Spanish author-inventors

Catalina Martinez

CSIC Institute of Public Goods and Policies

Madrid, Spain

APE-INV Final Conference

Paris 3 September 2013

Research project on academic patenting in Spain, 2010-2013

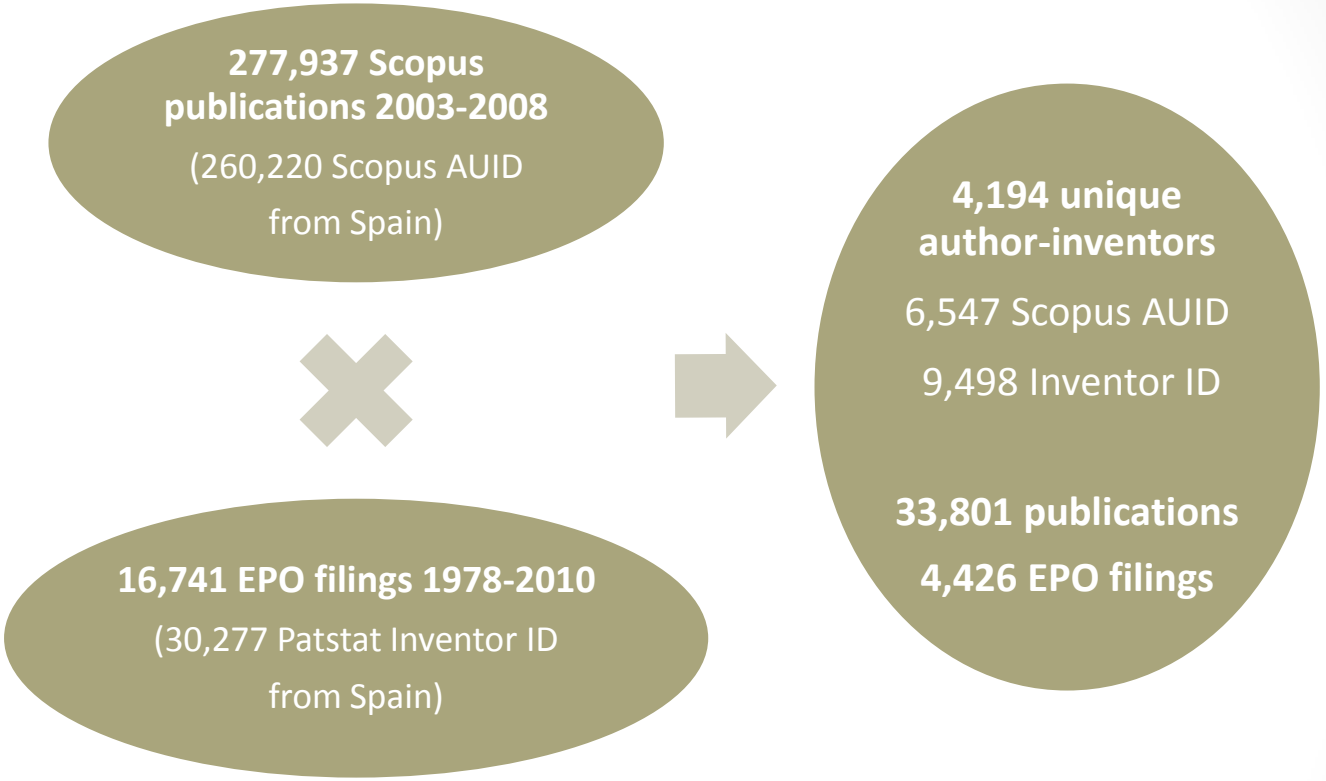
- **Novel database of Spanish author-inventors:** Broad coverage (all fields and public research institutions), complex matching and disambiguation methodology based on national name writing customs and standardisation of institutions names, including a final recursive quality control phase

- **Methodological working paper:** Maraut and Martinez (2013), "Identifying author-inventors from Spain: methods and a first insight into results", CSIC-IPP Working Paper 2013/2

- **Research paper forthcoming in the special issue on academic patenting in Europe of the journal *Industry and Innovation*:** Martinez, Azagra-Caro and Maraut (2013), "Academic inventors, scientific impact and the institutionalisation of Pasteur's Quadrant in Spain"

- **Spanish contribution to database of academic patenting in Europe**

Spanish Scopus authors matched to Spanish EPO inventors
(Maraut and Martinez, 2013)



Data sources:

- Scopus
- Patstat, EPO patent applications
- Frequency of Spanish names and surnames, Spanish National Official Statistics Institute (INE)
- Scimago normalisation of Scopus author institutions
- OECD Regpat (Maraut et al 2008)
- Scopus-Patstat fields correspondence (Schmoch et al 2011)
- KUL/Eurostat normalisation of Patstat applicant institutions (van Looy et al 2006)

Academic inventors, scientific impact and the institutionalisation of Pasteur's Quadrant in Spain

(Martinez, Azagra-Caro ,Maraut , 2013)

Exploratory research questions:

- Are papers written by Spanish academic inventors associated with higher scientific impact (citations received, journal prestige) ?
- Does this relationship change across different types of Spanish academic institutions, i.e. public universities, traditional public research centres and new independent research institutes in Pasteur's Quadrant?

