



Student entrepreneurs from technology-based universities: the impact of course curriculum on entrepreneurial entry

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- Universities are an important source of entrepreneurial activity
 - by generating technological knowledge that spills over and is leveraged by prospective entrepreneurs (**knowledge spillover theory of entrepreneurship**; for a review, Ghio et al., 2015)
 - by fostering the creation of new firms, especially by faculty members (**academic entrepreneurship**; for a review, Rothaermel et al., 2007)
 - in the form of new ventures created by students and recent graduates (**student entrepreneurship**)
- Student entrepreneurship is an under-investigated phenomenon



- **Empirical relevance**: student start-ups represent a **significant part of the entrepreneurial activity *directly* stemming** from universities (Åstebro et al., 2012)
- **Conceptual relevance**: **student entrepreneurs** are in a favorable position to **overcome the obstacles** to new venture growth encountered by academic and prospective entrepreneurs
 - Academic entrepreneurs find it difficult to gain access to the *commercial competences and assets* they need to grow (Colombo and Piva, 2012)
 - Prospective entrepreneurs find it difficult to *absorb knowledge* stemming from university knowledge (Colombo et al., 2010)
 - Alumni (i.e., students and recent graduates)
 - do not need a “genetic mutation” (Colombo and Piva, 2012) to become entrepreneurs, contrary to academic staff
 - are better positioned than prospective entrepreneurs to absorb university knowledge



- Focus: student entrepreneurship in technology-based universities
- Research question: what is the relationship between **alumni's course curriculum** and the **decision to become (student) entrepreneurs**?
- Theoretical background: literature on **opportunity recognition** and **human capital** theory (Becker, 1975)
- Empirical setting: student entrepreneurship at **Politecnico di Milano**
- Key results: greater likelihood of creating one or more student start-ups:
 - alumni that exhibit a **more specialized course curriculum**: this applies especially to alumni with a high **final degree score** (103/110 or better).
 - alumni that completed **management and economic courses**

- **Preliminary empirical evidence** on student entrepreneurship
 - variations over time in the characteristics of student entrepreneurs (Hsu et al., 2007)
 - student start-ups achieve better performance if closely related to their founders' degrees; stronger effect for the start-ups created by graduates of the top 10 schools (Åstebro et al., 2012)
- **Location choices** of student start-ups (Baltzopoulos and Brostrom, 2013) → student start-ups more likely to be located in the region where the student entrepreneurs completed their studies
- **Effect of university peers** on entrepreneurial entry (Lerner and Malmendier, 2013) → a higher share of former entrepreneurs in a section reduces entrepreneurship rates among students without an entrepreneurial background by reducing the rate of unsuccessful entrepreneurs



- **Ambiguous evidence** linking entrepreneurial entry to
 - **general** education (for a review, van der Sluis et al., 2008)
 - degree of **specialization** of the course curriculum (Lazear, 2004)

Positive relationship between **general education and opportunity recognition** (e.g., Arenius and DeClercq, 2005; Ucbasaran et al., 2008)
- Huge literature on the impact of **entrepreneurship education**
 - Focus on the impact of entrepreneurship education on **entrepreneurial intentions** (for a review, Bae et al., 2014)
 - Intentions are precursors of behavior
 - Long time periods between the educational experience and subsequent behavior



- An individual's ability to recognize entrepreneurial opportunities out of technological knowledge is enhanced by the knowledge that individuals developed about (Shane, 2000)
 - how use of technological knowledge can solve customer problems
 - how markets operate
- Being an expert in a specific technological field helps individuals to use technological knowledge to solve customer problems

H1. The alumni of technology-based universities are more likely to become entrepreneurs the more specialized is their course curriculum

- The quality of an individual's human capital positively moderates the effect of "being an expert" on opportunity recognition

H2. The higher the average degree score of the alumni of technology-based universities, the greater the positive effect of specialization of the course curriculum on the likelihood to become entrepreneurs



