REGIONAL ALIGNMENT AS PLATFORM. THE INNOVATIVE ADVANTAGE OF REGIONS

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Introduction

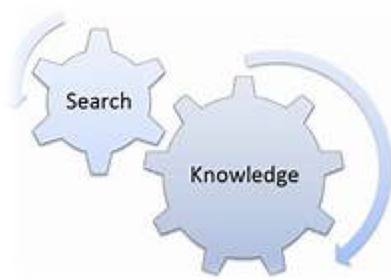
- ***<u>Motivation</u>***
- "What are the underlying reasons for differences in regional performance?"
- "Does region matter to local inventors?"
- "What are conditions for regions to be more innovative and explorative?"

Introduction

❑ ***What we know***

- New knowledge results from the combination of existing knowledge elements (Nelson & Winter, 1892; Schumpeter, 1934).
- The value and the innovativeness of new knowledge depend on the level of familiarity of knowledge used in combination (Fleming & Sorenson, 2004).

- Exploration results from searching beyond technological boundaries



Introduction

- ***<u>What we know (cont.)</u>***

- Boundary spanning is more costly and uncertainty to acquire external knowledge (Cohen & Levinthal, 1989; Kogut & Kulatilaka, 2001 ; Von Hippel, 1994)
  - The lack of shared language
  - The liability of legitimacy
  - The lack of trust among inventors from different communities

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Introduction

❑ ***What we know (cont.)***

➢ Regional economic literature has emphasized the role of regional knowledge platforms as a driving force for its competitive advantage (Asheim et al., 2011; Harmaakorpi & Melkas, 2005).

Analytical (scientific) knowledge ***Synthetic (technological)***

➢ Knowledge platform as capabilities to develop technological knowledge that open wide opportunities to other technologies and market expansion (Kim & Kogut, 1996; Kogut & Kulatilaka, 2001).

Introduction

❑ ***<u>What we don't know</u>***

- If regional knowledge platforms are critical factors to enhance regional advantages: **how does it happen? and what is the mechanism behind?**
- We suggest to analysis the role of synergies between scientific and technological knowledge bases to explain the origin of regional innovative capabilities.

- **RQ: how and what extent regions may provide knowledge platforms contributing to develop local inventors' innovative and explorative capabilities.**

Literature

❑ ***Regional concept***

Regional knowledge platforms are considered in a dynamic perspective:

- Regions are heterogeneous both in their original point and in the way they accumulate new scientific and technological knowledge.
- Synergies between technologies and scientific domains at the regional level are identified empirically at the national level.

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Regional alignment is the extent to which there are regional synergies of shared and complementary knowledge bases (e.g. science and technology), competences and skills across local agents. Regional alignment implies potential linkages between knowledge bases suggesting interactive learning processes between local agents.

Hypothesis

- ***Regional alignment may enhance regional invention's performance by:***
  - Helping local actors be aware of potential technologies (Cohen & Levinthal, 1990)
  - Reducing the screening and adoption cost of potentially external knowledge, thus increases the likelihood to explore new potential capabilities (Kogut & Kulatilaka, 2001)
  - Identifying their advantages among the regional knowledge platforms → position potential combinations among diversified and complementary knowledge sources
  - Generating interactive and collective learning across local actors
  - Enhancing the emergence of a collective identity by reinforcing actors' commitments on the community and by making sense of the logics of their actions (Lazaric et al., 2008).

Hypothesis H1: The regional alignment has a positive correlation with regional innovative performance.

Hypothesis H2: The regional alignment has a positive correlation with regional explorative capacity.

Data and Research Method

- Sample years (1990-2014) for patents and scientific publications in France
- Observed years for panel data (1995-2009) with 83,004 patents
- Unit of analysis: regions in France at NUTS3 level (94 regions)
- 25,068 patents and 57,399 references to scientific papers (the Classification of Scientific Journals-March 2016)
- 107,192 French patents (1990-2009) to measure the regional technological expertise
- 936,567 published scientific articles for all regions in France (NUTS3) to measure the regional scientific expertise (1990-2009)

Data and Research Method

- Interdependence $$\lambda_{ij} = \frac{J_{ij} - \mu_{ij}}{\sigma_{ij}} \quad , \lambda_{ij} \in R$$

J_{ij} is the actual number of observed co-occurrences between two technology i and scientific field j;
μ_{ij} is the expected (mean) value of a random technological co-occurrence and
σ is standard deviation

- Regional technological expertise $$RTE_{ir} = \frac{\sum P_{ir} / \sum P_r}{\sum P_{iN} / \sum P_N}$$

