

Determinants of university spin-off quantity and quality in Italy, Norway and the UK

Riccardo Fini, Kun Fu, Einar Rasmussen, Marius Mathison & Mike Wright



OECD, December 9, 2014

Objectives

- **Governments introduced mechanisms to stimulate spin-offs**
 - **Legislation; TTO establishment**
- **Major challenges to create successful university spin-offs (Grimaldi, et al., 2011)**
 - **Process complex in terms of resource & capability needs by universities**
- **Absent these, national level changes may be ineffective**
 - **Increases may be 'symbolic', not adding to economic, financial and social value**

Objectives

- **Differing and changing cross-country approaches to university spin-offs and IP ownership but:**
 - **Limited cross-country analysis or on changes**
- **RQ: How do *changes* in the institutional framework at national and university level influence both the quantity and quality of spin-offs from a university?**
- **[i.e. within and between country differences]**

Expectations

- *Need for TTO expertise not just establishment*
- *Creation of TTO per se by **universities** likely to call forth marginal spin-offs in order to meet quantity targets, but capabilities and social networks with VCs lacking*
- *Hypothesis 1: Universities with a TTO will generate:*
 - *(a) more spin-off companies but of*
 - *(b) lower average quality than universities without a TTO.*

Expectations

- *Changes in stance on professor's privilege at **national** level creates uncertainty for investors reducing willingness to invest and time taken for universities to build competencies*
- *Hypothesis 2: Universities in a context with higher variance in national Intellectual Property Rights (IPR) legislation will generate:*
 - *(a) more spin-off companies but of*
 - *(b) lower average quality, than universities in a context with lower variance.*

Expectations

- ***New legislation and university TTO creation reinforce each other; but changing legislation has reinforcing negative effect on quality***
- ***Hypothesis 3: Universities with a TTO and in a context with higher variance in national IPR legislation will generate:***
 - ***(a) more spin-off companies but of***
 - ***(b) lower average quality, than universities in a context with lower variance.***

Professors' Privilege and TTOs in Countries

- **UK**

- Removed in 1977
- 80% universities had TTOs by 2000

- **Norway**

- Removed in 2003
- TTOs emerged 2003-5

- **Italy**

- Introduced in 2001 and removed in 2005
- 40% universities without TTO by 2005

Data Sources

- **Macrodata**

- World Bank, Heritage Foundation
- Changes in national IPR regimes (Baldini et al., 2014)

- **University level**

- EUMIDA database and national sources: time-invariant and variant information on: universities' localization, legal status, year of establishment, educational fields, presence of a university hospital, STEM universities, eminence, size, etc.

- **Firm level**

- TTOs, Spinout surveys and national Companies Houses

The Sample

- **185 universities**
 - Italy: 68
 - Norway: 4
 - UK: 113
- **2323 spin-offs**
 - Italy: 878
 - Norway: 120
 - UK: 1325
- **Observation period 2000-2012.**

Dependent Variables

- ***University spin-offs quantity***
 - Count of the number of university spin-offs from a given university in a given year.
- ***University spin-offs quality***
 - Count of the number of university spin-offs from a given university in a given year, which have received the first round of VC-financing in that year (Lockett and Wright, 2005).
 - External validation of quality in terms of expected returns.

Independent Variables

- ***Establishment of University TTO.***
 - Dummy variable that switches from 0 to 1 the year in which the TTO is established.
- ***IPR Institutional Variance.***
 - Number of changes in country's IPR legislation divided by the number of years included in the observation period (i.e. 13). This variable ranges from 0 (UK) to 0.15 (Italy).
 - [alternative specifications consistent]
 - # years in place/ # years observed; # of changes

Controls and Method

- **Control Variables**

- Country-Level :

- GDP per capita, Unemployment Rate , Ease of Doing Business, Investment Freedom

- University-level:

- Size, Foundation Year, research funding, Prior knowledge in technology-transfer activities, Intellectual eminence, Educational fields , Cumulative entry, Industrial variance

- **Empirical method**

- **Multilevel Negative Binomial Regression**

Descriptives

Variable	Mean	Std. Dev.	Min	Max
Spinout quantity	0.97	2.11	0	31
Spinout quality	0.15	0.59	0	0.8
TTO establishment	0.72	0.45	0	1
IPR Institutional variance	0.16	0.20	0	0.38