- Economics and management courses provide alumni with knowledge about how markets operate and tools and techniques to analyse the competitive environment, the cost structures,...
- H3. The alumni of technology-based universities are more likely to become entrepreneurs if they completed economics and management courses***

- Unique dataset on the alumni that obtained a *Laurea* Degree in the old university system or a *Laurea Magistrale* (MSc level) Degree in the new system at POLIMI between 2000 and 2009
- Data sources
 - POLIMI database storing information on all alumni ever enrolled in any degree programs at POLIMI → demographic data and information concerning the course curriculum of **43,398 alumni**
 - **29,352** alumni obtained a *Laurea* Degree
 - **14,046** alumni obtained a *Laurea Magistrale* Degree
 - Italian Business Register → information on all Italian companies where the 43,398 alumni have ever been listed as shareholders



- **2,984 POLIMI student entrepreneurs** = alumni who founded a venture in Italy (i.e., became shareholders of the venture in the year of incorporation) between the year of enrolment in the *Laurea (Magistrale)* Degree at POLIMI and the 5th year after graduation
 - **2,499** obtained a *Laurea* Degree (**8.5%** of the alumni that obtained a *Laurea* Degree)
 - **485** obtained a *Laurea Magistrale* Degree (**3.4%**)
- **3,427 POLIMI student start-ups** = new ventures founded in Italy by POLIMI student entrepreneurs between the year of enrolment in the *Laurea (Magistrale)* Degree at POLIMI and the 5th year after graduation

At the end of 2013, the **active and independent** POLIMI student start-ups had:

- Total turnover: **1,951 mil €**
- Total number of employees: **5,194**



	POLIMI student start-ups (N=3,427)	
	No.	%
Active and independent firms	2,417	70.4
Turnover>2,000k€	118	5.2
Merged with or acquired by other firms	147	4.3
Failed and not active	868	25.3



- High heterogeneity as to the industry of activity: 71 different industries (NACE2 level)

