

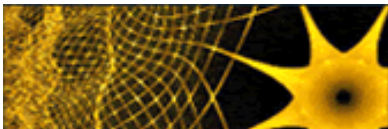
Do clusters generate greater innovation and growth?

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Clusters as generators of economic growth

▶ Clusters are considered to be behind:

1. Agglomeration economies
2. Interaction and networks
3. Knowledge spillovers
4. Collective learning mechanisms
5. Innovation
6. Economic growth

▶ Analysis based on case studies

1. But a tendency to resort to most favourable cases (Martin and Sunley, 2003)
2. Casting doubt about the connection between clusters, innovation and growth

▶ Few comparative and quantitative studies

Why so few studies?

► Several problems

1. Clusters are difficult to operationalise
 - Intricate interactions
 - Institutional linkages
 - Collective learning processes
2. But the interest on clusters has not ceased to increase
3. And databases have improved accordingly

► But few studies that link clusters to other factors behind innovation and growth

1. R&D inputs
2. Local socioeconomic conditions

Aims of the paper

- ▶ **Cover this gap in the literature and**
- ▶ **Analyse the interaction between**
 1. The presence of clusters
 2. R&D investment
 3. ‘Social filter’
- ▶ **Across 152 regions in the EU**
- ▶ **Over the period 1995-2006**

Structure of the paper

- ▶ **From clusters to innovation and growth**
- ▶ **From theory to practice**
- ▶ **The model**
- ▶ **The analysis**
 1. Static analysis
 2. Dynamic analysis
- ▶ **Conclusions**

From clusters to innovation and growth

► Innovation and growth depends on the presence in a territory of:

1. Interorganisation networks
2. Financial and legal institutions
3. Technical agencies and research infrastructures
4. Education and training systems
5. Governance structures (Iammarino, 2005)

► This implies:

1. Colocation of firms and related industries
2. A certain specialization...
3. Combined with cross-sectoral diversity
4. And a critical mass of firms and actors

From clusters to innovation and growth (II)

▶ But other factors also play a role

▶ ‘Social capability’

1. Conditions that lead to the emergence of a favourable ‘socio-institutional’ environment for innovation

▶ ‘Technological congruence’

1. Linked to the idea of the technological frontier (Aghion 2006)
2. Capacity of a region to absorb knowledge from external forces

▶ ‘Territorial embeddedness’

1. Combination of the two factors above

▶ And, of course:

1. R&D (linear models of innovation)
2. And the context (‘social filter’) (Rodríguez-Pose, 1999)

Three key approaches

Link between investment in R&D, patents, and economic growth.

(Fagerberg 1988, 1994 and 1997; Grossman and Helpman 1991; Maurseth and Verspagen 1999)

