

Spillover effect of on-farm diversification

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Overview

- Introduction & objective
- Study area & data
- Modeling approach
- Results and conclusions



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Introduction : transition in European rural areas

■ New societal demand for rural area

- Multifunctional agriculture
- Farm diversification

■ CAP beyond 2013

- Fully decoupled payments
- More focused on rural development & land management



=> Better understanding of dynamics of rural service supply



Objective

Test if spill-over effect in farm diversification exist

Hypothesis : diversified farms cluster

- Cost of diversification reduces in a diversified neighborhood (external returns to scale)
- Easy knowledge transfer (reducing transaction cost)

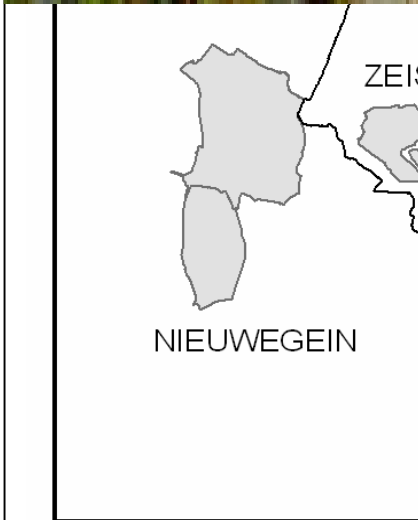
=> Probability to diversify is higher in a diversified neighborhood



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Data available

- Geographical Information System for Agricultural Businesses (GIAB)
- Full coverage data set for 2005
 - Farm production and household characteristics
 - Diversification (binary variable)
 - Agri-environmental schemes
 - Recreational activities
 - Short supply chains
 - Care farms
 - ...
 - Coordinates at the farmstead



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Theoretical result from a farm household utility maximization problem

$$q_d = g_d(p_f, p_d, R_d, R_o, w_o, h, t, v, Z_F, Z_H, S)$$

$$\frac{\partial q_d}{\partial p_d} > 0 \quad \frac{\partial q_d}{\partial R_d} < 0 \quad \frac{\partial q_d}{\partial h} > 0$$

f=food, d=diversification, o=others (non allocable)
p=output price, R=input price, w_o=off-farm wage,
h=neighborhood, t=time, v=transfers, Z_f=farm-,
Z_h=household-, S=location- characteristics

But data available = binary for diversification



Econometric model : a spatial probit

- Binary variable

$$y_i \begin{cases} 1 \text{ if } y_i^* \geq 0 \\ 0 \text{ if } y_i^* < 0 \end{cases}$$

Latent model

$$y^* = \rho W y^* + X\beta + \varepsilon$$

$$W = \begin{matrix} a & \begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix} \\ & \begin{matrix} a & b & c & d \end{matrix} \end{matrix}$$

- The reduced form

$$y^* = [I - \rho W]^{-1} X\beta + u$$



Bayesian Markov Chain Monte Carlo (MCMC)

methods

■ Based on :

- believes (prior)
- joint distribution(s) of parameters to estimate
- random draws from the distributions=> statistics over the sample

■ If interdependent joint distribution

- “frog technique” (Gibbs-sampler)

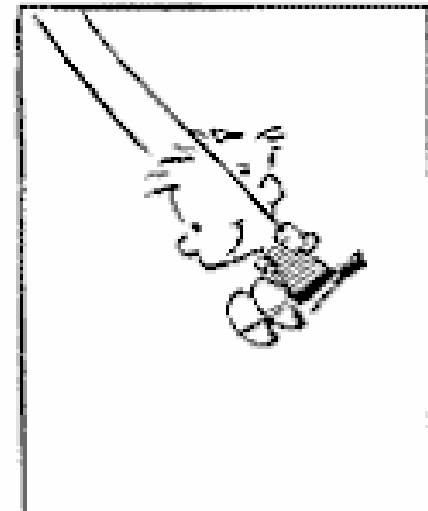
■ For spatial probit

- Routine by LeSage (Matlab spatial toolbox)
- “Double Gibbs-sampler”
- Non-informative prior, normal distribution for β and uniform for ρ



Estimated models

- Weighting matrix
 - M0 no
 - M1 5 nearest neighbors
 - M2 15 nearest neighbors
 - M3 2 km distance ban
 - M4 5 km distance ban



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Results

Model	Without W (M0)	2 km ban (M3)
average age	0.0149	0.0353
age sq	-0.0002	-0.0004
education	0.0341	0.0466
social network	1.6947	2.0964
size	0.0113	0.0131
size squared	-0.00001	-0.00002
organic	0.5104	0.6701
ground water	0.0138	0.0393
dist to road	-0.0618	-0.0878
dist to city	0.0108	0.0082
dist to attractive areas	-0.0392	-0.0210
ρ		0.4740
R-squared	0.1561	0.5539



Model comparison

	M 0	M1	M2	M3	M4
ρ		0.1508	0.3558	0.4740	0.5621
ρ / β_{size}	0	10.69	26.55	36.18	42.26
McFadden R-squared	0.1561	0.5410	0.5461	0.5539	0.5658
Quadratic probability score		0.1066	0.1061	0.1056	0.1056
Logarithmic probability score		0.3573	0.3554	0.3531	0.3528

- Bayesian model comparison is not yet possible



Discussion and conclusion

- Diversified farms cluster (hotspot)
 - Near to attractive landscape, further away from cities
 - Wet (low quality) soils
- Extend of spill-over effects is at least 5 km
- No analysis of “nature of the spill-over”
- Addressing the “cold spot” ?
 - Role of local demand



Bayesian specification

- Prior : β = normal, ρ = uniform prior : independent

$$p(\beta | \rho, y^*) \propto N(c^*, T^*) \quad \begin{aligned} c^* &= (X'X + T^{-1})(XSy^* + T^{-1}c) \\ T^* &= (X'X + T^{-1})^{-1}S = (I_n - \rho W) \end{aligned}$$

$$p(\rho | \beta, y^*) \propto |I_n - \rho W| \exp\left(\frac{1}{2} [Sy^* - X\beta]' [Sy^* - X\beta]\right)$$

$$y^* \sim TMVN\{(I_n - \rho W)^{-1} X\beta, [(I_n - \rho W)'(I_n - \rho W)]^{-1}\}$$

(LeSage and Pace, 2009)

Gibbs-sampler

1. select initial values for ρ , and y^* , a number of replications and a number of burn-in replications
2. draw β from its conditional distribution given initial values (step 1)
3. draw ρ from given the initial value (step 1) and β computed in step 2
4. draw y^* by :
 - Applying the Geweke procedure for identifying the truncated distribution of y^*
 - Drawing y^* from given β computed in step 1 and ρ computed in step 3 from the distribution identified in step 4a.



Marginal effects for model M3

Marginal effects	direct	indirect	total
average age	0.03472	0.0002	0.0578
average age square	-0.0004	-0.00024	-0.0007
maximum education	0.05066	0.0028	0.0787
social network	2.1658 [0.6798]*	1.1884	3.3542
size	0.0136	0.0075	0.0211
size squared	-0.000016	-0.000009	-0.00002
organic	0.6571 [0.2431]*	0.361	1.1020
ground water level	-	-	0.0491
distance to road	-	-	-0.1457
distance to city	-	-	0.0161
distance to attractive landscapes	-	-	-0.04812

$$pr[y|x_i = 0, \bar{X}, \bar{W}y] - pr[y|x_i = 1, \bar{X}, \bar{W}y]$$