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Estimated models in case study areas

Authors:

Davide Viaggi

Based on contributions by:

Bartolini, F., Borovšak, K., Cahuzac E., Desjeux, Y., Dupraz, P., Juvančič, L., Kuhlman, T., Linderhof, V., Maigne E., Marconi, V., Michels, R., Piorr, A., Pohle, D., Raggi, M., Rounsevell, M., Signorotti, C., Travnikar, T., Uthes, S.,van Arendonk, A., Viaggi, D., Yang, A., Zasada, I.

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1. Introduction and objectives

This document is the final deliverable of activities of task 5.2 of the SPARD project.

The objective of this work package is:

a) to prove that the methodology is feasible at different scales of application/ levels of aggregation;

b) that the modelling results are reliable for further specification by using and processing of data of higher or different quality (more disaggregated, higher spatial resolution, specific properties).

In task 5.2, econometric spatial models have been estimated at regional level based on disaggregated information (at sub-NUTS2 level). Attention has been focused on the detailed description of environmental context and locally relevant policy design components (e.g. zoning and targeting).

The exercise has been carried out in 6 case study areas at the main programming level (i.e. the level in which Rural development plans are designed). The selected case study areas are Brandenburg (NUTS 1, Germany), North Holland (NUTS 2, The Netherlands), Emilia Romagna (NUTS 2, Italy), Basse Normandie (NUTS 2, France), Eastern Slovenia (NUTS 2, Slovenia) and Scotland (NUTS1, UK).

Task 5.2 activities were highly data driven, and revealed to be highly dependent on data availability and format. Also questions and relevant issues were highly differentiated according to local conditions and policy design.

The aim of this document is to provide a synthesis of the results of the 6 case study areas and to discuss in particular what the main determinants of RDP results are and how spatial issues can be dealt with in RDP policy evaluation at the programming level.

The document only marginally addresses specific econometric issues in model formulation, as these are being dealt with in WP4 of the SPARD project.

The document is organised in three main sections. First, in section 2, a synthesis of the procedure and methodologies is provided, together with a summary of the measures addressed and of the developed models. Then, in section 3, a summary of the results is provided, followed in section 4 by a discussion. The document ends in section 5 with some concluding remarks.

The reports of the 6 case studies are included as annexes 1 to 6.

2. Procedure and methodology

This document and the annex is the result of a process that developed in the six case study areas with a continuous harmonisation of methodological decisions, during the year 2011 and 2012.

In this synthesis, we present tables of significant variables obtained by the models presented in the annexes. The value of the estimated coefficients was not reported as any comparison would be irrelevant considering different unit of measure of the independent variables and sometimes of the

dependent, including different mathematical formulation of the models. Instead we used a notation able to distinguish the level of significance and the sign of the coefficient, i.e.:

1. ---, --, - means significant at 1%, 5 and 10% respectively and negative coefficient;
2. +++, ++, + means significant at 1%, 5 and 10% respectively and positive coefficient.

In the results table, the case studies are aggregated in order of convenience, depending on the specific structure of results for each measure in each case study area.

Also independent variables are rarely comparable as they may use different measurement units or e.g. refer to different classes.

The summary of measures modelled and related dependent variables is given in Table 1.

Table 1 – Measures, case studies and related dependent variables modelled

Measure	Sub-measure	Dependent	Brandenburg	Noord-Holland	Emilia-Romagna	France	Slovenia	Scotland
121	all sub-measures	participation n farms/n farms	x		x	x	x	
121	all sub-measures	payments euro/ha	x			x	x	
214	all submeasures	participation n farms/n farms		x	x			x
214	all submeasures	participation UAA/UAA						
214	all submeasures	payments euro/ha		x				x
214	organic	participation n farms/n farms	x		x	x	x	
214	organic	participation UAA/UAA				x	x	
214	organic	payments euro/ha					x	
214	integrated	participation n farms/n farms			x			
214	grassland/meadows	participation n farms/n farms			x	x		
214	grassland/meadows	participation UAA/UAA				x		
214	locally designated measure	participation n farms/n farms				x		
214	locally designated measure	participation UAA/UAA				x		
214	conservation of natural ares and ladscape	participation n farms/n farms			x			
214	Environmental set aside	participation n farms/n farms			x			
214	habitat management	participation n farms/n farms						x
214	habitat management	payments euro/ha						x
214	bird protection	participation n farms/n farms						x
214	bird protection	payments euro/ha						x
214	water habitat	participation n farms/n farms						x
214	water habitat	payments euro/ha						x
214	A-E submeasures on arable land	participation n farms/n farms					x	
214	A-E submeasures on arable land	participation UAA/UAA					x	
214	A-E submeasures on arable land	payments euro/ha					x	
214	A-E submeasures on grassland	participation n farms/n farms					x	
214	A-E submeasures on grassland	participation UAA/UAA					x	
214	A-E submeasures on grassland	payments euro/ha					x	
311		participation n farms/n farms	x		x			
311		payments euro/ha	x					
313		participation n farms/n farms	x					
313		payments euro/ha	x					
322		participation n farms/n farms	x					
322		payments euro/ha	x					
311&313		participation n farms/n farms				x		

Measure 121 was the one most uniformly modelled throughout case studies (see Table 1).

Measure 214 was modelled in all case studies. However, the total measure was modelled using different dependent variables. In four out of six cases, (Brandenburg, Emilia Romagna, France and Slovenia) different sub-measures were modelled.

Finally, for measures of axis 3, measure 311 was the one more often modelled, followed by 313 and 322

Three types of measure were used for the dependent variable: percentage of participating farms, payment per hectare, and percentage of participating area. The last case is more relevant for area-related measures, such as measure 214. Not all combinations of measure and measurement unit were possible.

The choice of the measures to be modelled and of the measure for the dependent variable, as said, was largely driven by data availability. Some measures for which modelling was attempted but coefficient estimates are not available were not reported here.

A summary of impacts modelled is provided in Table 2.

Table 2 – Impact indicators, case studies and related measures modelled

Impact indicator	Measures used as explanation	Brandenburg	Noord-Holland	Emilia-Romagna	France	Slovenia	Scotland
Impact on land productivity	121					x	
Impact on labour productivity	121					x	
Farm size	121, 214, axis 3				x		
Labour	121, 214, axis 3				x		
Plot size (different crops and total)	121, 214, axis 3				x		
Crop diversity index	121, 214, axis 3				x		
Grassland index	121, 214, axis 3				x		
Forest index	121, 214, axis 3				x		
Farmland Nature Value Index=CDI+GI+FI					x		

Variables used were mostly proxies of actual impact indicators, more related to changes in structural features. In most cases, due to lack of data availability for the impact indicators or for reasonable proxies (in particular due to the late delivery of 2010 census data), modelling of effects of RDP on impact indicators was not possible. In addition, impact indicators can be studied in association with different bundles of measures. Only in the French case study all the measures studies were used as independent variables to study their effects on modelled impacts.

All models available from the case study reports have been used except for some model related to specific sub-measure of measure 214.

3. Synthesis of key results

3.1 Participation and payments in Measure 121

3.1.1. Participation

Participation models for measure 121 were available for all case study areas except for Noord Holland (the Netherlands). Except for Brandenburg, Germany, R^2 values are relatively high and the spatial components of the models significant (Table 3).

Factors positively affecting participation in measure 121 are dominated by structural variables, including in particular farm size, stocking density, specialisation and labour availability.

Legal status is also important, but all types seem to affect positively participation.

The role of local priorities is also important.

The participation tends to diminish with growing age of the farmers and in less populated and developed areas.

Also participation tends to be negatively associated with more extensive farming, remoteness of rural areas and higher natural value features, such as crop diversity and forestry areas.

The case of France shows a relevant connection among measures. In particular, there is a positive significant connection with the previous existence of early retirement payments, while the relationship with other measures is negative.

This may be a hint that much higher explanatory power would be possible if more information about the history of the farm (not only in connection to public payments) were available.

