

Searching for capacity building or efficiency? A distribution-sensitive analysis on funding modes and academic patenting in Europe

Thomas Zacharewicz, Mehmet Pinar, Jesús Heredia Carroza, Jesús Artero
University of Seville



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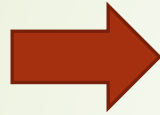
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Introduction

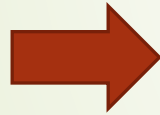


Context. Over the last decades, large increase research of competitive funding mechanisms in the EU.



Rationale. More competition for the allocation of financial resources would lead to better academic performance by improving efficiency, promoting innovation and steering research towards societal objectives.

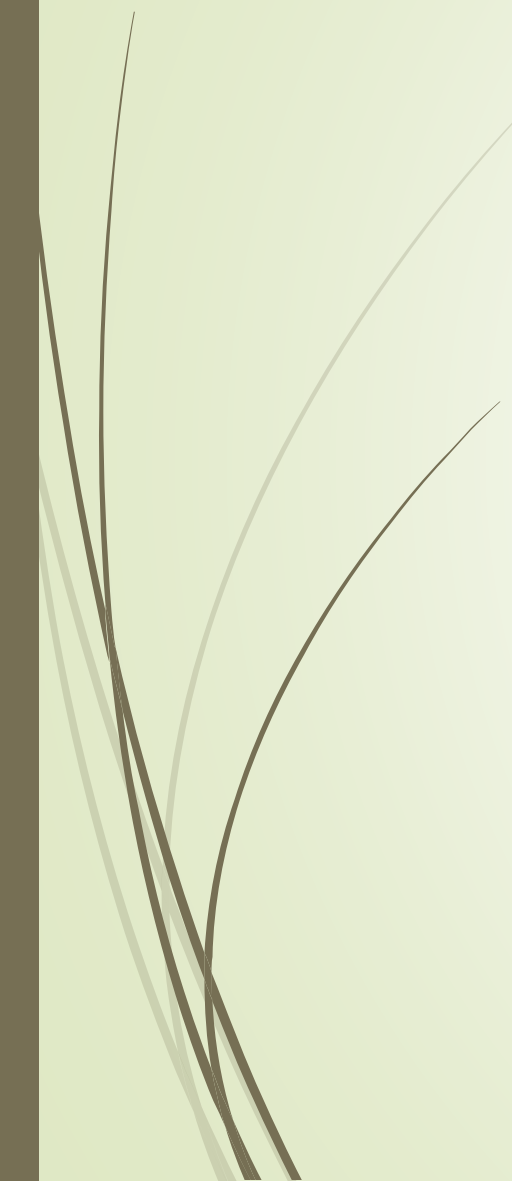
Mixed evidence



- Higher levels of competitive funding are expected to impact positively on scientific performance (Aghion et al., 2010; OECD, 2002, 2010, 2014, Wolszczak-Derlacz, 2025)
- Some studies find no impact (e.g. Auranen & Nieminen, 2010; Himanen et al., 2009; Zacharewicz et al., 2023)
- Others find a negative impact (Sandström and van den Besselaar, 2018)

Why do studies reach different conclusions?

Introduction



Our main argument: Studies overlook institutional heterogeneity across universities and build on average effect of funding modes on R&I activity.

But universities differ in

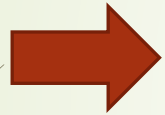
- Research infrastructure
- Technology transfer capacity
- Human resources
- Absorptive capacity
- Industry links

Our hypothesis: Funding mechanisms operate differently depending on institutional capacity.

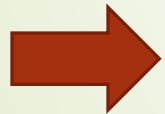
Conceptual framework. The evolution of academic patenting in Europe



Academic patenting in Europe has **expanded markedly** since the late 1980s, from 4% of total patent applications to around 10-15% in 2019.



