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Analysis

The incentives of private companies to invest in protected area certificates: How coalitions can improve ecosystem sustainability

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ABSTRACT

Since the early 80's, the global demand on nature has exceeded the earth's capacity. To reduce the overuse of the very resources on which human life depends, protected areas have been developed worldwide. Typically, national states, NGOs and charities have funded protected areas, with limited investment from private companies. This paper analyzes one option to increase private investment: an international market for protected area certificates. Following a cost–benefit analysis, a three-stage coalition game is developed. The corporate dependency on ecosystems is modeled through the ecological footprint. By implementing instruments such as side payments, membership restriction and non-compliance penalties, the model shows that corporate environmental agreements reduce the individual cost of ecological protection and enhance social welfare. The findings are supported by a sensitivity analysis conducted for the German tourism sector in Zanzibar.

1. Introduction

The development of a representative network of protected areas is nowadays a well-established instrument for the conservation of ecosystems that provide a multitude of provisioning, regulating, cultural and supporting services (Duraiappah & Naeem, 2005). However, there is limited involvement of private companies in preserving areas with global importance (Emerton et al., 2006). To enhance private funding for protected areas, international certification markets are developed. Still in their infancy, these markets are being led through initiatives such as REDD+ and GDI (Carius, 2010).[1] There are two drivers of corporate environmental responsibility that are emphasized in literature: the image effect of environmental commitment; and the mitigation of corporate ecological risks (e.g. natural disasters, depletion of resources) (CDP, 2012a,b; Dummett, 2006; Koellner et al., 2010). Regarding the second driver, it should be considered that many ecosystem services are public goods characterized by non-rivalry and non-excludability (Pascual & Muradian, 2010). This leads to the problem that companies that invest in the preservation of ecosystems not only have to share the resulting benefits (positive externalities) but also suffer from the exhaustion of ecological resources caused by other market participants (negative externalities) (Tietenberg & Lewis, 2012).

The application of game theory shows that externalities are crucial for determining the behavior of strategic players as they constitute the basis for the free rider problem; a situation in which the individual self-interest of players leads to a social outcome that is not Pareto optimal (Barrett, 2007). Environmental agreements (EAs) aim to overcome such social dilemmas and are typically described by cooperative approaches that are based on the concept of the core (Chander & Tulkens, 1997) or by non-cooperative approaches that follow internal and external stability conditions (Barrett, 1994; Carraro & Siniscalco, 1993). The objective of cooperative game theory is to distribute coalition payoffs in a manner that enables forming the socially optimal grand coalition. The core defines the set of payoff vectors that cannot be improved by any subgroup of players (Esteban & Dinar, 2013). In contrast, non-cooperative games develop individual payoff functions for each player under a given transfer scheme to predict sustainable coalition structures. A detailed overview of the different methods is given in Chander and Tulkens (2008) and Finus (2003).

So far, scientific EA studies that applied coalition game approaches either focused on the design of international EAs between countries that face global public good allocation problems (Barrett & Stavins, 2003; Finus et al., 2009) or on the cooperation between locally affected agents (e.g. companies, residents, neighboring countries) that sustainably manage common-pool resources (Abbink et al., 2005; Ambec & Ehlers, 2008). In order to extend the applicability of coalition games and analyze the incentives of private companies to invest in the sustainability of ecosystems, this article introduces a novel non-cooperative coalition game model. Basically, we assume that an international market for so called

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[1] The Reducing Emissions from Deforestation and Forest Degradation (REDD) scheme was adopted in the Bali Action Plan of the United Nations Framework Convention on Climate Change during the 13th session of its Conference of the Parties COP-13 held in Bali in 2007 with the aim to create incentives for emission reductions in developing countries. The COP-16 agreement on REDD+, which was established in Cancún in 2010, additionally considers the role of conservation measures, sustainable forest management and enhancement of forest carbon stocks. The Green Development Initiative (GDI) responds to the Convention on Biological Diversity by establishing an international standard and certification system that supports land management plans. GDI started with its two-year pilot phase in 2012.

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protected area certificates (PACs) exists. The land based certificates cover a defined geographical area and certify that the ecological values of this area are maintained in accordance with specific standards. By purchasing PACs, companies not only have the possibility to provide financial support for the conservation of nature but also to offset their impact on ecosystems and label their products accordingly. We further suppose that companies can choose in which projects they invest, and thus which ecosystem benefits are generated. The certificates do not grant any property rights so that companies do not obtain an improved access to preserved resources. In fact, the protected areas are either managed by government agencies, environmental charities or the local community (Dudley, 2008). Given this scenario, a coalition is defined as a corporate EA that enables signatories to collectively cope with and manage ecological challenges through a mutual obligation to buy PACs. Corporate EAs determine the number and type (e.g. origin, provided ecosystem services) of PACs that signatories are required to buy in a certain period, and can be part of a public or company driven environmental initiative. To appeal to both large companies as well as small and medium sized enterprises (SMEs), a transfer scheme is installed.

The model comprises two differences to previous EA models. First, non-cooperative coalition formation models are typically described as two-stage games in which players first decide on their participation, and second on their economic strategy (complete plan of action) and side payment schemes (Finus et al., 2009; Pintassilgo & Lindroos, 2008). In contrast, the presented model is based on a three-stage game approach adding another decision level at the beginning of the coalition formation process. The extension of the game is due to the image effect of environmental commitment. Depending on the behavior of their strategic opponents, companies might even be interested in buying PACs without the existence of a corporate EA. The image effect is also the reason for the second difference in model design. Here, price premiums reduce free rider incentives of private companies. If the extra revenue is sufficiently high, no free riding incentives might exist at all.