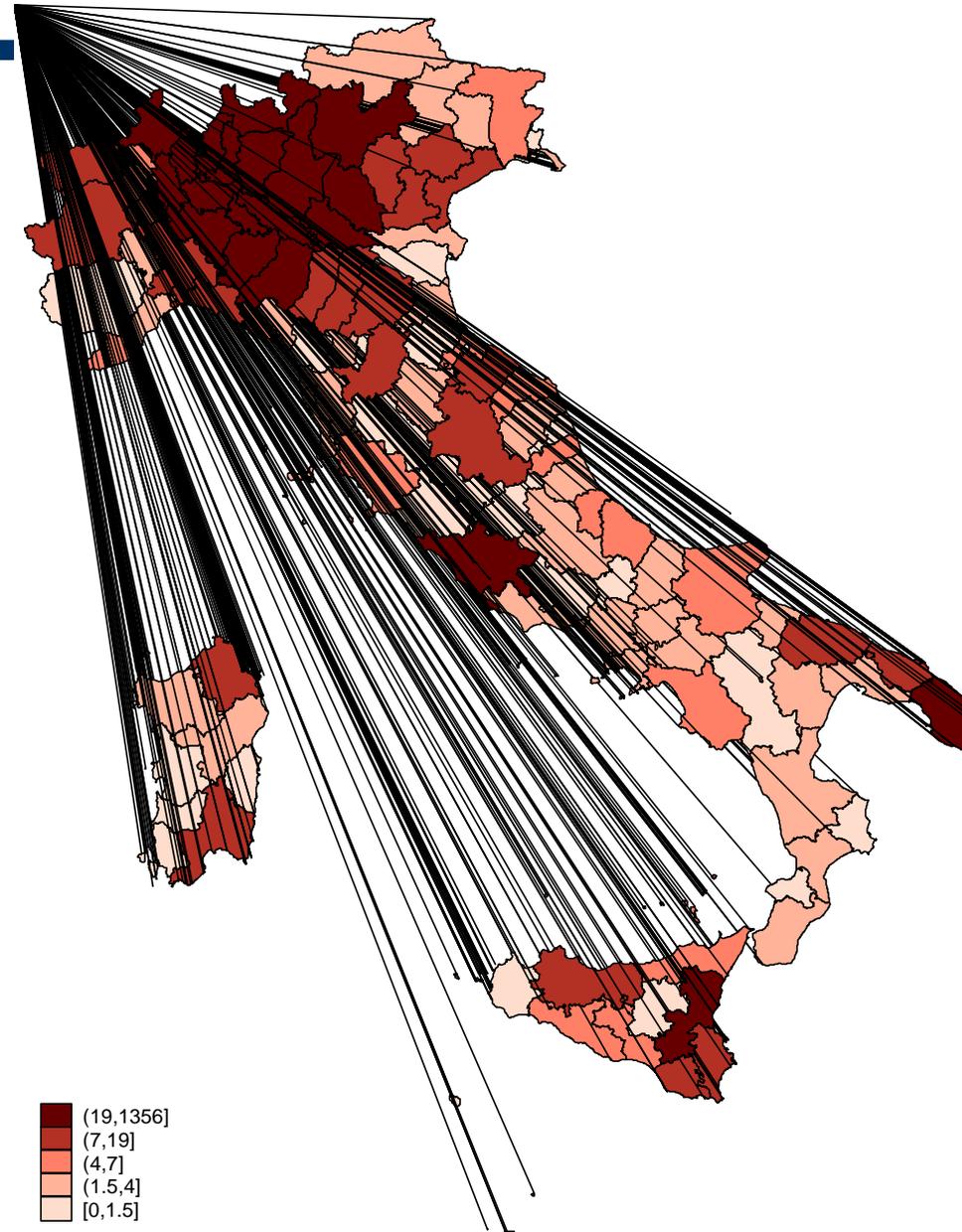
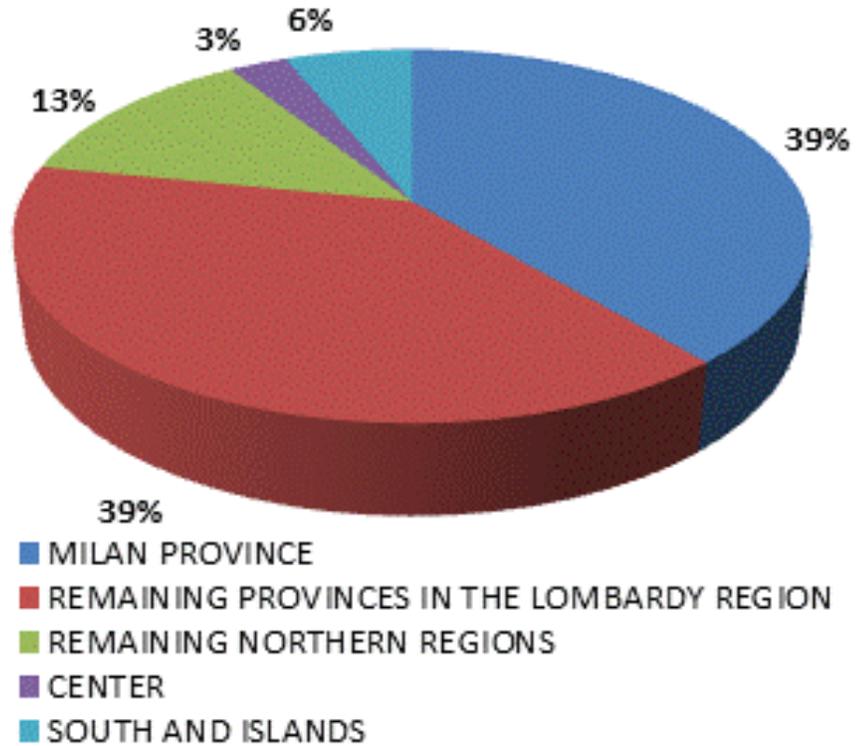
Industries (NACE 2 digit) with more than 100 POLIMI student start-ups	No.	% (No./3,427)
68 Real estate	499	14.6
41 Construction activities	475	13.9
71 Architectural and engineering activities and related technical consultancy	301	8.8
46 Wholesale	238	6.9
62 Computer programming, consultancy and facility management activities	215	6.3
74 Professional, scientific and technical activities	173	5.0
43 Specialized construction activities	139	4.0
47 Retail sale	137	4.0
70 Communication and management consultancy activities*	122	3.6
TOTAL	2,299	67.1

