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# Private ex-ante transaction costs for repeated biodiversity conservation auctions: a case study

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# Private ex-ante transaction costs for repeated biodiversity conservation auctions: a case study

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**Abstract**

The European Union's Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development has introduced promising changes in rewarding farmers by the implementation of conservation auctions and granting farmers' transaction costs. The paper therefore deals with the evaluation of private transaction costs within a case study using repeated auctions to reward plant biodiversity. Based on a review of the current literature the paper develops a specific definition of transaction costs as well as a methodology to measure and calculate the farmers' private transaction costs. The case study enfolds two field experiment auctions and two corresponding surveys. The transaction costs are measured by the use of written questionnaires and will be discussed both as a first reference value of farmers' transaction costs as well as compared to the individual payments within the case study auctions in order to investigate the real-life performance of this specific application of repeated conservation auctions in biodiversity protection efforts.

**Keywords:** agri-environmental policy, biodiversity conservation auctions, transaction costs, ecological services, plant biodiversity, experimental economics, EAFRD-Regulation

**JEL-Classification**: C93, D44, D82, H41, L14, Q24, Q28, Q57, R52

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## 1 Introduction

Since the reform of the Common Agricultural Policy (CAP) in 1992, agri-environmental schemes have been supported by the EU within the framework of the second pillar of the CAP. As part of the recent reform of the CAP, the European Commission has introduced structural changes in the support for rural development. In September 2006 the Commission approved a decision, fixing the total budget for rural development for the period 2007-2013 at 77.66 billion euros (European Commission, 2006c).

Two possibilities for promising changes in rewarding farmers – introduced by the European Union's Council Regulation (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) – are picked up in this paper: i) the implementation of conservation auctions as a new instrument for granting agri-environmental payments and awarding conservation contracts as well as ii) granting farmers' private transaction costs (Article 39, Council Regulation (EC) No 1698/2005).

Referring to the latter, the regulation states that the revised compensatory payment has to be based on income foregone and on additional costs, eventually including transaction costs, but can no longer contain an incentive component. In the previous Council regulation (EC) No 1257/1999 an incentive payment was allowed, which in the Commission Regulation (EC) No 445/2002 was limited to a maximum of 20% of the income foregone and additional costs. According to the European Commission, the premium calculation and thus also the incorporation of transaction costs needs to be based on a proof of the costs taken into account (European Commission, 2006b). In this respect, the European Commission also claims that establishing a methodology for the calculation of transaction costs should be of high importance (European Commission, 2006a).

But the EAFRD-Regulation gives no definition of transaction costs. Moreover, the Commission Regulation (EC) 1974/2006 of 15 December 2006, laying down detailed rules for the application of the EAFRD-Regulation, only gives the imprecise definition that transaction cost "shall mean cost related to letting the transaction take place and not directly attributable to the implementation cost of the commitment it relates to" (Article 27, Council Regulation (EC) No 1974/2006). Furthermore, it states that the transaction cost element shall be calculated over the duration of one commitment period and shall not exceed 20% of the income forgone and the additional cost. This corresponds precisely with the amount of the former incentive component, which was abolished since January 2007, following the objective of an economically more founded justification of payments in the European agri-environmental policy.

The most important reason for dropping the incentive payment seem to be an increasing pressure on the European CAP within the WTO trade negotiations, since most of the payments given to

farmers in Europe are assumed to be trade distorting and negatively influencing the world economy. Only policies falling in the so-called "green box" are acceptable by the WTO. Thus not incorporating any incentive in the compensation payment – and therefore only compensating for losses a farmer suffers – increases the chance of the being accepted by WTO (Swinbank, 1999; Mettepenningen, 2007).

Some studies have tried the measure the transactions costs for the administration in the provision of public goods (Falconer and Whitby, 1999; Whitby, 2000; Falconer and Saunders, 2002; Rorstad et al., 2007), but not much work has been done on estimating the farmer's or landowner's private transaction costs (Kasterine et al. 2001; McCann et al., 2005; Mettepenningen et al. 2007). Falconer (2000) gives an estimate of private transaction costs, based on research as part of the European research programme STEWPOL. Falconer and Saunders (2002) estimate private transaction costs of management agreements in England. The most comprehensive work to date is research by Mettepenningen et al. (2007) as part of the European research programme ITAES, analysing private transaction costs related to agri-environmental schemes, based on a survey as well as a follow-up analysis of one year.

Besides the need to prove transaction costs involved in agri-environmental payments, there is also an urgent need to design efficient and innovative agri-environmental programmes instead of using uniform flat-rate payments. Designing an efficient institutional structure, which also does not increase – or even decrease – transaction costs, would be an appropriate answer to this problem. One of the suggested approaches is the strengthening of incentive measures and market-creation. However, in the range of policy options aimed at conservation contracting, market-based instruments have only recently gained more attention. The implementation of this institutional reorientation in Europe is thus still characterised by a serve shortage of knowledge and practical experiences.

Since 1986 the U.S. Department of Agriculture has been awarding land retirement contracts for the Conservation Reserve Program (CRP) based on a competitive bidding mechanism. (Reichelderfer and Boggess, 1988; Szentandrasi et al. 1995; Babcock et al., 1996). In Australia, conservation auctions are used in areas such as salinity control, nutrient control and conservation of native vegetation where land use change is required to accomplish environmental improvement as part of the BushTender trials and other projects as part of the Market-based Instruments Pilot Program (Stoneham et al., 2003; Grafton 2005; National Market Based Instrument Working Group, 2005). In Europe, a conservation scheme combining auctioning and fixed-price payments had been used in two counties in the state of North Rhine-Westphalia,

Germany (Holm-Müller and Hilden, 2004). Moreover, the Challenge Fund in the UK was based on auctioning to encourage additional afforestation on private areas (CJC Consulting, 2004).