Table 3 – Measure 121: Results of participation models

Case study	Slovenia	Slovenia	Slovenia	Slovenia	Emilia-Romagna	Emilia-Romagna	Emilia-Romagna	Emilia-Romagna	Emilia-Romagna	Emilia-Romagna	Emilia-Romagna	Emilia-Romagna	Emilia-Romagna	Brandenburg	Brandenburg	Brandenburg	Brandenburg	Brandenburg	Brandenburg	Scotland		Scotland
Model			**a-spatial**	**spatial**			**aspatial**	**spatial lag**	**spatial lag**	**spatial lag**	**spatial error**	**spatial error**	**spatial error**			**OLS Aspatial**	**OLS Spatial lag**	**OLS Spatial error**	**Binary Logistic**			**OLS**
Model details								**queen 1**	**queen 2**	**queen 3**	**queen 1**	**queen 2**	**queen 3**									
R^2			0,37	0,46			0,45	0,53	0,52	0,51	0,53	0,51	0,49			0,08	0,081	0,08				
Adjusted R^2			0,35													0,05						0,1
Rho				0,39***				0.25***	0.26***	0,22**							0,09					
Lambda											0,31***	0,32***	0,22					0,023				
Intercept			--	---	Intercept									Intercept		+++	+++	+++	+++	Intercept		+++
I.	CD13	Stocking density (LSU per UAA in ha)	+++	+	d_lfa	Less favourable area (dummy)	--	-	-	--	-	-	--	Socio-Economics	Factor Tourism				++	B2 OWNED LAND	OWNERSHIP: Percentage of owned agricultural area	+++
	CD16	Purpose of agricultural production, % of sale	++	++	only_hhlab	Percentage of farms which use only household labour	-			-	-	-	--		Factor Working Place				+	B3 RENTED LAND	OWNERSHIP: Percentage of rented agricultural area	++
	CD17	Average UAA per farm	+	+	cond_dir	Percentage of farms which are conducted directly by the farm	++	++	+++	+++	+++	+++	+++	Landscape	Factor Forest/LFA	---	---	---		B4 SEASONAL RENT	OWNERSHIP: Percentage of seasonal rented agricultural land	+
III.	NAT_D	% of UAA located in Natura 2000 areas	-		part_colle	Percentage of cooperative	++	++	++	++	+++	+++	++	Farming Structure	Factor Large-scale Agriculture	+++	7.022***	7.064***	++	B5 SEASLET	OWNERSHIP: Percentage of seasonal let agricultural land	---
IV.	N1	Specific investment objectives, % of modernization	+	++	Pigs	Percentage of farm with pigs reared	--	--	-	--	--	-	--		Factor Co-operatives				+++	C13 OTHERCRPS	BIOPHYSICAL: Percentage of other crops area	--
					tractor_le	Percentage of farmers with tractor with low power than 100cv	--	---	---	---	---	--	---							C8 GRASSLESS	BIOPHYSICAL: Percentage of grass less than five years old area	---
					young	Percentage of young farmer (less than 40 years old)	+			+	++		+							D20 IMPROVED AGRI	BIO-PHYSICAL: Percentage of land capable for supporting improved agriculture	+
					uaa_more50	Farm with more than 50 ha UAA	+++	+++	+++	+++	+++	+++	+++							D21 MIXED AGRI.	BIO-PHYSICAL: Percentage of land capable for supporting rough agriculture	---
					sau_sup		++	+	++	++		+	++							D22 BUILTUP	BIO-PHYSICAL: Percentage of land capable for supporting built up areas	---
					prob_crops	Regional and province priority	+++	+++	+++	+++	+++	+++	+++							E24 CATTLE DENSITY	LIVESTOCK: Density cattle per UAA Ha	+++
																				E25 SHEEP	LIVESTOCK: Density sheep per UAA ha	---
																				F28 FTOCCUPS	LABOUR: Density of Full-time occupiers per holdings	
																				F29 PTOCCUPS	LABOUR: Density of Part-time occupiers per	-
																				F32 REG&CAS STAF	LABOUR: Density of Total regular & casual staff per holdings	++

Table 3 (cont.)

			France	France	France	France	France	France	France	France
			P1S1: Probit	P1S2: Tobit, with IMR derived from P1S1	P1S2PR: Tobit, with IMR and predictions from P1S1	P2S1: Spatial probit	P3S2: Tobit, including IMR derived from P2S1	P3S2PR: Tobit, with IMR and predictions from P2S1	Probit	Tobit
									Presence of farmer beneficiaries	Density of beneficiaries
R2				0,28	0,28		0,28	0,28		
rho						+				
(Intercept)										
Local ec and env.	alt_moy	Average altitude	+	+++		+	+++		+	
	log_denspop06p1	Log of population density		+++	++		+++	+++		+++
	txchom06	Unemployment rate		---	---		---	---		---
	Indic_FI_2007								--	---
	INDIC_AOC1	Dummy indicating the presence of areas supporting Protected Designation of Origin (PDO) products						-		-
	zauer4561	Dummy indicating the presence of rural areas		+++	++		+++	+++		+++
	ZVul1	Dummy indicating the presence of nitrate vulnerable zones	+						+	
	natura20001	Dummy indicating the presence of Natura 2000 areas	-	--	--	-	--	---	-	---
	CSP_max2	Dummy indicating that 'craft and related trades workers' socio-professional group is the most represented		++	++		++	--		++
	CSP_max3	Dummy indicating that 'manual worker' socio-professional group is the most represented		++	++		++	-		-
	CSP_max4	Dummy indicating that 'intermediate non manual workers' socio-professional group is the most represented		+			+			
	CSP_max6	Dummy indicating that 'employees' socio-professional group is the most represented		++	++		++	+		+
Agr. Structures	sth_sau_2000	Share of grassland within the UAA	-			-			-	
	log_mo2006	Log value of labour present on farm (farm heads, family labour and hired labour in AWU)	+++	+++		+++	+++		+++	
	AGE_MOY.2006	Average farmers' age	---	---	---	---	---	---	---	---
	ASB06_RNET	Share of agricultural incomes within household incomes								
	log_montanttotp1	Log value of cattle direct payments (1,000 €)	+++	++		+++			+++	
	pct_ste.2006	Share of partnership farms within all farms		+++	+++		+++	+++		+++
	pct_comp.2006	Share of company farms within all farms		+++	+++		+++	+++		+++
	Indic_Ann.Crop.2007	Average size of plots with annual crops	+	+++	++	++	+++	+++	+	+++
	Indic_Other.2007	Average size of other plots	+++	+++	+++	+++	+++	+++	+++	+++
	Indic_Total.2007	Average size of all plots	---			---			---	
	Indic_CDI_2007	Crop diversity index		---	---		---	---		---
	Indic_FI_2007	Forest index	--	---	---	---	---	---		
	OTE11	Dummy indicating that 'field-crop' type of farming is dominant		--	--		--	---		---
	OTE231	Dummy indicating that 'wine, fruits and vegetables' type of farming is dominant	+	+++	+++		+++	+++	+	+++
	OTE431	Dummy indicating that 'mixed cattle' type of farming is dominant	+++			+++			+++	
Other measures	indic_meca1	Dummy for previous existence of 'mechanisation' payments from RDP1	++	++	++	+++	++	++	++	++
	indic_ctecad1	Dummy for previous existence of 'AES payment' (other than grassland or crop diversification) payment from RDP1	+++			+++			+++	
	indic_maerot1	Dummy for previous existence of 'AES crop diversification payment' from RDP1				+				
	indic_phaepmsee1	Dummy for previous existence of AES grassland premium from RDP1		--	--		--	--		--
	indic_dja1	Dummy for previous existence of payment for setting up of young farmers from RDP1		--	-		--	-		-
	indic_ichn1	Dummy for previous existence of LFA payments from RDP1		-		-	-	--		--
	indic_preret1	Dummy for previous existence early retirement payments from RDP1	+++			+++			+++	
	PRED_214I_area	Predicted probability from the Probit explaining the adoption, as regards the indicator 214I_area						+		+
	PRED_214A_benef	Predicted probability from the Probit explaining the adoption, as regards the indicator 214A_benef			+					
	PRED_Axis3_benef	Predicted probability from the Probit explaining the adoption, as regards the indicator Axis3_benef						++		++
	IMRSTEP1	Inverse Mills ratio from the Probit model		+++	+++					
	IMRSTEP1_spatial	Inverse Mills ratio from the spatial Probit model					+++	+++		

3.1.2. Payments

Payment density (euro/ha) models for measure 121 were available for all case study areas except for the Netherlands and Italy (Table 4). Results are similar to participation models, though detailed results at country level may hint at the fact that local priorities guided payments towards farm typologies different from those with higher willingness to participate.

Except for Germany, R^2 values are relatively high and the spatial components of the models are significant.

Factors positively affecting payments remain dominated by structural variables, including in particular farm size, stocking density, specialisation and labour availability. Labour types become however less relevant and non-significant here (see France).

Legal status is also important, but in this case some typologies (e.g. cooperatives in Germany) reverse their effect on the dependent variable.

The role of local priorities is also important and seems to be reflected in changes in specialisation with higher positive effect.

Age becomes not relevant here compared to the participation model.

Also payments tend to be negatively associated with more extensive farming, remoteness of rural areas and higher natural value features, such as crop diversity and forestry areas.

