

The effects of public policies in fostering university spinoffs in Italy

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Summary

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- Data and variables
- Main findings
- Concluding remarks

Motivations

Since the **Lisbon agenda (2000)**, the European Union (EU) has encouraged the implementation of policies that might stimulate the establishment of academic spin-offs as they are considered a proxy of University engagement and knowledge transfer

- On the lines set by the **Lisbon agenda** and further reinforced by the European Commission's subsequent communications since 2000 (e.g. 2003, 2005, 2006, 2007), to **promote University engagement** and turn the European economy into "the most dynamic knowledge-based economy in the world"

For instance:

- **European Commission (2006)**, in relation to the third mission, invites Universities to become a significant player in the economy and, in this respect, **structured partnerships with the business community** begin to be considered crucial since they allow sharing of knowledge and results through a set of interaction modes, among whom, **in-campus start-ups and science parks**
- **European Commission (2007)**, with regard to the incentives policy, recommends research institutions to **"communicate clear incentives for researchers who take part in knowledge transfer activities"**

Accordingly, one of the “big six” innovation policy measures implemented in the EU is the funding for specific public research programs allocated in a competitive manner to universities and public research organizations (“competitive public research”, Veugelers 2015)

These programs represented the largest budget share for EU countries during 1990–2013 (approximately 18% of the total budget). Technology transfer accounted for 3% and the creation of spinoff companies was explicitly considered

On these lines an increasing number of member States began to implement laws which might promote the rise of academic spinoffs and started monitoring Universities’ third mission activities, among whom, the spinoffs creation has become pivotal

- Also [Emerging countries](#) started adopting several commercialization policies, introducing, for the first time, an explicit [legal framework](#) to commercialize public research results ([OECD, 2013](#))

Motivations –The European Perspective

Member States have implemented monitoring procedures and national plans with the aim to meet the EU address

Research assessment programs accounting for spinoff creation of certain main European countries

Country	Agency	Measure
France	French Agency for the Evaluation of Research and Teaching (AERES)	"Business start-ups through the institution's multi-, inter-, or trans-disciplinary experience" are counted as an "observable fact" from which quality indicators are derived under the evaluation criterion
Germany	The German Council of Science and Humanities	Research rating (Forschungsrating) program. Transfer to society is one of the indicators within the knowledge transfer evaluation and includes: number of (licensed) patents; money gained by licenses; funding by industry/business; spinoffs; consultancy work
Italy	National Agency for Research Evaluation (ANVUR)	Third mission is evaluated using eight indicators. One of these indicators (with a 10% weight) is the number of spinoffs officially acknowledged by the university according to internal rules during the reference period
Netherlands	Quality Assurance System for Research at Universities of Applied Sciences	Self evaluation program measures of societal relevance explicitly account for spinoffs as "things to consider" under the aspect "contribution to and better understanding of societal sectors"
UK	Higher Education Funding Council (HEFCE)	Measures used by the Higher Education Innovation Fund include the "number of, and the economic value and employment created through, spin-out companies created around HEI research outputs"

All these assessment programs and evaluation criteria clearly take into account or incentivize the creation of academic spin-offs

The Italian case

The periodical research quality assessment is giving increasing importance to the evaluation of the third mission, which sees spinoffs creation one of the crucial indicators

A crucial turning point in this policy path is clearly recognizable in 2004 when universities were called for the first time for assessment of their research performance and its economic valorization (patents, spinoffs, and others). Participation in this assessment constituted a priority ticket to public funds allocation, whereas up to that moment, universities had never been previously subjected to any research evaluation process and public funding was mainly decided on a historical basis

- The last evaluation procedure (2011-2014) formally established a constant yearly monitoring of the third mission ("SUA-terza missione") according to the [Legislative Decree 19/2012](#) and to the [Ministry Decree 47/2013](#). According to [Ministry Decree 453/2015](#), the [third mission competitive profile of institutions](#) (research centers and universities) will be [explicitly accounted for research funds attribution](#) with regards to the 2011-2014 evaluation

"SUA-terza missione"

Self-evaluation document on the third mission for universities and public research centers on yearly basis:

- i) research and publishing activities; ii) average number of patents per scholar over the last 10 years; iii) external founding over the last 10 years; iv) [number of spinoffs created over the last 10 years](#); v) number of external activities including conferences and cultural events organization etc

