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Participation of Italian farmers in rural development policy

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Abstract

The aim of this paper is to study farmers' participation in rural development policy (RDP) measures. We investigate to what extent regional RDP priorities are driven by regional characteristics and moreover, whether regional-level policy priorities help to explain farmers' participation in RDP measures. We estimate a multilevel binary choice model that includes both farm-level and regional-level explanatory variables. We conclude that regional governments select RDP priorities based on the specific features of their region. Regional policy priorities play an important role in explaining farmers' participation in agri-environmental schemes but not in measures aimed at improving farmer competitiveness.

Keywords: rural development policy, multi-level modelling, Italy

JEL classification: Q18

1. Introduction

Rural development policy (RDP) is the main European Union (EU) strategy that aims to improve (i) the competitiveness of agriculture and forestry; (ii) the environment and the countryside; and (iii) the quality of life in rural areas and the diversification of the rural economy. RDP provides a source of financial support for European farmers and rural communities (Dwyer *et al*., 2008). Nevertheless, a large share of farmers do not participate in existing rural development measures. Available data indicate that, in the EU, about 35 per cent of farmers who are registered in the Farm Accountancy Data

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Network (FADN) system participated in at least one RDP measure in the period 2000–2006 (European Commission, 2009). In Italy, this percentage is only 17 per cent. Moreover, participation of the overall farmer population (thus considering also farmers not registered in the FADN) is significantly lower. For example, in the period 2000–2006, the participation rate for RDP measures in Italy was 8.9 per cent.[1] Knowing that the Italian RDP budget for the same period has been spent completely, we can conclude that the budget was too low to allow a large share of farms to benefit from RDP measures (MIPAAF, 2012).

The issue of participation has raised the interest of academic studies and policy analyses which have focused on understanding the factors affecting farmers' participation in RDP contracts (Defrancesco *et al*., 2008; Peerlings and Polman, 2008, 2009; Mettepenningen, Verspecht and Van Huylenbroeck, 2009; Buysse, Verspecht and Van Huylenbroeck, 2011; Mettepenningen, Beckmann and Eggers, 2011). The majority of these studies have focused on farmers' participation in Agro-Environmental Schemes (AES) in different EU countries (see Defra, 2006; Defrancesco *et al*., 2008; Mettepenningen, Verspecht and Van Huylenbroeck, 2009; Mettepenningen, Beckmann and Eggers, 2011 for interesting overviews of these studies). The findings suggest that the decision to participate in AES is driven by several factors, such as farm structural features, specialisation, non-farm activities, the local context, networks, institutions and farmers' attitudes (Beedell and Rehman, 2000; Wynn, Crabtree and Potts, 2001; Defrancesco *et al*., 2008). Buysse, Verspecht and Van Huylenbroeck (2011) have studied farmers' participation in rural development investment support. They find that investment support for farm diversification and restructuring is effective, while environmental investment support is too low to cover short-run costs.

These studies have approached the issue of participation in specific groups of RDP contracts, namely AES and investment support. To the best of our knowledge, studies that explore participation across different RDP axes are still missing. This is the aim of this paper. We examine the effect of farm and farmer features and location on farmers' participation in two different groups of RDP contracts. The first group corresponds to axis 1 of the RDP and includes measures that support farm economic competitiveness through investments, training and marketing (Support for Competitiveness Schemes, SCS); the second group corresponds to RDP axis 2 and refers to measures that support the provision of environmental services, such as AES, afforestation and extensification (Support for Agri-Environmental Services, SAS).[2] We hypothesise that differences in farm characteristics and

1 We use information from 21 evaluation reports on the effectiveness of Italian RDP regional programmes in 2000–2006. Reports are available on request from the authors. Copies of these reports are also available from the Italian Ministry of Agricultural, Food and Forestry Affairs (MIPAAF). According to this information, the lowest participation rate is in the Lazio region (6.1 per cent), while the highest is in Basilicata (13.4 per cent).

2 It should be noted that the available information from the Italian FADN only provides information on whether the farmer is participating in an SCS and/or SAS contract and does not allow

location lead to different benefits, opportunities and transaction costs as a result of participation in an RDP contract.

Furthermore, we put special emphasis on the role of location, both in the conceptual and the empirical part of this paper. On the one hand, locational differences in environmental or agricultural features are likely to affect the willingness of farmers to participate in certain RDP measures. For instance, farmers who are located in areas that suffer from specific agri-environmentally related problems such as erosion or pollution are expected to show more interest in measures that can help to mitigate these problems. On the other hand, there is also a selection aspect linked to the location of a farm. This has to do with the implementation of the EU RDP and the role played by regional governments who can set regional priorities and eligibility constraints for RDP measures. In Italy, the governments of each of the 21 administrative regions are responsible to choose the RDP measures that most fit within the regional RDP priorities (Panico, Del Giudice and Pascucci, 2009). Regional policy-makers select those measures that are more relevant for their regions from the 'national' menu. For example, in regions characterised by extensive environmental resources (e.g. nature areas) more emphasis will be put on environmental services, while regions with a stronger farming sector are likely to focus on measures that reinforce the farming economic base. As a result, farmers are choosing RDP measures not from the full menu that is provided at EU level but from a sub-set of measures that are accessible at regional level (Panico, Del Giudice and Pascucci, 2009). The aim of the current study will therefore be to take into account the effect of this regional-level selection process on farmers' participation in the RDP programme. More specifically, we are interested in finding out to what extent regional characteristics are able to explain regional priorities in RDP and whether these regional priorities also drive farmers' participation in RDP programmes.

In order to achieve the objectives of our study, we use information related to 15,383 farmers from the Italian FADN 2006. This cross-sectional data set includes information about the participation of farmers in both the SCS and SAS groups of contracts. Our empirical strategy is based on the implementation of a multilevel binary choice model. This empirical model takes into account the fact that farm-level data are nested in the regional-level data and more specifically that farmers' participation in RDP is dependent on regional-level priorities with respect to the menu of RDP measures on offer. Furthermore, the multilevel approach estimates correct standard errors when we include both farm-level and regional data to explain farmers' participation decisions in RDP measures.

