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« What shapes farmers' attitudes towards agri-environmental payments : A case study in Lozere »

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What shapes farmers' attitudes towards agri-environmental payments : A case study in Lozere

S. Saïd and S. Thoyer

1. Introduction

Agri-environment schemes were introduced into the Common agricultural policy (CAP) in 1992 as a financial instrument to support farming practices contributing to protect the environment and to preserve natural resources. They are based on the voluntary provision of environmental services (above and beyond the regulatory duty of care level) by farmers on their private land in return for a compensatory payment by the EU and the member state. Agri-environmental measures are the object of a contract between individual farmers and the environmental service purchaser (the state or the environmental public authority), specifying the actions that should be undertaken, the contract length, the control method and the payments made to farmers.

Since the environmental benefits of such contracts have no market price, the question of how much farmers should be paid to provide such services remains open. The European Commission has privileged an approach based on the compensation of farmers' compliance costs: member states are required to calculate a payment which covers the additional costs associated with the adoption of the environmental-friendly practice or action, both in terms of financial costs (more expensive inputs, additional labour, investments in new equipment) and in terms of potential revenue losses (due to lower yields, lower farming intensity or lower quality of output). This payment principle is therefore founded on the expected willingness to accept by farmers who are the suppliers of the environmental service. However, since the net costs of technology switching is farmer's private information, payments cannot be perfectly tailored to reflect the true compliance costs of each individual farmer. They are thus calculated on the basis of the estimated costs of a representative farm at the national level, sometimes adjusted to reflect regional characteristics. Therefore payments do not take into account cost heterogeneity across farmers due to nature of soils, location of farm plots, farmers' technologies and know-how. They are uniform payments per environmental action.

Another approach would be to calculate farmers' payments on the basis of the willingness to pay by society for the service provided. Farmers providing environmental benefits with greater value would thus get higher payments. Payments would reflect the environmental demand characteristics instead of the environmental supply characteristics. It is less easy to implement since it requires to measure or reveal such willingness to pay. It is not implemented as such in practice. However, it is worth mentioning that the European Commission has partially adopted this demand-side approach in its recommendation to provide a premium payment over and above calculated costs to farmers who are located in environmentally-sensitive areas (such as Natura 2000 zones, and priority zones of the water framework directive). It is in effect a way of reflecting in agri-environmental payments the priority that society gives to environmentally vulnerable areas.

The third approach is disconnected from environmental supply or demand considerations. It consists in establishing agri-environmental payment rules on the basis of farmers' needs for income support. Agri-environmental payments often represent a non negligible –and secure- source of farm income and have contributed to maintain farming in less favourable areas. It is a fact that agri-environmental policies have often been used by member States to supplement farm income, in a way which was compatible with the decoupling requirements of the World Trade Organization. This is easily revealed by the analysis of agri-environmental measures selected by regions: regions wishing to support farm income tend to design measures which require a minimum effort from farmers, therefore creating windfall income effects without generating much environmental gains. This is typically the essence of the French grass premium[1].

Hence, although closely supervised by Brussels, payment rules vary from one member State to another, often reflecting the relative weights that national decision-makers give to these three approaches: the compliance cost rule (supply side), the environmental service rule (demand side), and the needs rule (income support). The ambiguity about the true objectives of agri-environmental scheme (genuine environmental concerns or income-support) explains partly the disappointing results of the evaluation conducted by the EC (CE, 2005; Primdahl et

1 The French Grass Premium is explicitly "the Prime Herbagère Agri-Environnemental (PHAE)". It is intended to livestock breeders.

al, 2003), which pointed out the insufficient environmental outcomes of agri-environmental payments.

To respond to these shortcomings, and following an audit of the European Court of Auditors, the European Commission has thus required that agri-environmental schemes include quantifiable objectives and be more cost-effective. It has suggested that new allocation rules for agri-environmental contracts - such as competitive bidding – should be designed to improve their efficiency (Journal Officiel de l'Union Européenne, 2005). Therefore a debate will arise about the design of agri-environmental contracts and the calculation of agri-environmental payments. The existing European agri-environmental scheme, based on a menu of technical recommendations associated with uniform payments, might evolve to include individually-designed packages with farm-fitted measures and differentiated payments. Since the acceptability of reforms by farmers is a major concern for European decision-makers, it is essential to understand better what shapes farmers' attitudes towards the design of agri-environmental schemes in order to forecast better their reaction to reform. In particular, since the payment rule is a compromise between efficiency objectives, equity concerns and budgetary constraints, it is likely that it will incorporate a variable mix of the three approaches described above. It is necessary to find out what are farmers' preferences over these three rules since it may condition –at least partially- their willingness to participate to the reformed agri-environmental schemes.

