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# A SPATIAL MODEL BASED ON THE ENDOGENOUS GROWTH THEORY FOR PORTUGAL. ANOTHER APPROACH

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## ABSTRACT

We built a model analyzing, through cross-section estimation methods, the influence of spatial effects in the conditional product convergence in the parishes' economies of mainland Portugal between 1991 and 2001 (the last year with data available for this spatial disaggregation level). Taking into account the estimation results, it is stated that there are not indications of convergence (the population is in the littoral of Portugal) and it can be seen that spatial spillover effects, spatial lag (capturing spatial autocorrelation through a spatially lagged dependent variable) and spatial error (capturing spatial autocorrelation through a spatially lagged error term) condition the convergence of product of Portuguese parishes in the period under consideration.

**Keywords:** endogenous growth theory; spatial econometrics; Portuguese context.

## 1. INTRODUCTION

There are some known studies concerning conditional convergence with spatial effects. (1)Fingleton (2001), for example has found spatial correlation at the level of productivity when, using data from 178 regions of the European Union, he introduced spillover effects in a model of endogenous growth. (2)Abreu et al. (2004) have investigated the spatial distribution of the rates of total productivity growth of factors using exploratory analyses of spatial data and other techniques of spatial econometrics. The sample consists of 73 countries and covers the period from 1960 to 2000. They have found significant spatial correlation in the rates of total factor productivity growth, indicating that high and low values tend to concentrate in space, forming the so-called "clusters". They have also found high indications of positive spatial autocorrelation at the level of the total factor productivity, which has increased throughout the period of 1960 to 2000. This result could indicate a tendency to clustering with time. (3)Nijkamp (2007) analyses spatial disparities, differences in regional growth and productivity and discuss their driving forces. In this paper starting from traditional regional growth theory, it introduces next findings from location and agglomeration theory, including infrastructure and network modelling, with a particular emphasis on spatial accessibility. Innovation, entrepreneurship and knowledge are addressed, too, and interpreted as critical success conditions for modern regional development. Next, elements from endogenous growth theory and the new economic geography are introduced.

There is, on the other hand, a variety of studies analysing conditional product convergence with spatial effects. Armstrong has defended that the evidence of convergence across European countries as mentioned by Barro and Sala-i-Martin is due to the omission of spatial autocorrelation in their analysis and bias resulting from the selection of European regions. Following on, (4)Sandberg (2004), for example, has examined the hypothesis of absolute and conditional convergence across Chinese provinces in the period from 1985 to 2000 and found indications that there had been absolute convergence during the periods of 1985 to 2000 and 1985 to 1990. He has also found evidence that conditional convergence had been seen in the sub-period of 1990 to 1995, with signs of spatial dependency across adjacent provinces. (5)Arbia et al. (2004) have studied the convergence of gross domestic product per capita among 125 regions of 10 European countries from 1985 to 1995, considering the influence of spatial effects. They concluded that the consideration of spatial dependency considerably improved the rates of convergence. (6)Lundberg (2004) has tested the hypothesis of conditional convergence with spatial effects between 1981 and 1990 and, in contrast to previous results, found no clear evidence favouring the hypothesis of conditional convergence. On the contrary, the results foresaw conditional divergence across municipalities located in the region of Stockholm throughout the period and for municipalities outside of the Stockholm region during the 1990s.

This study seeks to test conditional product convergence (using as a proxy the population, following the new economic geography theory, because the persons are potential workers and consumers, so where we have more persons we have more product) for the parishes economies of mainland Portugal from 1991 to 2001, through techniques of cross-section spatial econometrics.

## 2. MODEL OF CONDITIONAL CONVERGENCE WITH SPATIAL EFFECTS

Bearing in mind the theoretical considerations about conditional convergence, what is presented next is the model used to analyse conditional product convergence with spatial effects, at parishes' level in mainland

Portugal:

$$(1/T)\log(P_{it}/P_{i0}) = \alpha + \rho W_{ij} p_{it} + b \log P_{i0} + \varepsilon_{it}, \text{ with } \alpha > 0 \text{ e } \beta < 0 \quad (1)$$

In this equation (1) P is the product, p is the rate of growth of product in various regions, W is the matrix of distances, b is the convergence coefficient,  $\rho$  is the autoregressive spatial coefficient (of the spatial lag component) and  $\varepsilon$  is the error term (of the spatial error component, with,  $\varepsilon = \lambda W\varepsilon + \xi$ ). The indices i, j and t, represent the regions under study, the neighbouring regions and the period of time respectively.

### 3. DATA ANALYSIS

The data referring to population were obtained in the census (population data) of the National Statistics Institute. To carry out the cross-section estimations, the GeoDa<sup>1</sup> software was used (7)(Anselin 2010).

### 4. THE LINEAR MODEL

This part of the study will examine the specification procedures of (8)Florax et al. (2003) and will firstly examine through OLS estimates, the relevance of proceeding with estimate models with spatial lag and spatial error components, with recourse to LM specification tests.

The results confirm to what has been previously seen, or, in other words, product diverged in Portugal between 1991 and 2001. Convergence/divergence in the product will be conditioned by spillover effects, spatial error, according to the LM tests.

### 5. CONCLUSIONS

This study has sought to test the convergence of product across the 4052 parishes of mainland Portugal in the period of 1991 to 2001, with spillover effects, spatial lag and spatial error. To do so, cross-section estimates have been carried out with the OLS and ML estimation methods, following the specification procedures indicated by Florax et al. (2003) who suggest that models are first tested with the OLS method, to test what is the better specification (spatial lag or spatial error) and then the spatial lag or spatial error is estimated with the ML method.

Considering the analysis of the data and the estimation results previously carried out, it can be seen that product is subject to positive spatial autocorrelation and that the product diverged between 1991 and 2001 in Portugal. This is a preoccupant situation, because we are the population all in the littoral and no people in the interior.

### 6. REFERENCES

1. B. Fingleton. Equilibrium and Economic Growth: Spatial Econometric Models and Simulations. Journal of Regional Science, 41, 117-147 (2001).
2. M. Abreu; H. Groot; and R. Florax. Spatial Patterns of Technology Diffusion: An Empirical Analysis Using TFP. ERSA Conference, Porto 2004.
3. P. Nijkamp. Regional Development as Self-Organized Converging Growth. 2nd Central European Conference in Regional Science – CERS, Košice 2007.
4. K. Sandberg. Growth of GRP in Chinese Provinces : A Test for Spatial Spillovers. ERSA Conference, Porto 2004.
5. G. Arbia and G. Piras. Convergence in per-capita GDP across European regions using panel data models extended to spatial autocorrelation effects. ERSA Conference, Porto 2004.
6. J. Lundberg. Using Spatial Econometrics to Analyze Local Growth in Sweden. ERSA Conference, Porto 2004.
7. L. Anselin. Thirty years of spatial econometrics. Papers in Regional Science, 89, 3-25 (2010).
8. R.J.G.M Florax.; H. Folmer; and S.J. Rey. Specification searches in spatial econometrics: the relevance of Hendry's methodology. ERSA Conference, Porto 2003.

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<sup>1</sup> Available at <http://geodacenter.asu.edu/>