Data for this paper (subset of full database):

- 132,337 Scopus papers published in 2003-2008 written by Spanish academic authors, of which 17,452 are by Spanish academic authors with previous patenting experience as EPO inventors (13%): different disciplines, affiliated to all kinds of Spanish PROs.

The remainder of this presentation summarises main results of this paper, published in the September 2013 special issue of *Industry and Innovation* on Academic Patenting in Europe and available here: http://www.tandfonline.com/doi/full/10.1080/13662716.2013.824194

Spanish Public Research System

- **Universities:** 48 public universities
- **CSIC:** Spanish National Research Council, 3rd largest overarching multidisciplinary PRO in Europe
- **MOC:** Mission Oriented Centers, depend on sectoral ministries (e.g. agriculture, energy, defence, health)
- **IRIs:** Independent Research Institutes, not tied to the civil service model, not-for-profit foundations, Pasteur's Quadrant

Tenured researchers at public universities, CSIC and MOCs are civil servants (salary scale, restrictions v stability)

Productivity rewards are set nationally for CSIC and universities ("sexenios", promotion): growing importance of scientific impact, patents also start to be taken into account.

In contrast, IRIs are free to set own incentive schemes, evaluations, (high staff turnover, mainly from international job market)

Academic patenting literature

Better scientists are more likely to patent and publish more	Stephan *et al*. (2007); Fabrizio and Di Minin (2008); Azoulay *et al*. (2009)
Academic patenting may strengthen the **Matthew effect**, whereby more productive scientists enjoy increasing returns to reputation and visibility over time.	Breschi *et al*. (2008)
Inventors' **networks** are larger, more connected and more complex than those of their colleagues who never filed a patent	Meyer (2006); Forti *et al*. (2013)
Researchers who patent extensively may be more highly **cited by industry**	Agrawal and Henderson (2002)
Papers in **patent-paper pairs** are more cited than other articles at similar risk but not associated with patents. Complementary outputs in Pasteur's Quadrant	Murray and Stern (2007); Gans et al (2011)
The effect of patenting outlasts the initial idea leading to the patent, as it enables scientists to continue **sourcing ideas and funds from industry** over time	Azoulay *et al*. (2009)
Some institutions favour **positive attitudes toward commercialisation** (e.g. royalty shares, presence of prominent peers engaged in patenting, support to commercialisation)	Azoulay *et al*. (2009); Goldfarb *et al*. (2009)
The **costs and opportunities to engage in patenting** depend on individual research trajectories. The probability to patent is a positive function of productivity, basicness or impact for low-to-moderate-high values of publication related indicators, but a negative function for high values	Calderini *et al.* (2007)
The positive correlation between patenting and scientific productivity of scientists does not hold when **patents are owned by business** . Contract research more likely to be of less fundamental nature, less potential to find spillovers from consulting to basic research	Breschi *et al*. (2008); Fabrizio and Di Minin, (2008); Czarnitzki *et al*. (2009); Mejer (2011)