*NACE 7010 (Activities of head offices) excluded

- Turnover distribution:
 - 43.4% of total turnover → NACE35 “Energy”
 - 11,6% of total turnover → NACE46 “Wholesale”



Geographic distribution of POLIMI student start-ups





POLIMI student start-ups: how many POLIMI student entrepreneurs are part of the founding team?

No. POLIMI student entrepreneurs	POLIMI student start-ups	
	No.	%
1	2,671	77.9%
2	537	15.7%
3	116	3.4%
4	66	1.9%
≥5	37	1.1%
Total	3,427	100.0%



	Old university system			New university system		
	All the alumni (29,352 alumni)	Student entr. (2,499 alumni)		All the alumni (14,046 alumni)	Student entr. (485 alumni)	
Country of birth						
- Italy	28,641 (97.6%)	2,449(98.0%)		13,213(94.1%)	473 (97.5%)	***
- Foreign countries	711 (2.4%)	50 (2.0%)		831 (5.9%)	12 (2.5%)	
Geo. distribution of provinces of birth						
- Milan Province	9,561 (33.4%)	774 (31.6%)		3,686 (27.9%)	118 (24.9%)	***
- Other Lombardy provinces	12,242 (42.7%)	1,045(42.7%)		5,811 (44.0%)	183 (38.7%)	
- Other North.regions	3,942 (13.8%)	365 (14.9%)		2,081 (15.3%)	88 (18.6%)	
- Center	613 (2.1%)	68 (2.8%)		345 (2.6%)	21 (4.4%)	
- South and islands	2,283 (8.0%)	197 (8.0%)		1,355 (10.3%)	63 (13.3%)	
Gender						
- M	19,820 (67.5%)	1,884(75.4%)	***	9,267 (66.0%)	384 (79.2%)	***
- F	9,532 (32.5%)	615 (24.6%)		4,779 (34.0%)	101 (20.8%)	
School						
- Architecture	10,320 (35.2%)	984 (39.4%)	***	3,223 (22.9%)	114 (23.5%)	
- Desing	2,495 (8.5%)	226 (9.0%)		1,818 (12.9%)	65 (13.4%)	
- Civil Engineering	1,204 (4.1%)	115 (4.6%)		537 (3.8%)	22 (4.5%)	
- Architectural Eng	917 (3.1%)	127 (5.1%)		641 (4.6%)	30 (6.2%)	
- Industrial and Information Eng.	14,416 (49.1%)	1,047(41.9%)		7,827 (55.7%)	254 (52.4%)	

