Innovation Spillovers in EU Regions Reconsidered: a Spatial Panel Econometric Approach

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Motivation

Knowledge Production Function (KPF) studies focused on the contribution of research and development (RD) and research externalities to explain the variation in innovative activity across regions

Empirical evidence estimating cross-sectional relationship between patents, RD and RD in neighbouring regions through spatial econometric methods, largely supported the RD argument (ANSELIN et al, 1997, 2000; PIERGIOVANNI and SANTARELLI, 2001; ACS et al. 2002; DEL BARRIO-CASTRO and GARCÍAQUEVEDO, 2005; FRITSCH and SLAVTCHEV, 2007, just to mention some)

Cohesion Policy has been shaped accordingly, placing much attention on RD targeting (3%). Only recently the Smart Specialization approach has come to integrate the Innovation Policy debate

We argue that much of the emphasis on RD and externalities is misplaced. In particular, research externalities do not cause the concentration of innovative activities in a region. Rather, they are the result of the spatial clustering of innovative actors.

At the empirical level, cross-sectional estimation fails to consider RD endogeneity

Background

The regional KPF

$$Patents = b_0 + b_1RD + b_2UNIRD + b_3EDUC + controls + e$$

Extended accounting for inter-regional relationships through a contiguity matrix W $\partial Patents / \partial WX$

Bias in the effect of RD (b_1)

- The market potential (Bottazzi and Peri, 2003)
- The social capital (Tappeiner et al, 2008)
- The location-specific characteristics (Guastella and vanOort, forthcoming)

Bias in the effect of WRD

- Omission of spatially auto-correlated variables

Literature and novelty of the approach

- Focus on the EU only
  - FISCHER and VARGA (2003) for Austria;
  - DEL BARRIO-CASTRO GARCÍA-QUEVEDO (2005) for Spain;
  - FRITSCH and SLAVTCHEV (2005) for Germany;
  - GUMBAU-ALBERT and MAUDOS (2009) for Spain;
  - PONDS et al. (2010) for the Netherlands;
  - AUTANT-BERNARD and LESAGE (2011) for France;
  - GRIMPE and PATUELLI (2011) for Germany.

- Studies on the EU regions
  - BOTTAZZI and PERI (2003) for EU-15 regions; CROSS SECTION
  - Charlot et al (2014); SPATIAL PANEL excluding countries without sub-national territorial aggregates

- Our study
  - All the EU25 regions
  - More recent analysis (2005-2008)
  - Data imputation and reconstruction
  - Spatial panel data analysis

Empirical Approach

Procedure

I. Compare pooled and FE non-spatial estimator
II. Extend the model to spatial effects
III. Test over different distance bands for the contiguity matrix

Generalized Spatial Model (Spatial Durbin)

$$Y = rWY + bX - rbWX + e$$

a) Direct effects (change in patents in a region increasing X in the region)

b) Indirect effects and spillover (change in patents in a region increasing X in the neighbouring regions)

c) 200, 400 and 600 km

Description of the dataset

Dep Var: Patent applications to EPO, normalized by n of inhabotants

Indep Var:

- Private RD exp, normalized by GDP
- Public RD exp, normalized by GDP
- Tertiary Education of workforce

Controls

- Specialization in High and Medium-High tech
- Specialization in Knowledge Intensive Business Services
- Co-patenting with other regions
- Value Added per Employee
- FE (territorial capital, location specific factors)

172 NUTS I/II regions (OECD regional database + Eurostat)

Summary Statistics

Variable	2003 Mean	2003 Std. Dev.	2004 Mean	2004 Std. Dev.	2005 Mean	2005 Std. Dev.	2006 Mean	2006 Std. Dev.	2007 Mean	2007 Std. Dev.	2008 Mean	2008 Std. Dev.	Source
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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Preliminary results

All the coefficients are correctly sloped in the Pooled model

All the coefficients but the one associated to TEREDUC are highly significant

With inclusion of FE, UNIRD and HMHTECH become insignificant

The size of BIZRD decreases significantly

Spatial Model TESTS

LM LAG/ERR – both alternative significant

LR tests

	Pooled		FE	
BIZRD	0.464	***	0.274	***
	(0.023)		(0.051)	
UNIRD	0.078	***	0.000	
	(0.025)		(0.075)	
TEREDUC	0.036		0.590	***
	(0.065)		(0.163)	
HMHTECH	0.449	***	0.096	
	(0.039)		(0.090)	
KIS	0.898	***	0.569	**
	(0.106)		(0.251)	
VAEMP	1.209	***	1.320	***
	(0.050)		(0.326)	
COPEXTRA	0.016		-0.005	
	(0.012)		(0.009)	
cons	-20.490	***	-19.649	***
	(0.737)		(2.888)	

Results – Spatial Model

Size and significance of coefficients OK

Tests confirm SDM is the correct model

Indirect effects related to BIZRD only

Changing balance between DE and IE with increasing distance

Rethink the estimation strategy focusing on BIZRD IE and selecting the W matrix a priori

	200		400		600	
			Direct			
BIZRD	0.222	***	0.196	***	0.184	***
UNIRD	-0.022		-0.027		-0.022	
TEREDUC	0.462	**	0.440	**	0.433	**
HMHTECH	0.110		0.134	*	0.142	*
KIS	0.438	*	0.280		0.281	
VAEMP	1.465	***	1.390	***	1.344	***
COPEXTRA	-0.004		-0.003		-0.003	
			Indirect			
BIXRD	0.212	***	0.330	**	0.622	***
UNIRD	0.070		-0.031		-0.585	**
TEREDUC	0.126		0.057		-0.103	
HMHTECH	0.032		0.033		-0.035	
KIS	0.345		1.122	*	1.464	
VAEMP	-0.589		-0.607		-0.238	
COPEXTRA	-0.002		-0.013		0.011	
			Tests			
Vs LAG	14.92	[0.037]	21.22	[0.003]	17.56	[0.014]
Vs Err	16.85	[0.018]	21.22	[0.003]	23.32	[0.001]

Summary of evidence

Strong bias from cross-section to panel data in the estimation of the contribution of RD to innovation

The bias extends also to the case of interregional spillovers, although these continue to be strongly significant in the analysis

UNIRD? Keep the spatial specification simple to investigate non-linearities and interaction effects

Examine the extent to which the size and significance of spillovers effect varies across groups of regimes of regions (first study to use panel data models for the whole sample of EU regions). Insights suggest weak relevance of spillovers in NMS – alternative knowledge diffusion channels