Also for payments, the case of France shows a relevant connection among measures. The positive significant connection with the previous existence of early retirement payments remains, though less strong, and also a positive significant relationship with setting up of young farmers appears, while the relationship with other RD measures is negative.

Table 4 - Measure 121: Results of payments models

Case study	Slovenia	Slovenia	Slovenia	Slovenia	Brandenburg	Brandenburg	Brandenburg	Brandenburg	Brandenburg	Brandenburg	Scotland		Scotland	Scotland	Scotland
Model			**aspatial**	**spatial**			**OLS Aspatial**	**OLS Spatial lag**	**OLS Spatial error**	**Binary Logistic**			**aspatial**	**spatial lag**	**spatial error**
Model details															
R^2			0,57				0,06	0,065	0,066	0,121					
Adjusted R^2			0,55				0,03			0,016			17.3	22.42	21.43
Rho								-0.077						0,25***	
									-0.089						0,23 ***
Intercept			-		Intercept			+	+	++	Constant		+++		
I.	AAA	Labour productivity proxy (Standard output per Annual Work Unit)	+		Landscape	Factor Water/FFH	++	++	++		B2 OWNED LAND	OWNERSHIP: Percentage of owned agricultural area	+++	+++	+++
III.	NAT_D	% of UAA located in Natura 2000 areas	-			Factor Large-scale Agriculture	+	+	+		B4 SEASONAL RENT	OWNERSHIP: Percentage of seasonal rented agricultural land		++	++
IV.	L11	Supported areas as share of total UAA	+++		Farming Structure	Factor Grassland Management	---	--	--		B5 SEASLET	OWNERSHIP: Percentage of seasonal let agricultural land	---	---	---
	N2	Specific investment objectives, % of income stabilization	++			Factor Horticulture	++	++	++		C16 WOODLAND	BIOPHYSICAL: Percentage of woodland area	---	---	---
	O2	Type of investment, % of buildings	+++			Factor Co-operatives	---	--	--	-	C6 ROUGH	BIOPHYSICAL: Percentage of rough grazing area	---	---	---
											C8 GRASSLESS	BIOPHYSICAL: Percentage of grass less than five years old area	---	---	---
											C9 GRASSMORE	BIOPHYSICAL: Percentage of grass more than five years old area	+		
											D21 ROUGHLCA	BIO-PHYSICAL: Percentage of land capable for supporting rough agriculture	---	---	
											D22 BUILTUP	BIO-PHYSICAL: Percentage of land capable for supporting built up areas	---	---	---
											E24 CATTLE DENSITY	LIVESTOCK: Density cattle per UAA Ha	+++	+++	+++
											E25 SHEEP	LIVESTOCK: Density sheep per UAA ha	---	---	---
											F28 FTOCCUPS	LABOUR: Density of Full-time occupiers per holdings	++	+	+
											F31 PTSPOUSE	LABOUR: Density of Part-time spouses per holdings	---	--	--
											G33 NVZ	PROTECTED AREAS: Percentage of Nitrate Vulnerable Zones area	---	---	---
											H38 OTHERURB	REMOTENESS: Percentage of 'Other urban' areas	-		

Table 4 (continued)

Case study			France	France	France	France	France	France	France	France
Model			P1S1: Probit	P1S2: Tobit, with IMR derived from P1S1	P1S2PR: Tobit, with IMR and predictions from P1S1	P2S1: Spatial probit	P3S2: Tobit, including IMR derived from P2S1	P3S2PR: Tobit, with IMR and predictions from P2S1	Probit	Tobit
Model details									Presence of payments	Density of payments
R2/R2adjusted				0.45	0.46		0.45	0.46		
rho						0,17**			0,17**	
(Intercept)				+++	+++		+++	+++		+++
Local ec and env.	alt_moy	Average altitude		++	+++	+	++	+++	+	+++
	log_denspop06p1	Log of population density		+++	+++		+++			
	txchom06	Unemployment rate		---	---		---	---		---
	Indic_FI_2007								--	
	INDIC_AOC1	Dummy indicating areas supporting Protected Designation of Origin (PDO) products		-	---		-			
	zauer4561	Dummy indicating the presence of rural areas		+	++		+			
	ZVul1	Dummy indicating the presence of nitrate vulnerable zones	++			++			++	
	natura20001	Dummy indicating the presence of Natura 2000 areas		---	---		---	---		---
	sth_sau_2000	Share of grassland within the UAA		+++	+++		+++	+++		+++
	log_mo2006	Log value of labour present on farm (farm heads, family labour and hired labour in AWU)	+++	+++	--	+++	+++		+++	
	SUPMOYexpl.2006	Average farmsize		---	---		---	---		---
	AGE_MOY.2006	Average farmers' age	---	---	---	---	---	---		---
Agr. Structures	ASB06_RNET	Share of agricultural incomes within household incomes		-			-	--		--
	log_montanttotp1	Log value of cattle direct payments (1,000 €)	+++	+++		+++	+++	+++	+++	+++
	pct_ste.2006	Share of partnership farms within all farms	++	+++	+++	++	+++	+++	++	+++
	pct_comp.2006	Share of company farms within all farms		+++	+++		+++	+++		+++
	Indic_Ann.Crop.2007	Average size of plots with annual crops		+++	+++	+	+++	+++	+	+++
	Indic_Grassland.2007	Average size of grassland plots			---			-		-
	Indic_Per.Crops.2007	Average size of plots with permanent crops		++			++			
	Indic_Other.2007	Average size of other plots	++			+++			+++	
	Indic_Total.2007	Average size of all plots		---	---		---	---		---
	Indic_CDI_2007	Crop diversity index		---	---		---	---		---
	Indic_FI_2007	Forest index	-			--				
	OTE231	Dummy indicating that 'wine, fruits and vegetables' type of farming is dominant		+++	+++		+++	+++		+++
	OTE431	Dummy indicating that 'mixed cattle' type of farming is dominant	++	+++	+++	+	+++	+++		+++
	OTE4ab51	Dummy indicating that 'beef and dairy' type of farming is dominant		++	+++		++	++		++
	OTE61	Dummy indicating that 'mixed crop and livestock' type of farming is dominant		+++	+++		+++	+++		+++
Other measures	indic_meca1	Dummy for previous existence of 'mechanisation' payments from RDP1		+++	+++	++	+++	+++	++	+++
	indic_ctecad1	Dummy for previous existence of 'AES payment' (other than grassland or crop diversification) payment from RDP1	+++		--	+++			+++	
	indic_maerot1	Dummy for previous existence of 'AES crop diversification payment' from RDP1			--					
	indic_phaepmsee1	Dummy for previous existence of AES grassland premium from RDP1		---	---	-	---	--	-	--
	indic_dja1	Dummy for previous existence of payment for setting up of young farmers from RDP1	+	--			--	-		-
	indic_foret1	Dummy for previous existence of afforestation payments from RDP1			--					
	indic_forma1	Dummy for previous existence of training payments from RDP1			-					
	indic_poa1	Dummy for previous existence of Agricultural Orientation Premium			-					
	indic_preret1	Dummy for previous existence early retirement payments from RDP1	++			++			++	
	PRED_214I_area	Predicted probability from the Probit explaining the adoption, indicator 214I_area			++					
	PRED_214A_benef	Predicted probability from the Probit explaining the adoption, indicator 214A_benef			+++			+		+
	PRED_Axis3_benef	Predicted probability from the Probit explaining the adoption, indicator Axis3_benef			+++			+++		+++
	IMRSTEP1	Inverse Mills ratio from the Probit model		0.24	0.16					
	IMRSTEP1_spatial	Inverse Mills ratio from the spatial Probit model					0.22	0.21		

3.2 Participation and payments for Measure 214

3.1.1. Participation

This measure turned out to be the most complex to address, due to the number of sub-measures with different design by case study area. Models for participation in measure 214 as a whole are available only for Slovenia, Italy, Netherlands and UK (Table 5).

In some cases participation was modelled as share (percentage) of participating farms on the total of the statistical unit used as observation. In other cases UAA was used.

R^2 and R^2 adjusted were in most cases good, always above 0,19 and up to 0,86 in Slovenia.

The spatial component was always highly significant.

The intercept shows a varied behaviour, with cases in which it is positively significant, cases in which it is negatively significant, and cases in which it is not significant.

Significant factors affecting participation are generally less numerous and more varied than for other measures.

Farm specialisation or land use determinants are the most present. Policy design related to connected payments (Slovenia) or to explicit policy priorities (Emilia Romagna) are relevant when used.

Factors related to remoteness (rural areas, share of natural areas etc.) also play a role, usually in encouraging participation.

Farmer and management characteristics are less relevant here.

The results hint at the fact that different sub-measure may have driven the results in different directions and the overall participation may be the results of a complex mix of reasons, also in relation to the relevance of individual measures in each case study area.

