Institutional design of agri-environmental contracts in the European Union: the role of trust and social capital

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Abstract

Assessing potential uptake of agri-environmental schemes based on farm and farmer characteristics only results in an incomplete analysis because it neglects the effects of motivational issues of the institutional design of contracts, as set up by the government, and of social capital. In this paper we describe contract choice using a trivariate probit model and taking into account farm and farmer characteristics and motivational issues. Motivational issues in this study include the perception of institutional design, the use of extension services, trust in the government, and preferences for stable policies. Results show that besides farm and farmer characteristics these factors are important for the likelihood of enrolling in agri-environmental contracts. They do not influence every contract type in the same way and further decisions to conclude different contract types are connected. If farmers perceive the design of an agri-environmental scheme as weak or favour a stable policy they are less likely to conclude contracts for biodiversity protection. Farmers who do not trust the government are less likely to conclude contracts for less intensive practices. Involvement in general networks increases the probability of contracting for wildlife and landscape management and less intensive practices whereas this factor is not important for biodiversity protection. The results suggest that taking into account motivational issues and differentiating towards different contract types can increase effectiveness and efficiency of agri-environmental schemes.

Additional keywords: agricultural policy, agri-environmental scheme, contract choice, motivation, trivariate probit modelling

Introduction

Preserving nature and landscape, the quality of water, soil, air, and the typical rural landscapes is one of the major contemporary challenges for developed countries.

Agriculture and forestry, occupying most of the rural area throughout Europe, are activities that have a major influence on the European rural environment and landscape. The European countryside is mainly man-made, resulting from centuries of management of rural areas for production of food, feed, raw materials, and ornamental plants. As long as agricultural operations were relatively small in scale, before mechanization, scale enlargement, and the increased use of external inputs, there was a degree of harmony between agriculture and the countryside in which it operated.

After 1960, the rising cost of labour induced labour-saving and production-enhancing techniques that increased agricultural output and helped the dwindling numbers of farmers achieve income levels comparable to those outside the agricultural sector (Oskam & Slangen, 1998). It resulted in a strong mechanization, intensification of land use, strong specialization, farm and scale enlargement and increased use of non-factor inputs, such as concentrates, compound feed, fertilizers and pesticides. The side effects of these changes have led to a threatening of the quality of water, soil, air, nature and landscape.

While agriculture was experiencing these developments, at the demand side higher incomes and levels of welfare increased the demand for wildlife and landscape, as well as leisure and outdoor recreation. Changes in demand co-determine changes in the institutional environment. This implies that during a period of economic growth and the associated evolution of societal preferences, the rules of the game for the agricultural sector change. For example, ownership or property rights with respect to the environment or landscape, which were traditionally part of agriculture, are now being contested. Farmers have to adapt themselves not only to changed price signals, but also to a new institutional arrangement giving agriculture its proper place in society. The introduction of agri-environmental schemes (AESs) in the EU-member states is one of the changes in the rules of the game for the agricultural sector in the last 30 years.

In the European Union, the introduction of AESs was generally meant to promote a more environmentally friendly way of farming. However, AESs influence the behaviour of individual farmers in different ways, which can even be different from the intended ones. First, not all eligible farmers conclude agri-environmental contracts. Second, farmers might be more interested in the payments and could be trying to minimize their effort or even not to comply with their contracts in the correct way. To be able to design more effective and efficient contracts, policy makers (EU, national, or local) aiming at improving the agri-environment have an interest in the reasons why farmers choose a specific agri-environmental contract.

The purpose of this paper is to explain the factors that determine famers' motivation for the uptake of AESs, taking into account the institutional design of contracts and the level of social capital. The institutional design of contracts that is relevant for farmers differs across member states and regions in the European Union.

The first question is whether contract choice depends on farmers' preferences about institutional design of contracts. Designing a contract is a complex task (Bogetoft & Olesen, 2002). Governments have to choose from a spectrum of alternative elements of design such as eligibility rules, procedures for application, and administration requirements. Bogetoft & Olesen (2002) observed that contract parties often design contracts without using contract theory. Instead, the design of a contract is based on

experience and a process of trial and error. Farmers have their own perception of the choices the government makes. If institutional design is perceived as not appropriate, farmers are expected to be less likely to conclude any contract even if the operational opportunity costs of implementing the measures are negligible. Institutional design that fits a transaction adds to the value of a contract whereas inappropriate design lowers the value of a contract for the farmer. Depending on the information they have, farmers could perceive institutional design differently. Therefore the role of public and private extension in AES needs to be taken into account.

The second question is what is the role of social capital for the uptake of an AES? Social capital manifests itself in participation in agricultural and social networks and trust in government and society. Trust can complement government control and reduce transaction costs for both the farmer and the government. Trust is an important component of social capital.

In this paper we shall describe the motivation for different AES contract types, using a trivariate probit model where farmers can choose one, two or three types of contract, either separately or simultaneously. Perceived institutional design, extension services, social capital, and farmers' characteristics are expected to influence these choices differently because transaction characteristics are different.

The paper is structured as follows. The next chapter examines theoretically the contractual arrangements and the choice of different contract types. Moreover, the role of institutional factors in explaining contract choice is discussed. Then the empirical model is discussed and an overview of the data is presented. In the chapter thereafter the results from the analysis of the contractual arrangement and the estimation results and their interpretation are assessed. The last chapter concludes.