Geographic diffusion of academic patenting. Absolute number of academic patents remains higher in industrialised regions with strong firm-level R&D capacity, but relative share in total patenting tends to be larger in less developed regions. **Universities may act as partial substitutes for missing industrial R&D capabilities in weaker regional ecosystems**



Third mission of Universities. Ongoing cultural shift towards technology Transfer

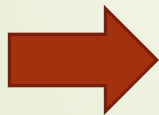
Conceptual framework. The role of Funding modes on academic production. Mixed evidence

Institutional funding (or basic instalment, block grant, GUF):

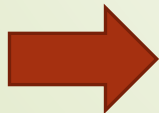
“The funding of institutions with no direct selection of projects or programmes to be performed. Under this type of funding, it is the receiving institution that has discretion over the R&D projects that are to be performed, not the funding organization” (Van Steen 2012).

Project funding

“Money attributed to a group or an individual to perform a R&D activity limited in scope, budget and time, normally on the basis of the submission of a project proposal describing the research activities to be done” (Lepori et al., 2007).



Consensus about the positive effect of Funding volumes on academic performance



Mixed evidence about the effect of Funding modes

Conceptual framework. Funding modes, capacity building, and efficiency in academic patenting

Low patenting universities

- Lack infrastructure
- Lack absorptive capacity
- Need stable resources

High patenting universities

- Capacity already exists
- Need incentives and strategic steering

Two mechanisms



Institutional Funding – capacity building effect

- Infrastructure
- Researchers
- TTOs
- Long-term capacity



Project Funding – efficiency effect

- Incentives
- Prioritisation
- Industry collaboration
- Strategic orientation



Conceptual framework. Funding modes, capacity building, and efficiency in academic patenting

H1. At lower levels of institutional patenting capacity, increases in total funding volume are expected to exert a stronger influence on patenting outcomes than changes in funding composition.

H2. As organizational capacity accumulates, the marginal impact of project funding is expected to increase across the patenting distribution.



Data and methodology

Data collected from the European Higher Education Sector Observatory (EHESO)

Sample: 344 universities, 17 EU countries

Data: 2011-2020

Dependent variable

Academic patents

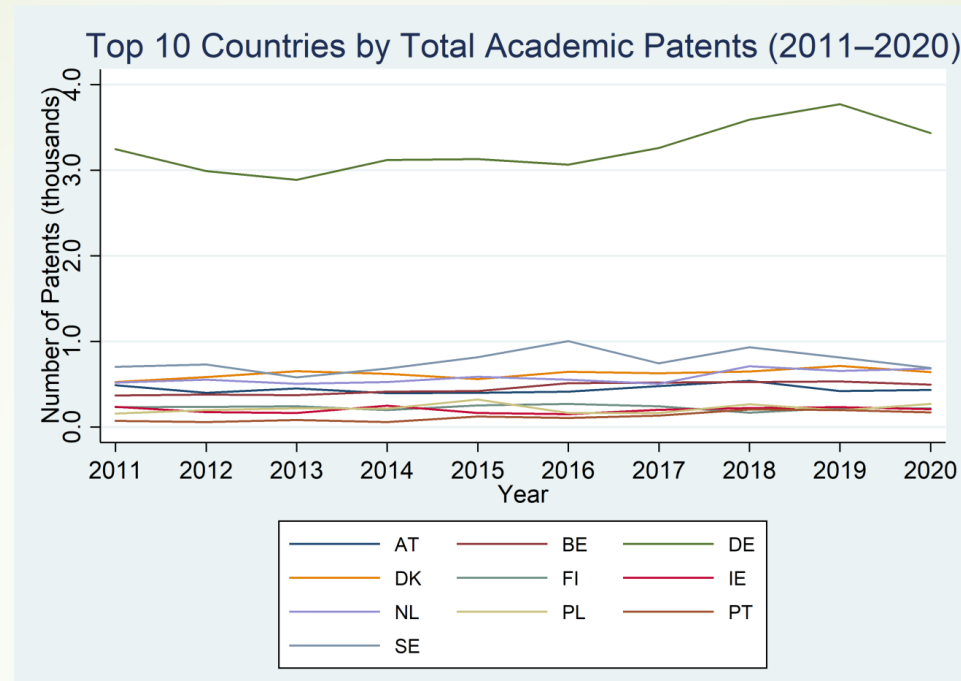
Funding variables

- Total current revenues
- Core funding
- Third-Party Funding

Controls

- Students/staff ratio
- EU projects
- Senior academics

Descriptive results



Patent activity across European universities is highly concentrated:

- Germany largely dominates + together with Sweden, Denmark, and the Netherlands, these four countries account for the majority of academic patenting in Europe.
- Leading systems are not necessarily dynamic: Germany and Sweden recorded fairly stable and slightly negative growth rates
- Smaller systems such as Portugal (+166%), Lithuania (+150%), and Estonia (+133%) posted rapid-albeit small-scale-expansions.

Descriptive results

Funding composition of patenting universities (aggregated by country)

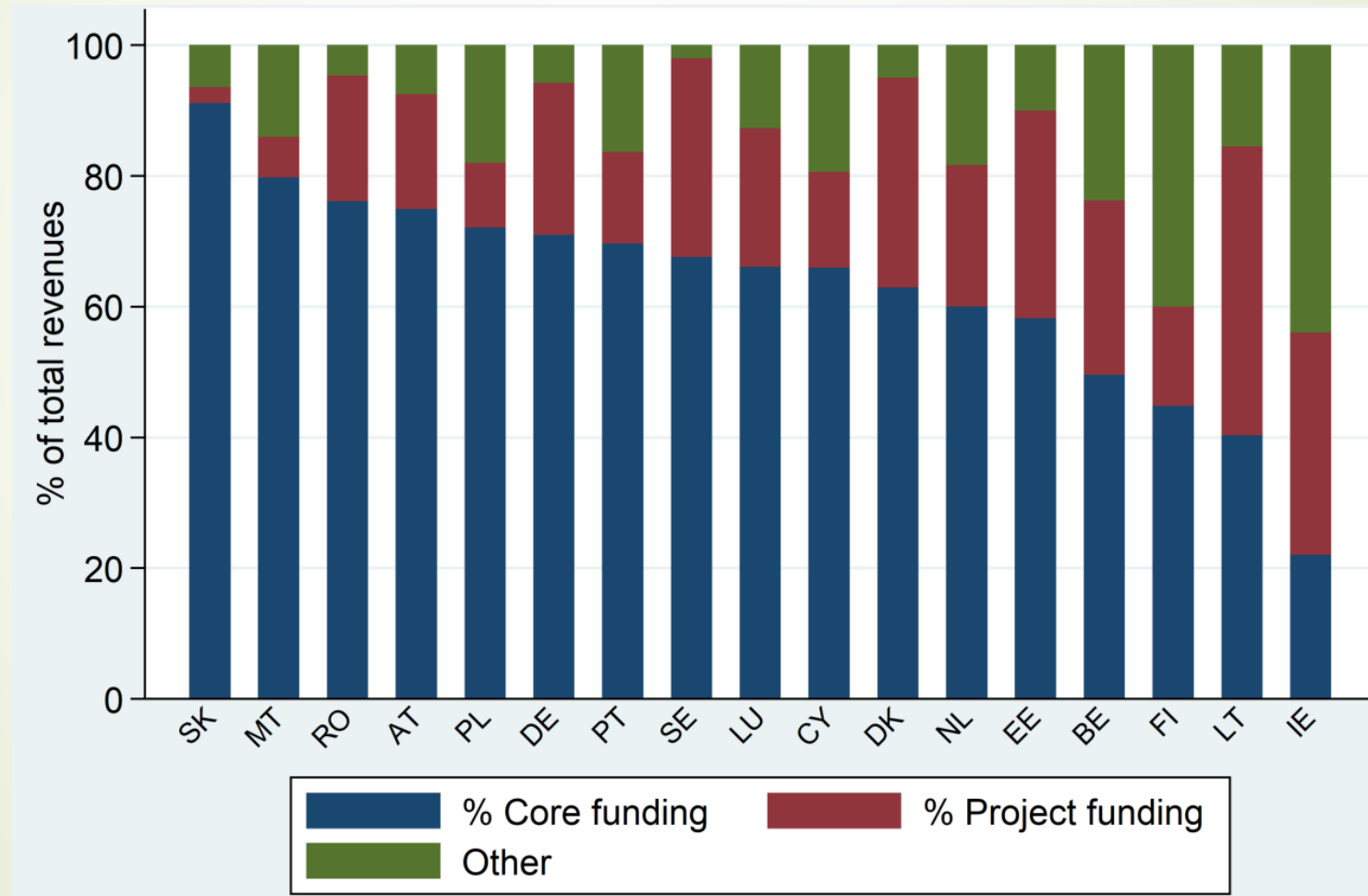


Table 1. Descriptive statistics and correlation matrix

Variables	Mean	SD	1	2	3	4	5	6	7
1. Number of academic patents	19.7	42.7							
2. Total Current Revenues (in Million €)	169	188	0.74						
3. Core funding (in Million €)	112	117	0.68	0.97					
4. Project funding (in Million €)	40.3	62.9	0.79	0.93	0.84				
5. Students per FTE staff	15.9	7.9	-0.33	-0.33	-0.31	-0.34			
6. EU projects	31.8	56.1	0.75	0.84	0.74	0.87	-0.34		
7. Senior academics	138.9	115.7	0.56	0.73	0.78	0.63	-0.27	0.51	

Notes: SD denotes standard deviation. All pair-wise correlation coefficients are statistically significant at the 1% level.

Results

Table 2. Linear Panel Regression Results: Funding and Academic Patenting