The main message is however that measure 214 can be probably better understood taking individual sub-measures into account, but as these are different for each area, this also implies that the analysis of determinants of participation can be more meaningful at the level of the programming territory.

Table 6 reports results from analogous participation models related to organic farming. Explanatory ability of the modes change in different directions (decreases in Slovenia, while increases in Emilia Romagna). The value of the spatial component remains highly significant and tends to increase. The significant variables also change to some extent. In Emilia Romagna variables related to the specific farm specialisation and more targeted preferentiality-related variables become significant, while more generic location variables lose their relevance. Variables in Slovenia remain the same except for some dummy variable related to farm size (small farms tend to become more relevant).

The same comparison is not possible for France, for which the aggregated model was not estimated. In the case of organic farming The model have a relatively low R2 in the case in which the

dependent variable is the area share, while models seem to perform much better in terms of share of beneficiaries. A number of variables are significant, though with different profiles depending on the model. In the model related to area, the most relevant positive variables are the size of grassland plots and the share of farms with partnerships, as well as the high level management profile and the location in protected DOP or similar areas. This hints at a potential duality in the field of organic farming, a duality that spreads either in areas in which it can be put into value through marketing strategies or it can be achieved at a low cost through grassland cultivation.

The most relevant variables with a negative effect are the amount of cattle and farm size.

Table 5 - Measure 214: Results of participation models

Dependent			**Participation UAA**	**Participation UAA**	**Participation UAA**	**Participation UAA**			**Participation holdings**			**Participation holdings**	**Participation holdings**	**Participation holdings**			**Participation holdings**
unit			**ha/ha**	**ha/ha**	**nf/nf**	**nf/nf**			**nf/nf**			**nf/nf**	**nf/nf**	**nf/nf**			**nf/nf**
Case study			**Slovenia**	**Slovenia**	**Slovenia**	**Slovenia**			**Noord Holland**			**Emilia Romagna**	**Emilia Romagna**	**Emilia Romagna**			**Scotland**
Model			**OLS aspatial**	**OLS spatial**	**OLS aspatial**	**OLS spatial**			**OLS aspatial**			**OLS aspatial**	**OLS spatial lag**	**OLS spatial error**			**aspatial**
Model details																	
R^2			0,83	0,86	0,75	0,77			0,26			0,37					
Adjusted R^2			0,83		0,75								0,43	0,44			0,19
Rho				0,25***		0,22***							0,24***				
Lambda														0,36***			
Intercept			+++	+++	+	+++	Intercept		---	Intercept					Intercept		
I.	CD16	Purpose of agricultural production, % of sale			+++	-	log(UAA)	log of total utilized agricultural area (UAA) in hectares	+++	DENS_AB	Density of inhabitants	-			B1 COMM GRAZ	OWNERSHIP: Percentage of common grazings	+++
I.	CD17	Average UAA per farm	---	---			perc_pasture	proportion of the UAA under grass	+++	ONLY_HHLAB	Percentage of farms which use only household labour	+	+		B4 SEASONAL RENT	OWNERSHIP: Percentage of seasonal rented agricultural land	++
I.	CD25	UAA, % of large farms (>10 ha)			-		perc_LFA	percentage of the utilized agricultural area (UAA) which is located in less favoured areas	+++	ARABLE	Percentage of farm with arable crops	--	---	---	B5 SEASLET	OWNERSHIP: Percentage of seasonal let agricultural land	-
IV.	nk	Average land area participating in AE measures - all (farms participating A-E)	+	++			mun_density	inhabitants per km^2	++	FOREST	Percentage of farm with forest	+++	+++	+++	C9 GRASS MORE	BIOPHYSICAL: Percentage of grass more than five years old area	-
IV.	pt1	Payment rights grassland (CAP Pillar I), all farms	+++	+++	+++	+++	perc_nature	percentage of the total area which is forest or natural land	--	LIVESTOCK	Percentage of farm with livestock	+	+	++	D19 MIXED	BIO-PHYSICAL: Percentage of land capable for supporting Mixed agriculture	+++
IV.	y3_all	EAFRD payments (all schemes) per hectare UAA	+++	+++	+++	+++	perc_agriculture	percentage of the total area of the municipality which is under cultivation by farmers	+++	PREFASS		+++	+++	++	D23 INLAND WATER	BIO-PHYSICAL: Percentage of inland water area	--
							perc_N2k	percentage of the UAA situated within Natura 2000 areas	++						E24 CATTLE DENSITY	LIVESTOCK: Density cattle per UAA Ha	--
							as.factor(type)dairy	Farm type=dairy	+++						E25 SHEEP	LIVESTOCK: Density sheep per UAA ha	++
							as.factor(type)other pasture	Farm type=pasture	+++						E26 BEEF	LIVESTOCK: Density beef heifers per UAA ha	++
															E27 DAIRY	LIVESTOCK: Density dairy heifers per UAA Ha	--
															F28 FTOCCUPS	LABOUR: Density of Full-time occupiers per holdings	+
															F32 REG&CAS STAF	LABOUR: Density of Total regular & casual staff per holdings	+++
															G33 NVZ	PROTECTED AREAS: Percentage of Nitrate Vulnerable Zones area	+++
															G34 SSSI	PROTECTED AREAS: Percentage of SSSI area	+++
															G35 DESIG	PROTECTED AREAS: Percentage of complete national designated areas	---
															H42 REMRURAL	REMOTENESS: Percentage of 'Accessible rural' areas	+++

Table 6 - Measure 214-Organic farming: Results of participation models

Dependent			**Participation UAA**	**Participation UAA**	**Participation holdings**	**Participation holdings**			**Participation UAA**	**Participation UAA**	**Participation UAA**
Unit			ha/ha	ha/ha	nf/nf	nf/nf			nf/nf	nf/nf	nf/nf
Case study			Slovenia	Slovenia	Slovenia	Slovenia	Emilia Romagna	Emilia Romagna	Emilia Romagna	Emilia Romagna	Emilia Romagna
Model			a-spatial	spatial	a-spatial	spatial			aspatial	spatial lag	spatial error
Model details											
R^2			0,38	0,5	0,71	0,73			0,45	0,51	0,51
Adjusted R^2			0,37		0,69						
Rho										0,28***	
Lambda				0,50***		0,37***					0,31***
Intercept			+++	+++	+++	+++	CONS		+	+	
I.	CD17	Average UAA per farm			--	--	FRUIT	Percentage of farm with fruit crops	++	+	
I.	CD22	UAA, % of small farms (0<2 ha)			+		GRAZING		-	--	---
I.	CD25	UAA, % of large farms (>10 ha)			+++	+++	FOREST	Percentage of farm with forest	+++	+++	+++
I.	CDR_D	Share of farm holdings engaged in plant production			--	-	LIVESTOCK	Percentage of farm with livestock	+++	++	++
II.	NAT_D	% of UAA located in Natura 2000 areas	++	+			PREFNAT		---	---	--
IV.	pph	Payment rights (CAP Pillar I), average/hectare	---	---	---	---	PREFPAE		++	++	++
IV.	pt1	Payment rights grassland (CAP Pillar I), all farms			+++	+++					
IV.	y3_all	EAFRD payments (all schemes) per hectare UAA			+++	+++					

Table 6 (cont.)