Motivations for agri-environmental measures at the farm level

Motivations and contract choice

Any transaction of the type 'You scratch my back, I'll scratch yours' – or as a *quid pro quo* – can be considered as a form of contract. If there is a long-term relation or a long duration between purchase and delivery (*quid* and *quo*), a contract is an essential element of the transaction relation (Hart & Holmström, 1987). A contract is a commitment to an enforceable mutual agreement recognized by non-interested third parties. Generally, a contract specifies the actions each party will take (for example the delivery of a good or service by one party and the payment to be made by the other party) and may assign decision-making powers (see for instance FitzRoy *et al.*, 1998).

Motivation questions arise because individuals have their own private interests, which seldom correspond perfectly to the interests of other parties, the group to which the individuals belong or society as a whole. Such problems arise because specific plans cannot be described in a complete enforceable contract (Milgrom & Roberts, 1992). Concerning motivation, many contracts contain a steering mechanism that defines performance criteria and the means to measure performance. Motivation is also included in the specification of a reward structure that marks the level of payment

if a minimum level of performance is attained. In the psychological literature it is argued that there are two kinds of motivation: (1) internal or intrinsic to the individual concerned, and (2) external or extrinsic (Le Grand, 2003). The feelings to do your work well does every so often not arise from external motivation like payments or direct commands but can be viewed as a form of internal motivation. It is also argued that there may be a trade-off between the two kinds of motivation, such that too heavy emphasis on extrinsic motivation can drive out internal motivation. So motivations activated by external factors, such as monetary incentives or direct order (as in hierarchical governance structure), can crowd out motivations that are internal to the individual (which may or may not include altruistic motivations) (Le Grand, 2003).

Several studies apply principal-agent theory to analyse the design of agri-environmental contracts focusing on hidden information and hidden actions (e.g., Ozanne *et al.*, 2001; White, 2002). Other studies focus on the characteristics of farms and farmers who conclude agri-environmental contracts (e.g., Crabtree *et al.*, 1998; Beedell & Rehman, 2000; Wynn *et al.*, 2001; Vanslembrouck *et al.*, 2002; Van Wenum, 2002). Van Huylenbroeck *et al.* (2000) developed a simulation model to evaluate the impact of agri-environmental programmes on production, management and economic results of dairy farms. Peerlings & Polman (2004) used a micro-econometric model to model agri-environmental contract choice. In their study they took into account transaction costs involved in contract choice. Compared with these studies we introduce the factors that are important for internal motivation, i.e., public and private extension services, trust in the government, perceived institutional design of contracts, and social capital.

Parties to a contract will choose to conclude or to renew a contract if the expected gains from doing so are greater than those of organizing the transaction in some other way or having no transaction at all (e.g., Masten, 1996; Masten & Saussier, 2002), or formally written as:

$$G^* = G^i, \text{ if } V^i > V^j, \text{ and} \quad (1)$$
$$= G^j, \text{ if } V^i \leq V^j$$

where G^i represents contract type i, G^j an alternative contract type j, V^i and V^j (the farmers beliefs about) the corresponding values of contract type i and alternative j, and G^* represents the contract type actually chosen.

Implementing an AES contract on a farm means that the farmer supplies a service to society where the government is the procurer of the service. Because the returns farmers expect are difficult to observe, a testable theory of contracting requires that the theory relates the benefits and costs of contract types to observable features of the transaction (Masten & Saussier, 2002). Therefore, the following relations are added to Equation 1:

$$V^i = V^i(x, e_i) \quad (2)$$
$$V^j = V^j(x, e_j) \quad (3)$$

where x represents a vector of observable attributes affecting the motivations for enrolling in a specific contract, and e_i and e_j represent error terms that may reflect either variables

omitted (like farm income or attitudes of farmers towards farming (Jongeneel *et al.*, 2008) or misperceptions on the part of the contract parties about the true values of V^i and V^j.

The model refers to two different contracts but can be extended to three or more. Farmers choose (a combination of) contract(s) if the gains from doing so are greater than those from another (combination of) contracts(s). Farmers can decide simultaneously whether to conclude one or more contracts. The explanatory variables of Equations 2 and 3 influence all these decisions.

Public and private extension services

The importance of providing farmers with information through agricultural extension services (e.g., on AES scheme objectives, eligibility, criteria) has been identified as vital with regard to shaping farmers' attitude towards AESs and their traditional farming practices, and to agricultural knowledge systems of rural communities. In particular, the way in which a farmer finds out about a scheme and how the scheme is 'sold' by street-level bureaucrats plays an important role in the successful uptake of schemes and in the way schemes are viewed by farmers (Wilson & Hart, 2001).

Morris *et al.* (2000) show that many arable farmers offered the generic type of resistance to agro-environmental schemes often in association with objection in principle to perceived constraints on freedom to farm, which was strengthened by lack of knowledge of the scheme. Furthermore, there were quite a number of non-participants whose potential enrolment was constrained by inadequate or incorrect information. Public and private extension services can help to overcome these information asymmetries. Morris *et al.* (2000) argue that participation can be enhanced by a purposeful promotion campaign and possible modification of scheme design. In our study we distinguish between both types of extension services because their role is different. Public extension services can be expected to inform farmers in a different way because they are connected to policy. Public extension may lead to lower costs, for example farmers may have a better understanding of what is required from them (see Falconer, 2000). Private extension services are often linked to organizations like suppliers, processing industries, fiscal advisors, and banks. Private extension focuses for instance on the improvement of dairy production or are dealing with investments.