Another important element is the uptake of a scheme by farmers. A perfectly designed and (in theory) most efficient scheme will, of course, have no environmental effect if there are no farmers carrying it out. Previous research has shown that the uptake of schemes is also influenced by the transaction costs they cause to the farmers. According to Falconer (2000) and Vanslembrouck and Van Huylenbroeck (2005), factors influencing the decision to take up agri-environmental programmes can by divided into two main categories: i) the attitude of the farmer related to the environment and ii) the contract terms including financial compensations. Because private transaction costs influence the net financial compensation farmers get from agri-environmental schemes, they will influence the latter category. Moreover, as in general farmers are assumed to not like administrative work (a major part of transaction costs) it will also negatively influence participation in the schemes. Work of Drake et al. (1999) in eight EU member states shows that there is great variability in farmers' perception of scheme bureaucracy and thus resulting transactional constraints.

The new guidelines for the calculation of compensatory payments as well as the objective of a more efficient spending of public funds within European agri-environmental payment programmes and the still limited research concerning farmer's private transaction costs are the starting points to examine private transaction costs in practise. The case study presented in this paper therefore discusses the specific mechanism of auctioning conservation contracts in biodiversity protection efforts within a case study area in Germany, focusing on the farmers ex-ante private transaction costs. In this case the main research questions are to develop and to test a methodology for measuring and calculating private transaction costs as well as to bring up a reference value and to discuss the transaction costs relevance compared to the related individual payments.

The paper is structured as follows. Section two gives a general introduction on defining and measuring private transaction. An innovative way of rewarding farmers within agri-environmental programs will be described by the use of conservation auction as a specific market creation in section three. The case study background of the paper will be pointed out in the fourth section by a description of the research project, the definition of transaction costs, the methodology and the survey design. The results of both surveys and the transaction costs calculation will be discussed in section five. Section six concludes.

## 2 Defining and measuring private transaction costs

### 2.1 Defining private transaction costs

Within the neo-classical framework economic decisions are not influenced by transaction costs and are therefore taken under the assumption that transaction costs are zero. But transaction costs do of course matter and must be taken into account while analysing governance structures or institutional settings in practice. In the transaction costs economics framework the transaction is the basic unit of analysis and the ultimate unit of activity (Commons, 1931; Commons, 1934). Transactions between actors are costly, mainly because of the actors bounded rationality, opportunistic behaviour and uncertainty. In consequences, we have to deal with information asymmetries and markets are by definition incomplete and costly to use (Williamson, 1975; Williamson, 1996). The concept of transaction costs is initially based on the work of Coase (1937). The transaction costs economics framework has been development by various influences from different disciplines, but is mainly connected to the work of Williamson (Williamson and Masten, 1999; Williamson, 2000; Groth, 2007).

Based on extensive research related to the transaction costs economics, there are various definitions of transaction costs but research mainly deals with theoretical considerations without actually measuring (private) transaction costs. Transaction costs are, for example, most often defined as: i) “costs of using the price mechanism” (Coase 1937), ii) “costs of search” (Stigler, 1961) or “search costs” (Alchian, 1969), iii) “costs of running the economic system” (Arrow, 1969), iv) “costs of information” (Alchian, 1969) and “costs that arise not from production of goods, but from their transfer from one agent to another” (Dahlman, 1979). Main transaction costs definitions therefore include search costs, information costs, negotiation costs and monitoring and enforcement costs.

Transaction costs are related to every transaction in practise, but hard to identify, to define and to measure. In general, search costs arise prior to the contracting, as the actors collect information on the contract itself, the prospective contractual partner and possible consequences of contracting. Negotiation costs are the costs of drawing the contracts. Ex-post to the transaction are monitoring and enforcement costs, whereby within the whole transaction process various other and possibly hidden transaction costs may arise.

Based on Falconer and Whitby (1999) a first typology of transaction costs related to agri-environmental programmes may be picked up. They separate private transaction costs incurred by the farmers and public transaction costs for the administration. Furthermore, it needs to be distinguished between fixed and variable transaction costs. Fixed transaction costs arise only once per programme and economies of scale as well as learning effects might be realised due to information and knowledge gathering. Variable transaction costs depend on the number of

hectare or the number of sites, like for example related to the price calculation, auditing and mapping the specific site. In addition to the above definitions, the OECD differentiates transaction costs according to the fact of how they are connected with the implementation and execution of political measures and distinguishes two categories: "non policy related transaction costs" and "policy related transaction costs". The farmers transaction costs are in this case defined as "policy related transaction costs" (OECD, 2001).

Related to the participation in an agri-environmental programme, private farmers transaction costs are also spread in time. Ex-ante transaction costs arise within the process of conservation contracting and could be divided into variable and fixed transaction costs. Mostly variable transaction costs arise during the contract duration and costs related to the control of the environmental service are ex-post transaction costs (Falconer and Whitby, 1999). Hence we can expect that more complicated payment schemes with more and complex management options incur higher transaction costs.

### 2.2 Measuring private transaction costs

As even defining transaction costs is not trivial, there are also few empirical studies on transaction costs in the context of agri-environmental programmes in general; even less on the farmers' private transaction costs. The reasons for difficulties in measuring transaction costs are: i) there is no standard terminology on transaction costs, ii) it is difficult to separate transaction costs from production costs, iii) if transaction costs are high, most transactions would not even take place and iv) different actors may face different transaction costs (Benham and Benham, 2000, Mettepenningen et al., 2007).