Case study			France	France	France	France	France	France	France	France	France	France	France	France	France	France	France	France
			Area	Area	Area	Area	Area	Area	Area	Area	Beneficiaries	Beneficiaries	Beneficiaries	Beneficiaries	Beneficiaries	Beneficiaries	Beneficiaries	Beneficiaries
Model			**P1S1: Probit**	**P1S2: Tobit, with IMR from P1S1**	**P1S2PR: Tobit, with IMR and predictions from P1S1**	**P2S1: Spatial probit**	**P3S2: Tobit, with IMR from P2S1**	**P3S2PR: Tobit, with IMR and predictions from P2S1**	**Probit**	**Tobit**	**P1S1: Probit**	**P1S2: Tobit, with IMR from P1S1**	**P1S2PR: Tobit, with IMR and predictions from P1S1**	**P2S1: Spatial probit**	**P3S2: Tobit, with IMR from P2S1**	**P3S2PR: Tobit, with IMR and predictions from P2S1**	**Probit**	**Tobit**
Model details									**Entered area**	**Area share**							**Presence of beneficiaries**	**Share of beneficiaries**
R2/R2adjusted				0,19	0,19		0,19	0,2				0,45	0,46		0,45	0,46		
rho						0,52***			0,52***					0,31***			0,31***	
(Intercept)				---	--	-	---	---	-	--	--	---	---	---	--	---	---	---
Local ec and env.	alt_moy	Average altitude											++			+++		+++
	log_denspop06p1	Log of population density	---			---			---		---	--		---			---	
	txchom06	Unemployment rate	+			+			+		++	+++	+++	++	+++	+++	++	+++
	Indic_FI_2007	Forest index	++	++	++			+		+	+++	+++	+++	+++	+++	+++	+++	+++
	INDIC_AOC1	Dummy indicating areas supporting Protected Designation of Origin (PDO) products	+++			+++			+++		+++	+++	+++	+++	++	+++	+++	+++
	zauer4561	Dummy indicating the presence of rural areas	---			---			---									
	Z_Vul1	Dummy indicating the presence of nitrate vulnerable zones										--	-		--	-		-
	natura20001	Dummy indicating the presence of Natura 2000 areas													-	---		---
	CSP_max2	Dummy indicating that 'craft and related trades workers' socio-professional group is the most represented										+	++			+		-
	CSP_max3	Dummy indicating that 'manual worker' socio-professional group is the most represented			+	+	+			+		+	+					
	CSP_max4	Dummy indicating that 'intermediate non manual workers' socio-professional group is the most represented										+++	+++		+++	++		++
	CSP_max5	Dummy indicating that 'executives & intellectual persons' socio-professional group is the most represented		++	++		++	++		++		+++	+++	+	+++	+++	+	+++
	CSP_max6	Dummy indicating that 'employees' socio-professional group is the most represented		+	+		++	+		+		+++	++		++	++		++
	sth_sau_2000	Share of grassland within the UAA		--			--	--		--	---	--	---	--		--	--	--
	log_mo2006	Log value of labour present on farm (farm heads, family labour and hired labour in AWU)	+++			+++	--	--	+++	--	+++	+++		+++		---	+++	---
	SUPMOYexpl.2006	Average farmsize	+	---	---		---	---		---		+	++			++		++
	MONO1	Dummy variable indicating the presence a dominant (more than 50% of the farms and more than 60% of the area) crop in the NUTS4									-			-				
	AGE_MOY.2006	Average farmers' age	-				++	++		++		-						
Farm Structure	ASB06_RNET	Share of agricultural incomes within household incomes	---			---			---		---	---	--	---			--	
	log_montanttotp1	Log value of cattle direct payments (1,000 €)	-	---	-		---	---		--		---	---		---	---		---
	pct_ste.2006	Share of partnership farms within all farms		+++	+++		+++	+++		---		++			+	+++		+++
	pct_comp.2006	Share of company farms within all farms						++			--		++	--	+++	+++	--	+++
	Indic_Ann.Crop.200	Average size of plots with annual crops								++								
	Indic_Grassland.200	Average size of grassland plots	+++	+++	++	+	+++	++	+			+++	+++		+++	+++		+++
	Indic_Per.Crops.200	Average size of plots with permanent crops	-	--		+	-		+		---	---	--	---			---	
	Indic_Other.2007	Average size of other plots	--															
	Indic_CDI_2007	Crop diversity index	++	--	-	+	---	---	+	---		--		-	---	--	+	--
	OTE11	Dummy indicating that 'field-crop' type of farming is dominant										---	---		---	---		---
	OTE231	Dummy indicating that 'wine, fruits and vegetables' type of farming is dominant		+			++											
	OTE431	Dummy indicating that 'mixed cattle' type of farming is dominant	+		+						+			+	---		+	
	OTE4ab51	Dummy indicating that 'beef and dairy' type of farming is dominant										---			---	--		--
	OTE61	Dummy indicating that 'mixed crop and livestock' type of farming is dominant										---	-		---	--		--
Other measure	indic_meca1	Dummy for previous existence of 'mechanisation' payments from RDP1	--			-	++	++	-	++								
	indic_ctecad1	Dummy for previous existence of 'AES payment' (other than grassland or crop diversification) payment from RDP1	+			+			+		+							
	indic_maerot1	Dummy for previous existence of 'AES crop diversification payment' from RDP1						-		-								
	indic_phaepmsee1	Dummy for previous existence of AES grassland premium from RDP1	+++	+++		+++	++		+++		+++	+++		+++	+++		+++	
	indic_dja1	Dummy for previous existence of payment for setting up of young farmers from RDP1									-	--	--	--	-		--	
	indic_foret1	Dummy for previous existence of afforestation payments from RDP1		-	--			-		-	++			++			++	
	indic_forma1	Dummy for previous existence of training payments from RDP1			--			--		--	+							
	indic_ichn1	Dummy for previous existence of LFA payments from RDP1	+++			+++		-	+++	-	+++	+++	+++	+++	+++	+	+++	+
	indic_poa1	Dummy for previous existence of Agricultural Orientation Premium	+++			+++			+++		+++			++			++	
	PRED_121_payment	Predicted probability from the Probit explaining the adoption, as regards the indicator 121_payment			-			--		--			++					
	PRED_214A_benef	Predicted probability from the Probit explaining the adoption, indicator 214A_benef						+		+			++			+++		+++
	PRED_Axis3_benef	Predicted probability from the Probit explaining the adoption, indicator Axis3_benef			+			++		++			++			+++		+++
	IMRSTEP1	Inverse Mills ratio from the Probit model										---	+++					
	IMRSTEP1_spatial	Inverse Mills ratio from the spatial Probit model					--									+++		

3.1.2. Payments

Models related to payments for measure 214 as a whole are available for Slovenia, Netherlands and UK (Table 7).

R^2 and adjusted R^2 are generally good, with the exception of the a-spatial UK model. Spatial components are significant at least in two cases.

Relevant explanatory variables are rather varied and include features of location (including density of population), specialisation and structural variables such as farm size.

Technology/specialisation features are dominant in the Netherlands and, less clearly, in UK. With some of them positively and strongly correlated and others that are negatively and strongly correlated.

Compared to the case of participation, variables that are significant tend to have a higher significance and to keep constant sign and significance across the model, which hints likely to clear design determinant linked to the amount of payment per crop/area.

Errore. L'origine riferimento non è stata trovata. reports the payment model for Slovenia, the only case study area implementing this type of model.

In this case the R^2 decreases, while the significant variables reduce to two, plus the intercept and are positively related to location in NATURA 2000 areas and negatively related to level of payments, which hints clearly at a policy design determinant connected to the level of payments.

Table 7 - Measure 214: Results of payment models

dependent			**Payments**	**Payments**			**Payments**	**Payments**			**Payments**	**Payments**	**Payments**
unit			**euro/ha**	**euro/ha**			**euro/ha**	**euro/ha**			**euro/ha**	**euro/ha**	**euro/ha**
Case study			**Slovenia**	**Slovenia**			**Noord Holland**	**Noord Holland**			**Scotland**	**Scotland**	**Scotland**
Model			**aspatial**	**spatial**			**probit aspatial**	**probit spatial lagged variables**			**aspatial**	**spatial lag**	**spatial error**
Model details													
R^2			0,47	0,57							0,16		
Adjusted R^2			0,45									0,36	0,35
Rho				0,44***								0,49***	
Lambda													0,51***
Intercept			--	---	Intercept		---	---	Intercept		---		
I.	CD13	Stocking density (LSU per UAA in ha)	---	---	FARMWORK	proportion of a farmer's time spent on work in the farm	---	---	B1 COMM GRAZ	OWNERSHIP: Percentage of common grazings	++		
I.	CD16	Purpose of agricultural production, % of sale	+++	+++	UAA	total utilized agricultural area (UAA) in hectares	++	++	C16 WOODLAND	BIOPHYSICAL: Percentage of woodland area	--	-	-
I.	CD17	Average UAA per farm	+++	+++	perc_pasture	proportion of the UAA under grass	+++	+++	C17 Glass houses	BIOPHYSICAL: Density of glasshouses	-		
I.	CD24	UAA, % of medium-large farms (5<10 ha)	-	-	PERC_OWNED	percentage of the land used by the farmer which he actually owns	+++	+++	D19 MIXED	BIO-PHYSICAL: Percentage of land capable for supporting Mixed agriculture	+++	+++	+++
II.	NS22	Average age of the population by municipalities	+++	++	mun_density	inhabitants per km^2	+++	+++	G33 NVZ	PROTECTED AREAS: Percentage of Nitrate Vulnerable Zones area	+++	+++	+++
IV.	pph	Payment rights (CAP Pillar I), average/hectare	+		rank_potential	agricultural potential on the basis of landscape types	+++	+++	G34 SSSI	PROTECTED AREAS: Percentage of SSSI area	++	+++	+++
					perc_N2k	percentage of the UAA situated within Natura 2000 areas	+++	+++	G36 RSPB	PROTECTED AREAS: Percentage of RSPB reserve areas	+++	++	+
					ORGANIC	farm type=organic	+++	+++	H42 REMRURAL	REMOTENESS: Percentage of 'Accessible rural' areas	+++	+++	+++
					DAIRY	farm type=dairy	---	---					
					ARABLE	farm type=arable	---	---					
					OPEN_AIR_H	farm type=open air horticulture	---	---					
					MIX	farm type=mixed farming		++					

Table 7 (cont.)

dependent			**payments**	**payments**
unit			**euro/ha**	**euro/ha**
Country			**Slovenia**	**Slovenia**
Model			**a-spatial**	**spatial**
Model details				
R^2			0,39	0,5
Adjusted R^2			0,37	
Rho				
Lambda				0,49***
Intercept			+++	+++
II.	NAT_D	% of UAA located in Natura 2000 areas	++	+
IV.	pph	Payment rights (CAP Pillar I), average/hectare	---	---

3.3 Participation and payments for Measure 311, 313 and 322

3.1.1. Participation

Models related to participation in axis 3 were developed for Italy, Germany and France. Depending on the local needs different bundles of measures were in fact used: in the Italian case study only measure 311, in the German case study measures 311, 313 and 322 separately; and in the French case study the sum of measure 311 and 313 (Table 8).

