Farmers' participation in European agri-environmental policies

Pierre Dupraz[1], Isabel Vanslembrouck[2], François Bonnieux[1] & Guido Van Huylenbroeck[2]

Abstract

This paper examines the factors influencing farmers' participation in several agri-environmental schemes. A multinominal logit model is used to separate between participating and non-participating farmers. In addition this model allows to predict farmers participation in one measure as well as in different measures simultaneously. Data stems from a survey conducted in eight European countries and includes a description of both farmer and farm characteristics. Three categories of schemes have been analysed: landscape maintenance, biodiversity protection and restriction of intensive farming practices. The combination of these three types of schemes provides eight possible packages which can be selected by eligible farmers. The multinominal logit model shows the importance of both farm and farmer as well as attitudinal characteristics on the participation in different combinations of schemes. For instance, the environmental concern favours landscape maintenance and biodiversity protection as well as their combinations with schemes requiring restrictions of intensive practices. However, it has a negative effect on the single participation in schemes requiring restrictions of intensive practices only. Our analysis confirms a number of previous findings. In addition, it shows the importance for policy makers to take into account that farmers have the opportunity to enter several schemes simultaneously. Indeed, due to cost complementarities, joint participation provides both private and public benefits.

Key-words: agri-environmental policy, multinominal logit model, joint production, farms

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1. Introduction

Agriculture and forestry occupy more than 80% of the area of the European Community (EU) and exert therefore a major influence on the European landscape. Just as in the case of the manufacturing industry and transport, agriculture has undergone significant structural changes in the past 50 years. Recent agricultural practices have had an important influence on landscape and natural resources. This influence often reaches a level that threatens the sustainability of agricultural production at the farm level. However, it is only recently that this impact has been recognised at European level and that programmes have been developed emphasising countryside management and stewardship.

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The programme package based on Regulation 2078/92 has been the most prominent approach at EU level so far to integrate environmental aspects into agricultural policy. These substantially different agri-environmental programmes have been developed and introduced in different member states and specific regions of the European Union to give incentives to farmers for a voluntary reduction of those farming practices which have a negative influence upon wildlife and landscape (Kazenwadel et al., 1998). The basis of this approach is the contractual agreement between the state and individual farmers, who receive premiums for certain 'environmental services'. The design of the individual programmes is left to the member states or regional authorities (Billing, 1998). This corresponds to the subsidiary principle and ensures, to a certain degree, that programmes are adapted to local needs. The Regulation as such can be regarded as a kind of framework of general requirements.

According to Van Huylenbroeck and Whitby (1999) the main role of agri-environmental policies is to change the production conditions for farmers in favour of landscape management and conservation efforts so that they will again pay more attention to it. The agri-environmental policies should be used to stimulate farmers to deliver countryside stewardship and environmental outputs and not as a market regulation instrument because for that the stewardship instruments are too expensive, in particular in terms of transaction costs (Whitby et al, 1998; Falconer, 2000), and not effective. Neither should these policies be used only as income transfer instruments, without delivering benefits to society. However, in case of market failure and when well targeted, these policies may be a suitable instrument to deliver agri-environmental goods.

Previous studies have shown that the participation to agri-environmental schemes depends on the farm characteristics and the preferences of farmer's household (Kazenwadel et al, 1998; Delvaux et al, 1999; Dupraz et al, 2000; Bonnieux et al, 1998; Drake et al 1999; Vanslembrouck et al., 2001). Also work from Crabtree et al. (1998) and Wynn et al. (2001) concentrated on modelling farmer's participation in agri-environmental schemes in Scotland, taking into account both farm and farmer characteristics. Their approach is similar to the one used in this article as they also used logit and multinominal logit models. However we do not restrict to the uptake decision, since we explicitly model the possible participation in several schemes.

First of all this analysis examines the factors influencing farmers' participation in agri-environmental schemes. The factors behind this decision making should be identified in order to make recommendations to policy-makers, if agri-environmental policy is to expand further as part of agricultural policy. By analysing determinants of farmers' participation in several schemes, it is possible to analyse whether the objectives of a scheme influence uptake. Based on a data set on the participation in agri-environmental measures of 1638 European farmers in eight countries, the paper investigates what kind of farm and household characteristics do influence uptake and in how far differences can be observed between different kind of measures. The originality of the analysis lies in the use of a multinominal logit model, allowing to separate not only between participating and non participating farmers but also among farmers only adopting one measure and others enrolled in different measures.

2. Modelling farmers' behaviour

The model is based on the maximisation of farmers utility. Hence farm and farmer characteristics are of interest. Farm characteristics determine the increment of farm profit derived by participation, while farmer's preferences on the other hand, including his attitude towards environment, will make a difference between farms in the same situation. Accordingly, the farmer's behaviour is formalised by the maximisation of his utility function. If participation in several schemes is possible, it is expected that to decide his participation in one or several schemes, a farmer is comparing between each other the indirect utility values associated with each combination of schemes. If e.g. three schemes are proposed there are eight different combinations including non participation. One and only one combination is selected by every farmer.