One way of how to estimate transaction costs is to measure the difference between the buying price and the selling price of a good or service (Williamson, 1993; McCann et al., 2005). A second method is using surveys or interviews (McCann and Easter, 1999; Rorstad et al., 2007). The difficulties of surveys are high costs and the fact that they are generally very time consuming. Another problem with surveys and interviews – depending on the time they took place – may be that respondents are asked to estimate future costs or remember costs of the past, which could lead to less reliable results (McCann et al., 2005). On the other hand, to run interviews and surveys enables the researcher to investigate the perception stakeholders have on transaction costs as well as further information. Falconer and Whitby (1999), Falconer et al. (2001) as well as McCann and Easter (2000) tried to measure public transaction costs as part of agri-environmental schemes on the basis of government data. Another possibility to measure transaction costs is to run a simulation in which researchers themselves go through all the steps of a transaction and notice the relevant data (Benham and Benham, 2000). Another need is to

decide when to measure transaction in the process of a transaction; before, during or after the transaction. McCann and Easter (2004), for instance, suggest a combination of an ex-post evaluation of transaction costs with a documentation of the process during the transaction. An ex-ante evaluation is in general desirable, but often difficult. Before measuring the transaction costs, the researcher should develop a framework indicating the types of costs that are likely to be incurred.

There are some studies about the transaction costs for public agencies or administrations in the context of providing public goods. But, as already mentioned, not much research and empirical work has been done on estimating the importance of the farmers' transaction costs of taking part in agri-environmental programmes. The main difficulties occurring with research on private transaction costs are: i) it is difficult to obtain completed surveys, ii) is unlikely that a random representative sample of the target population will be obtained, iii) researchers often have to persuade respondents to check their financial records and iv) the measurement should take place soon after the costs are incurred (McCann et al., 2005).

A work by Falconer (2000) – measuring private transaction costs in the context of agri-environmental payment schemes – made use of price lists of companies providing scheme-related services, interviews and a survey. From these studies it was concluded that private transaction costs of scheme participation mount up to a couple of hundred euros per farm in one year. This means that they can involve about 5% of the compensation payments and even 10% for organic aid schemes. Contrary, for the Wildlife Enhancement Scheme in the UK these costs represent even about 110% of the farmer payment (Falconer and Saunders, 2002). This briefly described results point out that there is a variation in private transaction costs and in general transaction costs represent less than 10% of the payments to farmers for schemes applied to easily observable indicators, but more than 10% for schemes which are more complex (Rorstad et al., 2007).

Beyond the field of agri-environmental policy, Wang (2003) provides a brief overview of past work concerning the measurement of transaction costs in various fields of research, like for example monetary and finance economics, the transaction sector, non-market transaction costs as well as environmental and ecological economics.

## 3 Auctioning conservation contracts

Even though the discussion concerning the use of economic instruments in environmental policy has already expanded in the 1990s, the diffusion of innovative policy design into practical institutional advancements had been slow. The potential efficiency gains of auctions in allocating contracts are evident (Latacz-Lohmann and Van der Hamsvoort, 1997; Latacz-Lohmann and

Van der Hamsvoort, 1998; Klemperer, 2002; Krishna, 2002; Chan et al., 2003). The main reason why auctions are also of interests for conservation contracting is the presence of an information asymmetry between the farmers and the administration (Latacz-Lohmann and Van der Hamsvoort, 1997). This is the case since the traded ecological goods and services are often generated by lands that are private property. A farmer, in this case, usually knows his own land as the base of production opportunities better than any public agency (Fraser, 1995; Wu and Babcock, 1996). Landowners will therefore calculate based on their individual costs and a price for the trades goods will emerge. This enables a more efficient use of public funds compared to fix flat-rate payments (not considering differences in the farmers' production costs). From a policy-maker's point of view, auctions to buy ecological services from landowners focus on budgetary cost-effectiveness gains and the possibility to gather information about the production costs of agricultural firms.

Standard selling auctions can be adopted as procurement or reverse auctions, like in the case of auctioning ecological services. But as especially Latacz-Lohmann and Schilizzi (2005) point out, auctions for ecological services differ from basic auction design in many respects. Thus auction theory is not well developed for this kind of specific auctioning and offers little guidance for designing conservation auctions in practice.

One aspect is that conservation auctions are usually repeated auctions and bids for the same ecological service on one site are invited in a sequence of various bidding rounds instead of a one-shot auction. This allows bidders to learn from the results of previous auctions and to adjust their bids (Reichelderfer and Boggess, 1988; Hailu and Schilizzi 2004). Also to be mentioned is the number of goods traded simultaneous and therefore to distinguish between single-unit auctions and multi-unit auctions (Kagel and Levin, 2001; Hailu and Thoyer, 2006). Auction theory mainly deals with the case of single-unit selling auctions, but conservation auctions are multi-unit procurement auctions and the administration selects various farmers with numerous heterogeneous sites to take part in the auction. Furthermore, it needs to be considered that conservation auctions can be used either as budget-constraint auctions or as target-constraint auctions (Latacz-Lohmann and Schilizzi, 2005). The budget-constraint auction is the usual case that agri-environmental schemes have a limited budget to spend and therefore applicants are accepted until the budget is exhausted. Another aspect of designing auctioning schemes is the question of whether a reserve price should be set. A reserve price is a price limit that defines the maximum amount that the administration is willing to accept (Stoneham et al., 2003; Latacz-Lohmann and Schilizzi, 2005).