The objectives of this paper are therefore twofold: (i) to provide insights into the way farmers perceive agri-environmental schemes. (ii) to design a methodology in order to measure the relative preference of farmers for three types of agri-environmental payments rules: payments based on compliance costs; payments based on environmental contributions; and payments based on needs for income support. This question echoes the debate on equity and justice principles which often defines three rules for a fair allocation: the accountability principle, the efficiency principle, and the needs principle (Konow, 2001). We design a choice experiment in which farmers can choose between different payment rules. A preliminary survey conducted in Lozere (France) allows us to analyse with a binomial logit model how these preferences are structured.

The main conclusion is that farmers are open to change: although the survey was conducted in a region of extensive livestock production, where agri-environmental measures are notoriously used to distribute income-support. Surveyed farmers clearly indicate that they would favour a system which would be better tailored to the characteristics of each farm and which would better take into account each farmer's true compliance costs and contribution to the environment.

The paper is organized as follows. Section 2 describes the case study and the survey design. Section 3 discusses the results on farmers' attitudes towards agri-environmental schemes. Section 4 describes the choice-modelling survey and presents the results of the logit model on farmers' preferences concerning agri-environmental payment rules. Section 5 concludes.

2. The case study

2.1. Farming systems in the Lozere area

Since it was not possible to design a nation-wide survey, we decided on the contrary to select a biased sample and to target a geographical area in which farmers could be expected to be very reluctant to accept changes in the design of existing agri-environmental schemes. The underlying assumption was that if our survey showed that farmers in such area accepted different allocation or payment rules, then we could hope to find even more encouraging results in other French regions.

Our survey was thus conducted in the Lozere *department*[2], located in the *Massif Central* mountain in the South-East of France. The climate is tough with cold winters and dry summers. The Lozere area is an essentially rural region of around 5100 km^2, of which 54% is farmland and the rest is mainly forests. The Lozère is characterized by low diversification of economic activity and is very dependent on agriculture, although the number of farmers is declining rapidly (minus 13% between 2000 and 2005, Agreste 2005) due to low agricultural income. Extensive livestock farming is the dominant farming system, with both cattle and sheep: 93% of farms have an average stocking density of less than one livestock unit per

[2] The French department is a geographical and administrative entity. There are 95 *departments* in France.

hectare. Although such extensive system does not generate much value added, it contributes to preserve the open landscape by maintaining large grazing areas.

We selected Lozere as the survey area for three reasons:

- Lozere is classified in class 5 of the 5 levels of less favoured area (LFA) defined by the European Commission. The average farm net income is 19 443 €, only half of the national average of 37 700 € (CNASEA, 2004). The CAP second pillar payments[3] represent up to 29% of the farm net income compared to 8.6% at the national level. Therefore, farmers are very dependant on CAP payments designed to fight back agricultural abandonment and to maintain the traditional landscape features.

- Farmers from Lozere have a long experience of agri-environmental contracts. Lozere was one of the first regions to experiment an agri-environmental scheme (called "agricultural abandonment control") under Article 19, in 1990 (Véron et al, 1999). It is also one of the area with the highest rate of farmers contracting for the grass premium (CNASEA, 2004): the grass premium payments represent 86% of all agri-environmental payments to Lozerian farmers (Agreste, 2006). It is an agri-environmental measure initially created in 1993 to encourage extensive livestock production on sown and natural pastures, with the stated objective of maintaining open landscapes and low soil and groundwater pollution levels. However, it is well known that livestock breeders in Lozere only need to adjust their traditional practices marginally to comply with the technical specification of the grass premium contract. Therefore, contracting for the grass premium does not require much additional effort from them. The grass premium typically provides windfall benefits to Lozerian farmers, and is considered by decision-makers more as an income-support measure to prevent land abandonment than as an environmental payment. The grass premium system has been reformed several times[4]: in the 2007-2013 French programme for rural development, it has been included in the agri-environmental scheme as a "national measure" entirely financed by the French state. Technical recommendations

[3] The second pillar payments (for rural development) are mainly the payments for natural handicap (in French the ICHN Indemnité Compensatoire d'Handicap Naturel) and agri-environmental measures.
[4] The predecessors of current grass premium are "Prime au maintien des système d'élevage extensive" (PMSEE) from 1993 to 2002 and "Prime Herbagère Agri-Environnementale 1" (PHAE1) from 2003 to 2006.

are designed, and payments per ha are calculated uniformly for the entire French territory.