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
ln (Total Revenues)				0.283***	0.283***	0.295***
				(0.0673)	(0.0752)	(0.0764)
ln (Core Funding)	0.00106	0.00930	0.00932	-0.0184*	-0.00791	-0.00865
	(0.00940)	(0.00937)	(0.00935)	(0.0109)	(0.0107)	(0.0108)
ln (Project Funding)	0.209***	0.147***	0.147***	0.146***	0.0900***	0.0915***
	(0.0285)	(0.0332)	(0.0344)	(0.0302)	(0.0311)	(0.0318)
ln (Student/Staff)	-0.279***	-0.266***	-0.265***	-0.276***	-0.237***	-0.237***
	(0.0390)	(0.0450)	(0.0451)	(0.0388)	(0.0439)	(0.0441)
ln (EU projects)	0.473***	0.551***	0.552***	0.400***	0.492***	0.488***
	(0.0245)	(0.0284)	(0.0291)	(0.0266)	(0.0298)	(0.0306)
ln (Senior)	0.244***	0.205***	0.203***	0.169***	0.0995**	0.0924**
	(0.0251)	(0.0334)	(0.0337)	(0.0281)	(0.0421)	(0.0426)
Observations	2,866	2,866	2,866	2,866	2,866	2,866
Year effects	NO	NO	YES	NO	NO	YES
Country effects	NO	YES	YES	NO	YES	YES
R-square	0.698	0.710	0.711	0.701	0.712	0.713

Notes: The dependent variable is the natural logarithm of the number of academic patents. All regressions include a constant term, but not reported. Robust standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Results

Table 5. Panel Quantile Regression Estimates (Core and Project Funding)