In order to avoid the appropriation of information rents and collusion it has to be considered carefully what kind of information will be given to bidders. Consequently and due to the fact that

only sealed-bid auctions are of interest in this case, there are two basic payment formats to be used within repeated multi-unit auctions for ecological services. Both payment formats will now be briefly discussed, in particular regarding strategic incentives and the expected farmers' bidding behaviour (McAfee and McMillian, 1987; Milgrom, 1989; Latacz-Lohmann and Van der Hamsvoort, 1997; Cason and Gangadharan, 2004; Cason and Gangadharan, 2005; Stoneham et al., 2003; Latacz-Lohmann and Schilizzi, 2005):

i. In the uniform-price sealed bid auction a sealed bid is submitted by each bidder, stating the individual price for a specific ecological service. The good is then bought at a price determined by the price of the highest winning bid or the lowest rejected bid. All successful bids are paid equal. The individual bid price therefore only determines the probability of acceptance but not the final payment and the optimal bidding strategy is to reveal the accurate opportunity costs.
ii. In the discriminatory-price sealed bid auction also a sealed bid is submitted for every site but all accepted bids are receiving payments according to the individual bid price. This creates incentives for bidders to bid a price above the individual opportunity costs and to ensure themselves information rents if the bid finally is successful.

The theory of budget-constrained auctions suggests that it is optimal for bidders in a discriminatory-price auction to overbid relative to their true costs of providing the ecological good (Latacz-Lohmann and van der Hamsvoort, 1997; Cason and Gangadharan, 2005). The bid curve does not therefore represent the true cost curve; it rather contains a rent for the bidder. Hence the supply curve is not identical within discriminatory-price auctions and uniform-price auctions, whereby the true opportunity costs (in theory) equal the bid prices within a uniform-price auction. The latter is based on the true marginal cost curve of environmental service provision without a rent element. Because of the incentive to overbid a discriminatory-price auction does thus reveal differences in opportunity costs, but only imperfectly so.

On the basis of theoretical considerations the payment format of a uniform-price auction seems to be the best choice since it creates no incentives for overbidding the individual opportunity costs. But particularly facing the practical considerations of a case study implementation some further aspects need to be considered (the discussion follows and complements Latacz-Lohmann and Schilizzi, 2005).

A main argument against uniform-price auctions, taken into account within the case study, is that farmers with low opportunity costs would benefit disproportional from a higher payment, because the strike price reflects the required compensation for owners of more productive sites. In contrast, a discriminatory-price auction does not pay landholders more than what they bid and

the critical incentive on overbidding the individual opportunity costs in discriminatory-price auctions could be reduced to some extent by using flexible reserve prices or budget-constraints.
Uniform pricing also seems to be more complex and more difficult to comprehend than the discriminatory-price auction. This may act as a barrier for farmers to participate, particularly within the first-time ever implementation of a conservation auction. In addition, uniform-price auctions expose bidders to greater risk as not only the acceptance probability is unknown but also the final payment.
Moreover, it was expected in this small case study that within repeated uniform-price auctions bidders would learn the uniform price paid for successful bids in previous auctions and adjust their bids in the next auction. This kind of bidders' learning will most probably lead to negative effects on the efficiency of the repeated auction performance and was decided to be avoided by any means in the field experiment. The argumentation is also based on findings by Cason et al. (2003). They used laboratory experiments to examine bidding behaviour in an auction when the value of the output was known, compared with when it was not. The experiments indicate that when bidders did not know the value of output, their bids tended to be based on the opportunity costs. By contrast, when bidders were given information about the significance of their biodiversity assets, they tend to raise bids and secure themselves information rents.
The choice between both payment formats is obviously controversial in practise. In the case study the discriminatory-price auction appealed to be the appropriate payment format against the background of repeated auctions as well as the objective of a high acceptance by farmers.

## 4 Case study background

### 4.1 The research project

The case study payment scheme conservation auctions are part of a research programme designed to reward environmental services in agriculture. It addresses the objectives of enhancing efficiency and acceptance of agri-environmental programmes by the use of an innovative market-orientation. This paper deals with the aspect of market creation by the use of conservation auctions, basically under the focus of evaluating the farmers' private ex-ante transaction costs. Within the payment scheme, regional-specific environmental goods of plant biodiversity – voluntary provided by the farmers – are rewarded as results of environmental services of agriculture. The prerequisite for a market-based support of environmental benefits is that ecological services need to be standardised according to their ecological quality and must meet certain conditions and requirements. This implies that ecological services are valuable goods and could be detected without complicated methods. Furthermore, the ecological goods

should act as an indicator and – in addition to their actual usefulness – should imply positive effects on other natural resources.

The overall objective is to reward landowners for their provision of environmental services, whereas the payment is – contrary to the majority of current agri-environmental programmes in the EU – not based on actions undertaken by the farmers (Kleijn and Sutherland, 2003), but result-orientated, based on specify ecological services. These ecological services are defined as ecological goods of plant biodiversity (Bertke, 2005). Ecological goods have to be clearly defined by transparent floristic criteria, so farmers are able to prove their fulfilment and a justifiable control of the supplied ecological goods can take place as part of the payment scheme. In this case, the production of the so-called ecological goods "grassland" aims at the protection of regional endangered plant communities, the preservation of grassland on marginal sites and the promotion of species-rich grassland. Therefore the number of species per plot and a catalogue of grassland species that are adapted to extensive grassland management and characteristic for regional plant communities are suitable for the definition of ecological goods grassland. Related to the ecological quality the following three categories were defined: grassland I, grassland II and grassland III, whereas grassland III represents the highest quality of ecological services (Gerowitt et al., 2003; Bertke, 2005).[2]

Thus within every category of ecological goods different prices are paid for the same quantity of a (heterogeneous) good, based on the bid prices per hectare. The bidders are bidding on one of three ecological goods, which are defined by the number of plant species targeted as well as the ecological quality of species specific to the region. If landowners do not exactly meet the ecological requirements of the ecological good the bid targeted on, they will not be paid at all. Thereby it is left to the farmers to decide how to achieve the desired grassland I, II or III status. The results were assessed by a ground control on the grassland site at the end of the contract period.[3] Successful farmers get paid in both auctions.