The results from our study are compared with previous findings in the literature to contextualise our Italian case study within the overall discussion on participation of European farmers in RDP contracts. The methodological

us to distinguish participation in a specific measure. Table A1 reports the list and main features of RDP contracts.

approach and the results from this paper are new for the Italian context and may also contribute to improve the policy-making debate at EU level.

2. Theoretical model and econometric strategy

Following Masten and Saussier (2002), we can formalise the farmer's decision to accept or reject an RDP contract as a discrete decision-making problem:

$$y* = \begin{cases} y = 0 & \text{if } U(V^0) \geq U(V^1), \\ y = 1 & \text{if } U(V^0) < U(V^1), \end{cases} \tag{1}$$

where $y*$ is the unobservable latent value of an RDP contract and V^0 and V^1 represent the (expected) net benefits associated with, respectively, the rejection and the acceptance of the contract (Masten and Saussier, 2002). Equation (1) shows that the RDP contract is chosen if the net benefits from accepting the contract exceed the net benefits from not accepting it.

In an RDP contract, a farmer is asked to allocate a certain amount of resources, e.g. his farmland, to implement one or more activities (Mettepenningen, Verspecht and Van Huylenbroeck, 2009). Financial support is guaranteed to farmers who take up the contract. Farmers' participation in an RDP contract is observed when the sum of the financial support and the net benefits from implementing the activity are larger than the implementation costs. In the case of measures related to SCS, the benefits derived from the implementation of the activity proposed by the RDP contract could, for instance, come from the modernisation of agricultural holdings. In this case, financial support is proportional to the overall amount of (private) financial resources that will be allocated by the farmer to the project. In the case of SAS, financial support is provided as a per-hectare payment, to compensate for reduced revenue (Peerlings and Polman, 2004, 2008, 2009; Polman and Slangen, 2008), and/or as a direct payment for the provision of a public good to society (Mettepenningen, Verspecht and Van Huylenbroeck, 2009; Mettepenningen, Beckmann and Eggers, 2011).

Overall costs of the RDP contract include: (i) the costs to implement the activity that are not compensated by benefits generated by the activity – these costs include operational, investment and uncertainty costs (Mettepenningen, Verspecht and Van Huylenbroeck, 2009); (ii) opportunity costs (profit foregone), and (iii) transaction costs (Ozanne, Hogan and Colman, 2001; White, 2002; Ferraro, 2008; Mettepenningen, Verspecht and Van Huylenbroeck, 2009). Transaction costs include both *ex ante* and *ex post* costs (Coggan, Whitten and Bennett, 2010). Search and information costs are typical *ex ante* costs experienced by farmers to get information about funding opportunities (Mettepenningen, Verspecht and Van Huylenbroeck, 2009; Coggan, Whitten and Bennett, 2010; Mettepenningen, Beckmann and Eggers, 2011). Negotiation costs are *ex post* costs to carry out the transaction, and may include administrative and legal costs, such as the costs of negotiating the

terms of the agreement, and the costs of formally designing the contract (Hobbs, 1997; Coggan, Whitten and Bennett, 2010).

Because benefits and costs of the specific RDP contracts are unobservable, farm and farmer characteristics that are likely to correlate with these costs and benefits are used as proxies in the empirical framework (Peerlings and Polman, 2009). A commonly used approach to estimate the probabilities of choosing different contractual solutions is to implement a discrete-choice model (Masten and Saussier, 2002). In this case, the observed contractual choice is considered as an expression of a continuous latent variable reflecting the propensity to choose a specific option among different alternatives (Defrancesco *et al*., 2008).

The generic empirical model of farmer i choosing an RDP contract s can be written as follows:

$$y^*_{si} = \beta_0 + \beta_s x_{si} + e_{si} \quad \forall s \in S, \tag{2}$$

$$\begin{array}{l} y_{si} = 1 \quad \text{if} \quad y^*_{si} > 0 \\ y_{si} = 0 \quad \text{otherwise} \end{array} \quad \forall s \in S, \tag{3}$$

where y^*_{si} is the unobservable value of contract s for farmer i (latent variable), y_{si} is the observable contract choice, x_{si} are the explanatory variables for farmer i, β_s is a vector of coefficients for contract s and e_{si} is a vector of unobservable characteristics related to farmer i and contract s.

Different econometric strategies can be implemented to estimate this empirical model. A relatively common approach is to use separate logit/probit models to depict the basic binary choice of participation or non-participation in a given RDP contract (Damianos and Giannakopoulos, 2002; Dupraz *et al*., 2002; Vanslembrouck, Van Huylenbroeck and Verbeke, 2002; Wossink and van Wenum, 2003). Another commonly used approach is to set up a bivariate probit model (Polman and Slangen, 2008; Peerlings and Polman, 2009), or to use a multinomial model (Wynn, Crabtree and Potts, 2001; Dupraz *et al*., 2002; Espinosa-Goded, Barreilo-Hurle and Ruto, 2010).

Our empirical strategy is based on the observation that the farmer's decision-making process is a nested problem. The reason for this is that the farmer's choice set (the menu) of RDP contracts has been restricted by decisions made at regional government level. As a result, SCS/SAS participation can be seen as a two-stage problem and may differ between regions because of several reasons: (i) regional government priorities may differ and therefore not all possible RDP measures are available in the menu. As a result, financial support is only offered for a limited number of RDP contracts; (ii) regional circumstances may make certain measures more attractive for farmers in some regions than in others, implying that relative costs and benefits from different RDP contracts can differ between regions; (iii) farm populations may differ between regions and this may affect farmers' decision-making processes through group or neighbour effects.

To incorporate these regional aspects, the econometric framework is based on a multilevel model that distinguishes two levels of analysis: the regional

level and the farm/farmer level. More specifically, farm-level decisions are nested within regional-level data. As argued before, farms in the same region can be seen as a group or cluster of entities that are likely to have more similar characteristics with other members of the group than with members of a different group. Ignoring such group effects may lead to an overestimation of the impact of farm-level indicators on participation decisions.

