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Économétrie spatiale des effets environnementaux et sociaux des mesures de développement rural de la politique agricole commune

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Desjeux, Y., Dupraz, P., Kuhlman, T., Paracchini, M. L., Michels, R., MAIGNE, E., Reinhard, S. (2015). Evaluating the impact of rural development measures on nature value indicators at different spatial levels: Application to France and The Netherlands. *Ecological Indicators*, O-line first.

Desjeux, Y., Dupraz, P., Latruffe, L., MAIGNE, E., Cahuzac, E. (2014). Evaluating the impact of rural development measures on farm labour use: a spatial approach. Presented at 14. EAAE Congress: "Agri-Food and Rural Innovations for Healthier Societies", Ljubljana, SVN (2014-08-26 - 2014-08-29) 8èmes journées de recherches en sciences sociales (JRSS), grenoble, FRA (2014-12-11 - 2014-12-12).

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Les aides directes de la politique agricole commune

Premier pilier: Fonds Européen Agricole de Garantie (FEAGA)

- aides sur déclarations annuelles de surfaces basées sur des références historiques qui dépendent des quotas laitiers et de rendements régionaux
- aides couplées à certaines surfaces ou cheptels (vaches allaitantes)

Deuxième pilier (RDP): Fonds européen agricole pour le développement rural

- aides à l'installation et à l'investissement pluriannuelles sur projet
- aides agri-environnementales pluriannuelles sur cahier des charges
- aides à la diversification des activités sur projet

- aides compensatoires des handicaps naturels

Toutes ces aides sont conditionnées depuis 2006 au respect des Directives s'appliquant à l'agriculture et de bonnes conditions agronomiques et environnementales: pratiques de référence pour les mesures agri-environnementales.

FARM BIODIVERSITY & LANDSCAPE

- ❖ One of the main objectives of rural development policy (RDP) is to promote and enhance the environment and the countryside => exploring the relationships between the implementation of the policy and environmental benefits helps in assessing the efficiency of the RDP
- ❖ Agriculture has positive and negative effects on the environment, particularly on biodiversity
- ❖ The concept of High Nature Value (HNV) farmland was introduced into the Common Agricultural Policy (CAP) (2007-2013) in order to strengthen the role of farming practices in biodiversity maintenance
- ❖ A Common Monitoring and Evaluation Framework (CMEF) has been introduced for monitoring and evaluating the RDP2 (2007-2013) across EU Member States. It includes series of indicators, among which some are targeting HNV issues
- ❖ But indicators need to be adapted/fine-tuned to account for national/regional/local characteristics of the RDP to be evaluated
- ❖ Furthermore, due to the heterogeneity of case-study areas, spatially explicit analyses are required
- **We propose an HNV indicator based on LPIS data, along with a method based on spatial econometrics analysing the effectiveness of RDP measures in maintaining and enhancing farmland nature value, accounting for spatial effects and delayed effects**

The Farm Nature Value indicator (FNVI)

- ❖ Based on Pointereau et al. (2010), with some modifications
- ❖ Computed from LPIS data
- ❖ Computed for 2007 and for 2010 => Change in the indicator is evaluated
- ❖ Scale of analysis: France (NUTS0) and Midi-Pyrénées (NUTS2)
- ❖ Spatial resolution: LAU1

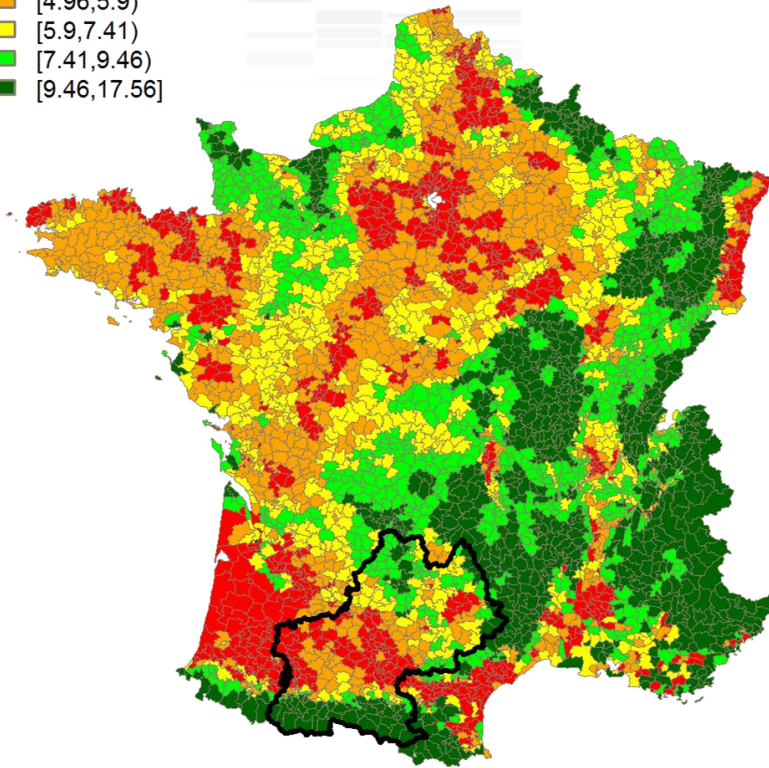
- ❖ **FNVI = Crop Diversity Index (CDI) + Grassland Index (GI) + 'Forest' Index (FI)**