### 4.2 Transaction cost definition, methodology and survey design

Since there is not the one and only definition and methodology to deal with private transaction costs and the relevant regulations within the current European agri-environmental policy do not

[2] The production of ecological goods shall achieve i) the maintenance of grassland on marginal sites, ii) the promotion of regional species-rich types of grassland and iii) the conservation of rare plant associations. Important is either the number of different species per control plot (circle with 2m radius = 12.6m²) as well as the existence of regional defined target species of extensive grasslands. The ecological goods and their represented ecological quality are defined as follows: grassland I: number of species >= 8/12.6m²; grassland II: number of species >= 8/12.6m² + 2 target species; grassland III: number of species >= 8/12.6m² + 4 target species. The definition of the ecological goods grassland used in the case study is based on the work of Bertke (2005) and has been designed in a previous conceptual project period.

[3] The ground control was part of a separate work area within the research project.

provide a detailed definition and methodology, a specific approach will be used in this survey. Within the case study the transaction costs refer to the private transaction costs relevant for all farmers and therefore only the ex-ante transaction costs will be considered. After submitting the bids there are no possibilities for additional adjustments and all further costs for the contribution of the defined ecological services are separated from the transaction costs as production costs and will not be included. Therefore the transaction costs are defined as: the expenditure of time for the application in the case study auction, monetary evaluated with an hourly wage.
The relevant farmers' administrative work incorporates the acquisition of the tender documents, the provision of information concerning the auction, the selection as well as the classification of the sites to be offered, the calculation of the bid price and filling in the documents. After completing the application (the bid), the documents only needed to be send back to the auctioneer (in this case the researchers), in a prepaid return envelope.

The evaluation of the transaction costs is based on two written questionnaires with one referring to each auction. Within the questionnaires the farmers were asked to note the relevant expenditure of time for participating in the auction until the closing of contracts. This expenditure of time represents the basis for the calculation of transaction costs and needs to be monetary evaluated in a second step. But which hourly wage should be consulted for this? Instead of using simplified external data, the farmers were also asked to note the hourly wage estimated as appropriate and therefore to include their individual valuation.
The costs of the farmers connected with the requirement of the documents as well as information concerning the auction are treated as fixed transaction costs since they result once for each auction but independent of the number of bids (the number of sites). In contrast, all further transaction costs arising in the process of the bidding procedure are variable transaction costs since they are affected by the number of bids submitted by one farmer.
After the data on the time expenditure and the hourly wage is collected, the transaction cost will be calculated as follows. In order to be able to discuss the consequences of a different basis of calculation on the amount of transaction costs, the calculation will be based both on the mean values and the median values of the time expenditure and the hourly wage. Thereby the general way of calculating will be the same and it is assumed that in this case the number of submitted bids (sites) and not the hectare of the submitted sites are influencing the variable farmers' transaction costs.
All in all, the following three different transaction costs will be calculated: i) the transaction costs per average farmer participating both in the auction and the survey, ii) the transaction costs

per bid of the farmers participating both in the auction and the survey and iii) the total transaction costs for all submitted bids within the auction.

For the first category the mean and median sums of the time expenditure will be monetary valued by the mean and median sum of the hourly wage. In order to take into account the different numbers of submitted bids, the transaction costs per farmer will be multiplied by the number of farmers participating both in the survey as well as the auction and will then be divided by the number of bids submitted by these farmers. The final calculation leads to the total transaction costs for all submitted bids in the auction, not only the ones submitted by farmers also participating in the survey. Therefore the transaction costs per bid will be multiplied by the total number of submitted bids.

The case study enfolded two field experiments auctions and two corresponding surveys to evaluate the transaction costs. In both surveys (and both auctions) the same potential cohort of farmers was part of the field experiment to learn about the bidding behaviour and the practical performance of repeated auctions as well as to measure the private transaction costs and their development in both auctions. Within the survey there were no specific incentives provided to participants and filling in the questionnaires was considered as part of participating in the case study.[4]

Since bidding behaviour is very sensitive to the type and amount of information communicated to farmers, no information except the definition of the ecological goods as part of the specification of services and the terms to be maintained was given to potential bidders in both auctions. The budget was also not pre-announced in both auctions and the potential bidders for the second auction were not informed about the highest accepted bid prices. They were only able to learn by the evaluation of their bids within the first auction.[5]

The basic proceeding and the timetable of both auctions will now be described briefly. Due to the involvement of the auctions in a research project and resulting restrictions, the contract period was one year or shorter and not five years, as usual in agri-environment schemes.

All conventional and ecological farmers with managed grassland sites in the model-region were qualified to submitted bids within the first auction, starting in the beginning of June 2004. In June 2004 three information meetings were held to inform interested farmers about the basic procedure and the necessary documents. The deadline for submitting bids ended after six weeks

[4] There was no possibility to run another auction/survey in another case study area with different farmers and a changed auction design due to financial and organisational restrictions.