To study the i^{th} farmer's choice we postulate random utility models, each one being associated to the m^{th} combination:

$$V_{im} = x_i' b_m + v_{im} \quad [1]$$

Supprimé : ¶ Most recent data available (1998, DG VI) shows that on average in EU-14 (excluding data from Germany) the number of farms included within at least one programme is 1 in every 7. This corresponds more or less with over 20% of European farmland. There exists however, as can be seen in table 1, a highly contrasting picture between Member States. High proportions are found in the 'new' Member States - 78% in Austria, 77% in Finland and 64% in Sweden. These figures are substantially greater than the average. Also Luxembourg with 60% and ... [1]

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V_{im} is the indirect utility level which the i^{th} farmer associates to the m^{th} combination, x_i is the vector describing the farmer's preferences and his farm characteristics, b_m is the vector of parameters to be estimated and v_{im} is the stochastic disturbance term. Let d_{im} be the dummy variable reporting the choice of the i^{th} farmer about the m^{th} combination. His decision rule is then:

$$\begin{cases} d_{im} = 1 \\ d_{ik} = 0; \forall k \neq m \end{cases} \Leftrightarrow \{V_{im} > V_{ik} \quad \forall k \neq m\} \quad [2]$$

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The econometric model is made operational by a particular choice of distribution of the disturbances. If and only if the disturbances of the different combinations are independent and identically distributed with the Gompertz cumulative distribution function ($F(v_{im}) = \exp(-\exp(-v_{im}))$), then the probability of choosing the m^{th} combination is (Gouriéroux, 1989):

$$P_{im} = \Pr\{d_{im} = 1\} = \frac{\exp(x_i' b_m)}{\sum_{k=0}^{M} \exp(x_i' b_k)} \quad [3]$$

The model in [3] is the multinomial logit model. It is characterised by the independence of irrelevant alternatives. From [3], equation [4] is derived and holds whatever the subset of eligible combinations including *m* and *k*.

$$P_{im} / P_{ik} = \exp(x_i'(b_m - b_k)) \quad \forall (m,k) \quad [4]$$

Since the model is based on the difference of expected utility levels in each pair of combinations, an indeterminacy must be removed to perform the estimation. The usual assumption $b_0 = 0$ solves the problem (Greene, 1997). The model is estimated using the maximum likelihood procedure. The expression of the model likelihood *L* is:

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$$\ln L = \sum_i \sum_{m=0}^{M} d_{im} \ln \left[\frac{\exp(x_i' b_m)}{1 + \sum_{k=1}^{M} \exp(x_i' b_k)} \right] \quad [5]$$

The marginal effect of the explanatory variable x_{ij} is derived from [1]:

$$\frac{\partial P_{im}}{\partial x_{ij}} = P_{im} \left[b_{mj} - \sum_{k=0}^{M} b_{kj} P_{ik} \right] \quad [6]$$

3. Data and empirical results

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Context

Most recent data available (1998, DG VI) shows that on average in EU-14 (excluding data from Germany) the number of farms included within at least one programme is 1 in every 7. This corresponds more or less with over 20% of European farmland. There exists however, as can be seen in table 1, a highly contrasting picture between Member States. High proportions are found in the 'new' Member States - 78% in Austria, 77% in Finland and 64% in Sweden. These figures are substantially greater than the average. Also Luxembourg with 60% and Portugal with 30% have a proportion higher than the EU average. Of the other Member States, Belgium, Greece, Spain, Italy and the Netherlands, with rates around or less than 7% are significantly below the EU average.

Table 1: Percentage of farms eligible under Reg. 2078/92

	Number of beneficiaries 000	Total number of holdings 000	% of farmers concerned all farms	zones obj. 1	zones non-obj. 1
Belgium	2.0	71	2.8	3.0	2.8
Denmark	8.0	69	11.6	-	11.6
Greece	2.4	774	0.3	0.3	-
Spain	33.9	1278	2.7	3.2	0.3
France	171.0	735	23.3	5.8	23.9
Ireland	32.2	153	21.0	21.0	-
Italy	176.3	2482	7.1	4.7	10.0
Luxembourg	1.9	3	60.3	-	60.3
Netherlands	6.7	113	5.9	1.8	6.0
Austria*	173.4	222	78.2	56.7	80.2
Portugal	137.9	451	30.6	30.6	-
Finland	77.8	101	77.2	-	77.2
Sweden	56.6	89	63.7	-	63.7
Great Britain	25.4	235	10.8	10.9	10.8

Source: http://europa.eu.int/comm/agriculture/envir/report/en/2078_en/Tab2.htm

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In order to get a clearer overall picture of the effects and success of the agri-environmental measures, efforts in the area of measurement, development of indicators and methodologies for evaluation seem necessary, especially to be able to compare the measures in different European countries.

General results

Data stem from a 1998-survey, which has been distributed in eight countries (Austria, Belgium, France, Germany, Greece, Italy, Sweden and the United Kingdom), as part of the research project "Market effects of countryside stewardship policies" (Van Huylenbroeck & Whitby, 1999). Available information includes a description of both the farmer (age, education, experience of farming and environmental attitude) and the farm (area, livestock, labour, income, type of farming)[3]. The sample includes 1638 farms which were eligible under the Regulation 2078/92. The average age of farmers is 45 years (standard deviation: 12 years), and on average they have 21 years of experience in farming, and 9 years of education. The sample includes livestock, mixed and permanent crops farms. Farm size ranges from 0.1 to 2230 hectares (mean equal to 57 hectares), and farmers reported from 0 to 7650 animals. In addition farm income ranges from –20,000 to 1,500,000 ECU[4] (average income is 26,000 ECU).

While 34.6% of surveyed farmers did not enter a scheme, 32.3% have entered one scheme only, 18.4% have entered two different schemes, 9.6% three and 5.1% four schemes or more. The distribution of farms according to the type of scheme is shown in Table 2. A number of farmers selected schemes targeting the reduction of a negative externality as well as programs whose objectives include the provision of a local public good (landscape beauty) or a pure public good (biodiversity). Otherwise enrolment in organic farming is limited in the sample. In comparison, local programs usually combine a menu of prescriptions and target multiple objectives.