- Due to practical constraints, we were limited on the number of surveyed farmers. We chose therefore to focus on a sample with low heterogeneity. The Lozerian farmers' situations (production system, type of agri-environmental contracts, environmental problem) are adapted for a small sampling.

Therefore, Lozerian farmers are familiar with agri-environmental contracting and their income depends heavily on the maintenance of the CAP' second pillar payments. They are mostly used to a uniform system in which all farmers get the same payment per ha notwithstanding their individual efforts or contributions to the environment. We can thus expect that any change in the allocation procedure of agri-environmental contracts might meet some opposition.

2.2. Sample description and survey design

Data collection was done by face to face interviews with farmers in August 2006 and they lasted on average one hour and a half. The questionnaire was structured into four sections. The first section was designed to collect data on the characteristics of the farming system and the farmer (production system, land use, labour use, income from other activities, gender, age, educational level, etc.). The second section included questions about the farmer' s opinion concerning what should be the objectives and targets of an agri-environmental scheme: to provide income support, to maintain traditional practices, to accelerate the adoption of more environmentally friendly practices, etc.). In the third section, we suggested new allocation and payments rules and asked farmers which design they would favour, had their the choice. The last section of the questionnaire is designed as a choice-modelling survey with choice cards allowing us to measure farmers' relative preferences over two payment rules: the uniform rule for which farmers are paid the same amount for the same action, without considerations for differences in compliance costs, environmental priorities or financial needs; and the differentiated payment rules which tailors payments according to one or several of the three criteria just cited above. The methodology and results derived from this last part of the survey are presented separately in section 4.

A random sample of 32 Lozerian farmers was drawn. Table 1 illustrates some descriptive statistics of the sample: they reflect the general characteristics of farmers in Lozère. All farmers are cattle breeders, the average stocking density is low (0.73 LU/ha[5]) and agri-environmental payments make up for 32% of their total income.

Table 1: Sample's descriptive statistics (N=32)

Variables	Average	Standard deviation	Min Max
Production system	62% beef cattle 18% dairy cattle 20% others		
Farmland (ha)	106,17	34.7	52 192
Livestock density (LU/ha)	0.73	0.16	0.39 1.1
Other revenue (%)	Yes = 38 No = 62		
Share of agri-environmental payment in total income (%)	32	20	10 80

Participation in voluntary agri-environmental schemes depends both on farmers' attitudes and behavioural responses, linked to their individual characteristics (such as age, education, sensitivity to environmental issues and on the adequation between the contract requirements (such as contract length, severity of technical specification etc.) and the farming constraints (Wilson, 1996; Wynn et al, 2001). Brotherton (1991), Wynn et al (2001) and Vanslembrouck et al (2002) therefore distinguish the "decision-subject characteristics" (i.e. the available scheme) and the "decision-maker characteristics" (the farmer) to show that the expected effect on farm production and income, and the farmers' environmental attitude are significant determinants of the acceptance rate of agri-environmental policies. There is a fairly large body of literature trying to measure the impact of farm size (Damianos and Giannakopoulos, 2002), of farmer's age (Wynn et al, 2001 and Bonnieux et al, 1998), of farmer's education level (Delavaux et al, 1999 and Dupraz et al, 2002), on decisions to participate in an agri-environmental scheme. Focusing on farmer's attitudes towards environmental protection, Morris and Potter (1995) propose an interesting classification of participant farmers: active participants who sign agri environmental contracts because they want to contribute to the improvement of the environment, passive adopters who sign agri-environmental measures

[5] Livestock Unit per hectare

only for financial reasons, conditional non-adopters who would participate if the contract terms changed and finally resistant non-adopter, who are against such measures whatever the type of contract.

Based on this existing literature, the questionnaire was used to test 3 hypothesis on the attitude of Lozerian farmers concerning changes in allocation and payment rules of agri-environmental contracts: the confirmation or contradiction of these hypothesis will help us to anticipate the acceptability of agri-environmental reforms.

Hypothesis 1: Lozerian farmers consider that the primary objective of agri-environmental schemes in their region is to provide income support.