With :

- CDI proxying the crop diversity
- GI proxying the share of permanent grasslands over the utilised agricultural area (UAA)
- FI proxying the share of afforested farm area over the UAA

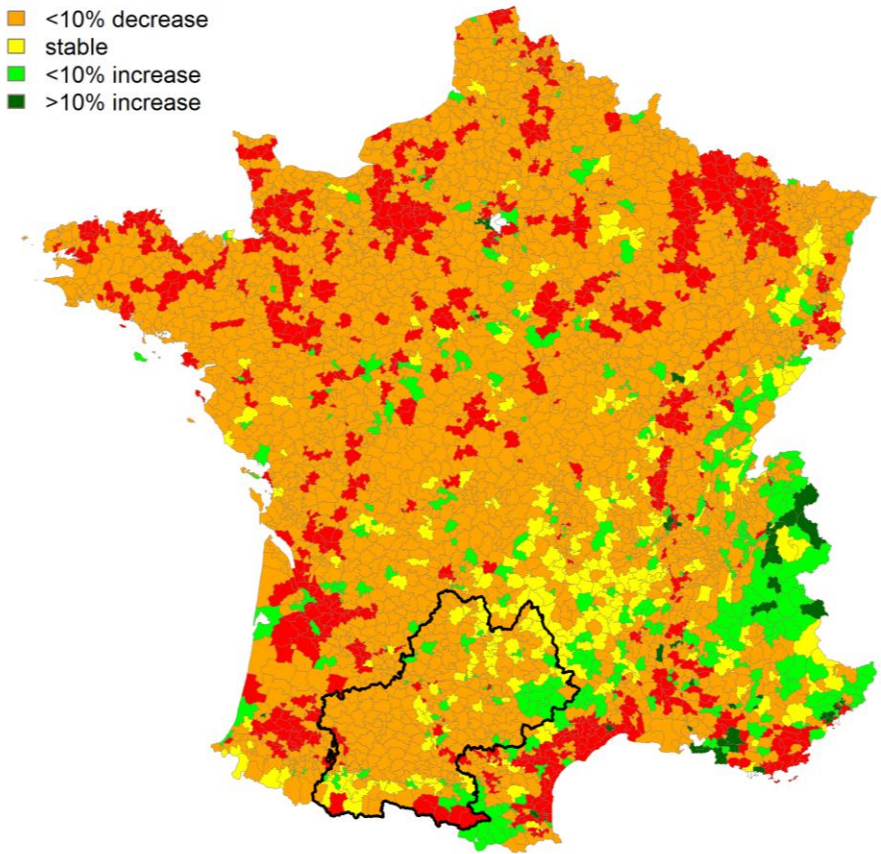
FNVI mapping

- [1,4.96)
- [4.96,5.9)
- [5.9,7.41)
- [7.41,9.46)
- [9.46,17.56]



In 2007

- >10% decrease
- <10% decrease
- stable
- <10% increase
- >10% increase



Percentage change over 2007-2010

<i>evol_fnvi</i>	Min.	Mean	Max.	Std. Dev	Moran's I
France	0.093	0.936	2.576	0.091	0.217***
Midi-Pyrénées	0.610	0.963	1.108	0.050	0.210***

FARM LABOUR

- ❖ In EU-25, farming activity represents a total of 7,975,700 AWU, drastically decreasing: ↘ 15.3% over the period 2005-2013 (Eurostat, 2013)
- ❖ Similar trend observed in France: 775,700 AWU in 2013, ↘ 14.6%. Although paid labour force shows an increasing trend, it fails compensating the decline in total labour.
 - **These trends reflect the evolution of farm labour productivity**
- ❖ Common Agricultural Policy (CAP) is the most important EU policy. Although increasing farm labour is not among its primary objective, investigating the indirect effects on farm labour demand is of relevance in a **context of increase in unemployment**
- ❖ Among CAP instruments, it is assumed that Rural Development Measures (RDM) may mitigate this general trend: evidence from farm level investigations ... with potential selection bias since exiting farms are not observed.
 - Investments subsidies may ↘ labour demands by substituting it by capital, but may ↗ production and the derived labour demands
 - Subsidies for farm diversification and agroenvironment increase the scope of farm outputs and are expected to ↗ labour demands
 - Agroenvironmental subsidies may ↗ labour demands by compensating for additional costs generated by new activities, or ↘ labour demand by compensating profit losses of extensive practice adoption.

