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Analysis

Forest owners' willingness to accept contracts for ecosystem service provision is sensitive to additionality

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ABSTRACT

A key prerequisite to ensure that payment for ecosystem services is effective is that the management measures landowners are paid to undertake are in fact additional to the status quo and hence bring about a change in provision. We investigated Danish forest owners' preferences for conditional contracts for the provision of ecosystem services in Natura 2000 policies in a sample covering 12.5% of the total private forest area. This involves allowing old trees to decay naturally, setting aside forest areas, accepting a fixed percentage of broadleaves and increasing access for the public. Forest owners may already provide some of these, e.g., if they derive private benefits from them, in which case additionality becomes an issue. This study investigates the link between forest owners' current management and their willingness to accept (WTA) payments for providing specific ecosystem services by eliciting current practice prior to a choice experiment on contracts. For most of these ecosystem services, owners differentiate their WTA significantly according to their current management. Owners who did not provide extended access had a mean WTA of €14/ha/year for accepting access up to 15 m from roads and paths and €28/ha/year for accepting access everywhere in their forest. However, forest owners who already allow extended access have a mean WTA around zero.

1. Introduction

The enhanced provision of ecosystem services from forests relies to a great extent on the forest management decisions made by private forest owners. In many European countries, a large percentage of the forest area is privately owned. Changes in private forest owners' management practices can be influenced by changes to the legal framework, e.g., demanding specific changes on private land. However, in recent years, focus on the potential of economic instruments to bring about efficient and legitimate changes in forest management has grown, particularly payments for ecosystem services[1] (PES, see, e.g., Engel et al., 2008; Wunder et al., 2008). According to Wunder et al. (2008), a PES contract is: (a) a voluntary transaction where (b) a well-defined environmental service or land use likely to secure that service (c) is 'bought' by at least one service buyer, (d) from at least one service provider, (e) on the condition that the service provider secures service (or management change) provision.

Wunder et al. (2008) also stress that for the performance of a PES-type contract to be efficient, it is important that the actions or services paid for are indeed additional in the sense that they have not already been carried out (provided), or would have been carried out (provided) in the absence of the contract. While the latter is difficult to observe in a counterfactual way in any specific case, the former may be observable to some extent ex ante, at least if information is not inherently asymmetric. The research question addressed here is as follows: *By obtaining information on forest owners' current management practices, is it possible to obtain ex ante estimates of the WTA for specific management changes that take into account the additionality aspect?*

Preference heterogeneity among forest owners is well documented, also in Denmark (Boon et al., 2004), and it is likely that some forest owners will derive private benefits from the management changes and the resulting changes in the forest ecosystem and services provided which we investigate here (untouched forest, allowing trees to decay naturally, increasing area with broadleaves and granting access). Therefore, their net loss is below the direct opportunity costs and financial losses, which may have an effect on their WTA and will certainly influence information rents when flat rate payment schemes are applied (Wunder et al., 2008; Juutinen et al., 2013) and information is private (Latacz-Lohman and van der Haamsvoort, 1997; Juutinen et al., 2013). A few papers examine evidence for preference heterogeneity in real conservation auctions and the related efficiency aspects (e.g., Vukina et al., 2008). Juutinen et al.'s study (2013) is the study which most closely resembles the current paper, as they calculate the likely information rents using a small sample of actual bids for the conservation of a small number of stands, and their likely financial value. Several studies have shown that

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[1] In the literature, payment for ecosystem services and payment for environmental services are both used extensively, but appear to refer largely to the same concepts and ideas.

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owners who have expressed environmental preferences or biodiversity concerns have reduced compensation claims when entering conservation contracts (Mäntymaa et al. 2009; Rabotyagov and Lin, 2013). More broadly, preference heterogeneity has been documented in both stated and revealed preference studies, which highlights the scope for potential targeting of contracts (Wilson and Hart, 2000; Vanslembrouck et al., 2002; Hudson and Lusk, 2004; Hackl et al., 2007; Ruto and Garrod, 2009; Broch and Vedel, 2012; Juutinen et al., 2008; Juutinen and Ollikainen, 2010), although none have concerned themselves with linking WTA measures with landowners' current management activities. Those who have come closest are Broch and Vedel (2012) who estimated the effect of already having forest on the property on farmers' WTA for afforestation schemes.

In this study we investigated forest owners' willingness to undertake specific management actions to enhance ecosystem services, with or without payments, on their property. We used a questionnaire including a choice experiment (CE) replication of contract choices. The ecosystem services chosen here, and the related forest management measures, are based on on-going policy debates in Denmark regarding access, biodiversity protection, e.g., in relation to NATURA 2000 initiatives, and the provision of clean groundwater for drinking water purposes. Prior to the choice experiment, we elicited information about the forest owners' current forest status and management practices, and we also elicited their own statements about current activities pertaining to the attributes of the CE.