R^2 for these measures were particularly low in Germany, low in Italy, but rather high in France.

The spatial component was mostly significant, with the exception of the spatial error models for measure 311 and 313 in Germany.

The intercept was always significant.

The "locational" variables are generally relevant for these measures, though sometimes different to explain (Italy), or ambiguous effects, i.e. different signs depending on the model/measure (Germany and France).

Among the connections with other measures, the French case study emphasises the positive effect of Less Favoured Areas (LFA) and grassland payments and the negative effects of early retirement payments.

Altogether, the outcomes of these models for France seem to reflect mainly the national/local prioritisation of the measures towards specific areas, which may be reflected in the higher performance of the model for this region.

On the contrary, in the case of Italy and Germany, the small number of statistical units exceeding the minimum threshold of participants (n >3) according to data protection requirements may have limited the explanatory power of these models.

Altogether, the main message derived for these highly local-specific measures is that it is difficult to provide any generalisation, neither in terms of explanatory variables nor in terms of the utility of spatial econometrics.

Table 8 - Measure 311, 313, 322: Results of participation models

Measure		**311**	**311**	**311**			**311**	**313**	**322**	**311**	**313**	**322**	**311**	**313**	**322**
Case study	**Emilia Romagna**	**Emilia Romagna**	**Emilia Romagna**	**Emilia Romagna**	**Brandenburg**	**Brandenburg**	**Brandenburg**	**Brandenburg**	**Brandenburg**	**Brandenburg**	**Brandenburg**	**Brandenburg**	**Brandenburg**	**Brandenburg**	**Brandenburg**
Model		**OLS**	**OLS Spatial lag**	**OLS Spatial error**			**OLS Aspatial**	**OLS Aspatial**	**OLS Aspatial**	**OLS Spatial error**	**OLS Spatial error**	**OLS Spatial error**	**Binary Logistic**	**Binary Logistic**	**Binary Logistic**
Model details															
R^2							0,04	0,01	0,13	0,04	0,02	0,15			
R2 adjusted		0,17	0,22	0,22			0,01	-0,02	0,1						
Rho			0,29*												
LAMBDA				0,31*						-0,04	-0,06	0,30***			
Intercept		+	+	+++	Intercept		+++		+++	+++		+++	---		
PIANURA	Location in plain	---	---	---	Socio-Economics	Factor Urban / Economic Development			--	+		--			--
COLLINA	Location in hill	---	---	---		Factor Tourism								+++	
MONTAGNA	Location in mountain	---	---	---		Factor Working Place			---			---	+	++	
ARABLE	Percentage of farm with arable crops	---	---			Factor Peri-urbanisation			---			---			--
FOREST	Percentage of farm with forest	+			Landscape	Factor Forest/LFA			---			---			
						Factor Water/FFH								+	
					Farming Structure	Factor Grassland Management	++		+++	++		++	++		
						Factor Horticulture									--
						Factor Co-operatives	--			--				+	
						Factor Arable Production			--			-		+++	

Table 8 (continued)

		311&313	311&313	311&313	311&313	311&313	311&313	311&313	311&313
		France	France	France	France	France	France	France	France
		P1S1: Probit	P1S2: Tobit, with IMR from P1S1	P1S2PR: Tobit, with IMR and predictions from P1S1	P2S1: Spatial probit	P3S2: Tobit, including IMR from P2S1	P3S2PR: Tobit, with IMR and predictions from P2S1	Probit	Tobit
			0,62	0,62		0,62	0,63		
					0,59***			0,59***	
		--	--	--	--	--	--	--	--
alt_moy	Average altitude	+++			+++			+++	
log_denspop06p1	Log of population density	---	+++	+++	+++	+++	+++	+++	+++
txchom06	Unemployment rate	---			+++			+++	
Indic_FI_2007		--						-	
INDIC_AOC1	Dummy: presence of areas supporting Protected Designation of Origin (PDO) products					++			
zauer4561	Dummy indicating the presence of rural areas								
ZVul1	Dummy indicating the presence of nitrate vulnerable zones								
natura20001	Dummy indicating the presence of Natura 2000 areas								
sth_sau_2000	Share of grassland within the UAA					+++	+++		+++
log_mo2006	Log value of labour present on farm (farm heads, family labour and hired labour in AWU)	+++			+++	---	---	+++	---
SUPMOYexpl.2006	Average farmsize	+++			++			++	
AGE_MOY.2006	Average farmers' age	--				++	++		++
ASB06_RNET	Share of agricultural incomes within household incomes			+			++		++
log_montanttotp1	Log value of cattle direct payments (1,000 €)		---	---		---	---		---
pct_ste.2006	Share of partnership farms within all farms	---				+++	+++		+++
pct_comp.2006	Share of company farms within all farms	---			---	++	++	---	++
Indic_Ann.Crop.2007	Average size of plots with annual crops					+	++		++
Indic_Grassland.2007	Average size of grassland plots		+++	+++		+++	+++		+++
Indic_Per.Crops.2007	Average size of plots with permanent crops	---	-		--			--	
Indic_Other.2007	Average size of other plots		---	--		---	--		--
Indic_Total.2007	Average size of all plots								
Indic_CDI_2007	Crop diversity index	-	--	---		--	--		--
OTE11	Dummy indicating that 'field-crop' type of farming is dominant	+				---	---		---
OTE231	Dummy indicating that 'wine, fruits and vegetables' type of farming is dominant								
OTE431	Dummy indicating that 'mixed cattle' type of farming is dominant	---		-	--			--	
OTE4ab51	Dummy indicating that 'beef and dairy' type of farming is dominant		--	--		--	---		---
indic_meca1	Dummy for previous existence of 'mechanisation' payments from RDP1								
indic_ctecad1	Dummy: existence of 'AES payment' (other than grassland or crop diversification) payment from RDP1	+++			+++	--	--	+++	--
indic_maerot1	Dummy for previous existence of 'AES crop diversification payment' from RDP1					---	---		---
indic_phaepmsee1	Dummy for previous existence of AES grassland premium from RDP1	---						-	
indic_dja1	Dummy for previous existence of payment for setting up of young farmers from RDP1								
indic_foret1	Dummy for previous existence of afforestation payments from RDP1								
indic_forma1	Dummy for previous existence of training payments from RDP1	+			+			+	
indic_ichn1	Dummy for previous existence of LFA payments from RDP1	+++			+++			+++	
indic_poa1	Dummy for previous existence of Agricultural Orientation Premium			-		---	---		---
indic_preret1	Dummy for previous existence early retirement payments from RDP1		---	---		---	---		---
IMRSTEP1_spatial	Inverse Mills ratio from the spatial Probit model					---	--		

3.1.2. Payments

Models of the density of payments in the measures 311, 313 and 322 are available for Germany. They are calculated per hectare for the measures 311 and 313 and per unit of population for measure 322 (Table 9).

The results are generally not good in terms of model performance for models in which the dependent variable is the amount of payments in euro/unit, while the models using the presence of payments in an observation unit as dependent variable have a much better performance, at least better than models using other dependent variables.

The results remain somehow similar to the previous case, with the intercept and some locational factors being the most prominent determinants. In particular, the urban/economic development has the most widespread positive effects consistently across models. Working place and tourism have also positive effects, but this is strictly related to measures 313 and 322 respectively.

This also happens for the majority of other determinants, particularly those related to farm specialisation (arable factor).

A few cases (grassland management, retirement) have a change in sign with the change of model type, probably hinting at the fact that the factors determining the concentration/participation in a municipality are different, and may possibly play in the opposite direction compared to those that determine the per unit payment allocation.