Trust in government and institutional design

The use of contracts will serve different purposes. In some cases contracts may be used chiefly to assure technical compliance with needs. In other cases contracts may seek to control opportunism or shirking. It is clear that in either case a level of trust may also be required in order to establish a relationship at all, before a contract could be used (Bennet & Robson, 2004). In general, the economic function of trust refers to the reduction of transaction costs and its influence on promoting co-operation and reducing the need (costs) for intervention to prevent or correct dishonesty (e.g., James & Sykuta, 2005). Klein-Woolthuis *et al.* (2005) give three interpretations of trust. First, within transaction cost economics and contract theory, contracts are a basis for trust. Contracting partners are limited, because they have no other option than to behave

trustworthily (opportunism will be at the expense of sanctions). Here contract and trust are positively related with contract as a prerequisite for trust. Second, social scientists often envisage contracts as being in conflict with trust. Third, contracts can be negatively related with trust, thereby decreasing or eliminating the need for control or contracts (Klein-Woolthuis, 1999; Nooteboom, 2002). In this paper we adopt a narrow definition of trust entailing the expectation that the government will not engage in opportunistic behaviour, even in the face of opportunities and incentives for opportunism, irrespective of the ability to monitor or control farmers (see also Klein Woolthuis *et al.*, 2005). This definition is felt to indicate what most people would call 'real trust'.

Motivation of farmers to participate in AESs can also be derived from trustworthiness and reputation of the government. AESs are contracts between farmers and the government and contracts are a two-sided mechanism. Both parties have to build up reputation and trust. A low level of trust of farmers in the government or a low reputation of the government has important consequences for the uptake of contracts. Important in this context is time inconsistency (Kydland & Prescott, 1977). This phenomenon, which can be considered as a kind of hidden action, refers to a government's propensity to modify policy or the rules of the game of the institutional environment, and people's awareness of the likelihood and implications of this. It affects commitment and creates a negative influence on the uptake of contracts, especially long-term ones.

Yang & Holzer (2006) discuss a number of arguments that could lead to difficulties in analysing the link between the performance of governments and trust in these governments. Applying these arguments to AESs leads to the following dimensions of trust between farmers and the government: (1) Farmers may have different expectations of what kind of AES the government should provide. As a result, their reactions to the same level of actual performance with respect to the institutional quality of AES design may be very different. It is not the actual performance that matters but the gap between expectation and performance. (2) Farmers may have negative perceptions regardless of how government is actually performing. (3) Government performance is produced collectively by a number of agencies but some agencies feature more strongly in farmers' image of government, like for instance the parliament. (4) Performance with respect to AESs is not the only criterion that farmers use to evaluate government. (5) For some issues bad governance leads to distrust but good governance tends to go unnoticed. Although these aspects have relevance, surveys show that citizens are able to assess the performance of public services in a rather objective way, without constantly referring to stereotypes.

Trust in government, parliament, or the civil service has received increased attention in recent years (Bouckart & Van Der Walle, 2003). These authors show that there may always be a certain cultural/political bias in trust attributes. The factors determining trust in government are not necessarily the same for every country or political culture and may vary over time. Several studies have shown that the institutional environment matters for the variability of contracts in relation to their transactions, that there are different arrangements in the same environment, and that the institutional environment influences the performance and duration of contracts (e.g., Ménard, 2000). It is not easy to obtain measures of relevant dimensions of the

institutional environment in order to isolate its impact on institutional arrangements (e.g., Oxley, 1999). For a country, trust in the administration responsible for AESs indicates congruence between farmers' preferences and the perceived actual functioning of the government in that country.

Assessment of AES contract requirements and of the effects of the contracts in terms of uptake and environmental effectiveness merely results in an incomplete analysis because it assumes that the design of the AES programme as set up by the European Union and national government is optimal. In this paper we shall focus on the perception of institutional design by farmers as explanatory factor for the uptake of AESs. Perceptions are used because farmers only observe part of the institutional design. If farmers perceive that the institutional design of contracts is weak they are less likely to conclude agri-environmental contracts.

Self-interest and social capital

Building-in self-interest means that people are doing things that are of interest to themselves. Such interests can vary from financial benefits to *responsible entrepreneurship*. The understanding of *responsible entrepreneurship* is fully on the move and is related to a varied and complex phenomenon. In general, self-interest can be understood to mean that a farmer should not only think in terms of the economic value of the firm (mostly represented by the profit of the farm). He should also consider social and ecological values as a result of the farm's activities in terms of social and ecological quantities. This is indicated by the 'Triple-P bottom line'. The three P's stand for People, Planet and Profit, i.e., the extent to which farms are able to realize sustainable developments from an economic (*Profit*), ecological (*Planet*), and societal (*People*) point of view. From this viewpoint, farms function in a socially responsible manner (*responsible entrepreneurship*) if the economic, social and ecological values that they produce fulfil the expectations of the stakeholders. Satisfying the social and ecological criteria actually creates a 'permit' to carry out farming activities (Van Huylenbroeck & Slangen, 2003). Concerning the social aspect of *responsible entrepreneurship*, farmers participating in social networks like sports clubs or clubs focused on community work are often more likely to participate because of their values. This can be driven by internal motives or social capital.

Social capital is "the shared knowledge, understandings, norms, rules, and expectations about patterns of interactions that groups of individuals bring to a recurrent activity" (Ostrom, 2000). Trust is perhaps the most important component of social capital. If one's confidence in an enforcement agency falters, one does not trust people to fulfil their agreements and agreements are not entered into (Dasgupta, 2000). In addition to trust, other elements of social capital include social norms, or behavioural strategies subscribed to by everyone in society, and networks of civic engagement (e.g., membership of a swimming club or religious community) that enhance co-operation. Higher participation in societal activities, such as being a passive – but especially an active – member of (agricultural or non-agricultural) organizations are indicators for higher levels of social capital (e.g., Beugelsdijk, 2003). Social capital could lead to lower transaction costs or change attitudes towards the agri-environment.