In this situation, the multilevel random effects model (MREM) is the most appropriate estimation procedure (Guo and Zao, 2000; Centre for Multilevel Modelling, 2008). The multilevel approach is superior to a single-level fixed effects model that includes regional dummy variables because the regional dummies limit the use – and hence the interpretation – of regional-level predictors. Furthermore, including regional-level predictors in a single-level model creates a high risk of Type 1 errors because standard errors of coefficients of regional-level predictors may be severely underestimated. Correcting standard errors for these effects would overcome this problem; however, it would not allow for the assessment of the degree of between-region variation. The MREM takes care of all these shortcomings and is therefore the preferred model in the situation of nested data.

We start from expressions (2) and (3) and we assume for simplicity that farmers can only choose to allocate resources to one RDP contract. The two-level generalised random intercept model can then be represented as: **Q4**

$$y_{ij}^{*} = \beta_0 + \beta_1 x_{ij} + u_j + e_{ij}, \tag{4}$$

where a total of n individuals (at level 1) are nested within j groups (at level 2). In our case, level 1 represents the farm or farmer level and level 2 represents the regional level. y_{ij}^{*} is the unobserved response variable for individual i in group j, and x_{ij} is an individual-level explanatory variable. Furthermore, u_j represents the group effects (level-2 residuals) and e_{ij} represents the level-1 residuals. **Q5**

Expressing the model in terms of the expected value of y_{ij}^{*} for an individual i in group j and with value x_{ij} gives:

$$E(y_{ij}^{*}|x_{ij}, u_j) = \beta_0 + \beta_1 x_{ij} + u_j. \tag{5}$$

For a binary response y_{ij}, we have $E(y_{ij}|x_{ij}, u_j) = \pi_{ij} = \Pr(y_{ij} = 1)$ and a generalised linear random intercept model for the dependency of the response probability π_{ij} on x_{ij} is written as:

$$F^{-1}(\pi_{ij}) = \beta_0 + \beta_1 x_{ij} + x_j, \tag{6}$$

where F^{-1} is the link function, which is the inverse cumulative distribution function of a known distribution. In a logit model, $F^{-1}(\pi_{ij})$ is the log-odds that $y = 1$. Expression (6) then becomes:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + \beta_1 x_{ij} + u_j. \quad (7)$$

Remark that β_1 is the effect of a 1-unit change in x on the log-odds that $y = 1$, while holding the group effect u constant. In other words, we are looking at the effect of x for individuals in the same group. β_1 is therefore also referred to as the cluster-specific effect. Furthermore, var(u_j) is referred to as the between-group variance or the unexplained level-2 variance.

A particular advantage of multilevel modelling is the ability to explore group-level predictors while simultaneously including random effects to allow for the effects of unobserved group-level variables. Suppose that we have one explanatory variable defined at level 1, x_{1ij}, and another at level 2, x_{2j}. The random intercept logit model in expression (7) can then be extended to include both predictors:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + \beta_1 x_{ij} + \beta_2 x_{2j} + u_j. \quad (8)$$

3. Data

Our empirical analysis of Italian farmers' participation in RDP contracts is based on the information from the 2006 FADN. This data set contains detailed information on 15,383 farmers. The sample is stratified based on three key variables, i.e. location (21 NUTS2 regions), economic size (6 classes) and farm types (19 types), and data are representative for the population of farmers in Italy (INEA, 2006). In 2006, FADN recorded farmers' participation in RDP contracts for the different Regional Rural Development Plans 2000–2006 as defined by Council Regulation (EC) 1257/99 (1999). We define the two groups of RDP contracts accordingly: SCS measures belong to axis 1, while SAS measures belong to axis 2 of the RDP. The two groups of contracts and the corresponding measures that belong to the two axes are described in Table A1.

In line with the conceptual and empirical framework, we will include both level-1 (farm-level) and level-2 (regional-level) explanatory variables in the analysis. Level-1 explanatory variables have been selected based on a review of the relevant literature and were identified as most relevant in affecting RDP contractual benefits and costs, and hence farmers' participation.

Farm-level variables include farm and farm manager characteristics (Table 1). First, several authors have found that farm size (*small*) and specialisation (*arable*, *horticult*, *perm_crop*, *livestock*) are of primary importance to explain farmers' participation in different agri-environmental contracts (Wynn, Crabtree and Potts, 2001; Damianos and Giannakopoulos, 2002; Vanslembrouck, Van Huylenbroeck and Verbeke, 2002; Defrancesco *et al*., 2008; Polman and Slangen, 2008; Peerlings and Polman, 2009). Wynn, Crabtree and Potts (2001), Vanslembrouck, Van Huylenbroeck and Verbeke (2002) and Polman and Slangen (2008) confirm that the type of AES contract used by

Table 1. Description of level-1 explanatory variables

Variables	Explanation	Mean[a]	Standard deviation
Dependent variables			
Participating in Supporting SCS	1 if farmer participates in SCS	5.6%	_
Participating in Supporting SAS	1 if farmer participates in SAS	19.1%	_
Internal factors (farm/farmer)			
Farm characteristics			
Farm size			
small	1 if farm <16 ESU	36%	–
Farm specialisation			
arable	1 if specialising in arable crop production	22%	–
horticult	1 if specialising in horticulture	7%	–
perm_crop	1 if specialising in permanent crops	30%	–
livestock	1 if specialising in livestock	23%	–
Labour use			
fam_labor	% AWU provided by family members	85.2	25.8
offfarm	1 if family off-farm labour is present	24%	–
Mechanisation			
hp_uaa	Horsepower per ha	21.1	379.1
Land tenancy			
uaa_rent	% UAA rented	30.1	38.6
Farmer characteristics			
Farmer age			
age	Number of years	54.0	13.8
Presence of successor			
succes	1 if a successor is present	6%	–
External factors			
Social capital			
Networks			
coop	1 if member of agriculture-related cooperative	52%	–
assoc	1 if member of an association	44%	–

Source: INEA (2006).

[a]In case of a dummy variable, this column reflects the share of observations for which the dummy = 1.

farmers can vary because it is dependent on the type of farming system. For example, participation (and rate of participation) in agri-environmental schemes is different for intensive and specialised dairy farms compared with specialised arable farms.