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[3] See Drake *et al.*, (1999) for a comprehensive presentation of the survey and questionnaire.
[4] ECU = European Currency Unit before 1999

An overview across countries highlights significant differences (Table 2). However the country bias mainly results from the way in which the Regulation 2078/92 has been implemented in the eight countries. But it is also partly due to the way in which the sample was selected. Nevertheless Austrian farmers were offered a wide range of environmental schemes whereas Greek farmers faced a limited number of opportunities.

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Table 2: Scheme profiles according to countries (1998-survey)

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Type of scheme	Enrolled farms total sample	relatively high number	no entrant
Input reduction	444	Austria, Germany, Greece	
Landscape protection	437	Austria, Belgium, Sweden	Greece
Extensification	356	Austria, France	Greece, UK
Local programs	336	Austria, France	
Biodiversity	306	France, Germany, UK	Greece
Organic farming	145	Italy, Sweden	UK
Set-aside	30	Austria, Germany	
Others	36	France	

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In order to simplify the database and the econometrics, seven schemes have been aggregated in three broader categories: landscape maintenance, biodiversity protection and restriction of intensive farming practices (Figure 1). These categories are homogeneous with respect to farmers' behaviour. Indeed simple logit models were considered to estimate the probability of entering each scheme, and every category gathers the schemes with similar profiles. The organic farming scheme will be omitted because it is very differently designed and implemented across countries. In some cases it provides a cost-sharing assistance in order to encourage a change in technology, but it may also offers compensation based on a flat rate per hectare or per unit of livestock. So merging in the same sample all farms which participate in an organic program would lead to major inconsistencies.

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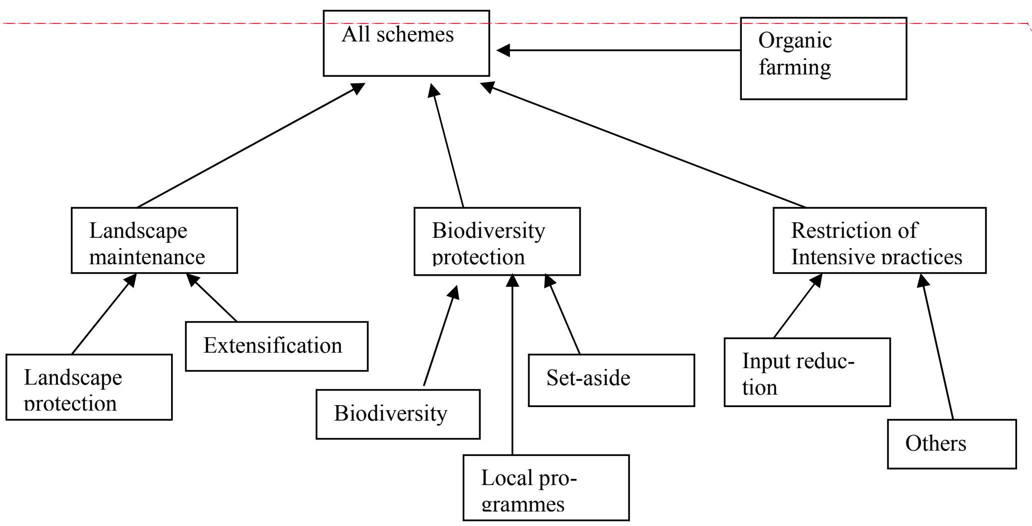

Figure 1: Aggregation of schemes.

These three types of schemes provide eight possible combinations. The actual participation in these different combinations of schemes is given in Table 3, last columns. Within our sample, 28% farmers participate in more than one scheme, 27% in only one scheme and 45% do not participate. Table 3 also displays the estimation results. The farmers' choices that are correctly predicted are on the diagonal of the table. As many as 54% of these choices are correctly predicted by our multinomial logit model[6]. According to these predicted values, 27% would participate in more than one schemes, 15% in only one scheme and 59% would not participate. Non participation is overestimated and the participation in a single scheme is underestimated, while the prediction for the participation in the combination of more than one scheme are more consistent. Despite these biases, the multinomial logit appears to give slightly better prediction of the total participation in each type of schemes than the separated estimation of simple logit models[7], especially for intensive practice restrictions (Table 4). Only the use of a multivariate probit model provides a better estimation of uptake for each type schemes; however, it only predicts 42% of actual choices of the farmers (Bonnieux & Dupraz, 2001).

Table 3: The distribution of surveyed farmers according to actual and predicted combinations of schemes

Actual Y*	Predicted Y* 0	1	2	3	4	5	6	7	Total	Actual distribution of combinations (%)
0	621	14	0	6	38	18	2	45	744	45
1	25	53	4	21	8	5	2	9	127	8
2	8	10	13	4	5	6	2	5	53	3
3	32	24	3	35	10	4	0	2	110	7
4	49	14	1	7	61	23	3	1	159	10
5	81	20	0	4	24	35	1	4	169	10
6	50	6	1	2	25	8	4	0	96	6
7	94	6	3	3	4	3	1	66	180	11
Total	960	147	25	82	175	102	15	132	1638	100
Predicted distribution of combinations (%)	59	9	2	5	11	6	1	8	100	

* Y = the dependent variable of the multinominal logit, namely the set of scheme combinations

0 : Non participation
1 : Participation in the three types of schemes
2 : Intensive practice restrictions and biodiversity protection
3 : Intensive practice restrictions and landscape maintenance
4 : Landscape maintenance and biodiversity protection
5 : Landscape maintenance
6 : Biodiversity protection
7 : Intensive practice restrictions

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[6] The maximum log likelihood equals 2034. With 105 degrees of freedom and the calculated χ^2 equal to 1563, the model is highly significant.
[7] The same set of explanatory variables was used in multinomial and simple logit models. All calculations have been performed with LIMDEP (Greene, 1998).