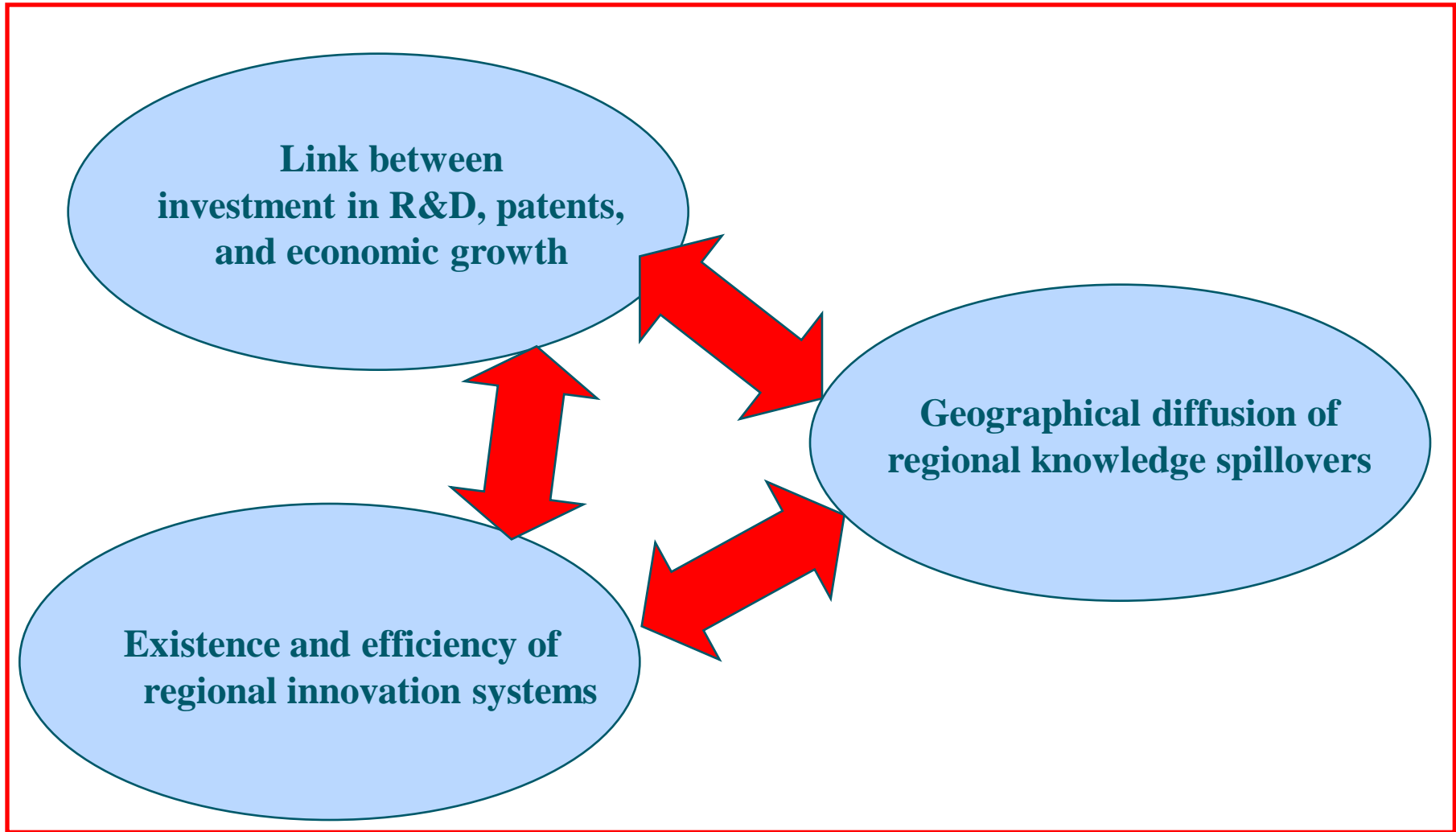
Geographical diffusion of regional knowledge spillovers;

(Anselin et al. 1997, Adams and Jaffe 2002; Audretsch and Feldman 2003, Leamer and Storper 2001, Storper and Venables 2004, Sonn and Storper 2005)

Existence and efficiency of regional innovation systems.

(Camagni 1995, Becattini 1987, Morgan 1997 and 2004, Cooke et al. 1997, Iammarino 2005, Rodriguez-Pose 1999)

Which need to be linked



Operationalising clusters

► Clusterisation index

1. Three variables
2. Index of cluster specialisation
 - Specialisation quotient representing employment intensity in a given regional cluster, compared with employment intensity in the region
3. Focus index
 - Share of a region's employment level represented by the cluster
4. Diversification of clusters
 - Presence of clusters in different industries
5. Data from the European Cluster Observatory
6. Combined using Principal Component Analysis (PCA)

Operationalising R&D and the ‘social filter’

▶ R&D filter

1. Basic input and output variables of the ‘linear model’
2. R&D as a percentage of GDP, as input
3. Patent applications per million inhabitants, as output
4. Combined using PCA

▶ Social filter

1. Four dimensions
2. Local market rigidities: Long-term unemployment, agricultural employment, corporate tax rate
3. Demographic characteristics: Population, % of young
4. Education: level of education and life-long learning
5. Relevance of science: Share of employed in science and technology
6. Combined by means of PCA

The model

$$\Delta \ln GDPpc_{i,(t+1)-t} = \alpha + \beta_1 \ln GDPpc_{i,t-1} + \beta_2 RFilter_{i,t} + \beta_3 SocFilter_{i,t} + \beta_4 ClusterIndex_{i,t} + \beta_5 ND + \varepsilon$$

Where:

$\Delta \ln GDPpc_{i,(t+1)-t}$ is the growth of GDP per capita in region i during the period of analysis;

α is a constant;

$\ln GDPpc_{i,t-1}$ represents the natural logarithm of GDP per capita in region i at the beginning of the period of analysis;

$RFilter_{i,t}$ denotes the R&D filter conditions in region i and time t ;

$SocFilter_{i,t}$ represents the social filter conditions in region i and time t ;

$ClusterIndex_{i,t}$ denotes the degree of clusterisation in region i and time t ;

ND are a series of national dummies;

ε is the error term.

