Startups by Recent University Graduates and their Faculty – Implications for University Entrepreneurship Policy

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University Goals and Metrics

- We used to count only the number of Nobel prices
- Then we started counting the number of papers published
- Now we count the number of firms started by faculty

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Research

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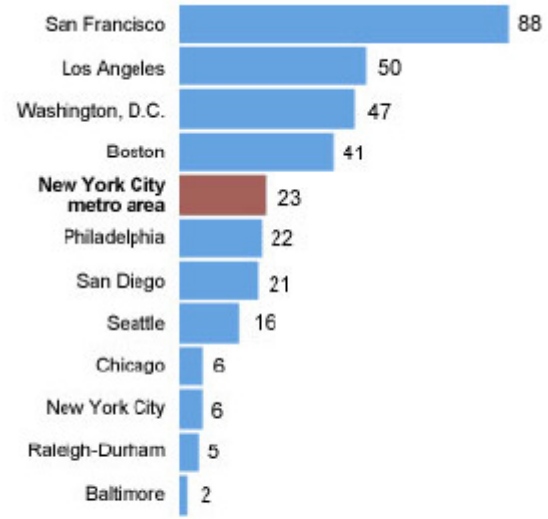
NYU Leads City's Effort to Encourage Corporate Start-Ups

Money Doesn't Always Buy Start-Ups

The New York City metropolitan region ranks first in university R&D spending ...

SOURCE: Center for an Urban Future, based on 2006 data from the National Science Foundation

... but in the middle of the pack in number of technology start-ups



SOURCE: Center for an Urban Future, based on data from the 2008 Deloitte Technology Fast 500 list

Dominant Assumptions

- Technological advances are created by faculty and research staff and diffused to society through a technology transfer process by faculty and staff
- This view does not have any room for students, neither as creators nor as diffusers of new technology

Previous Research on the Impact of Universities on Entrepreneurship

- The effects of university policies, government regulation (in particular Bayh-Dole act), the organization of TLO activities, university culture and researcher incentives (Åstebro and Bazzazian, 2011; Rothaermel et al., 2007; Djokovic and Souitaris 2008)
  - Faculty incentives (e.g. Lockett and wright, 2005; Friedman and Silberman, 2003; Louis et al., 1989; Di Gregorio and Shane, 2003; Markman et al., 2009; Belenzon and Schankerman, 2009; Lach and Schankerman, 2008),
  - University input metrics (e.g. O'Shea et al., 2005; Zucker et al., 1998; Powers and McDougall, 2005),
  - TLO organization (e.g. Markman et al., 2009; Belenzon and Schankerman, 2009; Lockett and Wright, 2005),
  - University culture and norms (Louis et al., 1989; 2001; Walsh et al., 2007; Stuart and Ding, 2006; Bercovitz and Feldman, 2008)