Table 4: Estimated and observed participation rates

Program	Intensive practice restrictions	Biodiversity protection	Landscape maintenance
Simple logit estimation	0.21	0.21	0.30
Multinomial Logit estimation	0.27	0.21	0.31
Observed rate	0.28	0.27	0.35

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Marginal effects of explanatory variables (Table 5 in Appendix)

As mentioned earlier, there are two categories of explanatory variables:

1) The characteristics of the farm include area, livestock density, area per worker, type of farming (described by dummy variables "livestock presence", "forest presence"), and agricultural training (dummies to categorise according to "Low agricultural education level" and "High agricultural education level").
2) The characteristics of the farmer's household include the farmer's age ("Under 45 years") and the farmer's general education level. The other explanatory variables describe farmers' attitude and opinions towards the environment and agri-environmental policy. The dummy variable "Environment concern" involves that the respondent ranks the environment among the three most important public policy issues. His/her opinions are more detailed with the variables "Opinion on environmental state" and "Opinion on farmers' environmental attitude". Previous participation to agri-environmental schemes and other participants' acquaintance ("Knows other participants") have a strong effect on participation probabilities.

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The table in the appendix gives the marginal effects of the explanatory variables on each combination. The marginal effects on the probability of non participation [Y=0] are the opposite effects of explanatory variables on the participation in one or several schemes.

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Considering farm characteristics, the participation is favoured by the presence of forest and the presence of animals. The area has no significant effect *per se*, but lower area per worker, and lower livestock density favours participation, suggesting that more extensive farmers are more suitable for agri-environmental participation. Both highest and lowest agricultural education level have a negative effect on participation.

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The age of the farmer has a negative effect and his general education level has a positive effect. The previous participation to agri-environmental schemes and the acquaintance with other participants ("Knows other participants") have a strong positive effect participation probabilities. The farmers with "environment concern" participate more than the others, but the farmers who think there are still serious environmental problems in agricultural areas participate less than the others.

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Except the variable "Knows other participants", the other explanatory variables have contrasted effects on the participation in the different combinations of schemes. The effects of farm characteristics appear to be linked to the type of schemes. The presence of forest favours the landscape maintenance and all the combinations of several schemes. The presence of animals favours the landscape maintenance and biodiversity protection but discourages the participation in schemes requiring restrictions of intensive practices. Accordingly, it only favours the association of the two first type of schemes and has no effect on the associations including the third one. Higher livestock density favours the biodiversity protection, single and in association with landscape maintenance; but discourages the participation in landscape maintenance alone and the acceptance of intensive practice restrictions. The farm area favours the combinations that include restrictions of intensive practices and discourages participation in landscape maintenance. The area per worker favours the landscape maintenance and biodiver-

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sity protection but clearly discourages the participation in combinations including restrictions of intensive practices. Higher agricultural education favours biodiversity protection and discourages landscape maintenance. Both highest and lowest level of agricultural education discourage the participation in several schemes simultaneously.

The previous participation in agri-environmental schemes has a positive effect on the participation in several schemes simultaneously, and on the single participation in biodiversity protection. All things equal, youngest farmers prefer entering no scheme or only one scheme that requires restrictions of intensive practices. They mostly avoid combinations which associate restrictions of intensive practices and biodiversity protection as well as landscape maintenance and biodiversity protection. General education favours all combinations of several schemes. It has a U-shape effect on restrictions of intensive practices.

Farmers' opinions also have contrasted effects on the participation in the different combinations of schemes. "Environment concern" favours landscape maintenance and biodiversity protection as well as their combinations with schemes requiring restrictions of intensive practices. However, it has a negative effect on the single participation in schemes requiring restrictions of intensive practices only. The opinion variables "serious problems remain in agricultural environment" and "farmers have a positive attitude towards environment" affect the combinations of schemes which associate landscape maintenance and restrictions on intensive practices, negatively and positively respectively.

Interesting is that inclusion of a country variable is not increasing the predictive power of the results. This indicates that the model measures well underlying universal motives for participation.

The significance of variables which are not strictly related to farm technology once more indicates that household characteristics, including opinions, should be considered in the microeconomic modelling of participation (Dupraz et al., 2000).

4. Concluding comments

Our results confirm earlier findings about the influence of farm and household characteristics on the uptake of agri-environmental policies. In their analysis on farmers' participation in a farm woodland incentive scheme, Crabtree et al. (1998) also found the probability of participation increases with the proportion of existing woodland, as opposed to the proportion of land under agricultural use, which has a negative impact on the probability of participation. This is also in line with the analysis of Wynn et al. (2000), who found that the ESA Scheme in Scotland favours extensive farms. Previous participation in the scheme(s) and acquaintance with other participants have a positive influence on participation in our analysis, as well as in both Scottish studies (Crabtree et al., 1998; Wynn et al., 2001). Although Crabtree (1998) found that age did not significantly affect the probability of entry, both our analysis as well as Wynn et al. (2001) show a negative relationship. Older farmers seem to be less willing to participate. Environmental concern as an explanatory variable seems harder to catch. This analysis shows that farmers with "environment concern" participate more than others, while farmers who think there are still a lot of environmental problems participate less. This result is more or less in line with the analysis of Wynn et al. (2001), who found no clear picture concerning the impact of the variable designed to measure a farmer's interest in conservation. It is clear that our results are rather consistent with those from Crabtree et al. (1998) and Wynn et

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Most previous studies are limited to the uptake decision. Some consider the selection of a single scheme among a set of schemes which are offered to eligible farmers. Our paper is more ambitious since it proposes a model which takes into account the possible participation in several schemes simultaneously. First of all several variables (area per worker, livestock density, age, environment concern) significantly affect the uptake decision whereas they do not influence joint participation. Secondly the participation rate does not significantly vary with farm area. However, farmers who operate the largest farms are more likely to select several schemes. Since our model integrates the possibility of simultaneous participation, it provides a better prediction of the farmers' rate of uptake.