Farm labour & farm size indicators

- ❖ Period: 2006-2011 (RDP2)
- ❖ Individual data aggregated at LAU1 level (formerly NUTS4); $N=3,699$
- ❖ The spatial weight matrix we used considers the immediate neighbours of each observation (LAU1): Spatial Contiguity matrix, row standardised
- ❖ **Dependent variables**

- **Evolution of labour on farm (in AWU) over the period**

[farmer, family members working on farm, and hired labour]

$$\text{evol.labour} = \frac{AWU_{\text{endperiod}} - AWU_{\text{beginningperiod}}}{AWU_{\text{beginningperiod}}}$$

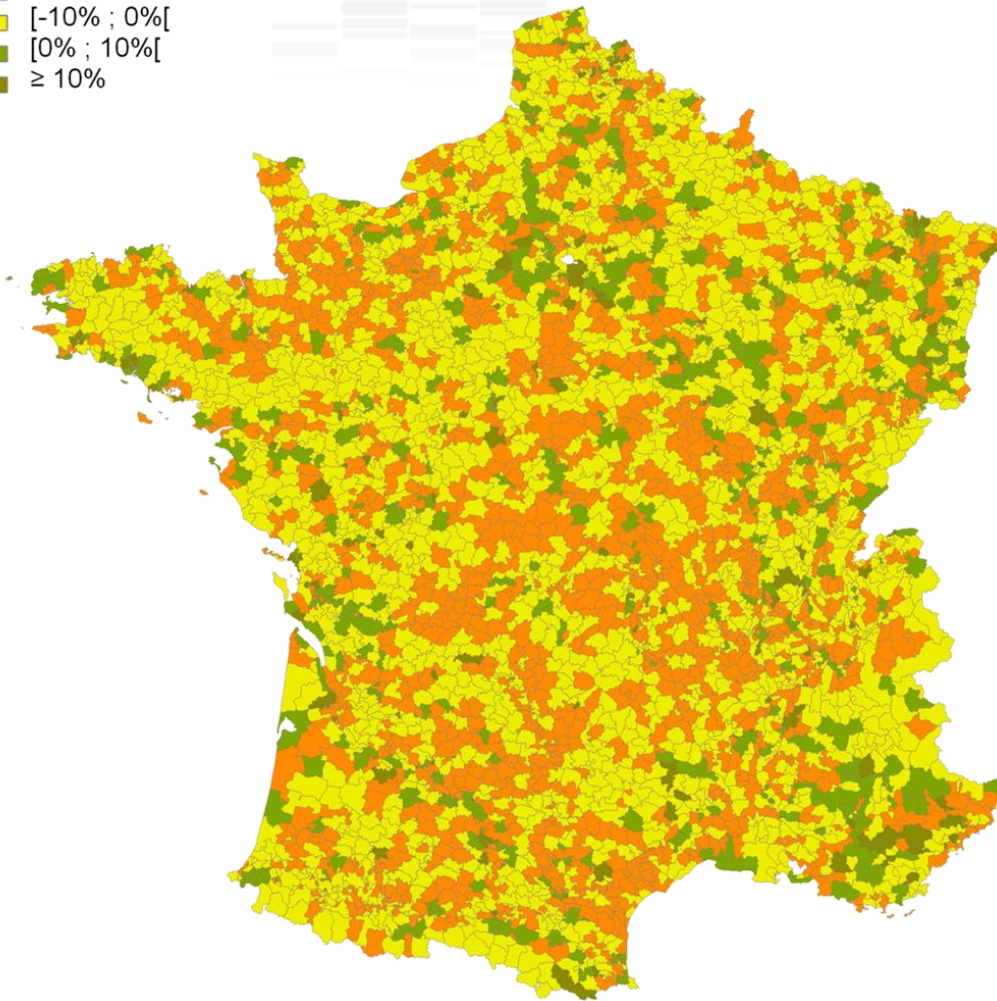
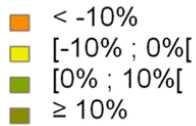
Variable	Min.	Mean	Max.	Std. Dev
evol.labour	-0.708	-0.073	1.390	0.109
evol.farmsize	0.066	1.052	3.248	0.158

- **Evolution of average farm size (in ha) over the period**

[Investigating the determinants of this impact indicator can bring additional insights in the evaluation of the effect of predicted measure uptakes on labour change]

$$\text{evol.farmsize} = \frac{Ha_{\text{endperiod}}}{Ha_{\text{beginningperiod}}}$$

FARM LABOUR CHANGES



- ❖ Variations in the farm labour changes are observed at disaggregated level from high decrease (red) to moderate increase (green)
- ❖ Using spatial data to investigate the effect of RDM on farm labour demand
 - can account for the geographical heterogeneity of RDM,
 - Since RDM are usually designed at NUTS2 and NUTS3 regional levels

Farm labour evolution in France 2006-2010 (data source: Mutualité Sociale Agricole; data processing by authors)

ESTIMATION STRATEGY

Accounting for Rural Development measures specificities

Considering the effect of RDP2 measures on FNVI or labour, contracted on a voluntary basis, an endogeneity problem is suspected

↳ To remove every potential endogeneity bias, the **predicted** uptakes of RDP2 measures are used **rather than observed** uptake indicators

- ❖ The first step: Modelling the probability of a positive uptake for each RDP2 measure
 - Spatial Probit (ie considering a spatial spill-over effect)

- ❖ The second step: Explaining the impact of the measures
 - Spatial regressions (specifications upon relevant tests)
 - Predicted uptake probabilities are retrieved from the 1st step spatial Probits and included as explanatory variables