The CE method has previously been applied to elicit landowners' preferences for policy initiatives regarding nature conservation on private land. Although the CE method has been applied in a vast amount of environmental valuation studies, its application in eliciting landowners' preferences for contracts is more limited (Hudson and Lusk, 2004; Horne, 2006; Ruto and Garrod, 2009; Espinosa-Goded et al., 2010; Broch and Vedel, 2012; Vedel et al., 2015).

The paper is structured as follows: first the econometric method and data collection are presented. A presentation of the results follows including a discussion about any potential interactions related to the forest owners' current management practices. This is then followed by the discussion and finally the conclusion.

2. Econometric method

Choice experiments are based on the random utility model (McFadden, 1973) and Lancaster's consumer choice theory (Lancaster, 1966). For a more detailed description of choice modeling in general, see Train (2009), as we only describe it briefly here. We assume that a respondent will choose an alternative *k* over another *j*, given that the former provides greater utility. The utility depends on the attributes of a specific alternative, but may also vary depending on the individual's characteristics, which in our case are described by the forest owner's current forest management practices. We gather variables describing all of these components in the vector *x*. To allow for heterogeneity between respondents, we model the choices using a random parameter logit model allowing for multiple choices of each respondent, and take advantage of the panel structure of the *N* choice sets on each individual which allows us to estimate individual βs. Thus, the probability that the *i*'th respondent will produce the sequence of *N* observed choices is:

$$\Pr = \int \left(\prod_{n=1}^{N} \left[\frac{\exp(\beta_i' x_{ikn})}{\sum_j^J \exp\left(\beta_i' x_{ijn}\right)} \right] \right) \phi(\beta | b, W) d\beta \quad (1)$$

where we assume a constant scale and $\phi(\beta|b, W)$ is a normal distribution function for β, with mean b and covariance W. Furthermore, we allow for a zero-mean error component (σ) with spread in order to capture the uncertainty associated with choosing the status quo as opposed to one of the alternative contracts (Greene and Hensher, 2007; Ferrini and Scarpa, 2007).

We calculate the marginal rate of substitution (WTA) using the Delta method (Greene, 2002), assuming no distribution around the price parameter. This is common practice to avoid the problem of identifying the distribution of a parameter calculated as the ratio between two random parameters. We tested models assuming a log-normal distribution around the price parameter and found that other parameters remained similar, as did the mean price parameter. Thus, the potential bias derived from assuming a fixed price is unproblematic.

In our model, we include variables which describe the current forest status and forest management practices related to the main attributes of the conservation contract alternatives. We interacted these variables with the relevant main attribute variables to obtain estimates of their effect on the stated WTA. Our general hypothesis is that a forest owner who has already set aside part of his/her forest as untouched or fully accessible, will reveal a different stated WTA from those who have not. Specifically, we would expect the WTA to be lower than for forest owners who have not already implemented such actions, but not necessarily zero, as the contract implies a restriction on future actions. We note that in Denmark, existing menus of contracts for payment for ecosystem services apply flat rates; however, site and context-specific opportunity cost calculations for individual measures are also applied, which reduces the scope for rents at poor sites with low opportunity costs, and enhances the incentive compatibility of our experimental context.

3. Data collection

Forest owners were sampled based on contact details obtained from the Danish National Forest Inventory, which applies a spatial grid to systematically select a random set of measurement plots which is therefore representative of the Danish forest area (Söderberg and Johannsen, 2000). This also allows us to identify a random set of forest owners, although it should be noted that the probability of being on the list depends on the amount of forest owned, i.e. owners of larger forest estates appear on the list with several plots. This allowed us to contact a random set of all forest owners, rather than relying on membership of forestry or agricultural organizations, or previous participation in subsidy schemes. From the total sample of contact details, a random set of forest owners was selected across a systematic stratification based on the number of times a forest owner appeared in the data, with owners of larger forests appearing more often due to the spatial grid applied. Thus, we oversampled the population of larger forest owners. As in several other European countries, forest ownership is characterized by extremely uneven property sizes. There are more than 25,000 forest owners in Denmark, but more than 20,000 own forest areas smaller than 10 ha. Yet, the largest 500 owners together own more than 50% of the total of private forests in the country. This implies a challenge for a study like this as these owners of large areas are very interesting from a policy perspective; however, randomly drawing the addresses may well result in a sample which only represents a small part of the forest area. Therefore, we decided to oversample the population of owners of large forests by allowing the probability of being selected to depend on the number of plots in the National Forest Inventory.

The data were collected through an online survey using the software SurveyXact in the period June–August 2012. The forest owners were contacted by letter which invited them to participate in the survey and included a brief explanation as to how potential respondents had been identified. The letter also included statements of support for the survey from the Director of the Danish Forest Association and the Director of the Danish Forest Owners Association. Furthermore, the letter contained a leaflet with brief information about the survey and the name of the website, where they could log-on to fill out the questionnaire online. The forest owners could also contact us and ask for a paper version of the questionnaire (three forest owners did this — one questionnaire was returned completed). Respondents were enticed to take part by offering them entry into a lottery if they completed the survey. The owners of larger forests had a higher probability of winning