Hypothesis 2: Lozerian farmers prefer agri-environmental schemes with standard technical specification and uniform payments (existing scheme), to schemes privileging individually-fitted technical packages and payments. .

Hypothesis 3: – farmers favour uniform payments over differentiated "individualized" payments - will be tested in section 4.

3. Factors shaping farmers' willingness to accept different agri-environmental schemes

3.1. Farmers' opinions on the objectives of agri-environmental schemes

Interviewed farmers were asked to select the sentence which reflected best their opinion on what should be the primary objective of an agri-environmental scheme. In the case of multiple responses, they were asked to rank them –from the most important to the least important. For each alternative, we calculated two indicators (table 2): the number of times this alternative was selected; and a *Borda* score (the number of responses was weighted by their rank, from 4 for the most important to 1 for the least important).

Table 2 : The objectives of agri-environmental measures

Agri-environmental objectives	Selection rate (% of respondents)*	Borda score (%)
Maintain existing practices Agri-environmental payments should target farmers who have maintained traditional environmentally- friendly practices. Their objective is to help to maintain these practices.	69	31
Provide income support Agri-environmental payments should target farmers with financial difficulties in naturally-handicapped areas in mountainous zones. Their objective is to support farm income and maintain agricultural activities in such area.	50	18
Protect most vulnerable zones Agri environmental payments should target farmers in priority zones where the environment is most at risk. Their objective is to protect highly vulnerable zones.	47	16
Encourage changes in practices Agri-environmental payments should target farmers who choose to adopt more environmentally friendly practices. Their objective is to encourage changes in agricultural practices.	75	35

***** the respondents could select several responses – the sum can therefore be superior to 100

Results from table 2 indicate that, although 50% of interviewed farmers select "provide income-support" as an objective of agri-environmental schemes, 75% of them cite "encourage changes towards more environmental friendly practices". The response difference between these two alternatives is statistically significant (p-value = 0.03 in a two sample-test of proportions). The Borda score confirms these results: it indicates that a change toward more environmental friendly practices is the most important objective (35%) followed by the objective of maintaining traditional environmentally friendly practices (31%). Contrary to hypothesis 1, the income-support justification of agri-environmental schemes is ranked before last with a Borda score of 18%, only followed by the "protect most vulnerable zone" alternative (16%). However, the test of percentage comparison shows that there is no significant difference between the two alternatives (p-value = 0.57 in a two sample-test of proportions).

3.2. Farmers' preferences in terms of agri-environmental contract design

The existing French agri-environmental schemes are based on standardized technical specifications and uniform payments par action. However, the introduction of competitive bidding procedures would impose the design of more flexible agri-environmental contracts, in

which either payments, or technical specifications or both could be tailored to the characteristics of each farm. We therefore asked respondents to select (and rank by order of preference in case of multiple responses) their preferred type of agri-environmental contracts amongst four:

Contract A: a menu of several agri-environmental measures, with fixed technical specifications and uniform payments (the current system).

Contract B: an agri-environmental contract imposing specific actions, based on fixed technical specifications, associated to differentiated payments reflecting farm's and farmer's characteristics (*i.e* this type of contract is used by the Conservation Reserve Program in USA).

Contract C: an agri-environmental contract with a fixed uniform payment per ha, but with differentiated technical specifications, adjusted to reflect the farm's characteristics and the farmer's preferences (*i.e.* this type of contract is used by the Countryside Stewardship Scheme in Great Britain).

Contract D: an entirely flexible contract design, in which both technical specifications and payments reflect the characeristics of the farm and the farmer's preferences (i.e this type of contract is found in the Australian Bush Tender).

We calculated the same indicators as in section 3.1 (table 3).

Table 3 : Farmers' preferences for agri-environmental contract types

Agri-environmental contract type	Selection rate (% of respondents)*	Borda score (%)
Contract A: fixed technical specifications and payments	16	15
Contract B: fixed technical specifications and differentiated payments	13	10
Contract C: fixed payments and adjusted technical specifications	25	20
Contract D: differentiated technical specifications and differentiated payments	59	55

* the respondents could select several responses – the sum can therefore be superior to 100

The results obtained were unexpected and contradicted our hypothesis 2. Contracts A and B, imposing fixed tchnical specifications are only chosen by respectively 16 and 13% of respondents and cumulate a borda score of 25%. The preferred contract type is the most flexible one (contract D): it was chosen by 59% of respondents with a Borda score of 55%.