First step example: PROBIT regarding M214I

(targeted measures aiming at protecting/restoring water quality and and/or biodiversity)

(Intercept)		0,046
sth_sau_2000		0,418***
log_mo06		0,291***
SUPMOYexpl06		-0,002*
MONO	Ref	
BIOR06		-0,359***
TRIOR06		-0,336**
AGE_MOY06		-0,038**
ASB06_RNET		-4,123***
log_denspop06p1		-0,071*
log_montanttop1		0,103***
EXOJA1		0,27***
OTE23		-0,573***
OTE43		-0,18**
OTE4ab		-0,619***
OTE6	Ref	
pct_ste06		1,412**
pct_comp06		0,579**
logpartetpsal		-0,324***
pct_TravCuma		-0,386*
IY_per_crops_2007		0,009**
zauer456		-0,182***
Zvul		0,131**
part_natura2000		1,776***
indic_ctecad		0,271*
rho		0,669***
BPT		0,72
BP1		0,746
N		3685
AUC		0,79

At the LAU1 level, the uptake of targeted measures aiming at protecting/restoring water quality and and/or biodiversity is

❖ positively related to:

- the share of grassland within the UAA in 2000;
- the labour present on the farm at the beginning of the period;
- the direct payments received for cattle;
- to the presence of new young farmers exempted from social security taxes;
- the share of partnership or company farms;
- the presence of a nitrate vulnerable zone;
- the presence of Natura 2000 areas;
- the presence of RDP contracts under the previous programming period.

❖ negatively related to:

- the average area of farms at the beginning of the period;
- the field-crop (bi- or tri-)orientation of the LAU1 at the beginning of the period;
- the farmers' age at the beginning of the period;
- the share of agricultural incomes within household incomes at the beginning of the period;
- the population density at the beginning of the period.

DATA of the second step

- ❖ Individual data aggregated at LAU1 level (formerly NUTS4); $N=3,699$
- ❖ The spatial weight matrix: Spatial Contiguity matrix, row standardised
- ❖ **Dependent variables:** 2007-2010 Change in FNVI (*evol_fnvi*) and FNVI components (*evol_cdi*, *evol_gi*, *evol_fi*), 2006-2011 change in farm labour and 2007-2010 change in farm size.

- ❖ **Independent variables:**

Context-specific:

- Share of grassland within the UAA in 2000 (*sh_grassl_2000*)
- Total labour (in Annual Working Units) on farm in 2006 (*log_lab06*)
- Average of rainfall over the period 2004-2006 (*rainf_2004_2006*)

Policy variables:

- 'mechanisation' payments (*d_mecha_rdp1*)
- 'CTE/CAD payments' (*d_aes_rdp1*)
- 'AES crop diversification' payments (*d_aesDiv_rdp1*)
- 'Setting up of young farmers' payments (*d_youngF_rdp1*)
- 'Afforestation' payments (*d_afforest_rdp1*)
- 'Training' payments (*d_train_rdp1*)
- 'Less Favoured Area' payments (*d_LFA_rdp1*)
- 'Processing and marketing' payments (*d_markproc_rdp1*)
- 'Early retirement' payments (*d_retir_rdp1*)

Previous RDP
ie RDP1
(2000-2006)
Dummy variables

DATA (cont'd)

❖ Independent variables (cont'd):

- Policy variables:
- 'farm modernisation' (Measure 121) (PredS_121_benef)
 - 'grassland premium' (Measure 214A) (PredS_214a_area)
 - 'conversion to organic farming' (Measure 214D) (PredS_214d_area)
 - local targeted agri-environmental schemes (AESs) for water or biodiversity protection (Measure 214I) (PredS_214i_area)
 - 'diversification into non-agricultural activities' and/or 'encouragement of tourism activities' measures (Measures 311 and 313, RDP2) (PredS_axis3_benef)

RDP2 (ie 2007-2013)

Predicted probability retrieved from the spatial probit explaining the uptake

Table 1: Spearman correlation analyses between uptakes of AESs and the indices (and FNVI) in terms of both absolute values at the beginning of the period and changes over the period

FRANCE				
		<i>indic_214a_area</i>	<i>indic_214d_area</i>	<i>indic_214i_area</i>
Crop diversity index CDI	2007	-0.43***	-0.11***	0.04**
	Change 2007-2010	0.20***	0.07***	-0.05***
Grassland index GI	2007	0.71***	0.07***	0.15***
	Change 2007-2010	0.04***	-0.04***	0.00
Forest index FI	2007	-0.05***	0.16***	0.03*
	Change 2007-2010	0.07***	-0.02	0.03*
Farm nature value indicator FNVI	2007	0.65***	0.047***	0.17***
	Change 2007-2010	0.38***	0.00	0.02
MIDI-PYRÉNÉES				
Crop diversity index CDI	2007	-0.54***	0.20***	-0.09
	Change 2007-2010	0.16***	0.05	0.17
Grassland index GI	2007	0.79***	-0.07	0.22***
	Change 2007-2010	0.11**	-0.06	-0.01
Forest index FI	2007	-0.07	0.05	0.12**
	Change 2007-2010	0.13**	-0.08	-0.02
Farm nature value indicator FNVI	2007	0.75***	-0.03	0.22***
	Change 2007-2010	0.34***	-0.01	0.03