An example can be found in Landcare group networks in Australia. The concept of social capital explains, at least in part, the apparent success of such networks (e.g., Sobels *et al.*, 2001).

The literature is far from unambiguous and consistent in defining social capital for empirical analysis (Beugelsdijk, 2003). For this reason we have to specify social capital. In this paper we shall use the individual level of social capital. At the individual level social capital relates to network resources and is thought of as a set of resources embedded in relationships (Beugelsdijk, 2003). At the individual level, trust is an element that is necessary for the existence of social capital. Several studies have shown the importance of trust in a society for economic transactions (Beugelsdijk, 2003). This type of trust is different from trust in a contracting partner where trust is focused on a single person or organization like the government.

Group membership is the second element of social capital included in this paper. The economic function of associational activity contains two elements (Beugelsdijk, 2003). The first element refers to the concept of collective action and argues that organized group behaviour leads to the generally shared idea that the pursuit of collective goods is not seen as contradictory to the achievement of personal wealth. Associational activity limits the costs of free riding. The second element, embeddedness in networks (group membership), promotes the spillover of knowledge and information between the different actors involved. Farmer networking could be important to the overall running costs of AESs (e.g., Falconer, 2000). Falconer (2000) argues, for example, that scheme participation may be promoted by friends and neighbours, which may also have a positive impact in terms of allowing reduction in the public costs of scheme promotion. Examples of such networks are environmental co-operatives in the Netherlands, in which farmers exchange information and are collectively involved in AESs. Some networks are not only for exchanging information but are in fact part of an institutional arrangement to participate in AESs and are therefore not exogenous like groups of farmers involved in contracting AESs. In this paper we look at the participation in groups of farmers who do focus on improving agriculture practices that are not directly linked to AESs.

Empirical model and data

The econometric method applied to the aforementioned theoretical model is a trivariate probit model. This technique (Capellari & Jenkins, 2003; Greene, 2003) enables us to model farmers' decisions to take up more than one contract at a time. Since the outcomes are treated as binary variables, any combination of contracts is possible. The contracts can be complements rather than just substitutes. Unlike the multinomial model the equation can vary across outcomes. The multivariate model applies when several decisions may be interdependent or may depend on a common set of explanatory variables:

$$y_1^* = \begin{cases} 1 & \text{if } X_1\beta_1 + \varepsilon_1 > 0 \\ 0 & \text{otherwise} \end{cases} \qquad y_2^* = \begin{cases} 1 & \text{if } X_2\beta_2 + \varepsilon_2 > 0 \\ 0 & \text{otherwise} \end{cases} \qquad y_3^* = \begin{cases} 1 & \text{if } X_3\beta_3 + \varepsilon_3 > 0 \\ 0 & \text{otherwise} \end{cases} \tag{4}$$

where ν_1, ν_2 and ν_3 are binary variables; X_1, X_2 and X_3 are explanatory variables; β_1, β_2 and β_3 are regression coefficients; ε_1, ε_2 and ε_3 are error terms.

This three-equation model is featured by correlated disturbances, which (due to identification reasons) are assumed to follow a normal distribution (variance is normalized to unity). That is:

$$\begin{aligned} &E[\varepsilon_1] = E[\varepsilon_2] = E[\varepsilon_3] = 0 \\ &\text{cov}[\varepsilon_1, \varepsilon_2, \varepsilon_3] = \rho = \{\rho_{1,2}, \rho_{1,3}, \rho_{2,3},\} \\ &\text{var}[\varepsilon_1] = \text{var}[\varepsilon_2] = \text{var}[\varepsilon_3] = 1 \end{aligned} \tag{5}$$

where ρ is a vector of correlation parameters denoting the extent to which the error terms co-vary. Should covariation be the case, we need to estimate the three equations jointly, following a trivariate normal distribution: $\{\varepsilon_1, \varepsilon_2, \varepsilon_3\} = \phi_3\,(0, 0, 0, 1, 1, 1, \rho)$.

As long as we are interested in simultaneous decisions, we need to define the joint probability. For example, the probability of observing the three decisions taking place at the same time ($\nu_1 = 1$, $\nu_2 = 1$, $\nu_3 = 1$) would be:

$$\Pr(\nu_1 = 1, \nu_2 = 1, \nu_3 = 1) = \int_{-\infty}^{U_1}\int_{-\infty}^{U_2}\int_{-\infty}^{U_3} \phi_3(X_{1i}\beta_1, X_{2i}\beta_{2'}, X_{3i}\beta_3, \rho)\mathrm{d}\varepsilon_1\mathrm{d}\varepsilon_2\mathrm{d}\varepsilon_3 = \tag{6}$$
$$\phi_3(X_{1i}\beta_1, X_{2i}\beta_{2'}, X_{3i}\beta_3, \rho)\mathrm{d}\varepsilon_1\mathrm{d}\varepsilon_2\mathrm{d}\varepsilon_3$$

As in the standard probit model, observations contribute some combination of $\Pr(\nu_k = 1)$ for $k\{1,2,3\}$, depending on their specific values on those variables. The log-likelihood is then just a sum across the eight possible contracting variables (that is, eight possible combinations of successes ($\nu_k = 1$) and failures ($\nu_k = 0$) times their associated probabilities (Greene, 2003). These probabilities may be drawn from Equation (6) as well. The most relevant coefficients estimated in the model are β_1, β_2, β_3 and $\rho(\rho_{1,2}, \rho_{1,3}, \rho_{2,3})$. The latter, if significantly different from 0, will evaluate to which extent each pair of decisions is interrelated. The Geweke-Hajivassiliou-Keane simulator (GHK) is used to approximate those integrals. See Capellari & Jenkins (2003) and Greene (2003) for a brief description of the GHK.