Data and method

▶ 152 regions

1. NUTS2 for most countries
2. NUTS1 for Belgium, Germany, Greece, the Netherlands and the UK

▶ Data sources

1. EUROSTAT
2. European Cluster Observatory
3. Two sector models
4. But many of the results of these models are contradictory (Krugman and Livas Elizondo, 1996 vs. Paluzie, 2001)

▶ Period

1. 1995-2006

▶ Method

1. Heteroskedasticity-consistent pooled OLS

Empirical results. Static analysis

	1	2	3	4(*)	5	6	7	8	9	10	11	12	13	14
Constant	2.157*** 0.350	0.955*** 0.256	1.288*** 0.2674	0.691*** 0.132	2.048*** 0.261	0.561*** 0.195	1.459*** 0.292	1.086 0.154	2.165*** 0.281	2.327*** 0.346	2.032*** 0.367	2.012*** 0.329	2.008*** 0.340	2.067*** 0.356
log GDPpc	0.757*** 0.038	0.947*** 0.027	0.901*** 0.0297	0.988*** 0.014	0.896*** 0.029	0.979*** 0.021	0.854*** 0.035	0.9101*** 0.006	0.722*** 0.030	0.738*** 0.0373	0.770*** 0.040	0.770*** 0.036	0.769*** 0.037	0.766*** 0.039
R&D Filter	0.009 0.008	0.034*** 0.006	0.036*** 0.006	0.006 0.006	0.027*** 0.007	0.038*** 0.006	0.019** 0.008	0.024*** 0.006	0.003 0.008			0.004 0.009	0.008 0.008	0.008 0.008
Social Filter	0.049*** 0.005									0.0494*** 0.0046	0.051*** 0.005	0.049*** 0.005	0.048*** 0.005	0.049*** 0.005
Clusterisation index	0.013** 0.005	-0.004 0.004	0.002 0.003	-0.003 0.003	-0.007 0.004	-0.003 0.003	0.010* 0.006	0.000 0.003	0.016*** 0.004	0.014** 0.005	0.011** 0.005			
<i>National dummies</i>	x	x	X		x	x	X	x	X	x	x	X	X	X
Social Filter														
long term unemployment		-0.002*** 0.001												
Agriculture employment			-0.007*** 0.001											
corporate tax rate				-0.010*** 0.001										
% of young					-0.045*** 0.005									
total population						-0.001 0.001								
Education							0.025*** 0.004							
life long learning								0.047*** 0.005						
HR in science & techno									0.019*** 0.001					
R&D Filter														
patent application										0.000** 0.000				
R&D expenditure											-0.009 0.007			
Clusterisation index														
Specialisation												0.0126* 0.0065		
Focus													0.011* 0.006	
Diversification														0.011

Empirical results. Dynamic analysis

Table 3 - Dynamic Analysis

	Lag 0	Lag 1	lag 2	lag 3	lag 4	lag 5	lag 6
Constant	2.157***	1.956***	1.689***	1.683***	1.283***	1.159***	1.392***
	0.350	0.314	0.282	0.243	0.253	0.256	0.248
Log GDPpc	0.757***	0.785***	0.820***	0.853***	0.874***	0.891***	0.899***
	0.038	0.034	0.031	0.028	0.0270	0.027	0.028
R&D Filter	0.009	0.015**	0.017***	0.017***	0.016***	0.014**	0.015**
	0.008	0.007	0.006	0.006	0.006	0.006	0.007
Social Filter	0.049***	0.043***	0.037***	0.031***	0.030***	0.025***	0.024***
	0.005	0.005	0.004	0.004	0.004	0.004	0.005
Clusterisation Index	0.013**	0.011**	0.009*	0.006	0.004	0.002	0.002
	0.005	0.005	0.005	0.005	0.005	0.005	0.005
R ²	0.925	0.932	0.940	0.947	0.956	0.964	0.968
F	614.21	582.94	630.35	705.77	763.65	927.23	1281.37
Number observations	1756	1596	1436	1276	1116	956	796