Significance levels: “” = 0.1; “**” = 0.05; “***” = 0.01*

Table 1: Moran's I statistics of the indices and composite indicator

	FRANCE	MIDI-PYRÉNÉES
Change in crop diversity index (<i>evol_cdi</i>)	0.247***	0.107***
Change in grassland index (<i>evol_gi</i>)	0.794***	0.112***
Change in forest index (<i>evol_fi</i>)	0.170***	0.135***
Change in farm nature value indicator (<i>evol_fnvi</i>)	0.217***	0.210***

Significance levels: “***” = 0.01

Formally a spatial lag model is expressed as $y = \rho Wy + X\beta + \varepsilon$, where y is a vector of observations of the dependent variable, Wy a spatially lagged dependent variable with a weights matrix W , X a matrix of observations of the independent variables, ε a vector of independent and identically distributed (iid) error terms, β a matrix of parameters to estimate, and ρ a spatial autoregressive coefficient to estimate.

¹ Formally a spatial error model is expressed as $y = X\beta + \varepsilon$, with $\varepsilon = \lambda W\varepsilon + u$, where ε is a vector of spatially autocorrelated error terms, u a vector of iid error terms, and λ a spatial autoregressive coefficient to estimate, reflecting the interdependence between the regression residuals.

¹ Formally a SAC model is expressed as a combination of spatial lag and spatial error models:

$$y = \rho Wy + X\beta + u, \text{ with } u = \lambda Wu + \varepsilon$$

Table 1: Diagnosis on model specifications

		FRANCE	MIDI-PYRÉNÉES
<i>evol_cdi</i>	Moran's I test	0.146***	0.021
	LM error	220.14***	0.37
	Robust LM error	24.89***	2.05
	LM lag	206.08***	1.07
	Robust LM lag	10.83***	2.75*
<i>evol_gi</i>	Moran's I test	0.061***	0.058**
	LM error	37.95***	2.84*
	Robust LM error	3.68*	0.00
	LM lag	43.70***	3.06*
	Robust LM lag	9.43***	0.22
<i>evol_fi</i>	Moran's I test	0.144***	0.063***
	LM error	215.07***	3.42*
	Robust LM error	6.78***	3.23*
	LM lag	230.67***	4.53**
	Robust LM lag	22.38***	4.33**
<i>evol_fnvi</i>	Moran's I test	0.113***	0.056**
	LM error	132.99***	2.70
	Robust LM error	17.75***	2.34
	LM lag	121.22***	4.86**
	Robust LM lag	5.97**	4.50**

Significance levels: "*" = 0.1; "**" = 0.05; "***" = 0.01

Spatial specifications

Based on Moran's I tests and Lagrange Multiplier (LM) Tests

		FRANCE	MIDI-PYRÉNÉES
<i>evol_cdi</i>	Moran's I test	0.146***	0.021
	Model chosen based on LM Tests	simultaneous autoregressive (SAC) model	OLS
<i>evol_gi</i>	Moran's I test	0.061***	0.058**
	Model chosen based on LM Tests	simultaneous autoregressive (SAC) model	Spatial lag (SAR) model
<i>evol_fi</i>	Moran's I test	0.144***	0.063***
	Model chosen based on LM Tests	simultaneous autoregressive (SAC) model	Spatial lag (SAR) model
<i>evol_fnvi</i>	Moran's I test	0.113***	0.056**
	Model chosen based on LM Tests	simultaneous autoregressive (SAC) model	Spatial lag (SAR) model

RESULTS

Overview, total impacts

	Dependent variables: evolution of the FNVI and related indices (CDI, GI, FI)			
	evol_fnvi	evol_cdi	evol_gi	evol_fi
Intercept	0.9907***	1.1031***	0.5544***	0.8757***
sh_grassl_2000	0.0733***	0.0444***	0.0579	0.5872*
log_lab06	0.0055*	0.0032	0.0101	-0.1783
rainf_2004_2006	0.0000*	0.0000	0.0000	0.0005
d_mecha_rdp1	0.0191***	0.0134**	0.0904**	0.4559**
d_aes_rdp1	0.0200**	0.0208**	-0.0097	-1.0328**
d_aesDiv_rdp1	-0.0011	-0.0173***	0.0715**	0.1558
d_youngF_rdp1	0.0134	0.0021	0.0350	-0.5426
d_afforest_rdp1	-0.0055	-0.0004	-0.0414	-0.1112
d_train_rdp1	-0.0026	-0.0074*	0.1204**	0.2083
d_LFA_rdp1	0.0176***	0.0208***	0.0123	-0.3236*
d_markproc_rdp1	-0.0001	-0.0031	0.0520	0.0108
d_retir_rdp1	0.0004	-0.0025	0.0472	-0.3392*
PredS_121_benef	-0.0495***	-0.0167	-0.2415**	-1.0976*
PredS_214a_area	0.0044	-0.0237***	-0.1721***	0.0634
PredS_214d_area	-0.0574***	-0.0071	0.1115	0.4508
PredS_214i_area	0.0244***	-0.0257***	-0.1336**	0.3373
PredS_axis3_benef	0.0093	0.0526***	-0.0500	0.3853
N	3685	3683	3659	3678
rho (ρ)	-0.08**	-0.19***	0.56**	0.77***
lambda (λ)	0.35***	0.51***	-0.52***	-0.79***