The difference in responses between contract A and contract D is statistically significant (p-value = 0.0003 in a two sample-test of proportions). Agri-environmental contracts based on fixed payment and adjusted technical specification (contract C) come second with a Borda score of 25%. The difference in responses for contract D and C is significant (p-value = 0.005 in a two sample-test of proportions).
Hence, despite the repeated claims of French farm unions for egalitarian rules in contract deign, it seems that farmers are rather is favour of more flexible designs reflecting better their differences. This result indicates that Lozerian farmers would not be put off by the outcomes of an agri-environmental auction: they would accept the contract heterogeneity induced by the competitive bidding procedure, provided it reflects their differences.

Because of the limited number of observations, we can only draw partial conclusions from this preliminary survey. Bearing in mind that the Lozerian agriculture is extremely dependent on existing agri-environmental schemes, we expected very conservative attitudes about agri-environmental reforms. The results show a different picture. Farmers are sensitive to the environmental impact of their agricultural practices.

The majority of them acknowledges that agri-environmental schemes should be specifically designed to encourage or to maintain more environmentally practices and that income-support is not a primary objective. Finally they are surprisingly favourable to an allocation system which would allow more flexibility in the design of contracts. These results encouraged us to investigate further on the payment rules that would be acceptable.

4. A choice-experiment to assess farmers' preferences on payment rules

4.1. The choice-experiment design

The underlying structure of the last section of the survey is a choice experiment in which interviewed farmers had to elicit their preferred payment rule. Choice experiment is a methodology based on stated preference. It is based on choice sets presenting different scenarios combining different attributes with different levels. For each choice set, respondents select their preferred scenario (Louvière, 1988, 1992, Adamowicz et al, 1994, Hanley and Mourato, 2001).

We have adapted this method to compare different payment rules: payments in favour of farmers having the greatest financial needs, payments compensating the largest compliance costs and payments rewarding the greatest environmental contribution. The design of the questionnaire is the following:

Each choice is described by the comparison of two hypothetical farmers, farmer A and farmer B. These farmers are located in the same area, they have identical farming activities, and they sign up for the same agri-environmental contract (same commitment, on an equivalent area, and for the same period). However, for reasons which are not explained in the survey – but are presented as independent of the farmer's will or capacity -, they can differ with respect to four attributes. Three attributes describe the farmer's situation (descriptive attributes): level of financial needs, level of compliance costs with the agri-environmental contract, level of environmental benefit provided by the implementation of the contract; and one attribute describes the level of agri-environmental payment (payment attribute). For each of these four attributes, three comparative situations (levels) are possible: farmers A and B have the same attribute level, farmer A's attribute is greater then farmer B's; farmer A's attribute is lower than farmer B's. The comparison is made only on the basis of ordinal ranking. No measure of difference intensity is provided.

Respondents are presented with 9 choice sets, which can be divided into three categories of three choice sets each. The first category describes a situation where the two farmers differ by only one descriptive attribute and by the payment attribute.

Figure 1: Example of a choice set in category 1: Farmer A provides greater environmental benefits than farmer B.

	Farmer A	Farmer B	Farmer A	Farmer B	Farmer A	Farmer B	
Financial needs	♦	♦	♦	♦	♦	♦	
Compliance costs	♣	♣	♣	♣	♣	♣	No choice
Environmental benefit	♥♥	♥	♥♥	♥	♥♥	♥	
Compensation payment	♠ ♠	♠	♠	♠ ♠	♠	♠	
	Option 1		Option 2		Option 3		Option 4

In this choice set, four options are proposed and the respondent must select his preferred option. Farmers A and B have equivalent financial needs and identical compliance costs, but farmer A provides greater environmental benefits than farmer B (for example, his land is located next to a river, in a more vulnerable zone, and therefore, although his environmental effort is the same as farmer B, his contribution to the improvement of environmental quality is greater). In option 1, farmer A gets a greater agri-environmental payment than farmer B. In option 2, farmer B gets a greater payment. In option 3, they get identical payments. Option 4 is selected by the respondent when none of the three previous choices suits him. The two other choice sets describe the situations when farmers differ respectively by their compliance costs and by their financial needs. In this category of choice set, we will call the first set "environmental gain difference, ED", the second set "compliance costs difference CD" and the last one "financial need difference, FD".

The second category describes the situation where farmers differ by two descriptive attributes, one displays a greater level for farmer A, the other one displays a greater level for farmer B.