Jongeneel, Polman and Slangen (2008) indicate that income from non-farming activities also has a positive effect on a farmer's likelihood to participate in AES. Variables related to labour use (*fam_labor*) and off-farm income (*offfarm*) are therefore included as a second group of level-1 indicators. Next, we take into account land tenure (*uaa_rent*), as this may affect investment intentions, and the level of mechanisation of the farm (*hp_uaa*). Defrancesco *et al*. (2008) and Polman and Slangen (2008) also point to the role of farmer-specific characteristics and we control for farmer age (*age* and age^2) and the presence of a successor (*succes*). Finally, several scholars highlight the effect of social capital on contractual choice. Participation in civic associations, clubs and professional networks is seen as a key element to explain economic behaviour (van Rijn, Bulte and Adekunle, 2012). For example, Polman and Slangen (2008) consider the influence of farmers' participation in professional and business-related associations in up-taking AES. Therefore, we also include indicators related to participation in professional and social networks (*coop*, *assoc*).

Level-2 explanatory variables include regional-level indicators related to the agricultural sector, rural areas and the environment. The relevance of regional differences has been highlighted by a number of authors. Vandermeulen *et al*. (2006) emphasised the role of different institutional environments in shaping farmers' decisions but also alternative business opportunities and business dynamics (see also Vanslembrouck, Van Huylenbroeck and Verbeke, 2002). The variables *per centlivestock*, *per centpermcrop*, *per centhorti*, *per centenv_constr* and *per centforestland* are derived from the FADN (2006) data set. They are calculated as the share of farms in a region that are included in the category 'specialised livestock farm' (level-1 variable *livestock*), 'specialised permanent crop farm' (level-1 variable *perm_crop*), 'specialised horticulture farm' (level-1 variable *horticult*), 'farm facing environmental constraints' and 'farm including forest land in total area'. The variable *per centGVA_Agri* was taken from European Commission (2011) and represents the share of the agricultural sector in the regional 'gross value added'. *per centGVA_Agri* is an indicator of the economic importance of the agricultural sector in a certain region. The variables *per centNature* and *per centLFA* are based on the data from European Commission (2011). *per centNature* represents the share of nature areas (as defined by Corine land cover) in the total area of a region. *per centLFA* is defined as the share of utilised agricultural area (UAA) in less-favoured areas in the total UAA of a region. The latter two variables were included because they are directly linked to two SAS measures. Table 2 summarises the regional-level variables.

Given the objective of this paper, special attention will be paid to another set of level-2 explanatory variables, namely, regional RDP priorities. Table 3 provides an overview of the regional budget expenditures for different RDP measures in the 21 Italian regions covered by our data set. Note that the observed budget expenditures are the result of a combination of priorities set at the level of the regional government – in terms of which measures to make

Table 2. Level-2 explanatory variables: regional-level differences in agriculture, rural and environment-related aspects

Region name	Percentage of GVA from agriculture *%GVA_Agri*	Percentage of farms specialised in livestock *%livestock*	Percentage of farms specialised in permanent crops *%permanent*	Percentage of farms specialised in horticulture *%horticulture*	Percentage of farms located in areas with environmental constrains *%env_constr*	Percentage of forest land in the region *%forestland*	Percentage of UAA in less-favoured areas *%LFA*	Percentage of nature areas in the region *%Nature*
Abruzzo	3.1	17.1	35.2	1.2	31.8	8.6	64.2	23.4
Apulia	4.5	7.4	57.7	1.6	27.4	8.7	37.2	5.2
Basilicata	6.2	27.5	25.6	0.6	56.9	10.4	93.5	12.2
Calabria	6.3	6.6	55.7	0.2	41.7	3.5	84.9	11.1
Campania	2.9	18.7	33.0	13.8	53.9	11.1	65.8	9.9
Emilia-Romagna	2.9	25.8	29.1	2.9	50.0	19.0	25.4	4.5
Friuli-Venezia-Giulia	1.8	15.7	32.7	3.1	14.9	38.6	22.9	13.8
Lazio	1.3	23.2	23.7	9.0	66.2	14.2	38.8	11.1
Liguria	1.6	4.6	16.3	64.7	17.1	5.5	76.5	16.9
Lombardy	1.3	47.2	16.9	5.0	20.3	23.2	22.4	14.0
Marche	1.8	12.0	20.1	1.2	29.9	20.3	45.5	10.2
Molise	4.0	25.4	10.4	0.4	73.3	36.9	66.6	11.4
P.A. Bolzano	4.9	27.3	45.0	10.8	69.2	46.5	96.8	41.8
P.A. Trento	3.3	22.5	65.7	3.6	72.1	16.8	100.0	28.8
Piedmont	2.0	23.3	31.5	9.4	21.4	23.4	32.4	20.9
Sardinia	3.9	58.6	10.1	4.7	38.3	10.6	67.0	35.8
Sicily	4.1	14.0	36.0	13.8	64.4	2.5	56.4	18.4
Tuscany	2.3	14.4	34.6	8.4	37.1	47.0	44.1	7.7
Umbria	3.2	20.7	17.6	0.9	77.2	60.9	70.5	8.7
Valle d'Aosta	1.5	84.1	13.1	0.0	10.3	84.1	100.0	67.8
Veneto	2.2	20.7	22.3	7.3	24.9	12.0	32.3	8.2

Source: Own calculations based on INEA (2006) and European Commission (2011).