Data

In 2005, face-to-face surveys were carried out in the following areas: Fryslân (the Netherlands), Flanders (Belgium), Czech Republic, Finland, Basse-Normandie (France), and Emilia Romagna (Italy). A total of 990 farmers were interviewed. In order to obtain better information on agri-environmental contracts, contracting farmers were willfully over-represented in the sample. In the Netherlands and France grassland was the most important form of land use, in Belgium it was a mixture of grassland and arable land, and in Finland and Italy arable land was most important. The questionnaire used addressed issues concerning the farm, the farmer's perception of agri-environmental contracts, information on income, social capital, motivational issues and hobbies.

Table 1. Data for the average farm in 2005 (n = 990).

Variable	Description	Average	SD [1]
DEPENDENT VARIABLES			
Contracting type	0 = no contract		
	1 = landscape management (area based)	0.16	
	2 = biodiversity protection	0.26	
	3 = restriction of intensive practices	0.25	
INDEPENDENT VARIABLES			
Farm characteristics			
Specialization dairy farming	Farm type dairy (percentage SGM [2] in dairy).	29.81	30.02
Specialization beef farming	Farm type beef cattle (percentage SGM in beef production (grazing cattle).	1.72	5.11
Farm size	Farm size (total number of SGM × 1000).	14.64	42.76
Trajectory	Dynamics in current farming (number of changes in farming practices not related to AES).	3.25	1.85
Future	Future of farm (dummy indicating whether farm is expected to be continued in the next 10 years).	0.87	
Intensity	Intensity of farm (measured in SGM per ha).	0.37	1.64
Farmer characteristics			
Age between 40 and 55, and age older than 55	Dummy age farm head between 40 and 55 and older than 55 (age of farm head or average age in case of more than one farm head).	0.23/0.50	
Medium education and high education	Dummy education medium level and high level (education of farm head or highest education in case of more farm heads).	0.80/0.14	
Off-farm income	Dummy off-farm labour income (off-farm employment) is more than 50%.	0.13	
Extension services			
Public extension	Dummy indicating that farmer often receives public extension.	0.60	
Private extension	Dummy indicating that farmer often receives private extension.	0.66	
Trust in government and institutional design			
Trust government	Dummy indicating that 'The ..... can be trusted' where ..... stands for agricultural administration, environmental administration, or EU (average score of Likert scales).	0.64	
Institutional design	Average score on six items on a Likert scale related to institutional design. – 'The eligibility rules are fair'. – 'The procedures for application are easy'. – 'The rules and requirements are easy to understand'. – 'The intended environmental benefits are clear and easy to understand'.	2.58	0.49

Table 1 (cont'd).

Variable	Description	Average	SD [1]
	– 'It is easy to find the right person in the administration to contact when there are problems'. – 'Regarding AES, administration behaviour is fair and responsible'.		
Preference stable policy	Dummy indicating that farmers believe that the current policy rules and regulations will remain constant over a longer period.	0.25	
Social capital			
Trust general	Dummy indicating that 'Generally speaking, most people can be trusted.'	0.74	
Participation social organizations	Dummy indicating that farmer often participates in activities of non-agricultural organizations like sports clubs and clubs focused on community work.	0.42	
Participation agricultural organizations	Dummy indicating that farmer often participates in agricultural organization (farmers union and local farmers' groups mainly oriented at improving agriculture).	0.31	
Case study area dummies			
Fryslân (the Netherlands)	Dummy indicating case study area Fryslân.	0.12	
Flanders (Belgium)	Dummy indicating case study area Flanders.	0.24	
Czech Republic	Dummy indicating case study area Czech Republic.	0.15	
Finland	Dummy indicating case study area Finland.	0.09	
Basse-Normandie (France)	Dummy indicating case study area Basse-Normandie.	0.27	
Emilia Romagna (Italy)	Dummy indicating case study area Emilia Romagna.	0.13	

[1] SD = standard deviation.

[2] SGM = The Standard Gross Margin (SGM) of a crop or livestock unit is defined as the value of output from one hectare or from one animal minus the cost of variable inputs required to produce that output. For each region all crop and livestock units are accorded an SGM. To avoid bias caused by fluctuations, e.g., in production (due to bad weather) or in input/output prices, three-year averages are taken.

In addition, farmers were asked about how they managed their contracts and their required farming practices.

From the questionnaire several variables were derived. They described the farming family (education level and age), their production system (e.g., farm legal status, farm size in Standard Gross Margins (SGM; for definition see Table 1)) the use of extension services, trust in the government and institutional design, and social capital (trust and participation in networks). The latter three sets of variables are important motivation variables. Table 1 gives an overview of the data used for the estimation.

We distinguished three groups of contracts: (1) focusing on landscape management, (2) on biodiversity protection, and (3) on the restriction of intensive practices (Bonnieux *et al.*, 2002). These groups were homogeneous with respect to the type of contract

requirements. Landscape management focused on the maintenance of landscape elements. Biodiversity protection referred to extensive management of grassland and management to promote flora and fauna. Winter cover on arable land and reduced use of fertilizers are examples of the restriction of intensive practices.

Farm and farmer characteristics are relevant for the uptake of AESs. From previous studies it follows that farm size and farm type influence the uptake of AESs (e.g., Wynn *et al.*, 2001; Vanslembrouck *et al.*, 2002). The type of service delivered by the farmer varies according to the farming system. Implementing a biodiversity protection contract on a specialized dairy farm will be different from implementing the same contract on a specialized arable farm. Farmers who develop their farm in a direction not related to AESs are expected to be less willing to be involved in agri-environmental contracts. Also Wynn *et al.* (2001) show the importance of the 'fit' of the scheme with the farm.