Figure 2: Example of a choice set in category 2: Farmer A has greater compliance costs than farmer B and farmer B provides more environmental benefits than farmer A

	Farmer A	Farmer B	Farmer A	Farmer B	Farmer A	Farmer B	
Financial needs	♦	♦	♦	♦	♦	♦	
Compliance costs	♣♣	♣	♣♣	♣	♣♣	♣	No choice
Environmental benefits	♥	♥♥	♥	♥♥	♥	♥♥	
Compensation payment	♠♠	♠	♠	♠♠	♠	♠	
	Option 1		Option 2		Option 3		Option 4

The two other choice sets of the second category describe the situations when farmers differ simultaneously by their compliance costs and financial needs; and by their financial needs and environmental benefits. In this category of choice set, we will call the first set "compliance costs and environmental gain difference on both sides, CED1" , the second set "financial need and compliance costs difference on both sides FCD1" and the last one "financial need and environmental gain difference on both sides, FED1".

The third category describes the situation where farmers differ by two attributes, with the greater levels of the two attributes being observed for the same farmer.

Figure 3: Example of choice set in category 3: Farmer A has greater compliance costs and provides more environmental benefit than farmer B

	Farmer A	Farmer B	Farmer A	Farmer B	Farmer A	Farmer B	
Financial needs	♦	♦	♦	♦	♦	♦	
Compliance costs	♣♣	♣	♣♣	♣	♣♣	♣	No choice
Environmental benefits	♥♥	♥	♥♥	♥	♥♥	♥	
Compensation payment	♠♠	♠	♠	♠♠	♠	♠	
	Option 1		Option 2		Option 3		Option 4

The two other choice sets of the second category describe the situations when farmers differ by their compliance costs and financial needs; and by their financial needs and environmental benefits. In this category of choice set, we will call the first set "compliance costs and environmental gain difference on the same side, CED2" , the second set "financial need and compliance costs difference on the same side FCD2" and the last one "financial need and environmental gain difference, on the same side FED2".

A discrete choice model is used to analyse the preference of farmers for payment rules, within a utility maximization framework. The basic assumption here is that farmers choose the payment rule which provides them with the highest utility. The utility is described by random utility theory, as a function of variables describing the nature of differences between the two farmers as well as a random error component that captures unexplained variance in the farmer's utility function.

$$U_{ij} = \beta X_j + \varepsilon_{ij} \quad (1)$$

where ε_{ij} represents the stochastic component of farmer i 's utility for criterion j, and β and X_j are respectively the vector of parameters and the matrix of variables describing the differences between the two farmers.

We model the probability that farmer i chooses the payment rule j from the total set of payment rules J. It is equal to the probability that the utility provided by j is higher than the utility of another payment rule j':

$$p(j/J) = P\left[\left(U_{ij}\right) > \left(U_{ij'}\right)\right] \forall j' \neq j, j' \in J \quad (2)$$

$$p(j/J) = P\left[\left(\beta X_j + \varepsilon_{ij}\right) > \left(\beta X_{j'} + \varepsilon_{ij'}\right)\right] \forall j' \neq j, j' \in J \quad (3)$$

$$p(j/J) = P\left[\varepsilon_{ij'} - \varepsilon_{ij} < \beta' X_j - \beta' X_{j'}\right] \forall j' \neq j, j' \in J \quad (4)$$

This probability can be estimated with a multinomial logit model which assumes that the error terms in the farmer utility function are independently and identically distributed as Gamble variable (Dellaert et al, 1999), leading to the following closed form expression for the probabilities: $p(j/J) = \exp\left(\beta X_j\right) / \sum_J \exp\left(\beta X_{j'}\right)$ (5)

For the next analyses, we will use a simpler model based on a binary-choice logit estimated with the responses on the first category of choice set (describing a situation where the two farmers differ by only one descriptive attribute, n=96). It allows to compare the preference of farmers for uniform payments, relative to differentiated payments. We estimate the model for the dichotomous dependent variable Y_i taking two values indexed as follows:

$$Y_i = \begin{cases} 0 \text{ if the farmer choose a differentiated payment} \\ 1 \text{ if the farmer choose an adjusted payment} \end{cases}$$

In the binomial logit model, we use three dummy variables FD, CD and ED to describe the differences between the two farmers:

- FD takes value 1 when the two farmers differ by their financial needs, 0 otherwise

- CD takes value 1 when the two farmers differ by their compliance costs, 0 otherwise.