The Italian case

To this scenario it has to be added

- **Inception of the Global Financial Crisis** and the severe funds cuts suffered by public research system
- Between 2008 and 2013 the **public support to Italian universities** has been **reduced by 14%**, while the decrease of **academic staff** has amounted to **-15%**
- The **replacement ratio** of the aging faculty has been **very low (20%)**, with very limited resource to open up academic career to young researchers
- In 2014 the **average age of the stock of assistant professors** in the Italian University system was **47 years**, only the **17%** of them **below the age of 40**

The joint occurrence of

- Severe cuts to funding devoted to research
- Increasing shortage of academic career opportunities particularly for early stage scholars
- Increased attention to the monitoring and evaluation of the University third mission

make Italy a peculiar case of study

Main objectives

The objective of the present work is to explore how the research assessment and spinoffs stimulating policies—**performance based research funding system**— introduced into the European scenario had an **impact on the proliferation of academic spinoffs**

We will investigate the impact of these policies looking at academic spinoffs from **two different perspectives**:

- ① as **academic research exploitation** and a measure of technology transfer
- ② as an **employment opportunity**

If the **first is coherent with the objective of University engagement**, the **second** might **disregard the primary objective** of the aforementioned policies representing only a **second best solution** for lack of academic opportunities as well as an alternative research funding possibility

Research hypotheses

H1: The introduction of performance based research funding policies increase the rate of establishment of academic spinoffs

- Molas-Gallart et al. (2002)'s definition, the University third mission is “the generation, use, application and exploitation of knowledge and other University capabilities outside academic environments”
- Increasing interest on the determinants of the establishment of academic spinoff
- Observe the start of spinoff creation activity at the beginning of the new millennium: introduction of a new regulatory framework (Law 297/1999 and Ministerial Decree 593/2000)
- Motivations for setting up a spinoff can be individual, institutional and context-specific
- There is a growing strand of literature that is investigating several aspects going from local macroeconomic characteristics to institutional and regulatory issues (see also a recent work by Muscio et al. 2016 on the role of institutional rules)

Our work contributes to this debate on the role of institutional/contextual characteristics on the rate of spinoff establishment focusing the investigation at a national/supra-national level of policy addresses

Research hypotheses

The establishment of academic spinoff as a measure of technology transfer: the exploitation of research

H2a: performance-based research funding policies fostered the rate of establishment of academic spinoffs in [more prestigious universities](#)

H2b: performance-based research funding policies increased the rate of establishment of academic spinoffs in [universities with good publication performance \(research oriented\)](#)

The establishment of academic spinoff as employment opportunity

H3a: performance-based research funding policies positively affect the rate of establishment of academic spinoffs if there is [lack of academic job opportunities](#)

H3b: performance-based research funding policies increase the rate of establishment of academic spinoffs where there is [relative skilled unemployment](#) at regional level

Data and variables

Our sample is composed of 1,445 year-university observations: 85 Italian universities between 1999 and 2015 (source: <http://www.spinoffricerca.it>.)

- **Dependent variable:** number of spinoffs

Trend variables

- **PRFS (performance based research funding system):** Dummy variable equal to 1 for observations starting from 2004 onwards, capturing the effects of the introduction of the PRFS on research productivity and spinoff creation of Italian universities. The evaluation program was launched in December 2003, so we consider 2004 as the break-point where universities start to implement their reactions to this competitive funding mechanism
- **Trend variable,** set to zero for year 2004, decreasing by one for each year before 2004, increasing by one for each year following 2004

Data and variables

Moderating variables – Exploiting scientific knowledge

- **Publication per Faculty:** Ratio between the total number of papers published by the faculty of a university in a certain year and the total number of professors (SCOPUS)
- **Ranked University:** Dummy variable equal to 1 for university-year observations when a university was listed in the ARWU. For years prior to 2003, the 2003 classification was used

Moderating variables – Exploiting employment opportunities

- **Lack of academic opportunities:** Ratio between the number of graduating PhD students in a university and the number of opened positions for assistant professorship at the regional level (MIUR)
- **Relative skilled unemployment:** Ratio between the rate of highly educated unemployment (holding either a short-cycle tertiary, bachelor or equivalent, master or equivalent, doctoral or equivalent degree) and the total rate of unemployment. The ratio is calculated per year per region (ISTAT)