Based on the literature, we included a number of farmer characteristics in the model (e.g., Wilson, 1997; Rizov, 2004). Dummy variables for age and education were added to the model. Reference categories for age and education were dropped from the model in order to avoid a dummy trap (Woolridge, 2006). Moreover, a variable for off-farm income was added to represent labour availability. According to Jongeneel *et al.* (2008) it was expected that if non-farming income is important a farmer is more likely to enroll in agri-environmental schemes.

Private as well as public extension services are expected to influence uptake. The questions on extension services did not focus on AESs and were formulated in general terms. It can be expected that information on AESs was only part of these extension services. Private extension is provided by feed suppliers, banks, researchers, and processing industries. Public extension will include the complete range of governmental regulation including AESs so that a positive influence is expected on the uptake of AES. Given the nature of private extension (focused on general farming practices) it is expected that this will negatively influence the uptake of AES. A positive assessment of institutional design is expected to increase the uptake of AES.

Social capital is measured using the following indicators: (1) trust in general, (2) participation in social networks, and (3) participation in agricultural networks. Higher levels of trust in general and trust in the government in particular (as contracting partner) are expected to enhance the uptake. The social networks are more general networks not related to agriculture but, for example, to involvement in sports clubs. Agricultural networks focus on improving agricultural practices. The more general networks are thought to increase the probability of uptake of AESs because the farmers concerned feel a large social responsibility. Participation in agricultural networks is expected to negatively influence uptake because the farmers are more oriented towards improving agricultural operation.

Country specificities, including characteristics of sampling in each case study, were taken into account through country dummies. The dummies were introduced as control variables. The Netherlands was taken as reference.

Results

The results of the estimations are presented in Table 2. The likelihood of participation

Table 2. Estimation results of multivariate probit model (n = 990).

Independent variable	Landscape management	Biodiversity protection	Restriction of intensive practices
Farm characteristics			
Specialization dairy farming	0.0015	0.0047 **	–0.0058 ***
Specialization beef farming	–0.094	0.0032	0.0035
Farm size	–0.0015	–0.0018	–0.0012
Trajectory	0.058 **	0.042	0.083 ***
Future	–0.061	0.073	–0.034
Intensity	–0.030		
Farmer characteristics			
Age between 40 and 55	0.053	–0.12	–0.083
Age older than 55	–0.046	–0.050	–0.35 ***
Medium education	0.073	0.11	0.083
High education	0.13	0.095	0.15
Off-farm income	0.031	0.029	0.32 **
Extension services			
Public extension	0.25 **	0.19 *	0.36 ***
Private extension	0.15	–0.16	–0.17 *
Trust in government and institutional design			
Trust government	–0.011	–0.022	0.21 **
Institutional design	0.15	0.45 ***	0.12 ***
Preference stable policy	0.050	0.38 ***	0.037
Social capital			
Trust general	–0.014	0.018	–0.012
Participation social organizations	0.24 **	0.082	0.27 ***
Participation agricultural organizations	–0.25**	–0.15 *	–0.28 ***
Case-study area dummies			
Flanders (Belgium)	–0.00054	–0.089	0.25
Czech Republic	–0.19	–1.90 ***	0.022
Finland	–1.49 ***	–0.84 ***	0.75 ***
Basse-Normandie (France)	0.24	0.080	–0.50 ***
Emilia Romagna (Italy)	0.039	–1.10 ***	–0.48 **

Constant	–1.89 ***	–2.02 ***	–0.80 *

[1] Statistical significance: * = $P < 0.10$; ** = $P < 0.05$; *** = $P < 0.01$.

in landscape management and biodiversity protection is positively related to specialization in dairy farming. Specialized dairy farmers are less likely to be involved in less intensive practices. The trajectory of the farm – the number of changes in farming practices not related to AES – has a positive effect on the likelihood of enrolling in landscape management and restriction of intensive practices. The intensity of the farm has no effect on the uptake of landscape management contracts (this variable was not included in the other equations). The future of the farm (whether the farmer expects his farm to be continued for the coming 10 years) has no statistically significant effect. Older farmers are less likely to enroll in contracts for restricting intensive practices. A large share of off-farm labour income makes contracts for restricting intensive practices more likely.

The perception of the institutional design has positive effects on participation in biodiversity and less intensive practices contracts. If farmers think that a stable policy is important they are more likely to be involved in biodiversity protection.

Trust in general has no effect on participation. Trust in the government only favours participation of farmers in contracts for restrictions on intensive practices. Participation in social organizations has positive effects on uptake of landscape maintenance and restriction on intensive practices contracts. Participation in organizations focused on improving farming has a negative impact on enrolling for the same contract types. Public extension services positively influence the uptake of all contract types. Furthermore, private extension services have a negative effect on the uptake of restricting intensive practices contracts. Farm size, intensity, and the future of the farm have no effect. A stable policy – i.e., no time inconsistency of the government – has a positive effect on participation for biodiversity protection contracts. The country dummies illustrate differences related to case-study specific factors such as the regional institutional environment, history and geographical characteristics of a case study area. We find evidence of correlation between the contracting decisions: the error terms between landscape management and biodiversity protection ($\rho_{1,2}$) are positively correlated and the error terms between biodiversity protection and restriction of intensive practices ($\rho_{1,3}$) are positively correlated. Finally, the error terms between biodiversity protection and restriction of intensive practices are positively correlated ($\rho_{2,3}$). The correlation coefficients are respectively 0.41, 0.38 and 0.38. These coefficients are statistically significant at the 0.01 level. The likelihood ratio test statistics suggest that $\rho_{1,2} = \rho_{1,3} = \rho_{2,3}$ can be rejected at the 1 percent significance level (LR–χ^2= 105.61).

