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The Impact of Fairness on Side Payments and Cost-Effectiveness in Agglomeration Payments for Biodiversity Conservation

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ABSTRACT

Agglomeration payment schemes aim at increasing the spatial connectivity of conserved land. Such payments are offered by a conservation agency to landowners subject to the condition that the conserved land is sufficiently connected to other conserved land. Facing this connectivity condition, landowners with conservation costs below the payment may need to offer some of their surplus through side payments to other landowners with high costs so that these conserve their land and the connectivity condition is met. Previous papers that modelled side payments in agglomeration payment schemes ignored that landowners may be sensitive to fairness and distributional issues. To incorporate fairness issues I relate a model of an agglomeration payment scheme to the well-known ultimatum game and show that if landowners are concerned about fairness and distribution the agency must offer higher payments and has to expect lower levels of cost-effectiveness.

1. Introduction

Conservation on private lands becomes increasingly important to meet global biodiversity goals. Common instruments for biodiversity conservation on private lands are compensation payment schemes. In these schemes landowners carrying out biodiversity-friendly measures are compensated for the associated profit losses. In Europe billions of Euros are spent on agri-environmental schemes every year (EU, 2010). In the US, voluntary schemes like the Conservation Reserve Program and the Wildlife Habitat Incentives Program induce landowners to manage their land in a biodiversity-enhancing manner (Lewis et al., 2011). Also in developing countries payment schemes, termed payments for environmental services, considerably gain in importance (Landell-Mills and Porras, 2002; Engel et al., 2008).

Usually these schemes are spatially homogenous in that the same payment is offered per unit area, independent of the location of the land on which the conservation measures are carried out. From an ecologically point of view this can be ineffective, because the value of a habitat for a species often depends on the habitat's proximity to other habitat (Hanski, 1999; McDonnell et al., 2002; Schulte et al., 2008; Drechsler, 2011). To increase the ecological effectiveness of payment schemes Parkhurst et al. (2002) proposed an "agglomeration bonus" that targets not only the total amount but also the spatial connectivity of land on which conservation measures are applied. Technically, such a bonus is paid on top of a homogeneous payment if the spatial connectivity of land with conservation measures meets a certain target set by the conservation agency. By this the agglomeration payment is a payment that is contingent on the achievement of some environmental target and, consequently, on some minimum participation level of the landowners. With these two features – the joint provision of a public good and the necessity of a minimum participation level to provide that good – the present management problem may be regarded as a public goods game (e.g., Gunnthorsdottir et al., 2007).

The agglomeration bonus and the ecological and economic effects of spatial agglomeration are receiving increasing attention in the literature both from a theoretical (Parkhurst and Shogren (2007, 2008), Drechsler et al. (2010)) and an applied (Lewis and Plantinga (2007), Schulte et al. (2008), Juutinen et al. (2009), Lewis et al. (2011)) perspective.

Due to their higher ecological effectiveness agglomeration bonus schemes may be more cost-effective than homogenous payments, i.e. provide higher levels of biodiversity for a given conservation budget. In an empirical analysis Lewis et al. (2011) confirmed that incorporating incentives for spatially agglomerating biodiversity-enhancing land-use measures increases the cost-effectiveness of the payment scheme. In a theoretical analysis Drechsler et al. (2010) investigated under which ecological and economic circumstances these cost-effectiveness gains are likely to be highest. The authors consider an "agglomeration

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payment" where landowners receive the full payment if the desired level of spatial aggregation is achieved and nothing otherwise. In that sense, the agglomeration bonus of Parkhurst et al. (2002) is a hybrid between a homogenous payment and an agglomeration payment. Wätzold and Drechsler (2014) showed that the cost-effectiveness of the agglomeration bonus always lies between that of the homogenous payment and the agglomeration payment, so either the homogenous payment is preferred to both agglomeration bonus and agglomeration payment or the agglomeration payment is preferred to the bonus. Therefore I consider only the agglomeration payment and not the bonus in the present paper.

Drechsler et al. (2010) found that the cost-effectiveness of the agglomeration payment is determined by three effects: the connectivity effect that measures the increased biodiversity benefits associated with the spatial aggregation of conservation measures and is most pronounced if the species dispersal ability is low; the patch selection effect which considers that conservation costs are usually spatially heterogeneous and spatial aggregation is likely to increase the unit cost of conserved land; and the surplus transfer effect which arises if the agglomeration target set be the agency can be met only if landowners whose costs exceed the agglomeration payment participate in the scheme, as well. Landowners whose costs are below the agglomeration payment therefore have an interest to induce the participation of those former landowners by offering them side payments. Drechsler et al. (2010) found that in most circumstances the connectivity and surplus effects dominate the patch selection effect so the agglomeration payment is generally more cost-effective than a homogenous payment and efficiency gains may be as large as 70%.