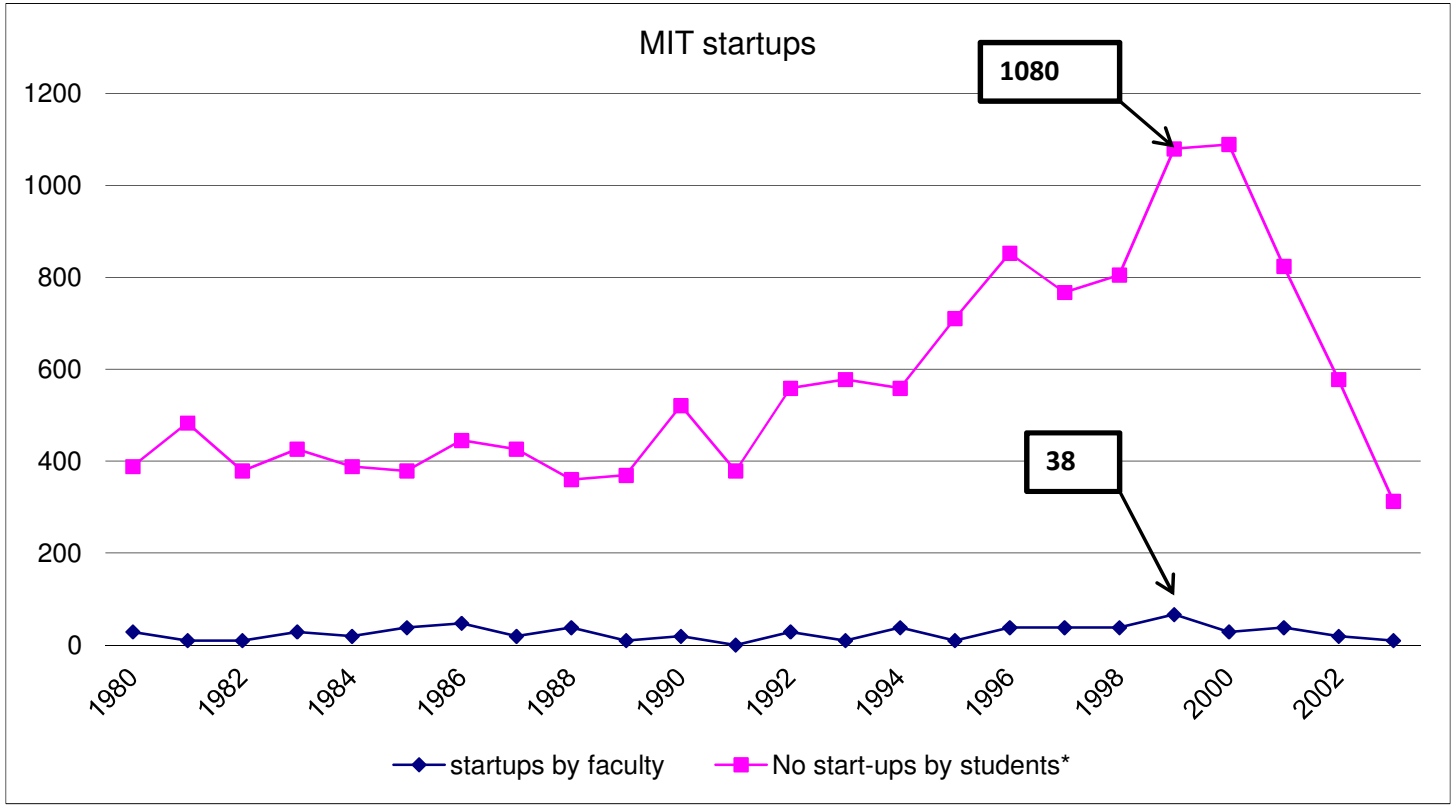
Dominant Policies

- Create incentives for faculty to disclose inventions
- Create technology licensing offices
- Create university incubator and science parks to assist faculty to commercialize their ideas
- Create university venture capital funds to fund faculty start-ups

Our Claim

- Startups by former students constitute the majority of entrepreneurial economic development affected by universities
- Faculty spinoffs on the other hand are rare
- Transforming universities to increase faculty spinoffs might then not be the most effective way to create entrepreneurial economic development

Alumni Startups in Relation to Faculty: MIT



Source: Special extract of survey by Charles Eesley of *all* MIT alumni. Responses were scaled up by a factor of 9.476 to account for survey non-responses and item non-responses as in Roberts and Eesley and (2009). Faculty spinoffs were approximately doubled to account for all MIT faculty, not just those being MIT alumni.

Calibration Analysis of Student-Faculty Ratio

Lower Bound :

$$\frac{\text{Alumni startups (MIT survey data)}}{\text{Faculty startups (MIT survey data)}} \equiv \frac{12}{1}$$

Upper Bound:

$$\frac{\text{Alumni startups (MIT survey data)}}{\text{Faculty startups (MIT's TLO data)}} \equiv \frac{48}{1}$$

If we accept that the number of unregistered faculty spinoffs is between 30-45 percent (Markman et al., 2008; Audretsch et al., 2005) the ratio will be 20-25:1

Quibbles

- But MIT is a special case!
- It includes *all* alumni even those graduated decades ago – can we really infer a causal effect of MIT?
- The students' start-ups might be of really low quality compared to faculty spin-offs

- We'll see...
- Lets look at *recent* grads then
- We'll see...

University Alumni Consistently Produce a lot of Start-ups

- 5% Harvard MBAs created significant startups (above $5 mill.) (Lerner and Malmendier, 2007)
- 24% MIT student (Roberts and Eesley, 2009)
- 24% Stanford MBAs (Lazear, 2005)
- 24% Tsinghua University (Eesley, Roberts and Yang, 2009)
- 36% engineering program Halmstad University (Eriksson, 1996)
- 42% Chalmers E-school (Lindholm-Dahlstrand and Berggren, 2007)

Faculty do *not* Create a lot of Spinoffs

- Average number of spin-offs per university per year among the top 100 U.S. research institutions (AUTM data)
- Mean: 2
- Mode: 0
- Maximum: 22 (MIT)

→ **They are not that many!**

General Patterns

- U.S. representative SESTAT data on entrepreneurship by *recent* graduates (<3 yrs) and university employees in science and engineering
- Use five panels: 1995-2006
- Survey with sampling weights that can be used to represent populations
- With entrepreneurs we mean someone who starts and own a new business and work full-time in that, and quit prior employment (if former faculty)
  - We exclude those working part-time, previously retired or declaring zero income when analyzing earnings. This raises the relative earnings of start-ups by faculty more than in student start-ups
    - rates of entrepreneurship
    - earnings relatives to their peers
    - survival of their businesses