Data and variables

Control variables

University control variables

- Technology University
- University size
- University age
- Faculty/Student ratio
- International student ratio
- University patenting activity
- TTO size

Other local controls

- Regional GDP growth
- STEM graduates
- RD expenditure
- Controls for the geographic area (North, Central, South) are included in all regressions

Main findings

Introduction of policies to foster university spinoffs increases the rate of establishment of academic spinoffs

The introduction of a performance based research funding system produced a positive effect on the intensity of the spinoff proliferation

- We estimate a negative binomial panel model on the number of academic spinoffs

Proxy variables for scientific research exploitation

- university's **publication performance** and **technological vocation** (technology university) have a **positive** impact
- the **prestige/reputation** of the University (according to the annual ranking of world universities) seem to have a **negative or a statistically insignificant** role

Variables representing the exploitation of employment opportunities

- **lack of academic opportunities**, **presence of relative skilled unemployment** at regional level positively contribute to the proliferation of academic spinoffs

Main findings

Introduction of policies to foster university spinoffs increases the rate of establishment of academic spinoffs

	(1)	(2)	(3)	(4)
	# spinoffs	# spinoffs	# spinoffs	# spinoffs
PRFS		1.073*** (0.221)		0.854*** (0.232)
Linear Trend			0.133*** (0.027)	0.100*** (0.028)
Publication per Faculty	1.132*** (0.277)	1.179*** (0.274)	0.508** (0.257)	0.682** (0.273)
Ranked University	-0.362* (0.191)	-0.315* (0.187)	-0.212 (0.188)	-0.215 (0.186)
Lack of academic opportunities	0.490*** (0.119)	0.200** (0.102)	0.305*** (0.121)	0.190** (0.098)
Relative skilled unemployment	2.014** (1.056)	1.727* (1.031)	1.863* (1.095)	2.305* (1.230)
University Size	1.103*** (0.163)	1.031*** (0.161)	1.173*** (0.161)	1.109*** (0.161)
University Age	-0.001** (0.000)	-0.001 (0.000)	-0.001** (0.000)	-0.001 (0.000)
Technology University	2.075*** (0.481)	2.077*** (0.471)	1.990*** (0.460)	1.987*** (0.460)
Faculty/Student Ratio	3.554*** (1.126)	3.693*** (1.126)	3.576*** (1.120)	3.640*** (1.121)
International student ratio	-2.162 (3.073)	-3.552 (3.118)	-3.823 (3.023)	-4.496 (3.087)
University patenting act.	-0.017** (0.007)	-0.020** (0.008)	-0.022*** (0.008)	-0.024*** (0.008)
TTO Size	0.019 (0.038)	0.019 (0.037)	0.023 (0.037)	0.025 (0.037)
Regional GDP growth	0.003 (0.002)	0.003* (0.002)	0.006*** (0.002)	0.006*** (0.002)
Regional STEM graduates	0.124*** (0.020)	0.032 (0.027)	0.031 (0.026)	-0.013 (0.030)
Regional R&D Exp.	-0.865*** (0.256)	-0.552** (0.259)	-0.798*** (0.249)	-0.573** (0.258)

Main findings

spinoff as a measure of technology transfer: the exploitation of research

Interacting the PRFS dummy variable with the proxies for the exploitation of scientific knowledge we want to understand if the introduction of research assessment and spinoff stimulating policies (performance-based research funding system) has positively moderated the role of scientific knowledge proxy variables

- Interaction with **Publication per Faculty**, representing the scientific productivity in terms of publication. The estimated coefficient shows up to be negative: **substitution effect or complementarity?**
- Results show PFRS and Publication per faculty are positive, while their interaction is negative, then it might exist complementarity between the two, however it diminishes after 2004 and can become substitution as time rolls on
- The same negative coefficient is detected when we focus on the interaction with **university's reputation (Ranked University)**

The introduction of research assessment and spinoff stimulating policies did not produced effects in term of better exploitation of academic scientific knowledge for the third mission purposes (spinoffs creation)