The results of this analysis are especially important in terms of policy design. A first important indication is that differences exist in participation characteristics among several schemes. This suggest that measures, clearly targeting specific groups of farmers and taking into account their expectations and limitations, can increase the efficiency of the policy. Effectiveness of measures can therefore be increased by better defining eligibility rules in relations to the objectives of a measure. The results suggest that eligibility rules based on farm related characteristics (presence of animals, used farm technology, ...) will result in a higher uptake than rules based on geographical designations. Restriction of intensive practices is only possible on farms with sufficient area, while more labour intensive conservation practices are more taken up by farmers with an excess of labour.

Another important result points out the importance of private transaction costs for uptake. The fact that previous knowledge and knowing other participants play an important role, indicates that information costs are still high, in particular for a first participation. A higher area per worker influences negatively uptake. It proves that participation is time consuming and depends on the opportunity cost of on farm labour. Another indication is that younger farmers who probably spend more time in developing their farm participate less, all other things equal. This brings us to the role of education. Although not totally consistent the results indicate that an increased general education level increases participation, in particular if this results in a higher environmental concern. Being more aware of environmental problems and possible solutions can contribute to the goal of making farmers more aware of their stewardship role and duty. The fact that general education seems to have a more influencing role than agricultural education may indicate that agricultural education is still too much technical oriented and pays not enough attention to the multifunctional role of agriculture.

Finally, our paper shows the importance for policy makers to take into account that farmers have the opportunity to enter several schemes simultaneously. Indeed, due to cost complementarities, joint participation provides both private and public benefits. The fact that a relative high number of surveyed farmers participate in more than one scheme suggest that a more individual negotiation with a tailor made design of programmes could be an interesting approach (see the French "contrat territorial d'exploitation"). This would certainly increase participation as programmes would then fit better in the management and aspiration of farmers. Of course a negative point is the high transaction costs in negotiating and monitoring such individual tailor made schemes. A way out may be to offer a standard package from which every farmer could select given the particular circumstances of his farm. This would certainly reduce the repeated cost of negotiation for each scheme. It also could decrease overall monitoring costs.

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Appendix

Table 5: Marginal effects of the explanatory variables on each combination

	Marginal effects	Standard Error	b/St.Er.|	P[|Z|>z	Mean of X
			on Prob[Y = 0]		
Intercept	0.7714	0.0625	12.3480	0.0000	
Environment concern	-0.1382	0.0398	-3.4740	0.0005	0.2552
Livestock presence	-0.2215	0.0431	-5.1430	0.0000	0.6886
Area per worker	0.0016	0.0008	2.0340	0.0419	24.8633
Area	-0.0003	0.0004	-0.8840	0.3764	57.4414
Livestock density	0.0099	0.0028	3.5830	0.0003	4.2249
Less then 45 year old	0.0675	0.0339	1.9910	0.0465	0.4945
Previous participation	-0.2400	0.0503	-4.7710	0.0000	0.1557
Forest presence	-0.2184	0.0431	-5.0710	0.0000	0.2234
Negative opinion on environment state	0.0643	0.0343	1.8740	0.0610	0.5861
Positive opinion on farmers' environmental attitude	0.0186	0.0314	0.5930	0.5534	0.4683
Knows other participants	-0.4197	0.0333	-12.602	0.0000	0.6252
Low general education level	0.1640	0.0437	3.7560	0.0002	0.2460
High general education level	-0.0613	0.0370	-1.6570	0.0975	0.3724
Low agricultural education level	0.2170	0.0424	5.1190	0.0000	0.4133
High agricultural education level	0.1673	0.0447	3.7450	0.0002	0.3071
			on Prob[Y = 1]		
Intercept	-0.0251	0.0146	-1.7130	0.0867	
Environment concern	0.0067	0.0080	0.8290	0.4074	0.2552
Livestock presence	-0.0165	0.0089	-1.8440	0.0651	0.6886
Area per worker	-0.0004	0.0002	-2.2850	0.0223	24.8633
Area	0.0001	0.0000	2.0640	0.0390	57.4414
Livestock density	0.0002	0.0003	0.7560	0.4498	4.2249
Less then 45 year old	-0.0108	0.0070	-1.5490	0.1214	0.4945
Previous participation	0.0282	0.0098	2.8850	0.0039	0.1557
Forest presence	0.0439	0.0116	3.7860	0.0002	0.2234
Negative opinion on environment state	-0.0143	0.0078	-1.8480	0.0646	0.5861
Positive opinion on farmers' environmental attitude	0.0115	0.0070	1.6440	0.1001	0.4683
Knows other participants	0.0486	0.0134	3.6370	0.0003	0.6252
Low general education level	-0.0644	0.0180	-3.5730	0.0004	0.2460
High general education level	0.0142	0.0073	1.9470	0.0515	0.3724
Low agricultural education level	-0.0923	0.0182	-5.0630	0.0000	0.4133
High agricultural education level	-0.0371	0.0111	-3.3410	0.0008	0.3071
			on Prob[Y = 2]		
Intercept	-0.0397	0.0167	-2.3790	0.0174	
Environment concern	-0.0005	0.0097	-0.0470	0.9622	0.2552
Livestock presence	-0.0029	0.0098	-0.2950	0.7680	0.6886
Area per worker	-0.0003	0.0002	-1.7190	0.0855	24.8633
Area	0.0001	0.0000	2.8490	0.0044	57.4414
Livestock density	0.0002	0.0004	0.4020	0.6880	4.2249
Less then 45 year old	0.0016	0.0072	0.2160	0.8293	0.4945
Previous participation	0.0226	0.0091	2.4730	0.0134	0.1557
Forest presence	0.0176	0.0085	2.0740	0.0381	0.2234
Negative opinion on environment state	-0.0215	0.0089	-2.4060	0.0161	0.5861
Positive opinion on farmers' environmental attitude	-0.0053	0.0072	-0.7420	0.4581	0.4683
Knows other participants	0.0281	0.0107	2.6270	0.0086	0.6252
Low general education level	-0.0335	0.0155	-2.1620	0.0307	0.2460
High general education level	-0.0060	0.0076	-0.7920	0.4285	0.3724
Low agricultural education level	-0.0262	0.0124	-2.1100	0.0348	0.4133
High agricultural education level	-0.0025	0.0087	-0.2840	0.7763	0.3071