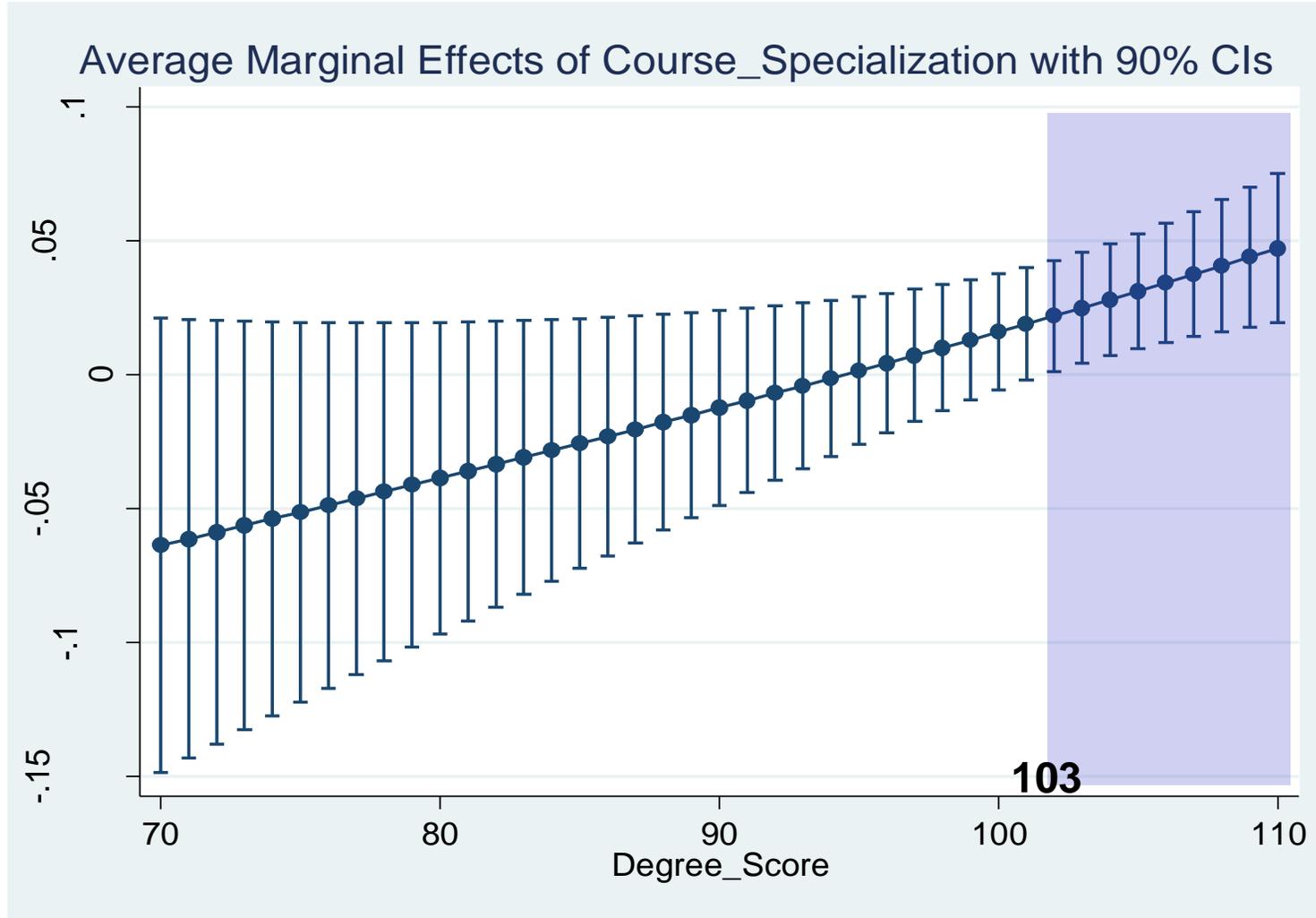
- Sample: **13,940** alumni that obtained a *Laurea Magistrale* Degree
 - **421** POLIMI student entrepreneurs
Altogether founded **434** POLIMI student start-ups
- Econometric model
 - Probit model
 - Dependent variable: dummy =1 for POLIMI student entrepreneurs
 - Explanatory variables
 - *Course_Specialization*: Herfindal index on the Educational Sector Codes (ESCs) associated to alumnus' courses
 - Check of robustness: *Special*, alternative measure built taking inspiration from Lazear (2004: 210)
 - *Course_Specialization* × *Degree_Score*
 - *DEconomics*: dummy =1 if the alumnus' course curriculum included any courses associated to the ESCs in the areas of Economics, Management and Management Engineering