Discussion and conclusions

Contract choice was described and analysed using a trivariate probit model. The model examined the influence of farmer and farm characteristics and motivational factors like institutional design of contracts, extension services, and social capital, to identify statistically significant variables related to the adoption of different contract types. Our results confirm earlier findings about the influence of farm and farmers' characteristics on the uptake of agri-environmental contracts (e.g., Crabtree *et al.*, 1998; Wynn *et al.*, 2001).

Most previous studies did not take into account motivational aspects about institutional design and social capital. First of all, these variables significantly affect the choice of some contract types but do not influence the choice of other ones. For example, participation in social networks is important for landscape management and for restrictions on intensive land use practices but is not important for biodiversity protection. Secondly, decisions to participate in more than one contract type are not taken independently. Farmers combine different contract types.

The results of the analysis are important in terms of policy design. They indicate that the implementation of a restricted intensive practices contract on specialized dairy farms is different from that on less specialized farms. This suggests that contracts have to be clearly targeted to well-specified transactions and have to take the characteristics of the farm and the farmer into account. This will increase the effectiveness and efficiency of the policy.

The results show the importance of institutional design. A negative farmer's perception of the institutional design can prevent him from contracting. The results furthermore suggest that public extension services can enhance the uptake and overcome negative perceptions. To enhance the uptake extension services should focus on the way AESs are being perceived. Trust in the government also increases uptake. Trust is a necessary condition of contracting, a conclusion that is in line with Klein Woolthuis *et al.* (2005). It means that well designed contracts cannot completely replace a lack of trust of farmers in the government. In short, the uptake can be increased by paying more attention to the motivational aspects of the institutional design of the contracts and by maintaining and developing trustworthiness.

Finally, our paper shows the importance of social capital for the uptake of AESs. Farmers who are frequently engaged in non-agricultural networks are more likely to be involved in AES. This implies that not only financial concerns are important for the uptake of agri-environmental schemes but also that farmers are influenced by their social networks, underlining the importance of internal motivation and responsible entrepreneurship and showing the importance of non-monetary benefits of being involved in AESs. Farmers who only participate in general farming networks are less likely to be involved in AES. Apparently, they have other preferences.

The analysis is subject to some qualifications. First, we only modelled a limited number of different contract types. Besides, only groups of similar contracts with different characteristics were analysed. This could have led to aggregation errors. Second, other factors, e.g., preferences for contract terms like contract duration and payment levels not included in the model, might have played a role in contract choice.

Despite these qualifications the approach discussed contributes to the existing literature because it makes it possible to determine the farmers' choice between different contract types. It introduces institutional preferences, public extension services, trust in the government and social capital. Given the farm-specific/contract-specific outcomes, the survey and model can help to better understand reasons why farms conclude a specific contract. This information is relevant given the larger emphasis the EU is putting on quantifying the effects of agri-environmental policies.

References

Beedell, J. & T. Rehman, 2000. Using social-psychology models to understand farmers' conservation behaviour. *Journal of Rural Studies* 16: 117–127.

Bennet, R.J. & P.J.A. Robson, 2004. The role of trust and contract in the supply of business advice. *Cambridge Journal of Economics* 28: 471–488.

Beugelsdijk, S., 2000. Culture and economic development in Europe. PhD thesis Tilburg University, Tilburg, 200 pp.

Bonnieux F., P. Dupraz & C. Retière, 2002. Farmer's supply of environmental benefits. In: E. Vardal (Ed.), Multifunctionality of Agriculture. Seminar Proceedings, 16–18 February 2002. Department of Economics of the University of Bergen, Research Council of Norway, pp. 105–133.

Bouckaert, G. & S. Van De Walle, 2003. Comparing measures of citizen trust and user satisfaction as indicators of 'good governance': difficulties in liking trust and satisfaction indicators. *International Review of Administrative Sciences* 69: 329–343.

Bogetoft, P. & H.B. Olesen, 2002. Ten rules of thumb in contract design: lessons from Danish agriculture. *European Review of Agricultural Economics* 29: 185–204.

Cappellari, L. & S.P. Jenkins, 2003. Multivariate probit regression using simulated maximum likelihood. *The Stata Journal* 3: 278–294.

Crabtree, B., N. Chalmers & N. Barron, 1998. Information for policy design: modelling participation in a farm woodland incentive contract. *Journal of Agricultural Economics* 49: 306–320.

Dasgupta, P., 2000. Economic progress and the idea of social capital. In: P. Dasgupta & I. Serageldin (Eds), Social Capital. A Multifaceted Perspective. World Bank, Washington, D.C., pp. 325–424.

FitzRoy, F.R., Z.J. Acs & D.A. Gerlowski, 1998. Management and Economics of Organization. Prentice Hall Europe, London, 598 pp.

Falconer, K., 2000. Farm-level constraints on agri-environmental scheme participation: a transactional perspective. *Journal of Rural Studies* 16: 379–394.

Greene, W.H., 2003. Econometric Analysis (5th edition). Prentice Hall, Upper Saddle River, New Jersey, 1026 pp.

Hart, O. & B. Holmström, 1987. Theory of contracts. In: T.F. Bewley (Ed.), Advances in Economic Theory; Fifth World Congress. Econometric Society Monographs No 12, Cambridge, pp. 71–155.