✓ Positive delayed effects of RDP1 measures on *evol_fnvi*

✓ Cumulative effects (predicted uptakes):

- Farm modernisation (121) <0
- Grassland (214A) < 0 on *evol_cdi* and *evol_gi*, but not significant on *evol_fnvi*
- Conversion to organic (214D) <0 on *evol_fnvi*, but not significant on evolution of indices
- Local AESs (214I) >0 on *evol_fnvi*, but <0 on *evol_cdi* and *evol_gi*

RESULTS (Cont'd)

Focus on grassland index (GI) – Total impacts (1/3)

	France				MIDI-PYRÉNÉES			
	<i>evol_fnvi</i>		<i>evol_gi</i>		<i>evol_fnvi</i>		<i>evol_gi</i>	
	SAC model		SAC model		SAR model		SAR model	
	Coefficients	Total impacts	Coefficients	Total impacts	Coefficients	Total impacts	Coefficients	Total impacts
Intercept	0.9907***	-	0.5544***	-				
sh_grassl_2000	0.0794***	0.0733***	0.0256	0.0579				
log_lab06	0.0059*	0.0055*	0.0044	0.0101				
rainf_2004_2006	0.0000*	0.0000*	0.0000	0.0000				
d_mecha_rdp1	0.0207***	0.0191***	0.0399**	0.0904**				
d_aes_rdp1	0.0217**	0.0200**	-0.0043	-0.0097				
d_aesDiv_rdp1	-0.0012	-0.0011	0.0315**	0.0715**				
d_youngF_rdp1	0.0145	0.0134	0.0155	0.0350				
d_afforest_rdp1	-0.0059	-0.0055	-0.0183	-0.0414				
d_train_rdp1	-0.0029	-0.0026	0.0531**	0.1204**				
d_LFA_rdp1	0.0190***	0.0176***	0.0054	0.0123				
d_markproc_rdp1	-0.0001	-0.0001	0.0230	0.0520	-0.0034	-0.0007	-0.0030	-0.0794
d_retir_rdp1	0.0004	0.0004	0.0208	0.0472	0.0045	0.0057	-0.1799**	-0.2199**
PredS_121_benef	-0.0536***	-0.0495***	-0.1065**	-0.2415**	0.0179	0.0225	-0.4086	-0.4994
PredS_214a_area	0.0048	0.0044	-0.0759***	-0.1721***	-0.0299**	-0.0376**	-0.5026***	-0.6142***
PredS_214d_area	-0.0622***	-0.0574***	0.0492	0.1115	0.0290**	0.0365**	0.0289	0.0353
PredS_214i_area	0.0264***	0.0244***	-0.0589**	-0.1336**	0.0110	0.0138	-0.0900	-0.1100
PredS_axis3_benef	0.0100	0.0093	-0.0221	-0.0500	-0.0118	-0.0148	0.2609	0.3188
N	3685		3659		327		325	
rho (ρ)	-0.08**		0.56**		0.20**		0.18*	
lambda (λ)	0.35***		-0.52***					

Spatial effects strengthen (eg on *evol_gi*) or diminish (eg on *evol_fnvi*) the effect of an explanatory variable

=> confirms that it is important to consider the spatial dimension

RESULTS (Cont'd)

Focus on grassland index (GI) – Total impacts (2/3)

	France				MIDI-PYRÉNÉES			
	<i>evol_fnvi</i>		<i>evol_gi</i>		<i>evol_fnvi</i>		<i>evol_gi</i>	
	SAC model		SAC model		SAR model		SAR model	
	Coefficients	Total impacts	Coefficients	Total impacts	Coefficients	Total impacts	Coefficients	Total impacts
Intercept	0.9907***	-	0.5544***	-				
sh_grassl_2000	0.0794***	0.0733***	0.0256	0.0579				
log_lab06	0.0059*	0.0055*	0.0044	0.0101				
rainf_2004_2006	0.0000*	0.0000*	0.0000	0.0000				
d_mecha_rdp1	0.0207***	0.0191***	0.0399**	0.0904**				
d_aes_rdp1	0.0217**	0.0200**	-0.0043	-0.0097				
d_aesDiv_rdp1	-0.0012	-0.0011	0.0315**	0.0715**				
d_youngF_rdp1	0.0145	0.0134	0.0155	0.0350				
d_afforest_rdp1	-0.0059	-0.0055	-0.0183	-0.0414				
d_train_rdp1	-0.0029	-0.0026	0.0531**	0.1204**				
d_LFA_rdp1	0.0190***	0.0176***	0.0054	0.0123				
d_markproc_rdp1	-0.0001	-0.0001	0.0230	0.0520				
d_retir_rdp1	0.0004	0.0004	0.0208	0.0472				
PredS_121_benef	-0.0536***	-0.0495***	-0.1065**	-0.2415**				
PredS_214a_area	0.0048	0.0044	-0.0759***	-0.1721***				
PredS_214d_area	-0.0622***	-0.0574***	0.0492	0.1115				
PredS_214i_area	0.0264***	0.0244***	-0.0589**	-0.1336**				
PredS_axis3_benef	0.0100	0.0093	-0.0221	-0.0500				
N	3685		3659					
rho (ρ)	-0.08**		0.56**					
lambda (λ)	0.35***		-0.52***					