- ED takes value 1 when the two farmers differ by the environmental benefits they provide, 0 otherwise.

To avoid the variable dummy trap, the variable FD is used as reference category and dropped from the model.

4.2. Preferences for uniform versus differentiated payments

Table 4 shows that when the two farmers differ by only one attribute, the choice of respondents is clear-cut. For FD, 28% choose a uniform payment, while 72% and 78% choose a differentiated payment for respectively CD and CE. It indicates that respondents think that an additional payment is more justified to compensate greater compliance costs or to reward greater environmental benefits than to mitigate financial needs.

The statistics of the responses to the second category of choice sets (CED1, CFD1, FED1) are less clear-cut. Responses in favour of a differentiated payment fall down to 54% of all responses. For the third category of choice sets (CED2, CFD2, FED2), the results show a very strong majority of respondents in favour of differentiated payments.

Table 4: Choice of differentiated payments

Variables	% of respondents choosing differentiated payments
FD	28
CD	72
ED	78
CED1	50
FCD1	40
FED1	47
CED2	87
FCD2	75
FED2	78

The results obtained from the dichotomous logit model are presented in table 7. The likelihood ratio chi-square of 24.21 (with a p-value of 0.00) indicates that the model as a whole fits significantly better than an empty model. The pseudo R^2 – an analogous measure of goodness of fit - is eqal to 0.19 which is reasonable for analysis based on cross sectional data (Greene, 1997, p 683). Alternatively, the goodness of fit is illustrated by the correct predictions' percentage, which amounts to 76%.

Table 5: Estimated coefficients, odds ratios and marginal effects

Explanatory variables	Estimated coefficients	Odds ratios	Marginal effects
CD	+ (**)	6.53 (0.01)**	0.43
ED	+ (**)	13.8 (0.00)**	0.56
Constant	- (**)	-	-

** ($p<0.01$) *($p<0.05$)

Percentage of correct predictions: 76%

Number of observations = 96

Pseudo-R^2 = 0.19

The positive signs of the significative estimated coefficients in table 5 confirm the intuitions provided by the statistics in table 4: the choice of a differentiated payment is influenced more by environmental gain difference and by compliance costs differences between farmers than by financial needs difference.

The odds-ratios show that the probability of choosing a differentiated payment is 6.53 times greater than the probability of choosing a uniform payment when farmers differ with respect to their compliance costs. When there is environmental benefit difference between the two farmers, the probability to choose a differentiated payment increases by 13.8 times compared to the situation when they differ with respect to financial needs. The marginal effects column confirms this result showing that a difference in environmental benefit increases the probability of choosing a differentiated payment by 56% compared to the situation where there is no difference in environmental benefit. A difference in compliance costs increases the probability of choosing an adjusted payment by 43%.

From these results, we can conclude that farmers prefer a differentiated payment in order to take into account differences between farmers in terms of compliance costs or environmental benefits than differences in financial needs. Furthermore, farmers are more likely to require a greater payment for a greater environmental benefit than for greater compliance costs. This result is slightly at odds with the responses of farmers on the objectives of agri-environmental schemes (see table 3 section 3.2): only a minority defended the principle of a scheme that would target compensations to farmers providing the greatest environmental contribution.

4.3. Extension

We use the same dichotomous logit model to compare the preferences of farmers for uniform payments, relative to differentiated payments but we add data obtained from the responses of the second and third choice sets. This allows us to test if preferences for one payment rule, observed when farmers differ only by one attribute, are confirmed when farmers differ by two attributes (n=288).

To avoid the dummy trap, CD, FCD1 and FCD2 are used as reference categories and dropped from the model. Thus, the following interpretation of estimated coefficient is made by comparison with these three reference categories.

The results are presented in table 6. The correct predictions' percentage amounts to 68% which indicates a reasonable goodness of fit but only three estimated parameters are significantly different from zero. This is mainly due to the lack of heterogeneity of responses in the third category choice set (see last three lines of table 4).