$RTE_{ir} = 1$ if $RTE_{ir} \geq 1$
$RTE_{ir} = 0$ if $RTE_{ir} < 1$

- Regional scientific expertise $$RSE_{jr} = \frac{\sum P_{jr} / \sum P_r}{\sum P_{jN} / \sum P_N}$$

$RSE_{jr} = 1$ if $RSE_{jr} \geq 1$
$RSE_{jr} = 0$ if $RSE_{jr} < 1$

P_{ir} is the number of patents (published papers) in technological field i (scientific field j) in region r
P_r is the total patents (published papers) in the region
P_{iN} is total patents (published papers) in domain i (scientific field j) in the nation
P_N is the total patents (published papers) in the nation.

Data and Research Method

- Interdependence (*ij*) $RA_{ijr} = \lambda_{ij} * RTE_{ir} * RSE_{jr}$
- Regional alignment $RA_r = 1/n * \sum_{ij} RA_{ijr}$
- Linear feedback model (Blundell et al., 2002; Salomon & Shaver, 2005)

$$E(y_{rt} | Y_{rt-1}, X_{rt}) = \delta Y_{rt-1} + e^{(\beta X_{rt})}$$

yrt is forward citation counts of region (r) at time (t)

yrt-1 is forward citation counts of region (r) at time (t-1)

X is the vector explanatory variables

β is the vector for the parameter of interest

Results

Table 2

Descriptive statistics

		1	2	3	4	5	6	7	8	9	10	11	12
1	Citation count	1.00											
2	Rate of exploration	-0.11	1.00										
3	Citation count of explorative patents	0.96	-0.09	1.00									
4	Mean technology control	0.29	0.07	0.33	1.00								
5	Number of classes	0.37	-0.17	0.39	0.43	1.00							
6	Number of single subclasses	0.60	-0.25	0.58	0.31	0.81	1.00						
7	Number of subclasses	0.58	-0.18	0.59	0.38	0.86	0.96	1.00					
8	Intensity to cite patents within region	0.16	-0.10	0.17	0.22	0.30	0.26	0.28	1.00				
9	Combination likelihood of subclass	0.18	0.42	0.23	0.33	0.26	0.18	0.30	0.15	1.00			
10	Coupling	0.16	-0.05	0.16	0.28	0.31	0.26	0.27	0.12	0.17	1.00		
11	Intensity to cite scientific publication	0.23	-0.05	0.24	0.18	0.23	0.24	0.26	0.06	0.14	0.16	1.00	
12	Regional alignment	0.12	-0.17	0.07	0.02	0.57	0.53	0.52	0.06	0.04	0.17	0.15	1.00

Results

Table 3					
Determinants of citation counts (5-year window)					
Variables	Baseline	Model 2	Robustness of the results		
	Model 1		Model 3	Model 4	Model 5
	GMM	GMM	GMM	GMM	GMM
Citation count (t-1)	0.164***	0.179***	0.083***	0.180***	0.180***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mean technology control	0.054***	0.047***	0.052***	0.049***	0.047***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of classes	0.035***	0.024***	0.021***	0.026***	0.023***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of single subclasses	0.002***	0.005***	0.007***	0.005***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of subclasses	0.006***	0.007***	0.007***	0.006***	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intensity to cite patents within region	0.182***	-0.424***	-2.210***	-0.246***	-0.221***
	(0.006)	(0.009)	(0.003)	(0.019)	(0.008)
Combination likelihood of subclass	0.080***	0.094***	0.079***	0.087***	0.098***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Coupling	0.389***	0.306***		0.312***	0.329***
	(0.001)	(0.002)		(0.002)	(0.002)
Intensity to cite scientific publication	0.243***	0.441***	0.619***	0.400***	0.452***
	(0.004)	(0.004)	(0.002)	(0.008)	(0.004)
Regional alignment (t-1)		0.296***	0.349***	0.340***	0.299***
		(0.001)	(0.001)	(0.001)	(0.001)
Constant	-1.30[illegible]	0.11[illegible]	1.03[illegible]	0.20[illegible]	0.13[illegible]
	(0.010)	(0.013)	(0.006)	(0.014)	(0.019)
Observations	1,410	1,410	1,410	1,222	1,365
Robust standard errors in parentheses					
*** p<0.01, ** p<0.05, * p<0.1					