➤ The strongest effect on *evol_gi* is, as expected, from Grassland (214A)

➤ But unexpectedly, the effect is negative on *evol_gi*
 => goes against the objective of the Grassland measure
 => permanent vs. temporary pasture?

➤ Differentiated effect on total index evolution (*evol_fnvi*) and grassland index evolution (*evol_gi*)
 => the various measures have conflicting consequences on farmers' decisions

RESULTS (Cont'd)

Focus on grassland index (GI) – Total impacts (3/3)

	France				MIDI-PYRÉNÉES			
	<i>evol_fnvi</i>		<i>evol_gi</i>		<i>evol_fnvi</i>		<i>evol_gi</i>	
	SAC model		SAC model		SAR model		SAR model	
	Coefficients	Total impacts	Coefficients	Total impacts	Coefficients	Total impacts	Coefficients	Total impacts
Intercept								
sh_grassl_2000								
log_lab06								
rainf_2004_2006								
d_mecha_rdp1								
d_aes_rdp1								
d_aesDiv_rdp1								
d_youngF_rdp1								
d_afforest_rdp1								
d_train_rdp1								
d_LFA_rdp1								
d_markproc_rdp1								
d_retir_rdp1	0.0004	0.0004	0.0208	0.0472	0.0043	0.0037	-0.1733	-0.2133
PredS_121_benef	-0.0536***	-0.0495***	-0.1065**	-0.2415**	0.0179	0.0225	-0.4086	-0.4994
PredS_214a_area	0.0048	0.0044	-0.0759***	-0.1721***	-0.0299**	-0.0376**	-0.5026***	-0.6142***
PredS_214d_area	-0.0622***	-0.0574***	0.0492	0.1115	0.0290**	0.0365**	0.0289	0.0353
PredS_214i_area	0.0264***	0.0244***	-0.0589**	-0.1336**	0.0110	0.0138	-0.0900	-0.1100
PredS_axis3_benef	0.0100	0.0093	-0.0221	-0.0500	-0.0118	-0.0148	0.2609	0.3188
N	3685		3659		327		325	
rho (ρ)	-0.08**		0.56**		0.20**		0.18*	
lambda (λ)	0.35***		-0.52***					

➤ Conversion to organic farming (214D) has no effect on *evol_gi* (and no effect on the other two sub-indices' evolution)

➤ But has a negative effect on total index evolution *evol_fnvi* at the France level => policy effects on FNVI-change depend on the combinations of policy effects on FNVI-components

➤ Has a positive effect on total index evolution *evol_fnvi* at Midi-Pyrénées level => discrepancy with France's results show that the scale of analysis is important

-0.0622* -0.0574*** 0.0492 0.1115 0.0290** 0.0365** 0.0289 0.0353**

RESULTS on Farm labour

spatial lag regression

	evol.labour	evol.farmsize
(Intercept)	-0.124***	0.707***
sh_grassl.2000	-0.008	0.013*
log_lab.2006	-0.001	0.002
invest.rdp1	0.009	-0.003
young_farmer.rdp1	0.041***	-0.026***
training.rdp1	0.017***	0.001
early_retir.rdp1	-0.017***	-0.002
LFA.rdp1	-0.004	-0.002
afforestation.rdp1	-0.001	0.004
agric_orientation.rdp1	0.003	-0.002
aes_cropdiv.rdp1	0.006	-0.005
aes_other.rdp1	0.026**	0.018**
Pred_Modern.benef	-0.006	-0.012
Pred_ExtGrassland.area	-0.007	-0.006
Pred_ConvOrganic.area	-0.013	0.002
Pred_WatBiodiv.area	0.033***	0.000
Pred_DivTour.benef	0.001	-0.006
AIC	-5793	-9069
N	3685	3676
ρ	0.124***	0.022

- ✓ Considering spatial lag is relevant
- ✓ Change in farm labour depends on several measures from the previous RDP1 (delayed effects)
- ✓ Opposite effects of setting-up of young farmers and early retirement schemes: settlement aid increased the labour and decreased enlargement possibilities. This is confirmed by the negative effect of the settlement aid on the evolution of farm size.
- ✓ From the current RDP2, the only measures having an impact on change in labour are those related to the protection/restoration of water quality and/or biodiversity (targeted measures)
- ✓ Other current RDP2 measures have no significant effect on the change in labour demand

RESULTS (Cont'd)

Effect of RDP1 measures

- ❖ The aid to promote the setting-up of young farmers, the training scheme, the AES combining investment and agroenvironmental payments have a positive effect , while the early retirement scheme has a negative effect on farm labour.
 - All these measures present an investment component that may explain the observed delayed effects, by creating the conditions (increase the production and the production scope) to slow the decrease in on-farm labour demand.
 - The exit of farmers (and related on-farm labour) through the early retirement scheme has been too fast to be balanced over the period by the setting-up of as many young farmers. Indeed, the early retirement scheme can therefore be seen as an incentive to increase the acreage per farm worker.