Altogether the models related to payments corroborate the impression of the difficulties in providing explanations for the measures of axis 3.

Table 9 - Measure 311, 313, 322: Results of payments models – Brandenburg

Measure		**311**	**313**	**322**	**311**	**313**	**322**	**311**	**313**	**322**	**311**	**313**	**322**
Unit		**euro/ha**	**euro/ha**	**euro/inhabitant**	**euro/ha**	**euro/ha**	**euro/inhabitant**	**euro/ha**	**euro/ha**	**euro/inhabitant**	**euro/ha**	**euro/ha**	**euro/inhabitant**
		OLS Aspatial	**OLS Aspatial**	**OLS Aspatial**	**OLS Spatial lag**	**OLS Spatial lag**	**OLS Spatial lag**	**OLS Spatial error**	**OLS Spatial error**	**OLS Spatial error**	**Binary Logistic**	**Binary Logistic**	**Binary Logistic**
R^2		0,09	0,11	0,08	0,095	0,115	0,078	0,106	0,115	0,08	0,731	0,438	0,22
Corrected R^2		0,06	0,09	0,05							0,565	0,351	0,108
Rho					-0,089	-0,058	0,1						
Lambda								-0,256**	-0,042	0,142			
Intercept		+++	+	+++	+++	+	+++	+++	+	+++	++	+++	+++
Socio-Economics	Factor Urban / Economic Development	+++	+++		+++	+++		+++	+++			+++	
	Factor Tourism						+++			+++			+
	Factor Working Place	+++			+++			+++			+++		
	Factor Retirement	---			---			---			--	+	
	Factor Peri-urbanisation			---			-			-			
Landscape	Factor Forest/LFA			--			---			---			
	Factor Water/FFH												+++
	Factor HNV Area										--	-	
Farming Structure	Factor Large-scale Agriculture		-			--			--				
	Factor Grassland Management			++	+		++	++		++		--	
	Factor Horticulture										+		
	Factor Arable Production		+++			+++			+++			+++	

3.4 Impacts

Impact models were investigated in only 2 case studies.

In the case of Slovenia, change in land and labour productivity is investigated using measure 121 RDP expenditure as an explanatory variable (Table 10).

R^2 is high (always above 0,75) and the spatial component is always significant. RDP spending is always consistently significant and positively related to (an increase in) land productivity and labour productivity. The other more consistent variable across models is the percentage of sales, showing that both land and labour productivity are associated with professional, market oriented farming.

The other explanatory variables tend to be differentiated among the different models. Attention should be drawn on a couple of variables (integrated production, percentage of large farms) that change their sign moving from the a-spatial to the spatial model, which may hint at some attention needed to perform a sensitivity analysis with a range of models in order to check the robustness of the results, and also that the spatial component may absorb "non-neutral" components of variability.

In the French case study (Table 11), impacts were analysed by impact indicator, using different measure-related explanatory variables. R^2 were relatively low, with some better values for high nature value index, crop diversity and plot size. Spatial analysis was not performed in this case. The explanatory variables show a varied range of signs and level of significance depending on indicators.

The role of RDP measures appears not very relevant. The most consistent result concerns measure 214 D (adoption of organic production) that is positively related to increase in labour productivity, crop diversity and indicators of high natural value farmland. It is also negatively related to increase in farm size, which could be consistent with the approach of organic agriculture. The other measure 214 sub-measures have zero or negative effects, even on environmental-related impact indicators, except in the case of measure 214I on the forest indicator, which is positive.

Measures 121 and 311&313 have, if any, negative effects on the impact indicators. As concerns the negative connection between these measures and natural value-related indictors, this may hint at a trade-off between modernisation and environment even within the RDPs. On the other hand, the negative connection with labour and plot size may hint at non-straightforward effects in terms of employment and farm development of RDP measures in axis 1 and 3.

Comparing the results from Slovenia and France, a strong difference can be found in the explanatory ability of the models, which may be due to the use of more straightforward and less varied explanatory variables in Slovenia, as compared to more truly impact-oriented and more varied explanatory variables, accompanied by a lager territorial variety and sample size in France.

Altogether, this hints at the difficulty in detecting actual effects of specific measures of the RDP on impact indicators in the context of all available determinants, even if impact indicators where available. If the results reported here are to be trusted, also contradictory or unwanted effects seem to emerge from RDPs, though the described difficulties detecting reliable effects should prevent from string claims in this direction based on the results of this study.

Table 10 – Impact models, Slovenia

Dependent	**Impact on land productivity**	**Impact on land productivity**	**Impact on labour productivity**	**Impact on labour productivity**
unit	**Economic size (as SO in 1000 eur) / UAA in ha (log)**	**Economic size (as SO in 1000 eur) / UAA in ha (log)**	**Economic size (as SO in 1000 eur) / AWU**	**Economic size (as SO in 1000 eur) / AWU**
Case study	**Slovenia**	**Slovenia**	**Slovenia**	**Slovenia**
Model	**Aspatial**	**Spatial lag**	**Aspatial**	**Spatial error**
Model details				
R^2 (%)	84,94	86,59	75,65	76,68
Rho		0,2267 (0)		0,2575 (0,0085)
Intercept	---	---	+++	+++
RDP spending per farm (in €), from measure 121	++	++	++	+
Num. of insurances on the farm, sum per municipality	+++	+++		
No. of persons participating in Agricultural Pension and Disability Insurance			+++	+++
LFA, % of mountain area	--			
LFA, % of hilly areas			---	--
Type of production, % of integrated	+++	+++	+++	---
LSU before investment, sum per municipality	--	--		
Average LSU, only on farms with livestock breeding			+++	+++
Purpose of agricultural production, % of sale	+++	+++	+++	+++
Type of investments , % of mechanization	---	---		
Population density, 2010	+++	+++		
Livestock Unit / UAA (ha)	+++	+++		
Average UAA per farm			+++	+++
UAA, % of small farms (0<2 ha)	++	++		
UAA, % of medium farms (5<10 ha)			---	---
UAA, % of large farms (>10 ha)			++	--

