



# Territorial analysis of the diffusion of organic farming in France: Between heterogeneity and spatial dependence



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## ABSTRACT

This paper discusses the development of organic farming (OF) in France from a collective point of view by focusing on the spatiotemporal diffusion of OF and considering different types of production. Based on the data on aid granted between 2007 and 2010 for conversion to OF (COF), the spatial dynamics of conversion is examined with regard to the distinctive capacities of micro-territories to accommodate farms engaged in OF to a greater or lesser extent. The *hurdle* model is applied to varying types of COF aid, which are related to different production systems. This allows for both the characterization of the geographical extent of the contracting of COF aid and its local intensity measured by the number of contracts within micro-territories. The spatial structure of COF contracting can be explained both by economic factors relating to the orientation of production systems and by phenomena of spatiotemporal dependence, which demonstrate the importance of producers' experience and of collective capacities. We can therefore speak of path dependence in relation to the establishment and maintenance of market access capabilities and social networks, which determine the potential and effectiveness of the development of organic agriculture at the micro-territorial level.

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## 1. Introduction

This article provides a spatial analysis of the diffusion of organic farming (OF) in France, globally and according to the type of production. Previous work has shown both, that is, heterogeneity in the dynamic distribution of organic agriculture across regions and within them, and phenomena of local spatiotemporal dependence (Allaire et al., 2014, 2015). The originality of this study lies in the uniqueness of its approach and aim: separate analyses are conducted for different types of production, and in each case careful attention is paid to both the spatial extent of the phenomenon (i.e. the presence of at least one OF producer by spatial unit) and its intensity (number of producers) within each of the micro-territories that constitute the spatial units observed.

By addressing the development of OF from a territorial point of view, the focus shifts from individual adoption towards that of territorial diffusion. The spatial diffusion of OF is not just the result of the spatial distribution of factors influencing individual adoption

of this technology. The territorial context (which includes social, economic, institutional and natural factors) plays its own important role in the diffusion of OF. Motivating or hindering forces that express themselves at different territorial levels partly explain the localization of organic farms. Certain locations are likely to accommodate OF farms (defining the extent of OF) and to accommodate them in greater or smaller numbers (defining the intensity of OF development), thereby making individual conversions more or less costly or risky. Several explanatory factors can be highlighted, such as the geography of production and of outlets (local markets and systems of collecting), the regional or local policies, and the local collective or institutional capacities.

### 1.1. The spatial distribution of organic farming

Several studies have analyzed spatial differences in the diffusion of OF, based on concentration indices, at different levels and for different countries (Beauchesne and Bryant, 1999; Ilbery et al., 1999; Frederiksen and Langer, 2004; Eades and Brown, 2006; Risgaard et al., 2007; Ilbery and Maye, 2011; Allaire et al., 2014); or by modelling agglomeration and neighbourhood effects (Nyblom et al., 2003; Bichler et al., 2005; Gabriel et al., 2009; Lewis et al., 2011;

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Bjorkhaug and Blekesaune, 2013). More qualitative approaches have enabled illustrations of the diffusion logic at work at very local levels (Noe, 2004), or from a structural perspective of a regional sector (Boivin and Traversac, 2011). Most of this work, inspired by economic geography, does not limit itself to observations about the proportion of organic area in a territory, but implicitly assumes that it is the effect of an investment, or an effort, that may be the result of the addition of private or collective efforts and of various structural factors (natural, socio-economic, political, etc.). This underlying assumption is necessary for considering whether or not the localization of OF is due to chance alone.

In an analysis of the spatial distribution of OF at the county level in Germany, Schmidtner et al. (2012) proposed two distinct and complementary spatial dynamics. They built on the proposal of Anselin (1988) by considering, first, the location factors that determine spatial heterogeneity (spatial structure) and, second, the agglomeration effects related to spatial dependence (also referred to as spatial autocorrelation or spatial interaction). Empirically, the authors used data aggregated at NUTS<sup>1</sup>3 level (which is not a very fine resolution), due to the lack of availability of individual data. However, their reasoning was still based on the modelling of individual behaviour; explanatory variables related to factors that influenced the decision at the farm level. Agglomeration effects (of counties favouring OF) therefore corresponded to spillover effects. In order to separate these two diffusion dynamics, the present study focuses on the proper role of territorial institutional capacities in explaining observed phenomena of spatial and, more precisely, spatiotemporal dependence.