RESULTS (Cont'd)

Effect of RDP2 measures

- ❖ Only M214I (targeted measures aiming at protecting/restoring water quality and and/or biodiversity) have a significant positive impact on farm labour
 - “Additional costs” effect dominates “forgone profit” effect
- ❖ Other RDP2 measures have no significant effect
 - M121 (modernisation/investment) do not increase labour substitution by physical assets. Undertaken investments may be implemented to comply with the environmental regulation, with negligible production/productivity side-effects
 - Results for M214A (extensive grassland), M214D (conversion to organic) and Axis3 (tourism and diversification activities) are surprising. An increase in farm labour would have been expected. But that result may hide a delayed effect (as labour usually adjusts with delay) that can not be captured due to data limitation
- ❖ Cross measure effects
 - M214I discourages the uptake of M214D and Axis3 measures.
 - Asymmetrically, M214D and Axis3 measures encourage the uptake of M214I
 - M214D and Axis3 measures may affect labour demand when associated with M214I

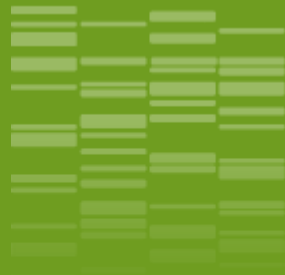
CONCLUSION

- ❖ From a methodological point of view, impacts of policy measures on FNVI-change
 - may be underestimated if spatial effects are not accounted for
 - may differ according to the scale of analysis (France vs. Midi-Pyrénées), which defines the implicit reference of changes in FNVI over time
 - may differ according to the index considered: a negative effect on FNVI-change may be observed while no significant effect is observed on the change of the FNVI-components
- ❖ Results show that RDP2 measures generally do not improve farm nature value
 - This may result from conflicting consequences of various measures on farmers' adaptation strategies (eg beneficiaries of grassland measure may convert their arable land into temporary pasture, thus decreasing their crop diversity index)
- ❖ More importantly, our results show that RDP1 have delayed effects => the effects observed for RDP2 measures in our analyses may be underestimated, since there may also be effects that will be observed in future years

- ❖ **No RDP2 measures negatively affect on-farm labour in France over the period studied. This is in line with previous study stating that the decrease in farm labour in France is mainly due to other drivers, including CAP Pillar I payments**

Dupraz, P., Latruffe, L. (2015). . Trends in family labour, hired labour and contract work on French field crop farms: The role of the Common Agricultural Policy. Food Policy, 51, 104-118.

- ❖ **Change in farm labour during the period positively influenced by RDP2 measures aiming at protecting/restoring water quality and and/or biodiversity**
- ❖ **The absence of impact of M214D (conversion to organic farming) is unexpected as organic farming usually requires higher labour force. One reason could be that farms that chose to convert during the period are those with already a higher availability of labour force**
- ❖ **Significant effects of RDP1 measures are observed, suggesting that RDP measures do have an effect on farm labour demand, but with some delays. These potential delayed effects of a policy on farm indicators are therefore to be considered while conducting policy evaluation**
- ❖ **A similar analysis has been applied at a lower scale (NUTS2 region), and no spatial lag effect was observed. Therefore, the scale onto which the methodology is to be applied does matter, and is to be carefully considered while conducting policy evaluation**
- ❖ **Nevertheless, these findings should be confirmed by applying the methodology over the overall period (2007-2013) and not only 2007-2011**



Thank you for your attention

Spatial Tobit on the positive values M214I

(targeted measures aiming at protecting/restoring water quality and and/or biodiversity)

Intercept	-1,526 ***
sth_sau_2000	0,619 ***
log_mo06	-0,174 ***
indic_meca	-0,217 **
indic_ctecad	0,471 *
indic_maerot	-0,032
indic_dja	0,244
indic_foret	0,011
indic_forma	-0,082
indic_ichn	-0,08
indic_poa	-0,054
indic_preret	-0,176 ***
PREDS_121_benef	-0,364
PREDS_214a_area	-0,268 **
PREDS_214d_area	0,709 ***
PREDS_214i_area	
PREDS_axis3_benef	0,636 ***
IMRSTEP1SPAT	-0,023
AIC	6647
N	2170
rho	0,446 ***

Predictive power of 214a_area is significant (negatively)
Predictive power of 214d_area is significant (positively)

Effects on M214i (area):

Context indicators

Share of permanent grassland within the UAA in 2000 (>0)

Employment in 2006 (<0)

RDP1 indicators:

Indic_meca (<0)

Indic_preret (<0)

Indic_ctecad (>0)

Uptake predictors:

214a (<0)

214d (>0)

Axis 3 (>0)