Designing REDD+ contracts to resolve additionality issues ☆

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ABSTRACT

To address the issue of potential information asymmetries inherent in the estimation of deforestation baselines required by the current Reducing Emissions from Deforestation and Forest Degradation+ (REDD+) scheme, we offer a theoretical analysis of an extended scheme relying on the theory of incentives. We compare two types of contracts: a deforestation-based contract and a policy-based contract. Each of them implies a dramatically different information rent/efficiency trade-off due to domestic implementation and transaction costs. If the contract is deforestation-based (resp. policy-based), information rents are awarded to countries with the *ex ante* lowest (resp. highest) intended deforestation. We show that a general contract can be offered to recipient countries in which the type of instrument proposed is endogenous, independent of the historical trend, unlike the current REDD+ mechanism. Dividing countries into two groups corresponding to the deforestation-based instrument and the policy-based instrument helps the donor country to obtain efficient deforestation and avoided deforestation levels.

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1. Introduction

One of the primary sources of carbon emissions is deforestation and forest degradation, which is responsible for total anthropogenic greenhouse gas emissions of approximately 12% (van der Werf et al., 2009; IPCC, 2014). These emissions are the second highest human-induced source of climate change (Lederer, 2011). There is an urgent need to cope with deforestation because induced climate change costs were estimated to increase to US$ 1 trillion by the 2100 time horizon (Eliasch, 2008). According to Kindermann et al. (2008), curbing deforestation is not an infeasible task, and Eliasch (2008) states

that 3.5 Gt CO_2 could be saved per year in the forest sector at relatively low cost compared to the abatement alternatives in other sectors. Consequently, to address the deforestation and forest degradation issue, the international community has been promoting the Reducing Emissions from Deforestation and Forest Degradation+ (REDD+) scheme as a part of the post-Kyoto architecture.[1]

After being introduced at the international level as a proposal at the 11th Conference Of the Parties (COP11) to the United Nations Framework Convention on Climate Change (UNFCCC) in Montreal 2005, the REDD scheme was conceptualized at COP13 in Bali 2007, extended to REDD+ in 2008 by the Subsidiary Body for Scientific and Technological Advice (SBSTA) established at COP13, and it became a formal policy at COP19 in Warsaw 2013. The original idea of the REDD+ scheme is rather simple and intuitive: developed countries delegate a part of their climate change mitigation obligations to developing countries through a contract by rewarding them to implement reductions in carbon emissions from forests, while covering their opportunity costs to do so by potentially altering their development paths or at least by stopping some of the marginally profitable forest conversion. This payment occurs either through a direct monetary transfer or through carbon offsets or credits saleable on the carbon market. The payment-basis lies in per unit reductions of deforestation in comparison to a *baseline* that needs to be agreed upon. As a consequence, the additionality issue is crucial because the contract must ensure that "*one is only paying for emissions reductions or stock enhancements that come on top of what would have happened without the contract*" (Angelsen, 2010). According to Karsenty and Ongolo (2012), the originality of REDD+ lies in its incentive properties because it intrinsically rewards states for their achievements in actions against deforestation. However the additionality issue gave rise to an intense debate, that underlined the risk of rewarding *tropical hot air*, *i.e.*, avoided deforestation that would also have been achieved without the REDD+ contract (Angelsen, 2008a).

The aim of this paper is to complement the pragmatic approaches adopted until now with a theoretical analysis to propose a cost-efficient alternative REDD+ mechanism, that avoids the inefficiencies of the current agreements due to potential information asymmetries. The objectives are then to take explicitly into account the risk of *hot air* due to *ex ante* asymmetric information and to theoretically design the ideal cost-efficient REDD+ scheme as a contractual relationship between countries in the light of the theory of incentives. To the best of our knowledge, there is no analytical paper of the REDD+ scheme in terms of the theory of incentives with a Principal–Agent relationship under this kind of asymmetric information[2] and exogenous implementation and transaction costs.

In the literature however, several studies have been interested in climate change mitigation and low cost policies compared to costly abatement of fossil fuel emissions, particularly regarding avoided deforestation (Heal and Conrad, 2006; Murray et al., 2009, 2013; Combes-Motel et al., 2009). With regards to tropical deforestation, van Soest and Lensink (2000) underline how conditionality on international aid transfers can improve short-run and long-run forest conservation. In a dynamic setting, they propose a transfer function that rewards developing countries both positively with the forest stock and negatively with the deforestation rate. Further to this approach, Ollivier (2012) studies the REDD+ mechanism as an international transfer and its impacts in the long-run on developing countries' growth. She analyzes the impacts of low and high transfer schemes to prevent agricultural land expansion and the interplay with the manufacturing sector.

In a contractual perspective, Karsenty and Ongolo (2012) describe literally how the theory of incentives is at the core of the REDD+ scheme, whereas Kerr (2013) and Angelsen (2017) propose to design results-based agreements and result-based aid (RBA), respectively, for REDD+ through a Principal–Agent framework. However, they do not consider formally incomplete information issues in using this framework. From our side, we distinguish our approach while using the theory of incentives with a Principal–Agent relationship in designing contracts with informational issues (Laffont and Martimort, 2002). This approach has been used by Martimort and Sand-Zantman (2016) in the context of multinational environmental agreements, by Mason and Plantinga (2013) to address the additionality issue raised by carbon offsets in the contracts offered by a government to landowners to induce carbon sequestration in forests, and by Horowitz and Just (2013) in the case of payments for environmental services to agricultural firms.[3,4] Plantinga and Richards (2010) acknowledge the additionality issue implied by the REDD+ contracts and propose to replace the historical deforestation baselines with negotiated baselines to induce participation and to mitigate the adverse selection issue.

Building on a thorough analysis of the REDD+ scheme, we show how the confusion between the concepts of business-as-usual deforestation path and of reference levels can lead to reward hot air for some countries, and we propose on the contrary to base the contract only on observable variables. Even though we acknowledge that some moral hazard may also plague the relationship between a recipient country and landowners, mainly at the implementation stage, we concentrate on the adverse selection issue essentially because the latter has not been studied yet in this context whereas the former has already been broadly analyzed in the literature.[5] As a consequence, we analyze the REDD+ mechanism in a reduced form way,

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[1] In this paper, we refer for simplicity to REDD+ that extends the original REDD scheme to conservation of forest, sustainable management of forest and forest enhancement.

[2] Because we want to focus on the impact of asymmetric information, we do not consider the uncertainties about the future values of the drivers of deforestation; these uncertainties are shared between parties.

[3] Sheriff (2009) proposes an empirical methodology to calibrate such a second-best land conservation mechanism.

[4] Note that there is an extensive literature dedicated to the optimal conservation programs in analyzing optimal compensation schemes at the farm level to overcome information asymmetry between farmers and governments, see Wu and Babcock (1996) and Arguedas and van Soest (2011) among others.

[5] For example, MacKenzie et al. (2012) analyze international carbon sequestration contracts as enforcement-proof incentive schemes in which a buyer provides an investment for afforestation or reforestation projects to a seller in a developing country. In their framework, the buyer demands a guaranteed