Results of Multilevel Negative Binomial Regression: Spin-off Quantity

	Model 1	Model 2	Model 3
TTO establishment (H1a)		0.244**	-0.082
IPR Institutional variance (H2a)		7.789***	4.552***
TTO X Institutional variance (H3a)			4.260***
Prior knowledge in technology-transfer activities	0.016***	0.017***	0.019***
Foundation year	0.000	0.000	0.000+
Sponsored research expenditure	0.385***	0.309***	0.286***
Size	0.124+	0.248***	0.247***
Intellectual eminence: Rank top 25%	0.833***	0.877***	0.879***
Intellectual eminence: Rank 25-50%	0.648***	0.699***	0.715***
Intellectual eminence: Rank 50-75%	0.263*	0.255*	0.270*
Education Field; General	1.076*	1.098**	1.103**
Education Field; Education	0.024	0.021	-0.038
Education Field; Humanities and Arts	-0.054	0.022	0.05
Education Field; Social Sciences, Business and Law	-1.426***	-1.100***	-1.089***
Education Field; Sciences	0.899***	0.827***	0.717**
Edu. Field; Engineering, Manufacturing and Construction	0.678***	0.649***	0.704***
Education Field; Agriculture	0.065	0.069	0.066
Education Field; Health and Welfare	0.229	0.139	0.269
Education Field; Services	0.089	-0.057	-0.027
GDP per capita	0.155	-0.51	-0.328
Easiness of doing business	-0.019	-0.022*	-0.014
Unemployment rate	-0.038	-0.155***	-0.146***
Constant	-7.799	-1.725	-3.592
Variance of intercept	0.140**	0.014	0.018
Chi-squared	6.135	6.135	6.135

Results of Multilevel Negative Binomial Regression: Spin-off Quality

	Model 4	Model 5	Model 6
TTO establishment (H1b)		-0.344+	-0.084
IPR Institutional variance (H2b)		-7.250**	-1.894
TTO X Institutional variance (H3b)			-7.280*
Cumulative entry	0.012***	0.012***	0.011***
Industrial variance	0.117***	0.125***	0.130***
Foundation year	0	0	0
Size	1.309***	0.961***	0.917***
Sponsored research expenditure	0.138	0.240*	0.283**
Intellectual eminence: Rank top 25%	1.077**	1.010*	1.015*
Intellectual eminence: Rank 25-50%	1.009*	0.934*	0.910*
Intellectual eminence: Rank 50-75%	0.041	0.061	0.02
Education Field; General	3.610***	3.327**	3.114**
Education Field; Education	-0.024	-0.108	-0.029
Education Field; Humanities and Arts	-0.577*	-0.617*	-0.564*
Education Field; Social Sciences, Business and Law	1.279	0.393	0.174
Education Field; Sciences	0.955	0.885	0.976
Education Field; Engineering, Manufacturing and Construction	1.586*	1.698*	1.541*
Education Field; Agriculture	0.028	0.005	0.017
Education Field; Health and Welfare	-0.836+	-0.508	-0.621
Education Field; Services	-0.187	0.147	0.127
GDP per capita	2.424***	3.006***	3.217***
Investment freedom	-0.004	-0.012+	-0.011
Constant	-48.44***	-49.40***	-51.21***
Variance of intercept	0.042	0.012	0.008
Observations	2,405	2,405	2,405
Number of groups	39	39	39

Implications

- Hypotheses supported
- Changes in framework conditions to increase spin-off creation by governments and universities likely result in maximizing number of firms created
 -but without being able to improve the potential economic impact (quality) of these firms
 - Implications for types of incentives and resources in universities
- Legislative changes and university level top-down initiatives (establishment of TTOs) need to be complemented with bottom-up initiatives.....
 - university-level control factors/mechanisms have higher impact than contextual influences

Implications

- Develop capabilities within entire university and its ecosystem to provide support needed to make spin-offs investor ready for VC and other external investment
- Develop networks to be able to attract VC
- Develop incentives for quality spin-offs not just number
 - Institutional negotiation issues (Lockett, Wright & Wild, 2014)
- Connect university commercialization policies with broader entrepreneurship and entrepreneurial finance policies

Implications

- **Critical mass and scientific eminence needed to spin-off firms with quality potential:**
 - Positive effect of size, research funds, and intellectual eminence (as well as of previous developed knowledge in tech-transfer = path-dependency)
 - Smaller, tier-B universities may be misplaced in attempting to adopt tech-transfer approaches based on elite universities (e.g. ICL, Cambridge, Polytechnic of Milan, Oslo...)

Future Directions

- Additional countries with different:
 - Ownership of IP conditions
 - Public v private universities
 - Involvement of TTOs in multiple activities
 - Regional policies and mix of universities
- Access to other forms of funding and variations across countries
 - Angel funding; crowdfunding, etc.
- Accounting, financial and economic performance
 - Data availability issues
- Analysis of challenges to TTO processes as regime changes