Table 3. Percentage of financial budget of Rural Development Plans per type of measure in Italian regions (2000–2006)[a]

	SCS				SAS					
Type of measure	Investment in agricultural holdings	Young farmers setting up	Improving processing and marketing	Other SCS measures	Agri-environment	Less-favoured areas and areas with environmental restrictions	Afforestation and other forestry measures	Protection of the environment	Other RDP measures	Total RDP budget
Region name										
Abruzzo	18.46	8.77	6.17	4.45	29.75	12.74	14.78	0.00	4.89	100.00
Apulia	22.75	5.15	10.49	1.14	4.17	0.90	5.07	4.26	46.08	100.00
Basilicata	34.28	2.74	30.62	2.28	3.46	2.21	4.45	0.00	19.95	100.00
Calabria	27.24	4.23	6.88	2.93	1.88	1.64	9.83	0.00	45.37	100.00
Campania	15.57	5.34	3.71	2.71	3.70	2.00	3.86	14.50	48.63	100.00
Emilia-Romagna	19.91	8.87	8.26	2.68	41.62	2.14	6.28	0.15	10.10	100.00
Friuli-Venezia-Giulia	6.49	8.75	4.67	3.19	36.49	9.52	26.39	0.00	4.52	100.00
Lazio	17.96	5.99	6.98	6.98	39.90	2.00	10.97	2.99	6.23	100.00
Liguria	29.57	5.39	2.73	5.78	7.75	6.46	8.35	1.90	32.07	100.00
Lombardy	17.10	1.16	11.05	1.26	44.81	0.01	14.68	0.08	9.86	100.00
Marche	26.59	3.73	7.71	1.29	19.25	4.08	6.73	0.80	29.83	100.00
Molise	10.63	6.08	6.98	0.00	7.11	8.56	20.22	0.00	40.42	100.00
P.A. Bolzano	13.20	8.10	5.79	4.98	23.06	5.56	3.94	2.67	32.71	100.00
P.A. Trento	7.44	2.20	10.24	0.29	11.07	11.39	16.62	0.00	40.76	100.00
Piedmont	17.44	2.85	12.69	4.35	17.61	5.61	8.84	3.98	26.62	100.00
Sardinia	21.14	7.18	11.09	3.20	1.86	6.46	2.11	0.00	46.97	100.00
Sicily	28.19	12.42	15.83	4.45	6.17	0.36	3.21	0.00	29.36	100.00
Tuscany	12.83	8.44	2.22	0.91	18.58	0.03	9.05	0.00	47.93	100.00
Umbria	18.64	3.32	8.72	4.83	24.54	3.15	12.71	5.18	18.91	100.00
Valle d'Aosta	0.00	3.95	0.00	0.00	31.79	60.84	0.78	0.00	2.64	100.00
Veneto	14.95	9.51	12.46	4.64	19.85	6.98	8.68	0.00	22.93	100.00

Source: MIPAAF (2012).

[a]Financial budget refers to public co-funding schemes (national + regional + European funds).

available in the RDP menu – and the choices made at farm level with respect to which RDP measures render a positive assessment when comparing individual costs and benefits. Given that the RDP budget has been spent completely, we may assume that observed expenditures at the end of the budget period are closely correlated with priorities that were set at the start of the period. We include a level-2 variable *SAS/farm* (*SCS/farm*) that is defined as the total regional RDP budget expenditures on SAS (SCS) measures divided by the total number of farms in the region. This variable provides a measure of policy priorities, but also says something about potential accessibility of the funds. More specifically, for a similar budget, there will be more competition in regions with a large farm population compared with a region where only a few farms are active. We will discuss the level-2 explanatory variables and the results of the econometric analysis in more detail in the next section.

4. Results

We observe interesting differences in the share of budget spent on different measures between regions (Table 3). First, SCS and SAS are not equally important in all the regions. In regions such as Tuscany and Campania, SCS and SAS measures cover only about 50 per cent of total RDP expenditures, while in Valle d'Aosta the joint SCS and SAS share in budget is close to 100 per cent. Furthermore, Basilicata spends about 75 per cent of its budget on SCS measures in contrast to a region such as Valle d'Aosta where more than 90 per cent of RDP measures result from SAS activities. Other interesting observations include the relatively high share of the budget assigned to the measure to set up young farmers in Sicily and the funding of afforestation projects in the region of Friuli-Venezia-Giulia.

If we compare the information on RDP expenditures (Table 3) and regional features (Table 2), a number of observations jump out. Valle d'Aosta is a typical mountainous region where agricultural activities mainly consist of Alpine livestock herding. The total region is identified as a 'less-favoured area', which is also reflected in the high share of LFA payments in the RDP budget. In the capital region of Lazio, a large share of farmers indicate to operate under environmental constraints. The region also spends about 40 per cent of its RDP budget on agri-environmental measures and another 10 per cent on afforestation measures. These observations seem to support the hypothesis that regional policy-makers select those measures from the national menu that are more relevant for their regions in the case of axis 2. However, for SCS measures (axis 1), the picture seems less straightforward. For example, both Basilicata and Liguria assign a relatively large share of the RDP budget to on-farm investments. The agricultural sector plays a central role in the economy of Basilicata (as evidenced by the high share of agriculture in regional GVA) but not in Liguria. Both regions also seem to have the majority of their UAA classified as LFA, leading to the expectation of a policy priority towards axis 2 instead of 1.

Pearson's correlation test (significance level of at least 10 per cent) confirms that the following regional features correspond to regional budget priorities in SAS measures: agriculture plays a minor role in the regional economy (*per centGVA_Agri*); a high share of specialised livestock farms (*per centlivestock*); a high share of farms with forestland (*per centforestland*); a high share of nature areas in total area (*per centNature*). In contrast, regions that are characterised by a relatively large agricultural sector and less important forestlands and nature areas display larger shares of regional budgets devoted to SCS measures.

Tables 4 and 5 present the results of the random intercept logit model for participation in SAS and SCS contracts, respectively. We estimate three specifications of the model: (i) with only level-1 explanatory variables (column (1)); (ii) including both level-1 variables and the indicator of regional policy priorities (*SAS/farm* and *SCS/farm*) to test the effect of regional budget priorities on farmers' participation in RDP measures (column (2)); (iii) with level-1 variables and indicators of regional features as level-2 variables to test whether farmers' decisions are affected – directly or indirectly through policy priorities – by regional characteristics (column (3)).

We note that the coefficients of the level-1 variables do not change dramatically after including level-2 variables to the model. This seems to suggest that farm and farmer characteristics have a robust effect on the participation of farmers in SAS and SCS contracts. The variance of the constant of the random effects parameters represents the between-group variance, or in other words the unexplained level-2 variance. Comparing the output in columns (1), (2) and (3) shows that the unexplained regional-level variance decreases significantly when regional features are included (from 1.653 to 0.0.336 for the SAS model and from 8.435 to 1.520 for SCS). This is a strong indication that including the level-2 variables to the models is essential. When discussing the results for SAS and SCS participation, we will therefore focus on the coefficients in columns (2) and (3).