The objective of the study is to evaluate the feasibility of an international market for PACs. Chapter 2 starts with a cost–benefit analysis in order to describe corporate incentives to invest in the sustainability of ecosystems. In chapter 3, the design of the three-stage coalition game model is specified. PAC threshold price developments are displayed for individual as well as for common behavior of market participants and a regulatory framework is suggested to create coalition stability. After the theoretical construction, chapter 4 illustrates the derived propositions in a numerical example applied for the German tourism sector in Zanzibar by using a sensitivity analysis approach. Finally, chapter 5 draws a critical conclusion and presents an outlook for future work.

2. Incentives of Private Companies to Invest in PACs

The process of modeling the PAC investment decision of private companies starts with a cost–benefit analysis. As already mentioned, there are two main drivers for voluntarily protecting ecosystems. First, the image effect of environmental commitment. Through the certification of environmental performance, companies have the opportunity to communicate their ecological objectives and increase their reputation in society (McWilliams & Siegel, 2011). If final products are labeled with ecological achievements (Grote et al., 2007; Rotherham, 2004), the image effect might even allow companies to differentiate their product portfolio, strengthen the brand and in the end realize a price premium (Dörr, 2008; Juutinen et al., 2011; Porter & Kramer, 2006). The second driver is the protection of ecosystems to mitigate ecological risks that have a direct influence on the business of a company and its supply-chain (Trucost, 2013). The higher the risks, the more a company stands to gain from the long-term conservation of nature (CDP, 2012a,b). The model uses the ecological footprint concept to consider a company's exposure to ecological risks. The corporate ecological footprint describes the company's dependency on ecosystems by measuring the amount of biologically productive land and water area a company requires to sustain its business and absorb its created waste (Wiedmann et al., 2006). It is naturally understood that the overall capacity of ecosystems in terms of resource production and waste absorption is limited (Rockström et al., 2009). The ability of ecosystems to regenerate without human intervention is expressed by the earth's biological capacity. Both the ecological footprint and the biological capacity are measured in global hectares (gha); a hectare with world average productivity. To control for variation in geographic conditions and specific land area types, local productivity is adjusted via yield factors (ratio of national to world average yield per hectare) and equivalence factors (conversion of relative productivity of land area types into world average biologically productive area) (Ewing et al., 2010; Wackernagel, 1994; Wackernagel & Rees, 1996). Looking at the expected cost of acquiring PACs, one has to distinguish between direct and indirect components. Direct costs contain the expenditures for the actual establishment, management and certification of protected areas, e.g. labor, administration and monitoring costs, as well as the costs that are connected with the development of the initial standard and certification scheme. In contrast, indirect costs consider the externalities that stem from the provision of a public good (Grote, 2009; Karousakis & Brooke, 2010). Merging benefits and costs, the following payoff function can be set up.

$$u_{ij} = \Pi_{ij,0}\left(p_i^*, \mathbf{x}_j^*\right) - p^Z \cdot Z_{ij} + p_i^P \cdot Y_{ij}^e + \widehat{p}^Z \cdot \gamma_i \varepsilon_{ij} \cdot b(Z) \tag{1}$$

Let C be the set of all green companies that buy PACs, F the set of all free riders and S_i the set of all companies in sector i. In the business as usual scenario, company $j \in S_i$ gains a net profit $\Pi_{ij,0}$ by choosing the optimal factor input $\mathbf{x}_j^* = (x_{j1}, \dots, x_{jm})$ at the market equilibrium price p_i^* with $m \in \mathbb{N}_+$. A part of the price p^Z for every purchased certificate Z_{ij} is needed to assure the accuracy of the PAC label and develop an appropriate standard and certification scheme. The remainder depends on the location of the protected area and specifies the expenses required for the preservation of one global hectare of land. A contributing company $j \in C$ that decides to invest in PACs can forward a part of the occurring certification costs to its customers whose share α_i is willing to pay a price premium p_i^P for PAC labeled products. Assuming that a company acquiring PACs wants to satisfy the whole demand of its environmentally conscious customers, not less than $Y_{ij}^e = \alpha_i f_i(\mathbf{x}_j^*)$ certificates have to be purchased with $f_i(\mathbf{x}_j)$ accounting for the production function that is increasing and concave in the number of factor inputs. The calculation of PACs that are used for product labeling is based on two assumptions. First, transaction costs for supplier changes are deemed to be sufficiently high so that eco-friendly customers from competitors cannot be lured away. Second, companies that decide to offer ecologically labeled products Y^e at a price $p^* + p^P$ continue to put normal products Y^o at a price p^* up for sale. Thus, PAC investors not only serve their environmental conscious customers α_i but also free riding customers $(1–\alpha_i)$ that refuse to pay a higher price. An upper limit for PAC investment does not exist. Hence, the quantity of certificates purchased by a green company can be extended by the amount Z_{ij}^+ with $Z_{ij} = Y_{ij}^e + Z_{ij}^+$. A free riding company $j \in F$ neither suffers from certification costs nor does it have the possibility to get a price premium for its products ($Z_{ij} = Y_{ij}^e = 0$).

The benefits of ecological risk mitigation derived from the development of protected areas are described by the function $b(Z)$ that is increasing and concave in the number of certificates purchased by all market participants. To get a monetary value, the benefit function is valued at the average price $\widehat{p}^Z$ for one global hectare of protected land. Furthermore, the benefit function is weighed by the corporate dependency on ecosystems to account for the profit that can be directly assigned to a company and for the indirect costs of providing a public good. A company's dependency on ecosystems is expressed by the corporate share of the total ecological footprint EF that results from multiplying sector i's dependency $\gamma_i = ef_i/EF$ by the market share of the company