[5] Due to the fact that both auctions were part of a research project, an interdisciplinary group of researchers acted as the auctioneer and evaluated the bids. The survey to measure the transaction costs and their calculation was designed, run and evaluated by the author alone.

and the bids were evaluated within one week. The contracts were closed in the middle of July 2004. According to the outcome-orientation, the ground control took place until the end of July 2005 and successful farmers got paid in August 2005. Within the first survey, 30 farmers both participated in the auction and answered the questionnaire. Altogether 38 farmers submitted an offer within the first auction; thus 78.9% of the relevant farmers are represented in the first survey.

The basic auction design was the same within the second auction, except for a change that needed to be done due to a short-term safeguarding of the auction budget. This adaptation refers to the circle of eligible farmers and the auction was limited to those farmers who already participated in the first auction. Therefore the documents were immediately sent to the relevant farmers in the middle of February 2006. The bids had to be received until the end of March 2006 and were evaluated in one week. The ground control took place by the end of July 2006 and after a successful control, the farmers got paid in August 2006. The second survey took place parallel to the repeated auction in early 2006. 30 farmers submitted offers within the auction and 25 of them also answered the questionnaire. Thus the response of 83.3% of the farmers is taken into account.

## 5 Results

### 5.1 Survey results

*The first survey (the auction 2004/2005)*

The bidding procedure within the first auction was separated into four steps, translated into the following questions:

a) How much time did you spend on the acquisition of the documents?
b) How much time did you spend on reading and understanding the documents?
c) How much time did you spend on the bid calculation (choice of the grassland site, ecological good and calculation of the bid price)?
d) How much time did you spend on filling in the complete documents?

Furthermore, the farmers were in a fifth question asked what they think is an adequate hourly wage for their administrative work within the auction. The main results of all five questions are presented in table 1. They include the minimum and the maximum value, the mean and the median value, the standard deviation (SD) as well as the number of farmers who answered the specific questions.

**Table 1. Main results of the first survey (auction 2004/2005)**

| | Min. | Max. | Mean | Median | SD | Farmers |
|---|---|---|---|---|---|---|
| Acquisition (in minutes) | 2 | 200 | 31.33 | 15 | 47.36 | 27 |
| Reading (in minutes) | 10 | 100 | 39.48 | 30 | 21.93 | 29 |
| Calculation (in minutes) | 5 | 400 | 90.71 | 55 | 10.48 | 28 |
| Filling in (in minutes) | 10 | 300 | 77.50 | 60 | 6.27 | 28 |
| Hourly wage (in €) | 10 | 25 | 16.76 | 15 | 5.39 | 21 |

Source: Own.

Looking at the large margin of time spend in the first question, it is important to take into account that some farmers asked for the documents simply with a brief phone call or by email. On the other hand, some farmers took a very time consuming trip to an information meeting in the case study area or even to the university to obtain the documents. Concerning the main tasks within the bidding process – the bid calculation and the filling of the documents – the difference in the time spend can be described by the different number of bids by every farmer since a separate bid needs to be calculated and the corresponding documents need to be filled in for each grassland site. This will be taken into account as part of the transaction costs calculation in the next section.

*The second survey (the auction 2006)*

Due to the decision to restrict the group of potential participating farmers to those farmers who already participated within the first auction, the documents had been directly send to the farmers. Thus the question on the time spend on the acquisition of the documents has not been considered in the second survey.

The procedure within the second auction was therefore separated into three steps, translated in the following questions:

a) How much time did you spend on reading and understanding the documents?
b) How much time did you spend on the bid calculation (choice of the grassland site, ecological good and calculation of the bid price)?
c) How much time did you spend on filling in the complete documents?

Additionally, the farmers were again asked what they think is an adequate hourly wage for their administrative work within the auction. The main results of all four questions are presented in table 2. As above they include the minimum and the maximum value, the mean and the median value, the standard deviation (SD) as well as the number of farmers who answered the particular questions.

**Table 2. Main results of the second survey (auction 2006)**

| | Min. | Max. | Mean | Median | SD | Farmers |
|---|---|---|---|---|---|---|
| Acquisition (in minutes) | -- | -- | -- | -- | -- | -- |
| Reading (in minutes) | 5 | 120 | 33.00 | 30 | 24.32 | 25 |
| Calculation (in minutes) | 5 | 300 | 67.80 | 50 | 71.53 | 25 |
| Filling in (in minutes) | 5 | 180 | 64.28 | 60 | 51.77 | 25 |
| Hourly wage (in €) | 10 | 60 | 21.42 | 20 | 12.41 | 24 |

Source: Own.

For a first interpretation of the results it is once again important to note that – due to the auction design – farmers had to submit an individual bid for each grassland site. In addition, it needs to be considered that the differences of the time spent within the second survey are also influenced by the bid valuation in the first auction and corresponding adjustments by the farmers.

It is to be expected that the successful farmers made no major adjustments and thus the follow-up bid was calculated quick and based on the calculation in the first auction. In contrast, for the farmers not being successful in the first auction it is to be expected that these farmers take into account the former bid valuation in detail. As a result this may be lead to a new and therefore much more time-consuming bid calculation, whereby a lower bid price will in general increase the probability of acceptance. On the other hand it is to be assumed that farmers will not submit sites again if the bid price would be below their specific costs.