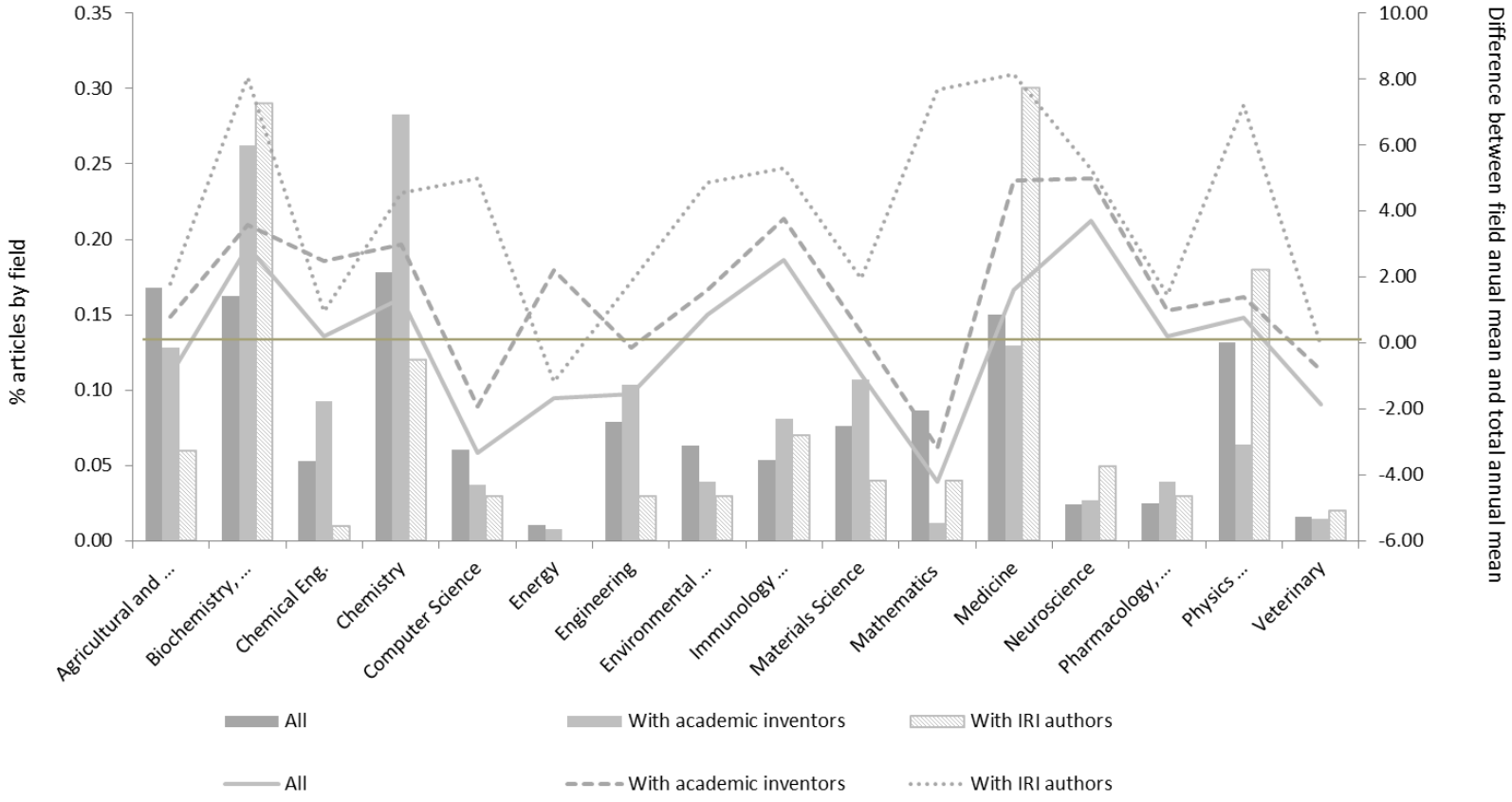
Descriptive statistics

	All academic articles, 2003-2008 (n= 132,337)				Academic articles with academic inventors, 2003-2008 (n=17,452)			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Publication year	2005.79	1.69	2003	2008	2005.92	1.65	2003	2008
Citations received*	7.92	17.08	0	1990	9.96	17.58	0	879
Journal rank	0.30	0.62	0	19.5	0.45	0.77	0	14.1
Number of authors	6.03	24.92	1	3031	5.96	23.20	1	2907
Foreign author dummy	0.40	0.49	0	1	0.35	0.48	0	1
Academic inventor dummy	0.13	0.34	0	1	1.00	0.00	1	1
Visibility not academic inventors**	5.65	7.18	0	214.4	6.21	7.84	0	198.8
Visibility academic inventors**					9.41	9.92	0	191
Patents academic-owned					2.03	7.95	0	80
Patents not academic-owned					1.79	3.71	0	112
Years since first patent					6.62	5.18	0	25
University authors	0.80	0.40	0	1	0.68	0.47	0	1
CSIC authors	0.23	0.42	0	1	0.39	0.49	0	1
MOC authors	0.05	0.22	0	1	0.05	0.22	0	1
IRI authors	0.06	0.24	0	1	0.10	0.30	0	1