Table 11 – Impact models, France

Dependent		Farm size	Farm size	Labour	Labour	Plot size (total)	Plot size (total)	Crop Diversity Index	Crop Diversity Index	Grassland Index	Grassland Index	Forest Index	Forest Index	Farmland Nature Value Index=CDI+GI+FI	Farmland Nature Value Index=CDI+GI+FI
Model				P1S2: Tobit, with IMR from P1S1	P3S2: Tobit, with IMR from P2S1	P1S2: Tobit, with IMR from P1S1	P3S2: Tobit, with IMR from P2S1	P1S2: Tobit, with IMR from P1S1	P3S2: Tobit, with IMR from P2S1	P1S2: Tobit, with IMR from P1S1	P3S2: Tobit, with IMR from P2S1	P1S2: Tobit, with IMR from P1S1	P3S2: Tobit, with IMR from P2S1	P1S2: Tobit, with IMR from P1S1	P3S2: Tobit, with IMR from P2S1
R2		0,05	0,05	0,06	0,06	0,18	0,19	0,19	0,2	0,06	0,06	0,13	0,13	0,22	0,22
(Intercept)		+++	+++		+	+++	+++	+++	+++	+++	+++	++	++	+++	+++
alt_moy	Average altitude	+		+++	+++	+++	+++					+++	+++	+++	+++
sth_sau_2000	Share of grassland within the UAA									++	+++		--	+++	+++
log_mo2006	Log value of labour present on farm (farm heads, family labour and hired labour in AWU)	+++	++							+					
SUPMOYexpl.2006	Average farmsize					+++	+++	+++	+++					+	
AGE_MOY.2006	Average farmers' age	+++		---	---		+++	++	++				++		
ASB06_RNET	Share of agricultural incomes within household incomes	---							+						
log_denspop06p1	Log of population density	---		+++	+++										++
txchom06	Unemployment rate	+++	++			+++	+++							++	
log_montanttotp1	Log value of cattle direct payments (1,000 €)	++				+++	+++			---	---		-		
pct_ste.2006	Share of partnership farms within all farms	++												-	-
pct_comp.2006	Share of company farms within all farms				+++		--	--		-	--			--	
Indic_Ann.Crop.2007	Average size of plots with annual crops		+	++	++	+++	+++	++	++			---	---		
Indic_Grassland.2007	Average size of grassland plots	++	+++	---	---			+++	+++				-		++
Indic_Per.Crops.2007	Average size of plots with permanent crops		++					++							
Indic_Other.2007	Average size of other plots	+++	+++			++	+++	+++	+++			---	---	+++	+++
Indic_Total.2007	Average size of all plots	+++	+++	+++	+++	+++	+++					+++	+++		
Indic_CDI_2007	Crop diversity index					+++	++	---	---	+++	+++	-	--		+
Indic_FI_2007	Forest index	+						++		+++	+++	---	---	---	---
INDIC_AOC1	Dummy indicating the presence of areas supporting Protected Designation of Origin (PDO) products	+++	+				--					+	+		
ZVul1	Dummy indicating the presence of nitrate vulnerable zones	+					--								
natura20001	Dummy indicating the presence of Natura 2000 areas	+++				+++	+++			+	++				+++
CSP_max2	Dummy indicating that 'craft and related trades workers' socio-professional group is the most represented	---	---	-						--	--			---	---
CSP_max3	Dummy indicating that 'manual worker' socio-professional group is the most represented													--	--
CSP_max6	Dummy indicating that 'employees' socio-professional group is the most represented														-
OTE11	Dummy indicating that 'field-crop' type of farming is dominant			++	++										
OTE231	Dummy indicating that 'wine, fruits and vegetables' type of farming is dominant					---	---		---	---	---		+	---	---
OTE431	Dummy indicating that 'mixed cattle' type of farming is dominant						--								--
OTE4ab51	Dummy indicating that 'beef and dairy' type of farming is dominant														--
indic_meca1	Dummy for previous existence of 'mechanisation' payments from RDP1		--			--	--							+	
indic_ctecad1	Dummy for previous existence of 'AES payment' (other than grassland or crop diversification) payment from RDP1	+++	++	++	+++									+++	++
indic_maerot1	Dummy for previous existence of 'AES crop diversification payment' from RDP1							---	---			+++			
indic_phaepmsee1	Dummy for previous existence of AES grassland premium from RDP1					-	-	+++	++		-				
indic_dja1	Dummy for previous existence of payment for setting up of young farmers from RDP1	---	---	++	++	-	--								
indic_foret1	Dummy for previous existence of afforestation payments from RDP1	++													---
indic_forma1	Dummy for previous existence of training payments from RDP1			+++	+++		+			++	++				
indic_ichn1	Dummy for previous existence of LFA payments from RDP1					-		+++	+++					+++	+++
indic_poa1	Dummy for previous existence of Agricultural Orientation Premium							++	---	++					
indic_preret1	Dummy for previous existence early retirement payments from RDP1			--	--	++	+++			+	+				
PRED_121_payment	Predicted probability from the Probit explaining the adoption, as regards the indicator 121_payment	--				---	---							---	--
PRED_214I_area	Predicted probability from the Probit explaining the adoption, as regards the indicator 214I_area	--									---		+++		
PRED_214A_benef	Predicted probability from the Probit explaining the adoption, as regards the indicator 214A_benef						-	---	---					--	-
PRED_214D_benef	Predicted probability from the Probit explaining the adoption, as regards the indicator 214D_benef	--		++					+++						+++
PRED_Axis3_benef	Predicted probability from the Probit explaining the adoption, as regards the indicator Axis3_benef			--	-	---	---						--	---	---

4. Discussion

In the majority of models showed a low ability to explain the dependent variables, with R^2 in the range of 0.1-0.3, but there were also several models with up to 0.7 values and higher. This is consistent with the difficulty in data availability (see below), but also with the complexity of factors affecting participation, that go far beyond environmental and structural determinants, including also personal attitudes, information and hidden transaction costs.

Within such limited explanatory ability of the econometric models developed, in most case studies spatial variables showed to be significant, though the additional explanatory power of the spatial component was somehow limited.

Hence, altogether, the results of the task 5.2 of the SPARD project show the relevance of spatial econometrics for the interpretation of the results of RDPs.

The results also emphasise differences in objectives and design across different measures, which remains one of the specific features in overall evaluation of RDPs and somehow one of the main problems in overall evaluation.

This also translates in different variables taking the role of main determinants, depending on measure, sub-measure and context of application.

Limitations

The experience carried out in task 5.2 of the SPARD project also emphasises limitations that have effects, among others, on the ability to provide insightful interpretations of the outcome of the econometric models.

The main limitations of the study are the following:

- The primary limitation is data availability to be used as dependent variables; in spite of the collaboration with the best data sources, the studies used data largely not appropriate in terms of scale, time frame, detail related to measures, coverage of effects, connection between dependent variables and determinants.
- Data availability remains a critical issue also for the explanatory variables themselves. In particular the lack of systematic individual information about non-participant seriously affects the possibility to econometrically estimate the determinants of participation and its effects.

Implications for further work

Implications for further work may be organised into two main chapters: a) lessons learned and direction for further activities; b) main gaps to be addressed in the future.

Among the lessons learned, we highlight the following:

- the most outstanding message is that the weaker part of the application of spatial econometrics to RDP evaluation is data availability; this implies that spatial econometrics application should be undertaken only when sufficient data are available, and, on the same ground, research priorities should be directed towards the creation of more suitable data bases for RDP evaluation;
- relevant differences among measures are very relevant due to different design (e.g. measures targeting farms vs. measures targeting land use), but also the different degree of participation; in particular, the use of spatial econometrics requires some "density" of participation and in order for the spatial component to be meaningful studied; also measures with many zeros (observations with no participation) may be a problem, particularly because they are often associated to some unclear concentration within the region;
- in other cases, in particular in measure of axis 3, the logic of participation may be different from individual farm participation and being connected to networks or having non-farmer beneficiaries, which also makes spatial analysis of little use, particularly in relation to study spillovers.

Among the issues that remain unaddressed, it is worth to mention:

- the connection and relationship between the detection of relevant spatial effects and the background spillover effects is still rather weak; in most cases it was not possible to clearly relate spatial effects with a clear economic expectation;
- on the same line, the rationale to use different levels of contiguity remain rather poor.
- those related to the differential effects of the farm selection process in the cases in which the applications were higher than the budget vs. the case in which all eligible applicants where funded;
- the use of eligible vs. the total population as the reference population, that would further allow to refine the analysis;
- the consideration of the policy design parameters in the econometric model, in order to attribute responsibility between factors affecting willingness to participate and policy factors affecting likelihood that the contracts are awarded; this is particularly relevant for cases, like Emilia Romagna, characterised by strong targeting processes.
- The more systematic use of area-based or payment-based proxies for uptake that were feasible only in a few cases.
- The use of impact variables as dependent variables in place of implementation variables that were mainly used in this study due to data availability. Some regions are already developing a more advanced monitoring and evaluation system for come parameters, such as the Farmland Bird Index and nitrogen balance

- This study is based largely on agricultural census 2000 information, but potentially improved analyses are possible when/where the 2010 (or 2011) census information is available.

In terms of specific insights for the remaining components of the project:

1. about task 5.3: the difficulties in model estimation and the potential uncertainty of the results achieved, as well as the difficulty including policy variables in the econometric models would probably lead to focus this task more on the theoretical possibility for ex-ante use than on numerical results for ex-ante analysis at this stage; the outcome of Task 5.2 at least reflects the need of higher consistency between ex-ante and ex-post dimensions of RDP evaluation.
2. about task 5.4: based on the above, the discussion of model results at the local level would serve to identify relevant issues of this exercise and areas of interest for decision makers; one of this already identified in Emilia Romagna is to test to what extent the targeting rules have been effective in concentrating participation in a specific area.
3. about WP6: based on the above, this WP would benefit of anecdotal evidence from the case studies leading to the idea that different levels of analysis are possible, but also that data are mostly missing and largely heterogeneous across areas.
4. about WP4: the above highlight several specificities in the spatial dimension of RDP that could justify further research in spatial modelling; key issues would include: suitable modelling of spatial contiguity for RDP-related spillovers; adaptation of spatial models to different concepts of dependent variables (participation, outcome, impact).

5. Concluding remarks

This work attempted the application of spatial econometrics at the outcome of RDPs at the scale of programming territories, using the units at the lowest available aggregation level as observations.

The study highlighted some relevance of spatial issues and some potential of spatial econometrics in contributing to explain participation to RDPs. It also showed several limitations of application, due mainly to data availability, many of which however not specific of spatial analysis, but rather common with any exercise aimed at explaining in detail the drivers of RDP effects.

Data limitations were particularly relevant concerning impacts indicators and the suitable scale of analysis, hindering in particular the possibility to exploit spatial econometrics for the analysis of the issues in which its use could be more relevant, i.e. those related to spillovers in the category of impacts causal chain.

The analysis however allowed to better identify (several) data and evaluation gaps, which could be the basis for further better oriented research and policy support activity. Some of these issues, particularly those related to RDP-tailored model specification, matching with priority perception by decision-makers and use of models' results for ex-ante analysis, will be further developed already in within the remaining activities of the SPARD project.

6. Annexes