Before turning to the discussion of the results, we confirm the necessity of using the multilevel model. Based on LR testing, we conclude that the between-regional variance remains significantly different from zero and hence ignoring the nested structure of the data set would lead to the estimation of wrong standard errors. We also calculate the variance partition coefficient (VPC), which measures the proportion of the total variance that is due to differences between groups. The VPC is calculated as the level-2 residual variance divided by the sum of level-2 and level-1 residual variance.[3] Based on the SAS results in column (2) and (3), we find a VPC equal to 23.1 per cent and 9.3 per cent respectively. In other words, 23.1 per cent (9.3 per cent) of the residual variation in the propensity to participate in a SAS contract is attributable to unobserved regional characteristics. Note that the VPC based on the SAS participation model including only level-1 explanatory variables

3 The logistic distribution for the level-1 residual implies a variance of $\pi^2/3 = 3.29$.

Table 4. Mixed effects logistic regression results (SAS)

	(1)				(2)				(3)			
	Coefficients	Standard error	Significance	OR[a]	Coefficients	Standard error	Significance	OR	Coefficients	Standard error	Significance	OR
Farm characteristics												
SCS	0.938	(0.115)	***	2.556	0.917	(0.115)	***	2.503	0.900	(0.115)	***	2.641
small	0.127	(0.054)	**	1.135	0.126	(0.054)	**	1.134	0.127	(0.054)	**	1.135
arable	−0.093	(0.074)		0.911	−0.094	(0.073)		0.910	−0.094	(0.074)		0.911
horticult	−1.200	(0.152)	***	0.301	−1.196	(0.152)	***	0.302	−1.193	(0.152)	***	0.303
perm_crop	−0.030	(0.070)		0.970	−0.030	(0.070)		0.970	−0.030	(0.070)		0.970
livestock	0.067	(0.073)		1.070	0.065	(0.073)		1.067	0.059	(0.073)		1.060
fam_labor	−0.003	(0.001)	***	0.997	−0.003	(0.001)	***	0.997	−0.003	(0.001)	***	0.997
hp_uaa	−0.010	(0.002)	***	0.990	−0.011	(0.002)	***	0.989	−0.011	(0.002)	***	0.989
offfarm	−0.095	(0.062)		0.910	−0.096	(0.062)		0.909	−0.102	(0.062)		0.903
uaa_rent	0.001	(0.001)		1.001	0.001	(0.001)		1.001	−0.001	(0.001)		1.001
Farmer characteristics												
age	−0.021	(0.011)	*	0.979	−0.022	(0.011)	*	0.979	−0.022	(0.011)	**	0.978
age^2	0.000	(0.000)		1.000	0.000	(0.000)		1.000	0.000	(0.000)		1.000
succes	−0.006	(0.102)		0.994	−0.006	(0.102)		0.994	−0.008	(0.102)		0.992
Social capital												
coop	−0.038	(0.051)		0.963	−0.038	(0.051)		0.963	−0.044	(0.051)		0.957
assoc	0.111	(0.056)	**	1.118	0.109	(0.056)	*	1.115	0.115	(0.056)	**	1.122

Regional-level variables												
SAS/farm	–	–		–	1.743	(0.465)	***	5.712	–	–		–
%GVA_Agri	–	–		–	–	–		–	0.063	(0.093)		1.065
%forestland	–	–		–	–	–		–	0.684	(0.769)		1.981
%Nature	–	–		–	–	–		–	0.075	(0.011)	***	1.078
cons	−0.519	(0.421)	**	0.595	−1.213	(0.423)	***	0.297	−2.211	(0.505)	***	0.110
Between-group variance												
Var(_cons)	1.653	(0.531)	***		0.986	(0.313)	***		0.336	(0.112)	***	
Observations: 15,383												
	Log-likelihood = −6042.55				Log-likelihood = −6036.99				Log-likelihood = −6026.25			

Source: Own calculations based on INEA (2006) and European Commission (2011).
[a]OR stands for odds ratio and is calculated as exp(coefficient) in the logistic model.
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

Table 5. Mixed effects logistic regression results (SCS)

	(1)				(2)				(3)			
	Coefficients	Standard error	Significance	OR[a]	Coefficients	Standard error	Significance	OR	Coefficients	Standard error	Significance	OR
Farm characteristics												
SAS	0.879	(0.116)	***	2.408	0.880	(0.117)	***	2.411	0.861	(0.116)	***	2.365
small	0.056	(0.125)		1.058	0.056	(0.125)		1.057	0.055	(0.125)		1.056
arable	−0.099	(0.168)		0.906	−0.099	(0.168)		0.906	−0.095	(0.168)		0.910
horticult	−0.816	(0.303)	***	0.442	−0.813	(0.303)	***	0.444	−0.788	(0.302)	***	0.455
perm_crop	−0.436	(0.161)	***	0.647	−0.435	(0.161)	***	0.647	−0.426	(0.161)	***	0.653
livestock	0.372	(0.154)	**	1.451	0.374	(0.154)	**	1.453	0.365	(0.154)	**	1.441
fam_labor	−0.002	(0.002)		0.998	−0.002	(0.002)		0.999	−0.002	(0.002)		0.998
hp_uaa	−0.007	(0.002)	***	0.993	−0.008	(0.002)	***	0.993	−0.008	(0.002)	***	0.992
offfarm	0.097	(0.128)		1.102	0.097	(0.128)		1.101	0.105	(0.128)		1.110
uaa_rent	−0.002	(0.001)		0.998	−0.002	(0.001)		0.998	−0.002	(0.001)		0.998
Farmer characteristics												
age	−0.011	(0.023)		0.989	−0.011	(0.023)		0.989	−0.011	(0.023)		0.989
age^2	−0.000	(0.000)		1.000	−0.000	(0.000)		1.000	−0.000	(0.000)		1.000
succes	0.098	(0.185)		1.102	0.097	(0.185)		1.102	0.099	(0.185)		1.104
Social capital												
coop	−0.093	(0.120)		0.911	−0.093	(0.120)		0.911	−0.108	(0.119)		0.898
assoc	0.154	(0.148)		1.167	0.153	(0.148)		1.165	0.176	(0.148)		1.193