To classify the results it also needs to be taken into account that within the second survey two farmers noticed a much higher appropriate hourly wage, compared to the first survey. This raises the question of whether the farmers really think this is the appropriate hourly wage for their administrative work – as intended by the questionnaire – or if they included other aspects (such as travel costs as part of the assessment of the grassland sites) into the hourly wage. These results also clarify the difficulties and nearly unavoidable practical inaccuracies of measuring transaction costs by the use of questionnaires.

### 5.2 Transaction costs calculation

Due to the large difference of individual expenditures of time and hourly wages mentioned within the questionnaires and to be able to discuss the consequences of the basis of calculation on the amount of the transaction costs, the following two ways of calculating transaction cost are used for both surveys. The calculation is based i) on the mean value of the time expenditure and on the mean value of the hourly wage as well as ii) on the median value of the time expenditure and on the median value of the hourly wage.

The transaction costs per average farmer, the transaction costs per bid and the total transaction costs for all submitted bids are shown in table 3, together with the underlying expenditure of

time and the hourly wage, valued as appropriate by the farmers. Thereby it needs to be mentioned that within the first auction 24 farmers – offering 114 grassland sites – participated in the auction and answered the questionnaire. Altogether 38 farmers offered 199 grassland sites in 2004. As part of the second auction 30 farmers submitted 295 bids whereof 25 farmers also answered the questionnaire and offered 211 grassland sites.

The results point out two findings. Firstly, the transaction costs vary greatly depending on the basis of calculation, which also shows the difficulties to identify a transaction costs amount that is equally relevant for all farmers participating in the payment scheme. Furthermore, we can identify ways to influence the transaction costs by whether using the mean values or the median values. Secondly, a comparison of both auctions highlights the transaction costs reducing effects of repeated auctions for all three classifications of transaction costs calculated within this case study (of course keeping in mind the to some extent changed auction design and therefore the slightly changed requirements for the farmers in the second auction).

**Table 3. Farmers' transaction costs – main results**

| | 1st survey (auction 2004/2005) | | 2nd survey (auction 2006) | |
|---|---|---|---|---|
| | Mean | Median | Mean | Median |
| Expenditure of time | 239 min. | 160 min. | 165 min. | 140 min. |
| Hourly wage | €17.00 | €15.00 | €21.00 | €20.00 |
| Transaction costs per farmer | €67.72 | €40.00 | €57.75 | €46.67 |
| Transaction costs per bid | €14.26 | €8.42 | €6.84 | €5.53 |
| Total transaction costs | €2,837.74 | €1,675.58 | €2,017.80 | €1,631.35 |

Source: Own.

Under consideration of the fact that different bids were submitted by each farmer, the transaction costs per bid are most significant and should be taken into account primary. These transaction costs decreased from the first to the second auction based on the mean values from €14.26 to €6.84 and based on the median values from €8.42 to €5.53.

### 5.3 Comparison of the transaction costs with the bids sums in both auctions

To participate in the case study conservation auctions landowners had to submit an individual bid for every grassland site, whereas every farmer was qualified to submit a various number of bids for all categories of ecological services. The offer includes the choice of the ecological good (grassland I, II or III), the calculation of the price per hectare as well as the description of the grassland site. The auction design is a repeated sealed-bid discriminatory-price multi-unit auction with a separate budget-constraint for each quality of ecological goods. Main results of

the submitted bids within the two first-price sealed-bid discriminatory-price auctions in the case study area are presented in table 4.

Analysing the wide ranges and standard deviations of individual bid prices within each category of ecological goods and both auctions, it becomes clear that the farmers were confronted with different opportunity cost for the provision of an in each case equal quality of ecological services. Within currently used fixed price payment schemes in the European agri-environmental policy, these cost differentials remain unknown to the administration and could therefore not be considered for conservation contracting.

**Table 4. Results of both case study auctions (submitted bids)**

| | 1st auction (2004/2005) | 2nd auction (2006) |
|---|---|---|
| Grassland I | | |
| - Range of prices in €/ha | 40 – 250 (Ø 100.92; SD 47.18) | 25 – 160 (Ø 93.94; SD 29.47) |
| - Number of sites | 130 | 216 |
| - Hectare | 221.16 | 340.65 |
| - Number of farmers | 27 | 26 |
| Grassland II | | |
| - Range of prices in €/ha | 55 – 300 (Ø 141.75; SD 59.55) | 75 – 300 (Ø 147.67; SD 46.92) |
| - Number of sites | 32 | 56 |
| - Hectare | 53.33 | 82.58 |
| - Number of farmers | 16 | 18 |
| Grassland III | | |
| - Range of prices in €/ha | 100 – 350 (Ø 202.78; SD 78.73) | 150 – 450 (Ø 257.35; SD 89.34) |
| - Number of sites | 18 | 23 |
| - Hectare | 36.98 | 31.61 |
| - Number of farmers | 8 | 7 |

Source: Groth, 2007. Note: Ø = mean; SD = standard deviation.

More important than practical efficiency gains of auctioning conservation contracts compared to uniform flat-rate payments is – in this paper – the comparison of the transaction costs per bid (per site) with the bid sums per bid (per site) as well as to learn about the proportion of the specific farmers' transaction costs. In order to discuss the relevance of the farmers' private transaction costs within the case study auctions the mean and the median sums per submitted bid are presented in table 5 for all qualities of environmental services.

**Table 5. Mean and median amount per submitted bid within both auctions**

| | 1st auction (2004/2005) | | 2nd auction (2006) | |
|---|---|---|---|---|
| | Mean | Median | Mean | Median |
| Grassland I | €156.81 | €116.47 | €150.38 | €98.70 |
| Grassland II | €217.94 | €182.53 | €205.17 | €152.86 |
| Grassland III | €354.91 | €142.88 | €326.50 | €318.00 |

Source: Groth 2006.