			on Prob[Y = 3]		
Intercept	0.0140	0.0195	0.7160	0.4737	
Environment concern	0.0267	0.0117	2.2760	0.0228	0.2552
Livestock presence	-0.0152	0.0122	-1.2460	0.2127	0.6886
Area per worker	-0.0007	0.0003	-2.6680	0.0076	24.8633
Area	0.0000	0.0001	0.7030	0.4818	57.4414
Livestock density	-0.0018	0.0010	-1.8960	0.0580	4.2249
Less then 45 year old	-0.0167	0.0100	-1.6750	0.0939	0.4945
Previous participation	0.0286	0.0126	2.2750	0.0229	0.1557
Forest presence	0.0310	0.0116	2.6770	0.0074	0.2234
Negative opinion on environment state	-0.0577	0.0130	-4.4380	0.0000	0.5861
Positive opinion on farmers' environmental attitude	0.0266	0.0102	2.5940	0.0095	0.4683
Knows other participants	0.0411	0.0136	3.0160	0.0026	0.6252
Low general education level	-0.1006	0.0210	-4.7830	0.0000	0.2460
High general education level	0.0108	0.0098	1.1050	0.2691	0.3724
Low agricultural education level	-0.0792	0.0173	-4.5680	0.0000	0.4133
High agricultural education level	-0.0504	0.0141	-3.5790	0.0003	0.3071
			on Prob[Y = 4]		
Intercept	-0.2488	0.0268	-9.3000	0.0000	
Environment concern	0.0776	0.0165	4.7040	0.0000	0.2552
Livestock presence	0.1337	0.0212	6.3130	0.0000	0.6886
Area per worker	0.0006	0.0002	2.6760	0.0074	24.8633
Area	0.0001	0.0001	0.6080	0.5430	57.4414
Livestock density	0.0012	0.0005	2.2310	0.0257	4.2249
Less then 45 year old	-0.0518	0.0138	-3.7600	0.0002	0.4945
Previous participation	0.0540	0.0168	3.2180	0.0013	0.1557
Forest presence	0.0546	0.0156	3.5080	0.0005	0.2234
Negative opinion on environment state	0.0081	0.0137	0.5940	0.5524	0.5861
Positive opinion on farmers' environmental attitude	-0.0187	0.0127	-1.4710	0.1414	0.4683
Knows other participants	0.0882	0.0183	4.8270	0.0000	0.6252
Low general education level	0.0140	0.0159	0.8820	0.3777	0.2460
High general education level	0.0335	0.0147	2.2770	0.0228	0.3724
Low agricultural education level	-0.0420	0.0157	-2.6680	0.0076	0.4133
High agricultural education level	-0.0552	0.0169	-3.2670	0.0011	0.3071
			on Prob[Y = 5]		
Intercept	-0.2635	0.0383	-6.8730	0.0000	
Environment concern	0.0344	0.0206	1.6710	0.0946	0.2552
Livestock presence	0.1549	0.0242	6.4110	0.0000	0.6886
Area per worker	0.0007	0.0004	1.6940	0.0903	24.8633
Area	-0.0004	0.0003	-1.6520	0.0985	57.4414
Livestock density	-0.0060	0.0023	-2.6780	0.0074	4.2249
Less then 45 year old	-0.0217	0.0188	-1.1540	0.2486	0.4945
Previous participation	0.0303	0.0241	1.2530	0.2102	0.1557
Forest presence	0.1190	0.0219	5.4340	0.0000	0.2234
Negative opinion on environment state	0.0205	0.0190	1.0790	0.2807	0.5861
Positive opinion on farmers' environmental attitude	-0.0125	0.0175	-0.7140	0.4755	0.4683
Knows other participants	0.0789	0.0207	3.8140	0.0001	0.6252
Low general education level	-0.0400	0.0228	-1.7480	0.0804	0.2460
High general education level	-0.0197	0.0206	-0.9530	0.3408	0.3724
Low agricultural education level	0.0764	0.0234	3.2680	0.0011	0.4133
High agricultural education level	0.0030	0.0247	0.1200	0.9044	0.3071