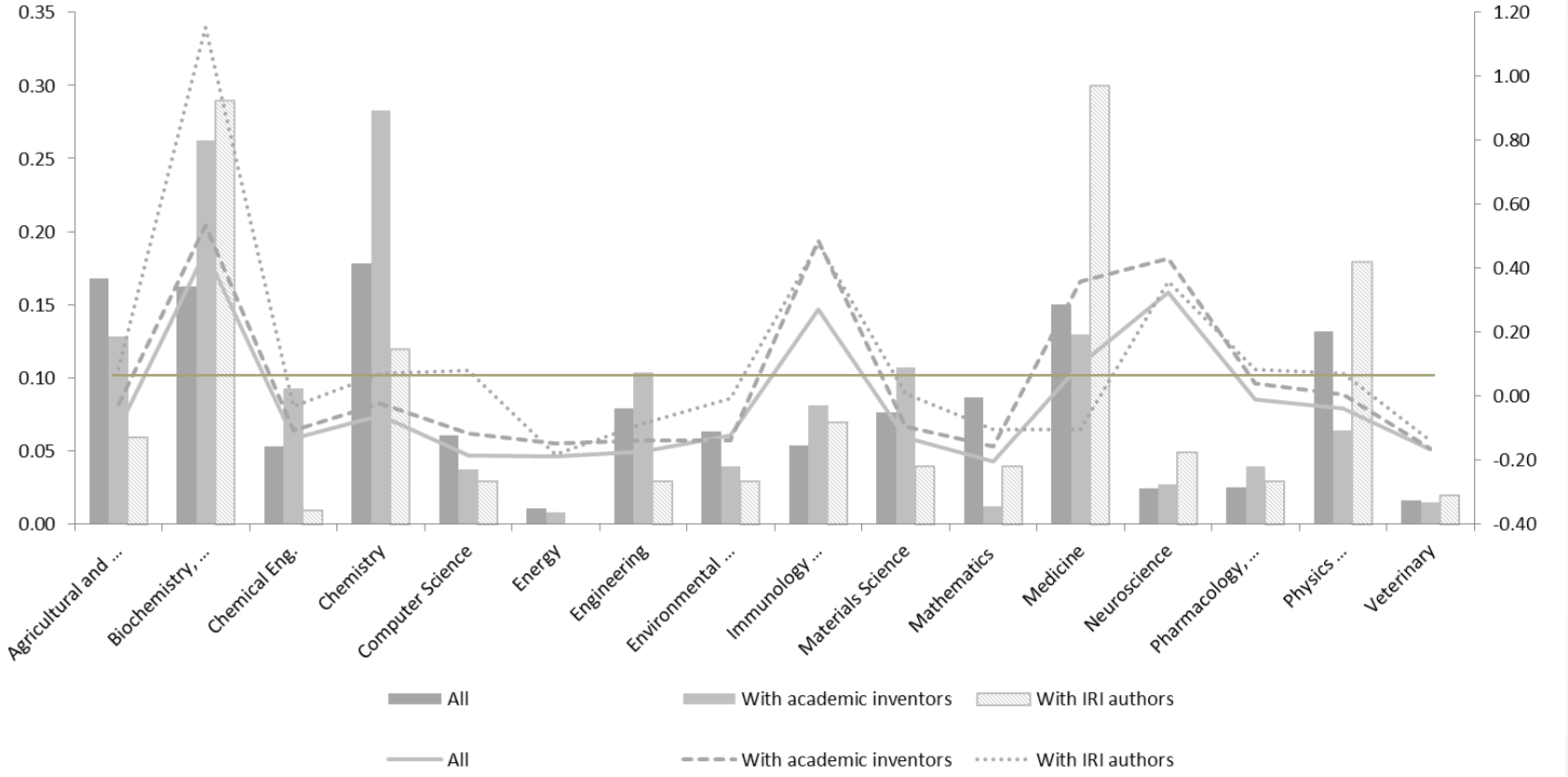
* Citations received up to end 2009

**Visibility variables for Spanish authors, academic inventors and others are only available for 2004-2008. Defined as citations received by previous year's publications of the article's authors.

Distribution of articles by field (left axis: bars) and difference with respect to annual mean of citations received (right axis: lines)



Distribution of articles by field (left axis: bars) and difference with respect to annual mean of journal rank (right axis: lines)



Average scientific impact of articles with different types of academic authors

	Mean citations received				Mean journal rank			
	Without academic inventors	With academic inventors	Diff	Sig	Without academic inventors	With academic inventors	Diff	Sig
All academic articles	7.62	9.96	-2.34	***	0.27	0.45	-0.18	***
with university authors	7.17	9.22	-2.04	***	0.24	0.39	-0.15	***
without university authors	9.54	11.55	-2.01	***	0.43	0.58	-0.15	***
with CSIC authors	9.03	10.84	-1.81	***	0.38	0.56	-0.17	***
without CSIC authors	7.26	9.39	-2.13	***	0.25	0.38	-0.13	***
with MOC authors	7.18	9.09	-1.91	***	0.24	0.46	-0.22	***
without MOC authors	7.64	10.01	-2.37	***	0.28	0.45	-0.18	***
with IRI authors	13.49	12.37	1.12		0.67	0.86	-0.19	***
without IRI authors	7.28	9.68	-2.40	***	0.25	0.41	-0.15	***

