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Title

Access to universities' public knowledge: Who's more regionalist?

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Extended Abstract:

Regions generate scientific and technological knowledge in their universities in the form of patents and papers, but sometimes regions producing that codified knowledge are unable to fully absorb, decode and/or exploit it. We explore this phenomenon through patent citations and using EU27 regions as units of analysis for 1990-2007. The paper contributes with a regional analysis of the use of university knowledge produced both inside and outside the region. Particularly we address the role of firms' R&D expenditure in encouraging the use of university knowledge at regional level.

Only a few recent papers have analyzed the use of university knowledge produced both inside and outside the region. For example, Acosta et al. (2011), study the outside dimension of research collaboration patterns; Abramo (2010) addresses both dimensions for a single country; and Azagra (2012) takes a large number of countries and years to analyze the national patterns of accessing public knowledge. None of this previous research focuses on a regional perspective for EU27.

A regional focus is suitable given the growing role of policies at regional level to achieve the European Research Area (ERA). It is well known that the program to develop the ERA is primarily a partnership between the European Commission and the member states; but the Commission, the Council and the Committee of the Regions all see a role for the regions in the ERA, as a result of a greater involvement of the regions in research and innovation policies (Charles et al., 2009). Note, however, that the identification of a particular kind of regionalism (the use of university knowledge that was internally produced in the region) is important, but it does not mean that firms should not take advantage of other free available knowledge located further away. A combination of intra and extra-regional acquisition university knowledge would be necessary to create a system of regional collaboration and learning in the way required by the ERA.

The theoretical and empirical background to motivate our hypothesis is organized around two questions: i) what explains the use of university knowledge inside and outside the regions by firms ii) what patent citations tell us about the use of university knowledge from a regional perspective. With respect to the first question, we review some key papers on the topics of absorptive capacity, the localization of knowledge spillovers, including ideas about the open innovation paradigm. Regarding the second question, we discuss some empirical papers illustrating that patent citations can be a good tool to measure access to the knowledge base inside and outside a region. Based on this literature review our main hypothesis suggests a relationship between the use of university knowledge and firms' R&D across European regions.

The data collection was designed by the Institute for Prospective Technological Studies (IPTS) in 2009. An international consortium of researchers from the University of Newcastle, Incentim and the Centre for Science and Technology Studies (CWTS) were responsible for implementing the data collection. The EPO Worldwide Patent Statistical Database (PATSTAT) database was used to compile a dataset of 649,156 direct EPO patents applied for in the period 1990-2007. These

649,156 patents involved 1,938,818 references, equating to an average of 3 references per patent (cf Criscuolo and Verspagen 2008 and Sapsalis et al. 2007). The team then identified which were university references. The strategy used differed depending on whether it was references to patent literature or to non-patent literature.

These matching procedures for the distribution of references by institutional sector resulted in 82% non-university references, 17% references of unknown institutional origin and 1% university references. As explained above, this 1% is an underestimation due to the single-author criterion.This 1%, or 20,630 university references (contained in 15,433 patents), is the basis for our analysis. These references were classified by applicant for EU27 NUTs II regions. In the case of multiple regions, fractional counts were applied, i.e. if a patent application involved two different regions, each scored 0.5 patents. Based on our classification by region applicants we are able to check whether there is a match between applicant region and region of a citation from a university.

To correctly estimate the effect of regional R&D structure on university citations, we assume that units (regions) are positively correlated within clusters (countries). Then, we use several econometric specifications in the framework of cluster count data models (Antweiler, 2001, Wooldridge, 2003, 2006). The initial results, after controlling for the technological size of the region (nº of patents and R&D expenditure) show that (see Table below):

- The use of university knowledge measured as patent citations to universities across European regions depends on both the supply and the demand.

- The university R&D structure presents a significant and positive sign. This is not surprising as regions with a strong economic support to their universities produce more outputs in terms of patents and papers (and probably of higher quality). Consequently, there are more opportunities for the region to cite these outputs.

- The firms' R&D structure has a significant and negative sign. This negative relationship is contrary to the scarce evidence on this topic and would suggest that regions with a high proportion of private R&D expenditure would use the internal knowledge less intensively than regions with a low proportion of R&D expenditure. Some explanations for this surprising result may be:

- Regions with a high participation of private R&D expenditure have a strong presence of big firms that are more prone to use external knowledge because they have more resources for accessing knowledge, wherever it is located.
- Regions with a high participation of private R&D expenditure are those specializing in sectors of high technology complexity, that need external not internal knowledge to support their innovations. While regions which specialize in low complexity technology take advantage of the internal proximity to the sources of knowledge.

The positive sign for the university R&D structure and the negative sign for the firms R&D structure is robust to other specifications (simple count models with cluster variances, ZIP models, etc.). In addition, using the R&D effort (% in terms of GDP) leads to similar results. These provisional findings prompt further close analysis of the phenomenon of the internal/external use of university knowledge and its relationship with the institutional structure of the R&D in European regions.

Negative Binomial Regressions (Random Effects)*				
	Model 1	Model 2	Model 3	Model 4
CONS	-7.95**	-6.27**	-7.43**	-6.33**
LRDTOT	0.90**	0.72**	0.88**	0.73**
PBUSRD	-1.32**	-1.88**		
PUNIVRD	2.60**	1.90**		
BUSRDGDP			-0.57**	-0.58**
UNIVRDGDP			0.96**	1.04**
NUMPATS	0.01**	0.48**	0.004**	0.05**
INTLINKS		-0.02**		-0.02**
NATLINKS		0.03*		0.03*
Log-likelihood	-592.0	-582.3	-532.1	-524.4
lnr	1.67	1.79	1.97	2.03
lns	2.41	2.48	2.89	2.90
r	5.29	5.97	7.17	7.62
s	11.2	11.9	18.07	18.11
Numb of obs	796	796	679	679
Numb of groups	22	22	22	22

Dependent variable: Number of own university citations in EPO documents of region i.
Explanatory variables: LRDTOT: Natural logarithm of total R&D expenditure of region i in PPS; PBUSRD: Percentage of business R&D expenditures over total R&D in region i; PUNIVRD: Percentage of university R&D expenditures over total R&D in region i; BUSRDGDP: Business R&D expenditures over GDP in region i; UNIVRDGDP: University R&D expenditures over GDP in region i; NUMPATS: Number of patents in region i; INTLINKS: Number of international university citations in EPO documents of region i (all countries except of the region i); NATLINKS: Number of national university citations in region i (except region i) in EPO documents of region i.
*Random effects are preferred to fixed effects. All models include binary variables for each year (not reported).