Drechsler (2011), in contrast, showed that without surplus transfer through side payments the spatial aggregation of land with conservation measures leads to efficiency losses if the dispersal ability of the species and/or the spatial variation in the conservation costs is high. Obviously the surplus transfer effect can be decisive on whether an agglomeration payment (or bonus) will be more or less cost-effective than a homogenous payment. Given the decisive role of the surplus transfer effect, the question arises whether side payments will actually take place in a real-world application.

Two approaches to answering this question are experimental economics and game theory. In the context of agglomeration payments these approaches have been applied by Parkhurst et al. (2002) and Parkhurst and Shogren (2007, 2008) who found that landowners are likely to cooperate to meet the agglomeration target set by the conservation agency. Banerjee et al. (2011) introduced transaction costs into the analysis of an agglomeration bonus scheme and Banerjee et al. (2012) explored the effect of the number of landowners on the level of coordination. These studies, however, neither addressed the cost-effectiveness of the payment scheme nor did they allow for side payments among the players. Bell et al. (2016) analysed an agent-based model with side payments and showed that these may enhance adoption of the payment scheme. However, they did not ask whether side payments take place at all.

The question of whether transfer payments between different actors take place has been investigated extensively through experiments in the context of the ultimatum game. Güth et al. (1982) is one of the first papers on the ultimatum game, followed by numerous others. In this two-player game one player is given an amount of money (π) a share (π_2) of which he is asked to offer to the other player. If player 2 accepts the offer s/he receives the offered amount π_2 and player 1 keeps $\pi_1 = \pi - \pi_2$. If in contrast player 2 rejects the offer both players receive nothing. In that manner player 2 can punish player 1 if s/he feels the offer is not sufficient. A "rational" player 2 gains no satisfaction from such punishment and instead will maximise his/her profit and accept any non-zero offer. Experiments, however, show that players also reject non-zero offers if these are regarded insultingly low. In the context of surplus transfer within an agglomeration payment scheme, landowners with positive surplus have the role of player 1 while landowners whose conservation cost exceeds the agglomeration payment have the role of player 2. The former type of landowners may offer a side payment to the latter type of landowners to induce his/her participation in the scheme.

Drechsler et al. (2010) assumed profit-maximising and "ideal[1]"-landowners who (i) are ready to offer up to their entire surplus to ensure that the surpluses of all landowners (whose participation in the scheme is required to meet the agency's agglomeration target) is positive, and (ii) landowners who accept any side payment as long as this provides them with a positive surplus (i.e., agglomeration payment plus side payment exceeds conservation cost). Under these two assumptions the only condition for meeting the agency's agglomeration target is that the aggregated surplus for all participating landowners is positive. In the present study I relax the two assumptions and consider that (i) landowners may offer less than their entire surplus, and (ii) landowners may not accept an offered side payment despite a resulting positive surplus, because they may feel the offer is too low. The reasons for these assumptions are that people care about fairness and equality (e.g., Johansson-Stenman and Konow, 2010), and so insultingly low offers are rejected (point (ii)). Higher side payments may need to be offered to reach a more even income distribution and avoid rejection, but landowners may hesitate to offer their entire surplus (point (i)).

The agency can respond to this behaviour in two ways: it can lower the agglomeration target and/or increase the agglomeration payment. Both options affect the cost-effectiveness of the agglomeration payment and I determine how the cost-effective design and the cost-effectiveness of the agglomeration payment depend on the landowners' behaviour. I show that whatever option the agency chooses, the cost-effectiveness of the agglomeration payment will be lower compared to the case of the "ideal" landowners considered by Drechsler et al. (2010) and explore the magnitude of this efficiency loss. For the analyses I develop an analytical model and solve it numerically. Model parameters are varied systematically to obtain a general understanding of the implications of landowners' behaviour. The present paper proceeds as follows: in the next Section 2 I present the model, Section 3 contains the results of the model analysis, and Section 4 concludes.

2. Methods

2.1. Verbal Outline of the Model

A model landscape is considered that consists of a number of patches each of which can be used for agricultural production or conservation. Conservation incurs an opportunity cost for which landowners need to be compensated financially by a payment p. As assumed by Drechsler et al. (2010), the compensation p is paid only to landowners whose patches are located within a certain subarea or zone of the landscape. In addition, the number of conserved patches in that zone must exceed a certain threshold specified by the conservation agency. In Drechsler et al. (2010) the size and location of the zone in the landscape is chosen by the landowners. In the present analysis I abstract from that question and consider a particular zone of given size but the agency can specify the threshold for the number of conserved patches, henceforth termed the habitat target.

Scaling the surplus of an agricultural patch to zero, the surplus of a conserved patch is given by the difference between payment p and opportunity cost. If that surplus is positive the patch is conserved; otherwise it is used for agriculture. Depending on the magnitude of the payment, the number of conserved patches in the considered zone may not be sufficiently large to meet the habitat target set by the agency

[1] "Ideal" is meant here from the point of view of the conservation agency which prefers cost-effectiveness of the payment scheme. Cost-effectiveness is achieved if the landowners care only about their aggregate surplus and not its distribution, because in this case the agency needs to offer only a payment that is just sufficient to obtain a (marginally small) positive aggregate surplus.