Main findings

spinoff as a measure of technology transfer: the exploitation of research

	(5)	(6)
	# spinoffs	# spinoffs
PRFS	1.731*** (0.493)	1.344*** (0.313)
Linear Trend	0.101*** (0.028)	0.087*** (0.029)
Publication per Faculty	1.252*** (0.795)	0.733*** (0.277)
Ranked University	-0.228 (0.187)	0.443 (0.319)
Lack of academic opportunities	0.220* (0.122)	0.228* (0.122)
Relative skilled unemployment	2.388* (1.225)	2.404* (1.228)
PRFS × Publication per Faculty	-1.631** (0.778)	
PRFS × Ranked University		-0.801*** (0.305)
University Size	1.130*** (0.161)	1.082*** (0.161)
University Age	-0.001 (0.000)	-0.001 (0.000)
Technology University	1.983*** (0.456)	1.993*** (0.459)
Faculty/Student Ratio	3.320*** (1.135)	3.595*** (1.136)
International student ratio	-4.083 (3.051)	-4.332 (3.083)
University patenting act.	-0.023*** (0.008)	-0.019** (0.008)
TTO Size	0.022 (0.037)	0.023 (0.037)
Regional GDP growth	0.264 (0.273)	0.185 (0.280)
Regional STEM graduates	0.017 (0.031)	0.020 (0.031)
Regional R&D Exp.	-0.551** (0.260)	-0.603** (0.261)

Main findings

Academic spinoff as employment opportunity

Investigate the moderating effect of other than scientific knowledge exploitation variables. We interact PFSR with two variables that can broadly represent employment opportunities

- All the three interacted variables the estimated coefficient is positive and significant:
 - ① lack of academic opportunity
 - ② relative skilled unemployment
- The recent literature has already highlighted as lack of academic opportunity in the academia of administrative inefficiency could be a significant determinant of the spinoffs creation (for instance Horta et al. 2016; Meoli and Vismara 2016)
- Our work add a new piece of the story

Main findings

Academic spinoff as employment opportunity

- Those policy addresses aimed to foster the third mission of university and the creation of academic spinoffs actually were **effective in increasing the number of spinoffs**

But

- failed with respect to their objective since the increase in the number of spinoffs is **not the result of third mission activity**

On the contrary

- It is the result of an **amplification effect** on some of the **spinoff determinants that are completely unrelated to the third mission intended as technology transfer activity**

Main findings

Academic spinoff as employment opportunity

	(7)	(8)
	# spinoffs	# spinoffs
PRFS	0.906*** (0.237)	1.599*** (0.603)
Linear Trend	0.048* (0.028)	0.048* (0.028)
Publication per Faculty	0.754*** (0.273)	-0.261 (0.187)
Ranked University	-0.225 (0.189)	-3.409 (3.060)
Lack of academic opportunities	0.092 (0.131)	0.216* (0.128)
Relative skilled unemployment	2.429** (1.273)	0.445 (1.341)
PRFS × Lack of academic opp.	0.972** (0.427)	
PRFS × Rel. skilled unemploy.		4.710*** (2.120)
University Size	1.096*** (0.162)	1.117*** (0.159)
University Age	-0.000 (0.000)	-0.000 (0.000)
Technology University	2.094*** (0.454)	0.663** (0.263)
Faculty/Student Ratio	4.264*** (1.134)	4.912*** (1.120)
International student ratio	-3.840 (3.074)	-3.409 (3.060)
University patenting act.	-0.025*** (0.008)	-0.025*** (0.008)
TTO Size	0.038 (0.037)	0.033 (0.036)
Regional GDP growth	0.420 (0.273)	0.384 (0.274)
Regional STEM graduates	0.038 (0.029)	0.032 (0.029)
Regional R&D Exp.	-0.392 (0.268)	-0.362 (0.266)

Concluding remarks

- We conclude that, unlike the current trend in the evaluation of higher education systems that looks at the number of academic spinoffs funded within the evaluation period as a good indicator of the accomplishment of technology transfer within the third mission, **the sheer number of spinoff companies is a very poor measure**
- In contrast, **one of the main societal–third mission–impacts of spinoff companies is occupational and largely the result of the “entrepreneurship of need”** because academic entrepreneurship is a tool to acquire public financing and to enter research consortia. In the framework proposed by Audretsch et al. (2016), this is **static rather than dynamic** entrepreneurship

These results call for further and cross country investigation, can be derived some policy implications on the role and the design of such policies as well as on the consolidated idea of spinoff as a technology transfer measure.