.g.* level of trust, notion of fairness, social capital), and institutional factors (*e.g.* property rights, existing law and policies, market structure). In the context of European agri-environmental schemes, Mettepenningen and van Huylenbroeck (2009) categorize factors influencing private TCs into institutional, farmer-, farm- and scheme-related factors. Antinori and Sathaye (2007) introduce a tiered model for analyzing TC determinants based on societal attributes (societal norms and culture), governmental attributes (government institutions, laws, policies), and individual and transaction attributes (asset specificity, uncertainty, frequency, project size).

Based on these frameworks, we identify four main groups of driving factors (Fig. 1): transaction characteristics, transactor characteristics, institutional design characteristics, and general project characteristics. Below, we describe each group of influencing factors in more detail. It should be noted that owing to the difficulty of measuring some factors, not all drivers mentioned below can be analyzed and reported.[2]

2.2.1. Transaction Characteristics

We define the first group of driving factors, *transaction characteristics*, as six sub-groups: asset specificity, (bio-physical) uncertainty, contract's frequency, project duration, co-objectives, and the sale of carbon credits. The first four factors were developed by Williamson (1979), of which asset specificity is the extent to which an investment in a good can be redeployed to alternative uses or by alternative users without loss of productive value. Asset specificity can be classified into spatial specificity (*e.g.* downstream water users can only buy clean water provided by upstream suppliers), physical specificity (the transaction requires specialized machinery and infrastructure), and human specificity (capacity building and training). A high level of asset specificity will increase TCs (Coggan et al., 2013; Williamson, 1985) due to increasing information requirements for implementation, contracting, administration, and monitoring. The second element, bio-physical uncertainty, refers to the uncertainty in determining the outcome of a transaction, resulting from (i) complexity of the asset, (ii) asymmetric

[1] The reason why we only focus on *ex ante* TCs is due to the fact that we initially targeted a large number of pipeline projects and therefore did not include questions about *ex post* TCs in our survey. However, the response rate for these projects turned out to be very low, making it impossible to compare *ex ante* and *ex post* TCs.

[2] In the end, we were able to measure most of the factors except for asset specificity, uncertainty, opportunism, bounded rationality, and social capital.