Results

Table 4			
Determinants of exploration's performance (5-year window)			
VARIABLES	Model 6	Model 7	Model 8
	Exploration rate	Citation count of exploration	
	FE	GMM	GMM
Citation count (t-1)		0.145***	0.172***
		(0.002)	(0.002)
Mean technology control	-0.001	0.047***	0.047***
	(0.001)	(0.001)	(0.001)
Number of classes	-0.003***	0.026***	0.024***
	(0.001)	(0.000)	(0.000)
Number of single subclasses	-0.005***	-0.003***	-0.006***
	(0.001)	(0.000)	(0.000)
Number of subclasses	0.001***	0.008***	0.009***
	(0.000)	(0.000)	(0.000)
Combination likelihood of subclass	0.040***	0.070***	0.072***
	(0.002)	(0.001)	(0.002)
Coupling	-0.011**	0.121***	0.143***
	(0.005)	(0.002)	(0.002)
Intensity to cite patents within region	-0.177***	1.128***	1.155***
	(0.068)	(0.031)	(0.051)
Intensity to cite scientific publication	-0.011	0.423***	0.457***
	(0.569)	(0.014)	(0.019)
Regional alignment (t-1)	0.086***	0.040***	0.322***
	(0.031)	(0.003)	(0.013)
Intensity to cite scientific publication x Regional alignment			-0.570***
			(0.026)
Constant	0.415***	0.265***	0.200***
	(0.055)	(0.028)	(0.036)
Observations	1,410	1,410	1,410
Standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Discussion and Conclusion

- Our primary finding is that everything else being equal, “aligned” region (i.e. region with higher synergy potentials) provides local inventors with better opportunities and higher learning capacities for justifying different potential trajectories in the region
- These results extend prior research on the link between science, technology and innovation. There are multifaceted interplays between science and technology rather than the notion of “science-dependence”
  - On one hand, it addresses regional knowledge platform, which refers to technological and scientific knowledge *expertise* in the region.
  - On the other hand, the platform implies regional *configurations* between science and technology, which is not linear one-way relation .

Discussion and Conclusion

- In policy perspective, beyond traditional view of regional knowledge bases, this paper shows the role of regional alignment to explain the heterogeneity in regional competitive advantage

  ➔ "one size policy does not fit all"

  ➔ calls for better place-based policies

Future Directions

Regional alignment induces these characteristics of region by:

- ➢Playing as the mechanism of knowledge spillovers and interactive learning → networks of local actors.
- ➢Acting as platform which generate a set of resources to permit local inventors to choose the optimal strategy of inventions in order to respond to market opportunities (Harmaakorpi & Melkas, 2005).
- ➢Co-evolving as a change in the structure of complementary knowledge bases (Dosi, 1982; Quatraro, 2016) → The patterns of synergies also change.

These features play as regional capabilities to create different valuable complementary options for local inventors when searching and acquiring distant knowledge.

THANK YOU!

Determinants of innovation's performance (5-year window)

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	Citation count of patents					Citation count of exploration	
	GMM	GMM	GMM	GMM	GMM	GMM	GMM
Citation count (t-1)	0.197***	0.167***	0.361***	0.367***	0.366***	0.326***	0.340***
	(0.000)	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)	(0.003)
Mean technology control	0.054***	0.054***	0.041***	0.046***	0.045***	0.052***	0.051***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Number of classes	0.036***	0.036***	0.020***	0.023***	0.023***	0.035***	0.033***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of single subclasses	0.002***	0.002***	0.007***	0.007***	0.006***	-0.011***	-0.014***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of subclasses	0.006***	0.006***	0.007***	0.006***	0.006***	0.011***	0.012***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intensity to cite patents within region	-0.066***	0.209***	-2.040***	-2.353***	-2.439***	0.748***	0.722***
	(0.000)	(0.007)	(0.020)	(0.028)	(0.013)	(0.046)	(0.085)
Combination likelihood of subclass	0.082***	0.078***	0.121***	0.106***	0.109***	0.021***	0.025***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)
Coupling	0.387***	0.393***	0.295***	0.239***	0.227***	0.076***	0.096***
	(0.000)	(0.001)	(0.002)	(0.003)	(0.003)	(0.005)	(0.008)
Intensity to cite scientific publication	0.253***	0.257***	0.610***	0.605***	0.630***	0.622***	0.661***
	(0.000)	(0.005)	(0.008)	(0.013)	(0.008)	(0.019)	(0.024)
Regional scientific advantage	-0.053***		-0.321***	-0.731***	-0.378***	-0.323***	-0.322***
	(0.000)		(0.002)	(0.005)	(0.002)	(0.006)	(0.007)
Regional technological advantage		0.068***	0.046***	0.065***	0.058***	0.149***	0.147***
		(0.007)	(0.011)	(0.013)	(0.009)	(0.012)	(0.013)
Regional alignment (t-1)			0.693***	0.649***	0.027***	0.029***	0.321***
			(0.004)	(0.007)	(0.008)	(0.005)	(0.019)
Coupling x Regional scientific advantage				0.115***			
				(0.002)			
Coupling x Regional alignment (t-1)					0.209***		
					(0.002)		
Regional alignment x Intensity to cite scientific publication							-0.582***
							(0.029)
Constant	-1.400	-1.514***	0.171***	0.096*	0.163***	-0.700***	-0.772***
	(0.000)	(0.019)	(0.045)	(0.057)	(0.048)	(0.052)	(0.055)
Observations	1,410	1,410	1,410	1,410	1,410	1,410	1,410