James, H.S. & M.E. Sykuta, 2005. Property right and organizational characteristics of producer owned firms and organization trust. *Annals of Public and Cooperative Economics* 76: 545–580.

Jongeneel, R.A., N.B.P. Polman & L.H.G. Slangen, 2008. Why are Dutch farmers going multifunctional? *Land Use Policy* 25: 81–94.

Klein Woolthuis, R., 1999. Trust, dependence and contract in interorganisational relationships; sleeping with the enemy. PhD thesis University Twente, Enschede, 217 pp.

Klein Woolthuis, R., B. Hillebrand & B. Nooteboom, 2005. Trust, contract and relationship development. *Organisation Studies* 26: 813–840.

Kydland, F.W. & E.C. Prescott, 1977. Rules rather than discretion: the inconsistency of optimal plans. *Journal of Political Economy* 85: 473–491.

Le Grand, J., 2003. Motivation, Agency and Public Policy: of Knights and Knaves, Pawns and Queens. Oxford University Press, Oxford, 191 pp.

Masten, S.E., 1996. Introduction. In: S.E. Masten (Ed.), Case Studies in Contracting and Organization. Oxford University Press, Oxford, pp. 3–28.

Masten, S.E. & S. Saussier, 2002. Econometrics of contracts: an assessment of developments in the

empirical literature on contracting. In: E. Brousseau & J.M. Glachant (Eds), The Economics of Contracts;
Theories and Applications. Cambridge University Press, Cambridge, pp. 273–293.

Ménard, C., 2000. Enforcement procedures and governance structures: what relationship. In: C. Ménard (Ed.), Institutions, Contracts and Organizations; Perspectives from New Institutional Economics. Edward Elgar, Cheltenham, pp. 234–253.

Milgrom, P. & J. Roberts, 1992. Economics, Organization and Management. Prentice Hall International, Englewood Cliffs, New Jersey, 621 pp.

Morris, J., J. Mills & I.M. Crawford, 2000. Promoting farmer uptake of agri-environmental schemes: the countryside stewardship arable options scheme. *Land Use Policy* 17: 241–254.

Nooteboom, B., 2002. Trust: Forms, Foundations, Functions, Failures and Figures. Edward Elgar, Cheltenham, 231 pp.

Oskam, A.J. & L.H.G. Slangen, 1998. The financial and economic consequences of a wildlife development and conservation plan: a case study for the ecological main structure in the Netherlands. In: S. Dabbert, A. Dubgaard, L.H.G. Slangen & M. Whitby (Eds), The Economics of Landscape and Wildlife Conservation. CAB International, Wallingford, pp. 113–133.

Ostrom, E., 2000. Social capital: a fad or a fundamental concept? In: P. Dasgupta & I. Serageldin (Eds), Social Capital. A Multifaceted Perspective. World Bank, Washington, D.C., pp. 172–214.

Oxley, J.E., 1999. Institutional environment and the mechanisms of governance: the impact of intellectual property protection on the structure of inter-firm alliances. *Journal of Economic Behavior and Organzation* 38: 283–309.

Ozanne, A., T. Hogan & D. Colman, 2001. Moral hazard, risk aversion and compliance monitoring in agri-environmental policy. *European Review of Agricultural Economics* 28: 329–347.

Peerlings, J. & N. Polman, 2004. Wildlife and landscape services production in Dutch dairy farming: jointness and transaction costs. *European Review of Agricultural Economics* 31: 427–449.

Rizov, M., 2004. Rural development and welfare implications of CAP reforms. *Journal of Policy Modeling* 26: 209–222.

Sobels, J., A. Curtis & S. Lockie, 2001. The role of land care group networks in rural Australia: exploring the contribution of social capital. *Journal of Rural Studies* 17: 265–276.

Van Huylenbroeck, G., G. Jacobs & P. Vanrolleghem, 2000. A simulation model to evaluate the impact of environmental programmes on dairy farms. *International Transactions in Operational Research* 7: 171–183.

Van Huylenbroeck, G. & L. Slangen, 2003. New institutional arrangements for rural areas. *Tijdschrift voor Sociaalwetenschappelijk Onderzoek van de Landbouw* 18: 107–121. (in Dutch)

Vanslembrouck, I., G. Van Huylenbroeck & W. Verbeke, 2002. Determinants of the willingness of Belgian farmers to participate in agri-environmental measures. *Journal of Agricultural Economics* 51: 489–511.

Van Wenum, J., 2002. Economic analysis of wildlife and conservation in crop farming. PhD thesis Wageningen University, Wageningen, 117 pp.

White, B., 2002. Designing voluntary agri-environmental policy with hidden information and hidden action: a note. *Journal of Agricultural Economics* 53: 353–360.

Wilson, G.A., 1997. Factors influencing farmer participation in environmentally sensitive areas scheme. *Journal of Environmental Management* 50: 67–93.

Wilson, G.A. & K. Hart, 2001. Farmer participation in agri-environmental schemes: towards conservation oriented thinking? *Sociologia Ruralis* 41: 254–274.

Wooldridge, M.J., 2002. Econometric Analysis of Cross Section and Panel Data. MIT, Cambridge, Massachusetts,

752 pp.
Wynn, G., B. Crabtree & J. Potts, 2001. Modelling farmer entry into the environmentally sensitive area schemes in Scotland. *Journal of Agricultural Economics* 52: 65–82.
Yang, K. & M. Holzer, 2006. The performance-trust link: implications for performance measurement. *Public Administration Review* 66: 114–126.

Note

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