Static analysis

No evidence of convergence

The R&D filter is positively associated with growth, but not when social filter and the cluster index are included

When these are included, R&D does not seem to make a difference

	1	2
Constant	2.157***	0.955***
	0.350	0.256
log GDPpc	0.757***	0.947***
	0.038	0.027
R&D Filter	0.009	0.034***
	0.008	0.006
Social Filter	0.049***	
	0.005	
Clusterisation index	0.013**	-0.004
	0.005	0.004
<i>National dummies</i>	x	x
R ²	0.925	0.883
F	614.21	1012.33
Number of observations	1756	1760

Static analysis (II)

Clusters seem to matter more than investment in R&D

And, when the social filter is included, the clusterisation index remains significant

	9	10	11
Constant	2.165*** 0.281	2.327*** 0.346	2.032*** 0.367
log GDPpc	0.722*** 0.030	0.738*** 0.0373	0.770*** 0.040
R&D Filter	0.003 0.008		
Social Filter		0.0494*** 0.0046	0.051*** 0.005
Clusterisation index	0.016*** 0.004	0.014** 0.005	0.011** 0.005
<i>National dummies</i>	X	x	x
R ²	0.916	0.926	0.925
F	418.44	538.64	773.24
Number of observations	1756	1756	1756

Dynamic analysis

In the short term,
the social filter and
the presence of
clusters seem to
drive growth

	Lag 0	Lag 1
Constant	2.157***	1.956***
	0.350	0.314
Log GDPpc	0.757***	0.785***
	0.038	0.034
R&D Filter	0.009	0.015**
	0.008	0.007
Social Filter	0.049***	0.043***
	0.005	0.005
Clusterisation Index	0.013**	0.011**
	0.005	0.005
R ²	0.925	0.932
F	614.21	582.94
Number observations	1756	1596

After one year,
investment in R&D
and patent
applications start to
make a difference

Dynamic analysis (II)

Over time, the impact of the presence of clusters wanes

While the coefficients of the R&D filter and specially the social filter remain significant

	lag 3	lag 4	lag 6
Constant	1.683***	1.283***	1.392***
	0.243	0.253	0.248
Log GDPpc	0.853***	0.874***	0.899***
	0.028	0.0270	0.028
R&D Filter	0.017***	0.016***	0.015**
	0.006	0.006	0.007
Social Filter	0.031***	0.030***	0.024***
	0.004	0.004	0.005
Clusterisation Index	0.006	0.004	0.002
	0.005	0.005	0.005
R ²	0.947	0.956	0.968
F	705.77	763.65	1281.37
Number observations	1276	1116	796

Overall results

- ▶ **Clusters, for the sake of having clusters, is not the solution**
- ▶ **It is much more important:**
 1. What happens in the firms within the cluster
 2. What is their relationship with the outside world
 3. And in which conditions these operate
- ▶ **Regional economic conditions (proxied by the ‘social filter’) have the strongest association with economic growth**
 1. Presence of innovation enhancing local factors as key
 2. Capacity to enhance innovation production, but fundamentally absorption

Overall results (II)

- ▶ **The role of clusters in promoting growth in the medium term may have been somewhat overstated**
 1. Clusters are associated with growth in the short run
 2. But their importance wanes over time
- ▶ **Hard innovation indicators (R&D and patents), in combination with an adequate ‘social filter’ increase their influence over time**
- ▶ **Clusters seem to matter, when they become the hub for regional systems of innovation**
- ▶ **This only happens when they are located in innovation prone environments with adequate social filters**
- ▶ **But even then, their influence seems to be weaker than investment in R&D**

Overall results (III)

- ▶ **It may have been the case that the influence of clusters for economic growth may have been overstated and what really matters is setting up the adequate conditions for innovation**
 1. Greater education and life-long learning
 2. Lower unemployment and employment in less dynamic sectors
 3. More emphasis in science and technology

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More information

<http://personal.lse.ac.uk/rodrigu1/>

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