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

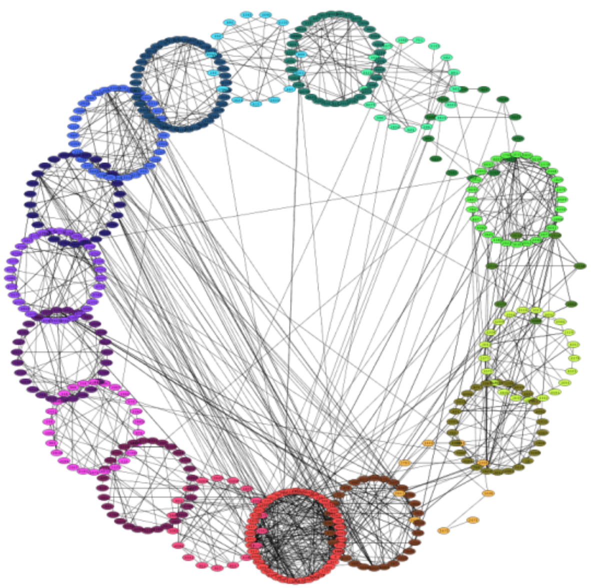
Table 2

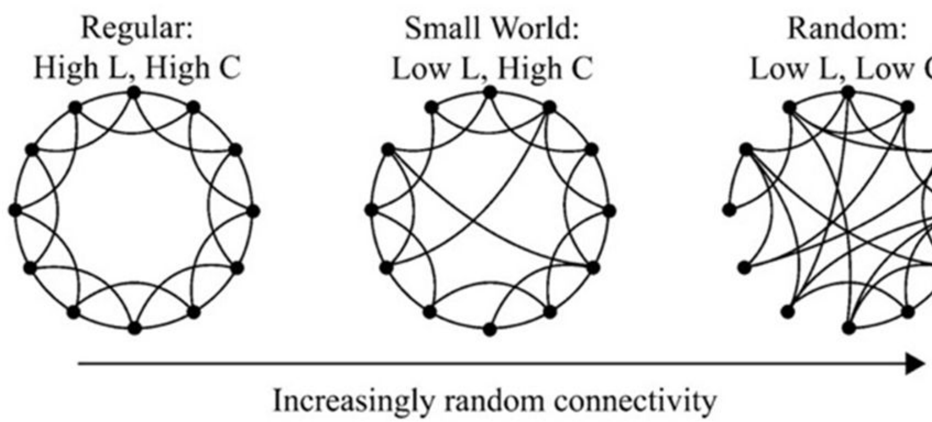
Correlation matrix

	Variable	Obs	Mean	Std. Dev.	Min	Max
1	Citation count	1.410	141.75	627.85	0.00	9826
2	Rate of exploration	1.410	0.33	0.18	0.00	1
3	Citation count of explorative patents	1.410	70.64	255.54	0.00	4942
4	Mean technology control	1.410	17.73	8.90	0.00	67.87
5	Number of classes	1.410	52.68	29.12	0.00	119
6	Number of single subclasses	1.410	18.45	24.01	0.00	160
7	Number of subclasses	1.410	52.28	59.37	0.00	328
8	Intensity to cite patents within region	1.410	0.04	0.06	0.00	0.50
9	Combination likelihood of subclass	1.410	2.69	2.06	0.00	30
10	Coupling	1.410	2.47	1.04	0.00	11.63
11	Intensity to cite scientific publication	1.410	0.13	0.24	0.00	3.14
12	Regional alignment	1.410	0.16	0.22	0.00	1.22

Future Direction

- FRQ: How may the regional networks (between science and technology) affect its branching.





A **small-world network** is a type of mathematical graph in which most nodes are not neighbors of one another, but most nodes can be reached from every other by a small number of hops or steps.

Watts, D. J. & Strogatz, S. H. Collective dynamic of "small world" networks. Nature 393, 440-442. (1998)