Regional-level variables												
SCS/farm	–	–		–	−5.804	(4.377)		0.003	–	–		–
%GVA_Agri	–	–		–	–	–		–	−0.413	(0.222)	*	0.662
%forestland	–	–		–	–	–		–	6.137	(1.764)	***	462.876
%Nature	–	–		–	–	–		–	0.118	(0.028)	***	1.126
Cons	−3.116	(0.911)	***	0.044	−1.272	(1.659)		0.280	−5.346	(1.093)	***	0.005
Between-group variance												
Var(_cons)	8.435	(3.355)	***		7.794	(3.121)	***		1.520	(0.626)	***	
Observations: 15,383	Log-likelihood = −1578.83				Log-likelihood = −1577.96				Log-likelihood = −1561.22			

Source: Own calculations based on INEA (2006) and European Commission (2011).
[a]OR stands for odds ratio and is calculated as exp(coefficient) in the logistic model.
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

was substantially higher (33.4 per cent). The VPC in the case of the SCS model in column (2) is 70.3 per cent and in column (3), 31.6 per cent.

Coefficient estimates in the random intercept logit model represent the within-group effects of the explanatory variables on the log-odds to observe participation in SAS or SCS contracts. To facilitate interpretation, we have converted the log-odds to the odds ratio in Tables 4 and 5. In the case of a dummy explanatory variable, the odds ratio divides the odds of participation if the dummy is 1 to the odds of participation in the default category. For a continuous variable, the odds ratio reflects the change in the odds of participation in the case of a 1-unit increase in the explanatory variable.

The variables *SAS* and *SCS* are included to test whether taking up a measure in one of the axes influences the participation in the other axis. The results in Tables 4 and 5 show that the effect of this variable is large and highly significant. It seems that farmers who actively participate in RDP are using both axes. In other words, while regional governments may prioritise one axis over the other, the farmers who are targeted – or make use of the available budget – are likely to participate in measures from different axes, regardless of the set budget priorities.

When looking at the farm characteristics (column (3)), we find that the odds of participating in SAS contracts is 14 per cent higher for a small farm (*small*) than for a large farm. With respect to farm specialisation, the results indicate that the odds of participating in SCS contracts are 44 per cent higher for specialised livestock farms (*livestock*) than for non-livestock farms. Farms specialising in horticulture (*horticult*) and specialised permanent crop farms (*perm_crop*), on the other hand, have lower odds of participating in SCS contracts.

The share of family labour (*fam_labor*) has a significantly negative coefficient in the case of SAS contracts but the odds ratio is very small, while the impact of the use of family labour is not significant in the case of SCS participation. A high degree of mechanisation decreases the odds of participation in both SCS and SAS contracts significantly. Off-farm activities (*offfarm*) and rented land (*uaa_rent)* do not lead to significant differences in participation in SCS or SAS contracts. Looking at the impact of farmer characteristics (*age*), the odds of participation in SAS contracts are higher for younger farmers.

With regard to explanatory variables concerning social capital, membership to a cooperative (*coop*) has no significant effects on participation. In contrast, the odds of participating in SAS contracts are about 12 per cent higher for farmers who are members of a professional association (*assoc*) than for non-members.

Next, we provide an interpretation of the regional explanatory variables. Regional variables can be interpreted as contextual effects. First, we find a significantly positive effect of budget priorities on SAS participation (column (2)). Farms that are located in regions with high RDP budget dispositions focused on axis-2 measures have higher odds of participating in axis 2 than

farmers in other regions. For SCS measures, the significance of regional budget priorities on farmers' participation could not be confirmed. Q6

In the case of participation in SAS contracts, we find a significantly positive effect of the share of nature areas (*per centnature*) in a certain region (column (3)). More specifically, a 1-unit increase in the variable *per centnature* increases the odds of a farm in that region to participate in an SAS contract by 8 per cent. In the case of SCS participation, we note that the odds ratio in the case of the regional-level explanatory variable *per centforestland* (column (3)) is very large. This can be explained by the fact that the number of farms in the data set that participate in SCS contracts is relatively small (only about 5 per cent) and consequently, the number of farms per region that participate in SCS is limited. Previous research has shown that a lack of variation in the observations (in our case, at regional level) can lead to high odds ratios. The interpretation of the regional-level effects for SCS may therefore be flawed.

5. Discussion and conclusions

In this paper, we examined the causal effect of farm and farmer features and location on farmers' participation in two different groups of RDP contracts: (i) measures that support farm economic competitiveness, through investments, training and marketing (SCS); (ii) measures that support the provision of environmental services, such as AES, afforestation and extensification (SAS). We hypothesise that differences in farm characteristics and location lead to different benefits, opportunities and transaction costs as a result of participation in an RDP contract. Furthermore, we put special emphasis on the role of location, both in the conceptual and the empirical part. The main contribution of this paper is that we investigate to what extent regional RDP priorities are driven by regional characteristics and, moreover, whether regional-level policy priorities help to explain farmers' participation in RDP measures.

Our results confirm that regional features matter for explaining farmers' participation in RDP contracts. The main findings can be summarised as follows. (i) Regional policy-makers select those RDP measures from the national menu that are most relevant for their region. This is specifically confirmed in the case of SAS measures, where we found that SAS measures represent a larger share of the regional RDP budget in regions with more forestland and nature areas. (ii) Farmers who are located in regions with large regional budgets allocated towards SAS measures are more likely to participate in these measures. (iii) Farmers located in regions that have a high prevalence of nature areas are more likely to participate in SAS contracts.