The role of context cannot only be analyzed in terms of mere externalities, there are also increasing returns to adoption due to systemic economies of scale associated with the concentration of organic farms. These are partly territorialized and include formal and informal networks of organic farmers, technical support structures, downstream structuring, etc. Experience, individual and collective, acquired at the territorial level can improve the territory's institutional quality. We can therefore speak of "path dependence" (Bichler et al., 2005; Allaire et al., 2014), which is reflected by spatial or temporal autocorrelation in diffusion models. This leads us to consider the heterogeneity and spatial dependence of OF diffusion beyond individual behaviours and determinants. The path dependence is both systemic (network effects on learning costs) and based on collective capabilities (clarification of opportunities) derived from collective past experience.

These are the phenomena that are discussed here, starting with an analysis of public aid contracting for conversion to organic farming (COF) in France, during the period from 2007 to 2010, valorizing exhaustive administrative data. The article's specific aim is to explore the causalities involved in OF geographic diffusion according to different types of production, based on an econometric model of the extent and intensity of contracting, and by taking the characteristics of micro-territories, as defined on the basis of the NUTS4 scale, into account. The proposed model is designed to distinguish spatial heterogeneity from spatial dependence. Before presenting the data we used, our models and our results, we assess the recent dynamics of OF diffusion in France.

## 1.2. The dynamics of organic farming diffusion in France

Although French organic farming continues to lag, with a share of 3.1% of the UAA<sup>2</sup> (utilized agricultural area) in 2010 (Agence Bio, 2012), it grew significantly between 2007 and 2010, with a

doubling of area and farms. This could be explained, not only by increased demand, but also by enhanced aid measures for conversion to organic farming, or COF aid, under the Hexagonal Rural Development Programme (PDRH) 2007–2013 (under the European Rural Development Regulation). However, the heterogeneous character of the spatial distribution of organic farms remains substantial (see Fig. 1). Despite a diffusion of OF into new territories and for new productions, there are still OF "deserts"; not only in the cereal plains of the Paris Basin, but also in certain areas located in regions where OF is more prevalent. At the same time, OF continues to grow significantly in the areas where it is already present.

Little research has been done on the diffusion and spatial structure of OF in France or even in other countries. Papers by Allaire et al. (2014, 2015) provide an original contribution relating to all the French regions. The first made an exploratory analysis of the diffusion of OF in its spatial and temporal dimension between 1993 and 2009, derived from conversion aid data. Based on various indicators (location quotient – LQ, Gini and Moran indices) from the "ESDA" (Exploratory Spatial Data Analysis) toolbox, different regional and sub-regional spatial dynamics were highlighted. Areas where the development of OF is important could be characterized by clustered groupings of micro-territories with high LQ, or, conversely, the latter could be randomly distributed across the regional territory. The spatial structure of the conversion (with COF aid) thus seems to include phenomena of path dependence in certain contexts.

Allaire et al. (2015) studied the dynamics of uneven OF spatial diffusion by analyzing the links between location (regional and local contexts), market access and the propensity of municipalities to accommodate at least one certified organic farm in the year 2010. This paper showed that the network of small towns, the profile of potential consumers, the proximity to certified organic operators downstream, and the diversity of production at the local level were all structural elements of the spatial dynamics of OF, to which spatial and temporal agglomeration effects should be added.

To build on this existing work, analyses should be conducted on the causal relationships between territorial factors, the anteriority of OF, and the dynamics of conversion according to production type (Fig. 2). These territorial factors are structural, whether they are related to the natural environment, to the size distribution of farms, to dominant technical and commercial orientations, or (to some extent) to the public zoning policy; and they are institutional (or collective), i.e. related to collective capacities that support individual capacities and are specific (idiosyncratic) to a territory. Based on various databases, the present analysis seeks to examine and explain the role of the latter type of factor in different contexts.

## 2. Data and methodology

The paper uses databases collected by the rural development observatory (ODR):<sup>3</sup>

- The lists, provided by INAO (French National Institute of Origin and Quality), of certified organic operators active in the third quarter of 2010, issued by certifying bodies responsible for the accreditation of different operators (farmers, processors and distributors), with information about the first year of certification, but not about productive activity.
- The lists of beneficiaries of aid for COF, introduced in France in 1993, with the indication of the type of production which is in conversion.

<sup>1</sup> The NUTS classification (nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU.

<sup>2</sup> This places France 19th on the OF development rank for European countries.

<sup>3</sup> ODR prepares and makes available to the public and agreed users information and indicators on agriculture (employment, structures, and types of production), the economy of rural territories, rural policies, environment, and quality signs. It is managed by an INRA unit, to which the authors of this article belong.

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