The estimated parameters for FD and ED confirm the results presented in table 5 on a restricted data set: the financial needs difference decreases the choice of differentiated payment while the environmental gain difference increases it, compared to a situation displaying differences in compliance costs. The odds-ratios show that the probability of choosing a differentiated payment is 3.24 times greater than the probability of choosing a uniform payment when there is a difference in environmental benefit alone (ED=1) or associated to a cost compliance difference (CED2=1). When there is a difference in financial needs (FD=1), the probability to choose a differentiated payment is 0.23 times lower than when there is a difference in compliance cost alone (CD=1) or associated to environmental differences for the same farmer (FCD2=1) or separately for the two farmers (FDC1=1). The marginal effects column confirms that when there is a difference in environmental benefits (ED=1) or when it is reinforced by a difference for the same farmer in compliance costs (CED2=1), then the probability of choosing a differentiated payment increases by 21%. A

difference in financial needs decreases the probability of choosing a differentiated payment by 34%.

Table 6: The estimated coefficient, the odds ratios and the marginal effects

Explanatory variables	Estimated coefficients	Odds ratios	Marginal effects
FD	-1,44**	0,23**	-0,34
ED	1,17*	3,24*	0,21
FED1	-0,63	0,52	-0,15
CED1	-0,63	0,52	-0,15
FED2	-0,76	2,14	0,15
CED2	1,17*	3,24*	0,21
Constant	0,51	-	-

** ($p<0.01$) *($p<0.05$)

Percentage of correct predictions: 68%

Number of observations = 288

Pseudo-R^2 = 0.1

Table 7 calculates simple percentages which provide additional insights into the "competition" between the three types of agri-environmental payment rules when one rule justifies greater payments to farmer A whereas another rule justifies greater payments to farmer B (responses from category 2 of choice sets).

Table 7: Frequency of the payment rule choice

Variables	Frequency
If FED1=1	31% of respondents choose to allocate a greater payment to the farmer providing greater environmental benefits 16% of respondents choose to allocate a greater payment to the farmer facing greater financial difficulties 53% of respondents choose to allocate the same payment to both farmers.
If FCD1=1	41 of respondents choose to allocate a greater payment to the farmer displaying higher compliance costs 0% of respondents choose to allocate a greater payment to the farmer facing greater financial difficulties 59% of respondents choose a payment to allocate the same payment to both farmers.
If CED1=1	19% of respondents choose to allocate a greater payment to the farmer providing greater environmental benefits. 28% of respondents choose to allocate a greater payment to the farmer displaying higher compliance costs. 53% of respondents choose to allocate the same payment to both farmers.

The table 7 shows that when differences between farmers require to establish a hierarchy between payment rules, then more than half of the respondents prefer not to choose and select therefore a uniform payment. However, for the respondents who choose a differentiated payment, the relative percentages of responses indicate the following ranking: what justifies a greater payment is (1) first a higher compliance cost, (2) second, a greater environmental benefit, (3) and finally larger financial needs. This last result confirms only partially the previous analysis (table 6): it reinforces the evidence that financial needs are not a priority criterion to calculate agri-environmental payments. However, it also shows that the hierarchy between the compliance cost rule and the environmental benefit rule is not clear-cut, and that almost half of respondents value them equally. There is therefore a need to organize more interviews in order to extend the data base and to be able to conduct the polynomial logit analysis described in section 4.1.

5. Conclusion and perspectives

Agri-environmental schemes are based on the voluntary provision of environmental services by farmers. Countries like the United States and Australia have experimented several ways to allocate agri-environmental contracts in order to make efficiency and budgetary gains. The European Commission is also envisaging reforms. In this context, it is important to measure the acceptability by farmers of new allocation and payment rules. This paper provides insights on these issues, based on a survey with Lozerian farmers.

The main result of the survey is that Lozerian farmers, although their farm revenues are very dependant on the existing agri-environmental scheme (especially the grass premium), are open to changes in payment rules. First of all, they are a majority to agree that agri-environmental measures should be specifically designed to compensate additional costs of adopting more environmentally-friendly techniques, and are not justified as income-support measures. Second, an important majority also prefer more flexible allocation system in which technical recommendations and payments reflect better individual characteristics. At last, a simple choice modelling shows that they favour payment rules providing greater payments to farmers providing greater benefits and displaying larger compliance costs. However, the results do not allow to establish a clear ranking between these two criteria.

The conclusion is twofold: for agri-environmental measures whose objectives are to maintain existing practices –and which therefore do not provide additional environmental benefits and do not impose additional costs on farmers, a uniform payment is preferred. However, for agri-environmental measures imposing genuine changes in farming systems, it seems that farmers are willing to accept new procedures reflecting better their differences. A competitive bidding, including a bid-ranking rule based on a performance index including both costs and environmental contributions, could be envisaged. This preliminary study seems to indicate that it could respond to farmer's expectations.

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