Due to the fact that every landowner made a various number of bids, the calculation only refers to the mean and median transaction costs per bid and their share of the mean and median sums per submitted bid. The mean and median farmers' transaction costs proportion of the bid sums for both auctions and all three ecological goods are shown in table 6.

Depending on the ecological good and whether the calculation is based on the mean or the median value, the results show a transaction costs proportion between 4.0% and 9.1% in the first auction. Within the repeated auction in 2006 the transaction costs decreased to a proportion in the range of 1.7% to 5.6%.

**Table 6. Farmers' transaction costs proportion of the bid sums**

| | 1st auction (2004/2005) | | 2nd auction (2006) | |
|---|---|---|---|---|
| | Mean | Median | Mean | Median |
| Grassland I | 9.1% | 7.2% | 4.5% | 5.6% |
| Grassland II | 6.5% | 4.6% | 3.3% | 3.6% |
| Grassland III | 4.0% | 5.9% | 2.1% | 1.7% |

Source: own.

These results clarify a relatively low amount of the specific transaction costs for all ecological goods, a decrease of their relevance from the first to the second auction and therefore the potential of repeated auctions for a reduction of transaction cost.

## 6 Conclusion

Some obvious conclusions emerge from this small case study on farmers' private ex-ante transaction costs as part of the field experiment conservation auctions to reward plant biodiversity. It is apparent that the transaction costs could be measured and some first reference values as well as a specific definition and a methodological procedure are introduced and put up for further discussion. Nonetheless, the results show that no unique transaction costs amount exists for all farmers within both surveys. Rather – discovered by the use of auctions – specific opportunity cost and private transaction costs show up and an analysis going beyond this description of transaction costs leads to a farmers' transaction costs proportion of the bid sums between 9.1% and 1.7%. Since the evaluation of the survey was made anonymous, it is not possible to make any statement if farmers with large or if farmers with small transaction costs won the auctions.

The range of transaction costs of farmers' payments fits reasonably with some former studies measuring private transaction costs in the context of agri-environmental payment schemes, indicating that there is a variation in private transaction costs and transaction costs in general represent less than 10% of the payments to farmers for schemes applied to easily observable indicators (Falconer, 2000; Rorstad et al., 2007).

The results from the German case study presented in this paper basically support a positive evaluation of auctioning conservation contracts as part of the future European agri-environmental policy since it could be shown that auctions are practicable for farmers and it is not to be expected that high administrative burdens generally oppose their participation. To evaluate the transaction costs against the initially described background of the EAFRD-Regulation also some fundamental problems should be made clear. The different farmers' private transaction costs – based on an individual expenditure of time as well as its unequal valuation – leads to the conclusion that an economically justifiable inclusion of a unique value of transaction costs – equally relevant for all farmers – is not possible and would lead to the same economic problems as fixed flat-rate payments. Moreover, and based on the specific definition of transaction costs used in this survey, a transaction costs share of up to 20% of the income forgone and the additional cost may overrate this new component of payments within agri-environmental schemes. To solve this problem auctioning conservation contracts can be the appropriate way. This is the case since the payment – and therefore also the transaction cost element – does not need to be fixed a-priori by the administration. The bid prices based on the individual opportunity costs are relevant instead and therefore an inclusion of the private transaction costs can take place as part of the bid price, whereupon an appropriate remuneration of the farmers is to be expected.

Furthermore, a promising way to reduce the farmers' transaction costs within future conservation auctions as well as existing agri-environmental programs using fixed flat-rate payments will be described briefly; a software-supported filling in of documents and an online-data submission. This kind of a new bid submission system enables farmers to submit their bids directly through an online service that performs several automated checks and delivers the digital format used by the governmental agency. Expected benefits are a higher accuracy of submitted bids, an easier processing of information and a higher quality due to fewer mistakes of data. Efficiency gains are expected for the governmental agency as well as for the farmers by a decrease of administrative labour costs. This will be achieved by automated information processing and by the higher accuracy of data that decreases the amount communication and actions required per application. However, setting up a reliable online application system requires investments in its development and changing the working processes of the governmental agency. The implementation of this kind of institutional advancement will eventually lead to a decrease in transaction costs.

To learn about the farmers' attitudes and technical equipments they were in both survey within the case study asked to state if they have the possibility to use internet access and are willing to participate in an – at that time still hypothetical – online-submission system. In the first survey

35 farmers answered both questions. Altogether 71.4% of the farmers are able to use internet access and 62.9% would make use of an online-submission system. All in all 27 farmers answered the questions in the second survey. Thereof 77.8% of the farmers have an internet access and 70.4% of the farmers stated the will to use the option of a software-based application. The results first insides that at present not all farmers participating in the case study are able to use internet access and are willing to make use of a corresponding software-based filling of applications. Nonetheless, the predominant positive valuations shows the necessity to develop and to provide at least the additional possibility of an online-based submission system in order to realise the potential to reduce transactions costs, both for the farmers as well as for the administration.

In summary, this case study can be rated as another step in evaluating farmers' private transaction costs considering a promising institutional innovation as part of the European agri-environmental policy; but much more work is needed. Therefore we should talk more about real institutional changes in the way farmers are paid and we do need more case studies with farmers. This will be a promising and urgent way to learn what we can only learn from practice and to really take into account the farmers attitudes and experiences ("to learn by asking those who are doing") in order to develop a sustainable future European agri-environmental policy. Less regulations and more market creation by a cautiously implemented use of conservation auctions could be a substantial step in the right direction.

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