			on Prob[Y = 6]		
Intercept	-0.1702	0.0251	-6.7680	0.0000	
Environment concern	0.0540	0.0145	3.7250	0.0002	0.2552
Livestock presence	0.0805	0.0201	4.0130	0.0001	0.6886
Area per worker	0.0003	0.0002	1.9120	0.0559	24.8633
Area	0.0001	0.0001	1.5660	0.1175	57.4414
Livestock density	0.0015	0.0004	3.4140	0.0006	4.2249
Less then 45 year old	-0.0002	0.0116	-0.0200	0.9844	0.4945
Previous participation	0.0516	0.0155	3.3240	0.0009	0.1557
Forest presence	0.0113	0.0143	0.7870	0.4314	0.2234
Negative opinion on environment state	-0.0011	0.0126	-0.0880	0.9301	0.5861
Positive opinion on farmers' environmental attitude	-0.0101	0.0118	-0.8560	0.3921	0.4683
Knows other participants	0.0297	0.0138	2.1550	0.0311	0.6252
Low general education level	-0.0051	0.0148	-0.3440	0.7307	0.2460
High general education level	-0.0212	0.0136	-1.5540	0.1201	0.3724
Low agricultural education level	-0.0365	0.0168	-2.1820	0.0291	0.4133
High agricultural education level	0.0006	0.0132	0.0430	0.9658	0.3071
			on Prob[Y = 7]		
Intercept	-0.0380	0.0314	-1.2090	0.2266	
Environment concern	-0.0606	0.0219	-2.7640	0.0057	0.2552
Livestock presence	-0.1130	0.0255	-4.4330	0.0000	0.6886
Area per worker	-0.0018	0.0005	-3.7660	0.0002	24.8633
Area	0.0003	0.0001	3.2960	0.0010	57.4414
Livestock density	-0.0051	0.0027	-1.8860	0.0593	4.2249
Less then 45 year old	0.0322	0.0175	1.8390	0.0659	0.4945
Previous participation	0.0248	0.0238	1.0420	0.2974	0.1557
Forest presence	-0.0590	0.0240	-2.4520	0.0142	0.2234
Negative opinion on environment state	0.0017	0.0162	0.1050	0.9166	0.5861
Positive opinion on farmers' environmental attitude	-0.0101	0.0148	-0.6800	0.4964	0.4683
Knows other participants	0.1050	0.0201	5.2290	0.0000	0.6252
Low general education level	0.0655	0.0216	3.0370	0.0024	0.2460
High general education level	0.0495	0.0186	2.6630	0.0077	0.3724
Low agricultural education level	-0.0170	0.0186	-0.9160	0.3598	0.4133
High agricultural education level	-0.0256	0.0241	-1.0620	0.2884	0.3071

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Most recent data available (1998, DG VI) shows that on average in EU-14 (excluding data from Germany) the number of farms included within at least one programme is 1 in every 7. This corresponds more or less with over 20% of European farmland. There exists however, as can be seen in table 1, a highly contrasting picture between Member States. High proportions are found in the 'new' Member States - 78% in Austria, 77% in Finland and 64% in Sweden. These figures are substantially greater than the average. Also Luxembourg with 60% and Portugal with 30% have a proportion higher than the EU average. Of the other Member States, Belgium, Greece, Spain, Italy and the Netherlands, with rates around or less than 7% are significantly below the EU average.

Table 1. Percentage of farms benefiting under Reg. 2078/92

	number of beneficiaries 000	***total number of holdings 000***	***% of farmers concerned***		
			all farms	***zones obj. 1***	***zones non-obj. 1***
Belgium	*2.0*	*71*	*2.8*	*3.0*	*2.8*
Denmark	*8.0*	*69*	*11.6*	*-*	*11.6*
Greece	*2.4*	*774*	*0.3*	*0.3*	*-*
Spain	*33.9*	*1278*	*2.7*	*3.2*	*0.3*
France	*171.0*	*735*	*23.3*	*5.8*	*23.9*
Ireland	*32.2*	*153*	*21.0*	*21.0*	*-*
Italy	*176.3*	*2482*	*7.1*	*4.7*	*10.0*
Luxembourg	*1.9*	*3*	*60.3*	*-*	*60.3*
Netherlands	*6.7*	*113*	*5.9*	*1.8*	*6.0*
Austria*	*173.4*	*222*	*78.2*	*56.7*	*80.2*
Portugal	*137.9*	*451*	*30.6*	*30.6*	*-*
Finland	*77.8*	*101*	*77.2*	*-*	*77.2*
Sweden	*56.6*	*89*	*63.7*	*-*	*63.7*
Great Britain	*25.4*	*235*	*10.8*	*10.9*	*10.8*

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s can be seen in table 1, a highly contrasting picture between Member States.