Percentiles	10	20	30	40	50	60	70	80	90
ln(Core Funding)	0.0342***	0.0146**	0.00658	0.00311	-0.0245***	-0.0209***	-0.0270***	-0.0309***	-0.0814
	(0.00321)	(0.00676)	(0.0268)	(0.0149)	(0.00714)	(0.00448)	(0.00850)	(0.0112)	(0.0600)
ln(Project Funding)	0.118***	0.178***	0.153*	0.175***	0.212***	0.323***	0.282***	0.308***	0.272***
	(0.0298)	(0.0564)	(0.0928)	(0.0334)	(0.0352)	(0.0359)	(0.0153)	(0.0417)	(0.0514)
ln(Student/Staff)	-0.153***	-0.295***	-0.363***	-0.340***	-0.449***	-0.410***	-0.466***	-0.399***	-0.276***
	(0.0215)	(0.0251)	(0.0989)	(0.0369)	(0.0673)	(0.0506)	(0.0352)	(0.0811)	(0.0926)
ln(EU projects)	0.449***	0.514***	0.549***	0.550***	0.507***	0.399***	0.416***	0.383***	0.428***
	(0.0232)	(0.0435)	(0.0660)	(0.0273)	(0.0339)	(0.0285)	(0.0122)	(0.0343)	(0.0474)
ln(Senior)	0.269***	0.309***	0.304***	0.250***	0.248***	0.234***	0.223***	0.206***	0.232***
	(0.0102)	(0.0179)	(0.0181)	(0.0181)	(0.0301)	(0.0207)	(0.0130)	(0.0204)	(0.0280)
Observations	2,866	2,866	2,866	2,866	2,866	2,866	2,866	2,866	2,866
Mean AR	0.497	0.409	0.404	0.370	0.421	0.43	0.576	0.363	0.436

Notes: Standard errors are reported in parentheses. All explanatory variables lagged by one year are used as instrumental variables. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Results

Panel Quantile Regression Estimates with all funding variables.

Percentiles	10	20	30	40	50	60	70	80	90
ln(Total Revenues)	0.127**	0.243***	0.260**	0.403***	0.284***	0.109	0.101**	0.254***	0.447***
	(0.0594)	(0.0615)	(0.112)	(0.128)	(0.0786)	(0.0704)	(0.0425)	(0.0289)	(0.0294)
ln(Core Funding)	0.0289***	-0.0126*	-0.0119	-0.0394***	-0.0337***	-0.0258***	-0.0304***	-0.0294***	-0.0761***
	(0.00656)	(0.00731)	(0.0143)	(0.00822)	(0.00660)	(0.00400)	(0.00752)	(0.00258)	(0.00468)
ln(Project Funding)	0.140***	0.167***	0.129***	0.0880***	0.206***	0.290***	0.298***	0.260***	0.270***
	(0.0143)	(0.0189)	(0.0290)	(0.0137)	(0.00947)	(0.0197)	(0.0171)	(0.00709)	(0.0133)
ln(Student/Staff)	-0.101***	-0.261***	-0.357***	-0.379***	-0.382***	-0.434***	-0.400***	-0.321***	-0.193***
	(0.0116)	(0.0210)	(0.0325)	(0.0255)	(0.0326)	(0.0136)	(0.0316)	(0.0205)	(0.0125)
ln(EU projects)	0.398***	0.424***	0.455***	0.431***	0.389***	0.374***	0.372***	0.322***	0.241***
	(0.0169)	(0.0181)	(0.0276)	(0.0589)	(0.0375)	(0.0188)	(0.00970)	(0.00791)	(0.0120)
ln(Senior)	0.223***	0.256***	0.244***	0.164***	0.164***	0.195***	0.185***	0.154***	0.0766***
	(0.0174)	(0.0163)	(0.0334)	(0.0332)	(0.0149)	(0.0244)	(0.0192)	(0.0255)	(0.0137)
Observations	2,866	2,866	2,866	2,866	2,866	2,866	2,866	2,866	2,866
Mean AR	0.498	0.352	0.494	0.386	0.400	0.426	0.392	0.46	0.403

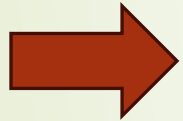
Notes: Standard errors are reported in parentheses. All explanatory variables lagged by one year are used as instrumental variables. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.



DISCUSSION



At the lower end of the patenting distribution, total revenues and core institutional funding display positive and statistically significant effects. positive effect of core funding is concentrated primarily in the lowest quantiles. **Partial support to H1.**



Impact of project funding increases substantially toward the upper quantiles of the distribution. Among research-intensive universities, competitive funding is associated with larger patent elasticities. Strong **Support to H2.**

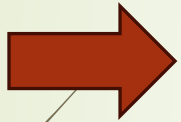


DISCUSSION – Policy implication

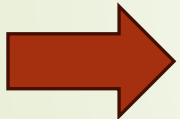


No one-size-fits-all model.

