



HAL
open science

Spatial diffusion of Organic Farming

Ghislain Geniaux

► **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

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - ShareAlike 4.0 International License



Spatial diffusion of OF

Ghislain Geniaux
INRA Ecodéveloppement
UR 767.
geniaux@avignon.inra.fr

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 developed 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 spatially 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.
- Privilegiate 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 technics,
 - 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 R² 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 R² 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.