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Table 1. Percentage of farms benefiting under Reg. 2078/92

	number of beneficiaries 000	***total number of holdings 000***	***% of farmers concerned***		
			all farms	***zones obj. 1***	***zones non-obj. 1***
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Greece	*2.4*	*774*	*0.3*	*0.3*	*-*
Spain	*33.9*	*1278*	*2.7*	*3.2*	*0.3*
France	*171.0*	*735*	*23.3*	*5.8*	*23.9*
Ireland	*32.2*	*153*	*21.0*	*21.0*	*-*
Italy	*176.3*	*2482*	*7.1*	*4.7*	*10.0*
Luxembourg	*1.9*	*3*	*60.3*	*-*	*60.3*
Netherlands	*6.7*	*113*	*5.9*	*1.8*	*6.0*
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Finland	*77.8*	*101*	*77.2*	*-*	*77.2*
Sweden	*56.6*	*89*	*63.7*	*-*	*63.7*
Great Britain	*25.4*	*235*	*10.8*	*10.9*	*10.8*

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** In the case of Germany, figures supplied cannot be used for comparison since the data supplied refers to contracts, not to individual farmers. ... the best estimate is that Germany has a level of take-up above the average, which would slightly raise the figures for EU-12 and EU-15*

Source: http://europa.eu.int/comm/agriculture/envir/report/en/2078_en/Tab2.htm

In order to get a clearer overall picture of the effects and success of the agri-environ-mental measures, efforts in the area of measurement, development of indicators and methodologies for evaluation seem necessary, especially to be able to compare the measures in different European countries.

This paper reviews findings from a EU research project on the actual application of agri-environmental and countryside management policies in 8 EU countries. According to Van Huylenbroeck and Whitby (1999) the main role of agri-environmental policies is to change the production conditions for farmers in favour of landscape management and conservation efforts so that they will again pay more attention to it. The agri-environ-mental policies should be used to stimulate farmers to deliver countryside stewardship and environmental outputs and not as a market regulation instrument because for that the stewardship instruments are too expensive, in particular in terms of transaction costs (Whitby et al, 1998; Falconer, 2000), and not effective. Neither should these policies be used only as income transfer instruments, without delivering benefits to society. However, in case of market failure and when well targeted, these policies may be a suitable instrument to deliver agri-environmental goods.

Key factor in the success is however uptake by farmers. Therefor this analysis aims to examine the factors influencing farmers' participation in agri-environmental schemes. The factors behind this decision making should be identified in order to make recommendations to policy-makers, if agri-environmental policy is to expand further as part of agricultural policy. By analysing determinants of farmers' enrolment in several schemes, it is possible to analyse whether the objectives of a scheme influence uptake. Based on a data set on the participation in agri-environmental measures of 1770 European farmers in 8 countries, the paper investigates what kind of farm and household characteristics do influence uptake and in how far differences can be observed between different kind of measures. The originality of the analysis lies in the use of a multinominal logit model, allowing to separate not only between participating and non participating farmers but also among farmers only adopting one measure and others enrolled in different measures.

Modelling farmers' behaviour

Previous studies have shown that the participation to agri-environmental schemes depends on the farm characteristics and the preferences of farmer's household (Kazenwadel et al, 1998; Delvaux et al, 1999; Dupraz et al, 2000; Bonnieux et al, 1998; Drake et al 1999; Giannakopoulos, 2000; Vanslembrouck et al., 2001).

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but also among farmers only adopting one measure and others enrolled in different measures.

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(Kazenwadel et al, 1998; Delvaux et al, 1999; Dupraz et al, 2000; Bonnieux et al, 1998; Drake et al 1999; Giannakopoulos, 2000; Vanslembrouck et al., 2001)

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In order to get a clearer overall picture of the effects and success of the agri-environ

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Also work from Crabtree et al. (1998) and Wynn et al. (2001) concentrated on modelling farmer's participation in agri-environmental schemes in Scotland, taking into account both farm and farmer

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* *In the case of Germany, figures supplied cannot be used for comparison since the data supplied refers to contracts, not to individual farmers. ... the best estimate is that Germany has a level of take-up above the average, which would slightly raise the figures for EU-12 and EU-15*

Source: http://europa.eu.int/comm/agriculture/envir/report/en/2078_en/Tab2.htm

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in several schemes, it is possible to analyse whether the objectives of a scheme influence uptake. Based on a data set on the participation in agri-environmental measures of 1770 European farmers in 8 countries, the paper investigates what kind of farm and household characteristics do influence uptake and in how far differences can be observed between different kind of measures. The originality of the analysis lies in the use of a multinominal logit model, allowing to separate not only between participating and non participating

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mental measures, efforts in the area of measurement, development of indicators and methodologies for evaluation seem necessary, especially to be able to compare the measures in different European countries.

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characteristics. Their approach is similar to the one used in this article as they also used logit an multinominal logit models. However the main difference is that we explicitly model the possibility of enrolment in different schemes.

The reason to take both farm and farmer characteristics in the model is that farm chara

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This paper reviews findings from a EU research project on the actual application of agri-environmental and countryside management policies in 8 EU countries. According to Van Huylenbroeck and Whitby (1999) the main role of agri-environmental policies is to change the production conditions for farmers in favour of landscape management and conservation efforts so that they will again pay more attention to it. The agri-environ

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mental policies should be used to stimulate farmers to deliver countryside stewardship and environmental outputs and not as a market regulation instrument because for that the stewardship instruments are too expensive, in particular in terms of transaction costs

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, and not effective. Neither should these policies be used only as income transfer instruments, without delivering benefits to society. However, in case of market failure and when well targeted, these policies may be a suitable instrument to deliver agri-environmental goods.

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Key factor in the success is however uptake by farmers. Therefor this analysis aims to examine the factors influencing farmers' participation in agri-environmental schemes. The factors behind this decision making should be identified in order to make recommendations to policy-makers, if agri-environmental policy is to expand further as part of agricultural policy. By analysing determinants of farmers

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Their approach is similar to the one used in this article as they also used logit an multinomial logit models. However the main difference is that we explicitly model the possibility of enrolment in different schemes.

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reason to take both farm and farmer characteristics in the model is that

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influence his decision