Increase of resources may be more efficient than increase of competitive funding for low-capacity institutions. Role of stability.



For more research-intensive institutions, competitive funding appears to function as a steering mechanism that enhances innovation performance



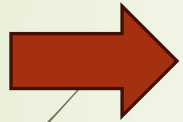
The negative marginal association of core funding at higher quantiles highlights a potential trade-off between stability and flexibility.



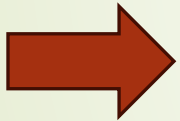
DISCUSSION – Limitations and future studies



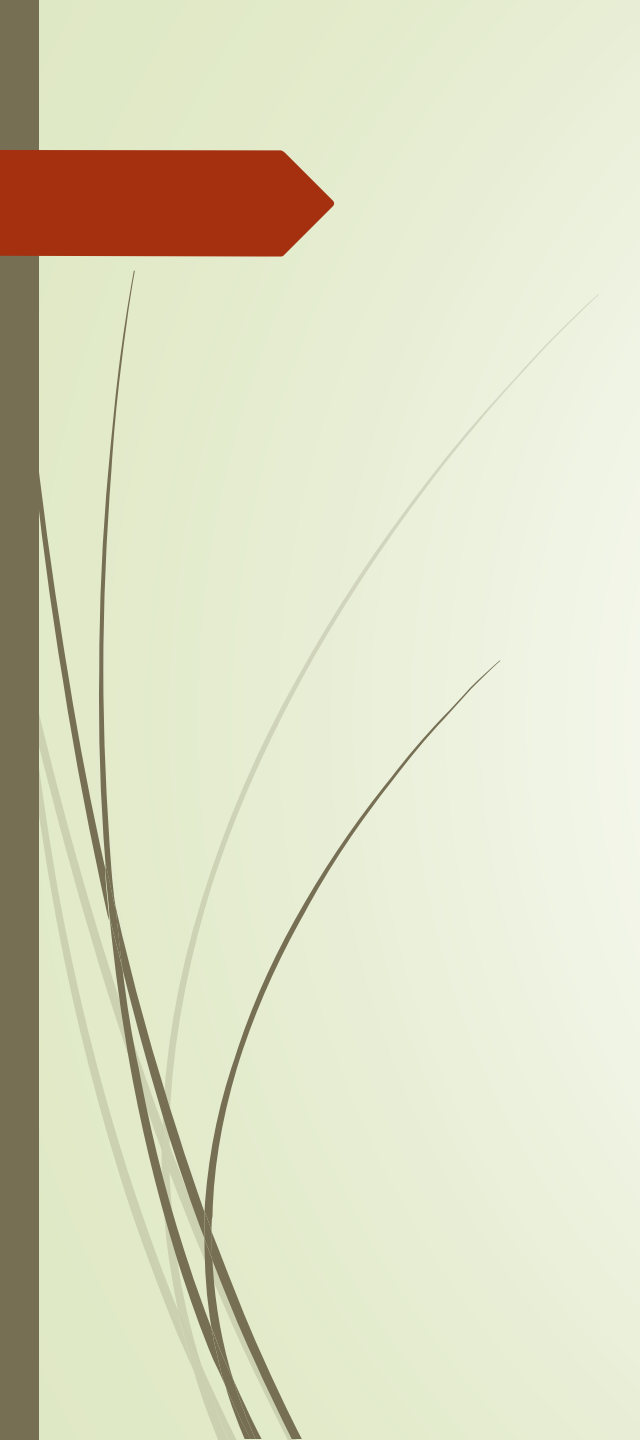
Include licensing income, spin-offs, or collaborative public-private research agreements



Project funding treated as an homogeneous category. Limited data on funding composition.



High correlation across variables



**Thank you!!!
¿¿Any question??**

tzacharewicz@us.es