Rates of Entrepreneurship

- Recent graduates outnumber their faculty 24:1 in the number of start-ups created
- Recent graduates > twice as likely as their faculty to start a business within 3 years
  - These relationships do not depend on school quality: student entrepreneurship is a widespread phenomenon

Quality: 1st Year Earnings

- Students start-up owners earn about ½ of faculty start-up owners
  - But that's a really unfair comparison
- Student start-up owners earn 12% more than their peers who become employed
- Those who use their education earn 23% more
- Those who come from top-rated schools and who use their education earn 31% more than their peers who become employed
  - Regressions control for composition effects
  - Using regressions the results are -7%, +1%, +11%
- Faculty that start businesses earn 19% more than their peers, but that is not very surprising (Stern, 2004)

Quality: Survival

- survive 2-3 years
  - 60% of faculty start-ups
  - 34% of recent graduates
- Three-year earnings growth
  - 13.3% faulty
  - 6.9% recent graduates
  - Earnings growth from top-rated schools
    - 5.1% faulty
    - 28.1% recent graduates
      - 38% for recent graduates who use their education

Three Case Studies

- MIT, Halmstad, and Chalmers

MIT

- World-leading applied engineering research at MIT; +$1 billion
- Venture capital industry originated in Boston
- Large supply of potential co-founders and employees
- Students started stimulating entrepreneurship already in the 1960s
- Entrepreneurship courses and entrepreneurship center created only recently (late 1990s)
  - 24% of all alumni become entrepreneurs
  - Recent graduates (<3 yrs out) create only 1.5 times the start-ups of MIT faculty

→ **To replicate MIT one may need a 30-40 year perspective**

An Antithesis to MIT: Halmstad University, Sweden

- **Halmstad**
  - 90,000 inhabitants
  - Local economy mix of small scale operations: 75% employed in companies <10 employees
  - No local venture capital
  - No research labs or research driven businesses

→ **Not very favorable local economic conditions**

- **Halmstad University**
  - A small nurses' college created in 1973
  - University formed in 1983
  - In 2008 the university had 50 degree programs, 5000 full time students, around 40 professors and a research budget of $8 mill.
    - 55% of Chalmers' student volume, but only 6% of its R&D budget

→ **Not R&D oriented or spin-off creating among its faculty**

Halmstad University

- **Early programs at university of Halmstad**
  - Innovation Engineering Program (started in 1979)
  - Computer Engineering
  - Mechatronics
- **Student start-ups**
  - 36% from innovation engineering
  - 21% from computer engineering between 1979 and 1992
  - Out of 15 spinoffs from a Research Center , 80% were formed by students
- **Takeaway**
  - Universities with local resource constraints can stimulate entrepreneurship with clever program design and strong culture

Chalmers Entrepreneurship School

- Chalmers University of Technology in Gothenburg, Sweden, formed E-School in 1997
- One of the top engineering schools in Sweden
- Pair high quality undergraduate students with inventions from Chalmers' laboratories
- **Key features of the program**
  - Students don't bring their own venture ideas
  - Each projects' cash expenses (up to €10,000) paid by Chalmers
  - The inventor agrees in a contract to provide reasonable effort
  - The inventor, the student, and Chalmers each obtain one third ownership rights

Chalmers

- **Impacts**
  - After finishing E-school half the students continue their business
  - 80% of the businesses remain in the region
  - 32 firms were created between 1998 and 2007
    - 26 survivors employing 220 (based on 20 students graduating per year)

Chalmers E-School Examples(2002-2007)

Early Growth Companies	Area of Technology
Aidera	ICT/Biotech
E-logistik	ICT/Logistic
ICU Intelligence	ICT
Lamera	Material Technology
Oxeon	Material Technology
Parans	Solar Lightening

Startup Companies	Area of Technology
Capeco	Chemical Technology
Pylos Nutraceuticals	Functional Food
SafeDrive	Consumer Products
SPR Biosensor	Nanotech/Biotech
Lumina Adhesives	Medical Device
Syspiro	Medical Device

Seed Companies	Area of Technology
Arterion	Medical Device
Denator	Biotech(Instruments)
Ecoera	Cleantech
Hyron BioMedical	Pharmaceuticals
Layerlab	Biotech
Midorion	Nanotech/Biotech
MindValue	ICT
PharmaSurgics	Pharmaceuticals
Tendera	Medical Device
Vasasesor	Sensor Technology

Summary

- Start-ups by recent graduates generally outnumber faculty spin-offs 24:1
- Recent graduates are twice as likely to start a business as their faculty
- Start-ups by recent graduates are not of poor quality
- Universities can affect entrepreneurship in several ways
  - Clever program design
  - Peers and culture are important
  - Access to great ideas useful

Potential Implications

- Tweaking TLO operations have only marginal effects
- Incentivizing faculty to create businesses may not be the most effective way for new businesses to be formed
- Supporting students have the biggest gross impact on start-up rates