***p<0.01

	Citations (negbin)		Journal rank (OLS)	
	Academic articles without IRI authors	Academic articles with IRI authors	Academic articles without IRI authors	Academic articles with IRI authors
Number of authors	0.016***	0.017**	0.001***	0.001***
	(0.003)	(0.007)	(0.000)	(0.000)
Foreign author dummy	1.652***	4.168***	0.081***	0.266***
	(0.049)	(0.337)	(0.003)	(0.027)
Visibility of Spanish authors not academic inventors	0.233***	0.173***	0.006***	0.003
	(0.004)	(0.015)	(0.000)	(0.002)
Spanish academic inventor dummy	1.209***	0.009	0.040***	-0.105***
	(0.076)	(0.377)	(0.006)	(0.038)
Scientific fields	yes	yes	yes	yes
Publication years	yes	yes	yes	yes
Affiliation dummies	yes	yes	yes	yes
Total R-sq			0.244	0.268
Log Likelihood	-293351.8	-23711.87		
Alpha	1.034	0.989		
Observations	107912	7341	107912	7341

	Negative binomial estimation of citations received		Ordinary least squares estimation of journal rank	
	Articles without IRI authors	Articles with IRI authors	Articles without IRI authors	Articles with IRI authors
	1	2	3	4
Number of authors	0.095	0.038	0.000	0.003*
	(0.169)	(0.055)	(0.000)	(0.002)
Foreign author dummy	0.983**	2.782***	0.105***	0.290***
	(0.448)	(0.530)	(0.012)	(0.058)
Visibility of Spanish authors not academic inventors	0.128***	0.116***	0.002	0.005
	(0.016)	(0.028)	(0.001)	(0.004)
Characteristics of Spanish academic inventors:				
Visibility	0.119***	0.032	0.007***	0.003
	(0.012)	(0.025)	(0.001)	(0.003)
Number of patents owned by academic institutions	0.054***	0.035	0.003***	0.040*
	(0.014)	(0.102)	(0.001)	(0.021)
Number of patents not owned by academic institutions	0.003	-0.119**	-0.004	-0.029***
	(0.026)	(0.051)	(0.003)	(0.007)
Years since first patent	-0.029**	-0.038	0.003**	-0.002
	(0.014)	(0.075)	(0.001)	(0.010)
Scientific fields	yes	yes	yes	yes
Publication years	yes	yes	yes	yes
Affiliation dummies	yes	yes	yes	yes
Total R-sq			0.293	0.269
Log Likelihood	-41188.6	-5338.491		
Alpha	0.785	0.707		
Observations	13906	1693	13906	1693

Conclusions

The positive and significant association between past patenting experience of authors and scientific impact holds for articles from public universities and traditional PROs (similar results obtained for citations and journal rank)

….but not for the highly cited articles published in highly ranked journals with authors from IRIs, which are relatively new centres aiming to optimise the conditions favourable for carrying out research on Pasteur's Quadrant.

- Non-linear relationship between scientific impact and patenting experience; the advantage provided by authors with patenting experience diminishes when scientific impact increases
- When institutions aim to combine excellence and use-inspired research, reaching the highest levels of excellence may require specialisation and a dual structure of research staff
- The positive association between scientific impact and patenting experience is stronger in environments producing on average lower impact research, where researchers face stronger financial and labour constraints. Specialisation in more applied research may enable researchers to have access to more resources, consolidate research groups, benefit from spillovers from contract research and be more productive
- Caveats: data limitations, endogeneity concerns
- Further research…

Annex

	Citations (negbin)		
	With universities	With CSIC	With MOC
Number of authors	0.010***	0.006***	0.007***
	(0.002)	(0.002)	(0.003)
Foreign author dummy	1.742***	1.431***	1.505***
	(0.054)	(0.104)	(0.165)
Visibility Spanish not academic inventors	0.234***	0.180***	0.167***
	(0.005)	(0.008)	(0.014)
Spanish academic inventor dummy	1.224***	0.647***	1.119***
	(0.087)	(0.124)	(0.262)
Scientific fields	yes	yes	yes
Publication years	yes	yes	yes
Affiliation dummies	yes	yes	yes
Log Likelihood	-246870	-77170	-15342.93
Alpha	1.062	0.859	0.780
Observations	91667	26326	5739