Variable	Mean	Std. Dev.	Min	Max
<i>Course_Specialization</i>	0.24	0.14	0.06	0.82
<i>DEconomics</i>	0.49	0.50	0.00	1.00
<i>Degree_Score</i>	103.16	7.50	73.00	113.00
<i>DPrior_Shareholder</i>	0.04	0.19	0.00	1.00
<i>DWoman</i>	0.34	0.47	0.00	1.00
<i>Enrolment_Age</i>	24.00	1.59	22.00	31.00
<i>DBachelor_Outside</i>	0.12	0.33	0.00	1.00
<i>DFailing_Student</i>	0.49	0.50	0.00	1.00
<i>DBorn_Abroad</i>	0.06	0.24	0.00	1.00
<i>Distance_from_Milan</i>	189.77	322.77	0.00	1061.00
<i>DInd_Inf_Eng</i>	0.56	0.50	0.00	1.00

	Model 1	Model 2	Model 3
Constant	-2.129 (0.617) **	-2.407 (0.623) ***	-1.619 (0.840) †
Course_Specialization	-	0.342 (0.164) *	-2.901 (2.356)
Course_Specialization×Degree_Score	-	-	0.031 (0.023)
DEconomics	-	0.165 (0.046) ***	0.163 (0.046) ***
Degree_Score	0.004 (0.003)	0.004 (0.003)	-0.003 (0.006)
DPrior_Shareholder	0.882 (0.072) ***	0.878 (0.073) ***	0.879 (0.073) ***
DWoman	-0.356 (0.054) ***	-0.371 (0.055) ***	-0.372 (0.055) ***
Enrolment_Age	-0.001 (0.018)	0.000 (0.018)	0.000 (0.018)
DBachelor_Outside	-0.234 (0.100) *	-0.243 (0.100) **	-0.249 (0.100) *
DFailing_Student	-0.008 (0.047)	0.001 (0.048)	0.003 (0.048)
DBorn_Abroad	-0.535 (0.151) ***	-0.538 (0.152) ***	-0.527 (0.152) **
Distance_from_Milan	0.034 (0.008) ***	0.032 (0.008) ***	0.031 (0.008) ***
DInd_Inf_Engineering	-0.147 (0.049) **	-0.157 (0.050) **	-0.155 (0.050) **
No. observations	13,940	13,940	13,940
McFadden's Adjusted R ²	0.057	0.061	0.061
Percentage correctly classified	96.98%	96.98%	96.98%

Legend: † p-value<0.1; * p-value<0.05; ** p-value<0.01; *** p-value<0.001





Estimated probabilities of becoming student entrepreneurs
(all dummy variables=median; all continuous variables=mean)

		Course_Specialization	
		Low (5th percentile=0.08)	High (95th percentile=0.50)
Degree_Score	Low (5th percentile=89)	0.024	0.021
	High (95th percentile=113)	0.022	0.042

+86% (horizontal arrow from 0.022 to 0.042)

+94% (vertical arrow from 0.021 to 0.042)

+ 45% when *DEconomics* increases from 0 to 1

- Nascent literature on student entrepreneurship
- Literature on the impact of university education on entrepreneurial entry: ambiguous effect

Original addition of this paper: the **structure** of the **course curriculum** does matter

1. For *university managers*: to further stimulate student entrepreneurship, develop degree programs
 - With specialized course curricula
 - Including at least one course in the areas of Economics and Management

2. For *policy-makers*:
 - Student entrepreneurship is a phenomenon of great economic impact
 - It is possible to foster economic development by stimulating student entrepreneurship through proper design of university curricula



- **Extension of the research** to a representative sample of Italian universities
 - Are there differences between **technical and non-technical** universities?
 - Moderating effect of
 - **university quality**
 - **resources available locally:**
 - Finance
- Analysis of
 - the antecedents of the **creation of *successful start-ups***
 - the differences between start-ups created by solo entrepreneurs and start-up created by **entrepreneurial teams**



Q&A