



Spatial diffusion of Organic Farming

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► To cite this version:

Ghislain Geniaux. Spatial diffusion of Organic Farming. Impact of the location of agricultural production on ecosystem services, Nov 2015, Dijon, France. 16 p. hal-01606145

HAL Id: hal-01606145

<https://hal.science/hal-01606145>

Submitted on 5 Jun 2020

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Spatial diffusion of OF

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Statistical model of OF switching : motives and determinants

- Determinant of OF choice at farm level are extensively studied, qualitatively and quantitatively.
- I propose to start the discussion at the conclusion of a recent literature survey on this issue : Geniaux et al. 2010 « *Les déterminants de la conversion à l'agriculture biologique : une revue de la littérature économique* », livrable AgriBio3

Motives and Determinants

- Motives (Padel 2001)
 - Agronomic, agro-ecologic challenge,
 - Ethical, religious and societal choices,
 - Pollution and environmental issues,
 - Health issues,
 - Profit/rentability (Geniaux, Mzoughi, Napoleone, 2014)
- Classification of observable determinants of choices
 - Farmer characteristics
 - Farm characteristics
 - External (neighbouring, market, policy)

Modelisation of OF switching

- Qualitative analysis of small sample
see Bellon et Lamine 2010 for a review
- Econometric models at farm scale :
 - Dependant variable :
 - binary (OF/CF) → logit/probit Lohr and Salomonson 2000, Pietola and Oude Lansink 2001, Genius et al., 2006, Sauer and Park 2009
 - multinomial (several levels of engagement in OF, alternatives label, AC) → logit/probit Anderson et al 2005, Burton et al 2003, Koesling et al 2008
 - Share of OF → Tobit Khaledi et al. 2010
 - Number of Year in CF before switching → duration model Lapple and Donnellan 2009, Kallas et al. 2010

Explanatory Variables

- Farmer characteristics
 - Age –
 - Education +
 - Farming experience +/-
 - Risk aversion --/+
 - Environmental/ethical motives* +
 - Other sources of earning/work +/-

Explanatory Variables

- Farms characteristics
 - Size +/-
 - Production type (wine +, green garden +, cereal -, ...)
 - Specialisation level – except wine sector
 - Juridic statute* (collective forms +)
 - technical efficiency +/-
 - short supply* chains +

Explanatory Variables

- Factors external to the farm
 - Neighbouring context (population, agronomic, soil, climat) +/-
 - Transformers and supply chains +
- Policy (local aids,...) :
 - National policy
 - Local policy (promote for ?)

Some remarks about theses models

- Poor explanatory power without « motives » variables
- Endogeneity problem with ex post « motives » variables, and with some ex post farm characteristics.
- Discrete choice model with spatial dependence are complicated to implement particularly on large sample.
- For internal characteristics, only age and education have universal effect.

Spatial dependance and OF diffusion

- ◉ What for :
 - ◉ Accurate estimation of determinants effects β
 - ◉ Spatial diffusion process
- ◉ More developped at aggregated scale (municipality or higher, Bichler et al 2005a, Lewis et al. 2009, Geniaux et al. 2009, **Allaire et al. 2015**)
- ◉ How to interpret spatial dependance in SAR model :

$$Y = \lambda WY + X\beta + err$$

Precaution

- ◉ Share of OF are highly heterogeneous between type of production, and share of type of production are highly spatially correlated
 - ◉ Global OF analysis can be problematic
 - ◉ A ratio between CF and OF has to be preferred → OLS/SAR inappropriate → logit/probit
 - ◉ logit/probit with spatial dependence are undeveloped, particularly for large sample.
- ◉ Discrete choice model at farm scale would be preferred to take into account soil, farm and farmer characteristics, and to analyse close neighboring effects.

Precaution

- ◉ Where Spatial Autocorrelation come from in SAR model ?
 - ◉ Missing covariates spatially autocorrelated
 - ◉ Non linearity of spatially autocorrelated covariates.
 - ◉ Spatially varying coefficients (spatial heterogeneity)
 - ◉ Spatial process of diffusion
- ◉ A model with low adjustment fit $R^2 < 0.4$ imply a correction through WY that constitutes a proxy of unobserved spatial covariates X.
- ◉ A high spatial parameter is a diagnostic of model miss-specification when adjustment fit is low and perhaps a spatial process when adjustment fit is high

Spatial dependence and OF diffusion

- ◉ Why observed Spatial Dependence is high ?
 - ◉ Poor explanatory power of empirical models.
 - ◉ Bad specification of model.
 - ◉ Missing explanatory variables that are spatially correlated
 - ◉ Non linearity
- Overestimate spatial parameters
 - Biased estimation of spatial effect $(I - \lambda W)^{-1} \beta$

A working program for analysing Spatial Diffusion of OF

- Exhaustive database with farm and farmer characteristics for whole France (French Census 2010)
- Take benefit of MSA database in which annual Farm earning are available for 2002-2015 and Agence Bio Data that allow to distinguish between OF installation and CF to OF switch.
- Privilege analysis at farm scale
 - To analyse small neighbouring effects
 - To take into account farm and farmer characteristics
- Sector based analysis
 - Is spatial dependance related to the total number of OF neighbors or to the number of OF neighbors in same agricultural sector
- Analysis of OF/AC and OF intention to switch.

A working program for analysing Spatial Diffusion of OF

- PROBIT MODEL with spatial dependence using
« Approximate likelihood estimation of spatial autoregressive binary choice models » D. Martinetti and G. Geniaux 2015
 - Available for SAR, SEM, SARAR and SDM models,
 - Highly accurate estimation using maximum likelihood techniques,
 - Usable for large sample size : Up to 1 million observations with sufficiently sparse spatial weight matrices,
 - Soon available as R cran package

First results

- Municipal scale results (36 000 obs)
 - Share of UAA of OF at municipal
 - SAR model → High spatial parameter (~ 0.6) with low adjustment R^2 around 0.2
 - Wine and Fruit +, crop –
 - Population municipal + (Wpop -)
 - Short supply chaines + (Wssc not significant)
 - Share of UAA of intention to OF
 - SAR model → High spatial parameter (~ 0.5) with low adjustment R^2 less 0.2

First results

- Sector by sector
 - No spatial autocorrelation for crop/cereal and maraichage (vegetables)
 - High spatial autocorellation for WINE and for FRUIT, more related to the total share of OF in the neighbouring than the share of OF in the same production sector.