Apart from the regional features, farm and farmer characteristics are also important. (i) Small farms with a low level of mechanisation are more likely to participate in SAS contracts. This result is in line with findings from Vanslembrouck, Van Huylenbroeck and Verbeke (2002) for small-farm participation in environmentally oriented policy contracts in Belgium. Small farms may have higher benefits and lower opportunity costs than large

farms in allocating their labour time and assets to implement environmental services. (ii) Farms that are specialised in livestock are more likely to participate in SCS contracts, while those that are specialised in horticulture or permanent crop production are less likely to do so. Assessment reports of Italian RDP programmes in 2000–2006 qualitatively confirm that measures in the group of SCS contracts, such as investment in agricultural holdings, young farmers setting up, training, or measures in the group of SAS contracts, such as extensification or organic production, have mainly been geared towards livestock farmers. (iii) Older farmers are less likely to participate in SAS contracts. (iv) Farmers' professional associations play a role by increasing the likelihood to participate in SAS contracts. This result is in line with the expectation that participation in professional networks reduces costs of participation, for example by reducing transaction costs such as information costs (Falconer, 2000; Polman and Slangen, 2008). This result may also be linked to the relevance of professional associations in the domain of agri-environmental service provision and organic agriculture.

While the current study highlights the importance of regional features for explaining farmers' participation in RDP measures, a number of interesting questions remain. For example, it would be interesting to disaggregate the broad categories of SCS and SAS into farmers' participation in specific RDP measures. While all the contracts in the SCS or SAS group share the same basic contractual mechanisms and policy objectives, the structure of benefits and costs of each specific contract will differ. For example, farmers who take up an SAS contract to promote extensification of agricultural practices through a cost-compensation mechanism do not experience compliance costs. This is different, for example, in a situation in which they participate and implement activities linked to agri-environmental contracts. These distinctions may be relevant because a different structure of costs is likely to affect decision-maker behaviour to a greater extent than a different structure of benefits and hence may result in differences in participation. In line with this argument, the role of transaction costs that are related to the RDP contractual design should also be more directly analysed and measured. A possible approach would be to implement field experiments with farmers to detect the role of transaction costs (i.e. information and negotiation costs) in decision-making settings mimicking the main participation mechanisms related to RDP measures.

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Appendix

Table A1. Definition of RDP contracts

RDP contract choice		RDP measures 2000–2006[a]	Description of the support scheme
Axis 1 – Supporting SCS	Investment subsidies for supporting the competitiveness of agricultural activities: all subsidies for investment in farm assets (agricultural land, human capital, buildings, property rights, forest, land, machinery and equipment) received during the accounting year. They also include any subsidies on interest rates. In addition, they may include national (or regional) investment aids	(a) Investment in agricultural holdings	The total amount of support, expressed as a percentage of the volume of eligible investment, is limited to a maximum of 40 and 50 % in less-favoured areas. Where investments are undertaken by young farmers, these percentages may reach a maximum of 45 and 55 % in less-favoured areas
		(b) Young farmers setting up	The setting-up aid may comprise (i) a single premium up to the maximum eligible amount of EUR 25,000 per farmer, (ii) an interest subsidy on loans taken on with a view to covering the costs arising from setting up; the capitalised value of the interest subsidy may not exceed the value of the premium
		(c) Training	The total amount of support is a percentage of the total investment in training activities fixed per year and farm at Member State level
		(g) Improving processing and marketing of agricultural products	The total amount of support, expressed as a percentage of the volume of eligible investment,

			is limited to a maximum of (i) 50 % in Objective 1 regions and (ii) 40 % in the other regions
		(m) Marketing of quality agricultural products and setting up of quality schemes	The total amount of support is set as a percentage of the total investment in marketing and quality management activities per year and farm at Member State level
		(j) Land improvement	The total amount of support is a percentage of the total investment in land improvement fixed per year and farm at Member State level
		(y) Use of farm advisory services	The total amount of support is a percentage of the total investment in advisory services fixed per year and farm at Member State level
Axis 2 – SAS	Rural development ('second pillar') direct payments due to agricultural activities which provide environmental services: all direct payments received during the accounting year	(f) Agri-environment	Support is granted to farmers who give agri-environmental commitments for at least five years. Where necessary, a longer period is determined for particular types of commitments in view of their environmental effects. Support in respect of an agri-environmental commitment shall be granted annually and be calculated on the basis of (i) income foregone, (ii) additional costs resulting from the commitment given, and (iii) the need to provide an incentive. The cost of any non-remunerative capital works necessary for the fulfilment of the commitments may also be taken into account in calculating the level of annual support Maximum amounts per year eligible for community support are EUR 600 per hectare in

(*continued*)

Table A1. (*continued*)

RDP contract choice	RDP measures 2000–2006[a]	Description of the support scheme
		the case of annual crops, EUR 900 per hectare in case of specialised perennial crops and EUR 450 per hectare in case of other land uses. These amounts shall be based on that area of the holding to which agri-environmental commitments apply
	(e1) Less-favoured areas and areas with environmental restrictions	Compensatory allowances granted to farmers per hectare of areas used for agriculture. Minimum compensatory allowance is fixed at EUR 25 and maximum compensatory allowance is fixed at EUR 200 per hectare of areas used for agriculture
	(h) Afforestation of agricultural land	Support shall be granted for the afforestation of agricultural land provided that such planting is adapted to local conditions and is compatible with the environment. Such support may include, in addition to planting costs, (i) an annual premium per hectare afforested to cover maintenance costs for a period of up to 5 years, (ii) an annual premium per hectare to cover loss of income resulting from afforestation for a maximum period of 20 years for farmers or associations thereof who worked the land before its afforestation or for any other private law person

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	Maximum amounts per year of the annual premium to cover loss of income eligible for community support are fixed in 725 per hectare
(i) Other forestry measures	Payments are granted to the beneficiaries provided that the protective and ecological values of these forests are ensured in a sustainable manner and the measures to be carried out are laid down by contract and their cost specified therein. Payments are fixed between a minimum payment of EUR 40 per hectare and a maximum payment of EUR 120 per hectare
(t) Protection of the environment	The total amount of payment is a percentage of the costs determined per year and/or farm and/or hectare at Member State level.

Source: Own elaboration based on EC Reg. 1257/99 (1999) and European Commission (2009).
[a]The titles of the measures and the related letters are taken from EU regulation EC Reg. 1257/99.