ACADEMIC ENTREPRENEURSHIP
Bayh-Dole
versus
The Professor's Privilege

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What is the current thinking on university spin-offs?

Faculty should do more spin-offs

Universities should spin off more start-ups

Policies have been created to accomplish these goals:

- Changes to laws to allow universities to take ownership and control rights of academics' IP
  - Bayh-Dole in U.S., copied by Denmark, Norway, Finland, Germany, Japan, China, and Belgium
- Creation of TLOs to manage IP and stimulate spin-offs
- University funding of start-ups
- Academics (particularly in STEM fields) encouraged to create more spin-offs
- Spin-off counts suggested to join bibliometric measures and external funding as criteria for evaluations of university performance

Still, university spin-offs are rather few and far between

Swedish Political Context

- Professor's Privilege in place since 1949
  - Professor own 100% of I.P.
  - Professor retain all control rights
- Politicians
  - Are concerned about the so called Swedish/European paradox
  - Have enviously observed "enormous success" of the post-BDA commercialization of research in the U.S.
  - Have twice debated in parliament whether to scrap the P.P. in favour of BDA legislation
  - Are aware that neighbours Denmark, Norway, Finland and Germany have converted to BDA
  - Fear that University Chancellors and Rectors, because universities by default have no stake in IPR, do not sufficiently strong promote academic entrepreneurship
  - Again consider repealing the P.P.

Recent time-series evidence

Changing from Professor's Privilege to Bayh-Dole legislation has

- decreased academic patenting
- decreased start-ups
- decreased university-industry collaboration significantly in Denmark, Norway and Germany
  - Czarnitzki et al., 2015; 2016; Hvide and Jones, 2015; Valentin and Lund-Jensen, 2007

Do we have sufficient evidence?

- Are these studies assessing particular BDA implementations or providing fundamental evidence on the effect of switching IPR regimes?
- Are these studies capturing initial problems of institutional immaturity, while positive effects take more time to materialize?

  *quality of coaching and support * university/TTO greed * intertia in achieving cultural shifts in academia*

How can we further improve our understanding of BDA vs PP ?

- We could wait for a switch in a country maintaining the PP …

  … but few remain, and even if one occurs we would have to wait several years to get our hands on appropriate data

- We could wait for longer time series which allow BDE institutions to mature…

  … but in the meantime, parallell development obscures our before-after comparission

- We could also find a mature PP environment and compare it to a mature BDA environment

Objective

- To compare U.S. vs Sweden on
  - The *rate* of STEM academic entrepreneurship
  - The *earnings* from commercialization
- One of the main differences: IPR regime. Cash-flow rights and control right are very different.

Bayh-Dole (42%) vs Professor's Privilege (100%)

  - Expect higher absolute rate of academic entrepreneurship in the U.S.
    driven by difference in the general institutions of entrepreneurship
  - Expect higher relative rate of academic entrepreneurship in Sweden
    driven by PP / BDA differences
  - No strong prior expectation on U.S./Sweden differences in returns to entrepreneurship
    BDA expected to trim the tail of entrepreneurship quality, but may also – depending on TTO incentives and quality – stimulate over-entry

Why study the private returns to entrepreneurship?

- Making money is an important motivator for employment choices
- A relevant proxy for venture performance
  - allows us to pick up signs of over-entry
  - has bearing on a discussion of the magnitude of social returns
- If the private returns to entrepreneurship are negative
  - we need theory going beyond income maximisation to explain their behavior
  - one might ask for policies to discourage such wasteful activities
  - but if social returns are clearly positive there is an argument for subsidizing the expected losses of the agents (see Mansfield et al., 1977)
- If the returns are *positive* they need no subsidies

U.S. – Sweden Institutions

Measure	U.S.	Sweden
IP regime	Bayh-Dole 30% ownership of IP	Professor's Privilege 100% ownership of IP
Taxes/GDP (effective)	25%	45%
University-industry collaboration	High	High
University System	Large, public & private, large variety	Small, public, little variety
Labor Market	Deregulated	Coming down from heavy regulation
Labor turnover	35%-40%	10%-15%
Academic Earnings	Highest in world, skew	Modest, with wage compression
Patenting / academic	6 %	5-7 %

General Methodology

- Lots of things vary between Sweden and the U.S.
- We try to difference those out
- Entrepreneurship rates: Difference-in-Difference
  - Rate of entrepreneurship by academics (a)
  - Rate of entrepreneurship by non-academics with similar Ph.D.'s (b)
  - Difference between (a/b) between U.S. and Sweden
- Earnings: Triple Difference-in-difference
  - Earnings by academics (a)
  - Earnings by same academics after becoming entrepreneurs (b)
  - Earnings by non-academics with similar Ph.D.'s (c)
  - Earnings by same non-academics after becoming entrepreneurs (d)
  - Difference between (a/b) – (c/d) between U.S. and Sweden

Data

- **Statistics Sweden Register data**
- *All individuals* with a Ph.D. in STEM (Medicine, Natural Science or Engineering) who during 1999-2008 were employed at a Swedish university. Removed all above 60 years of age.
  - 278 individuals *leaving* a Swedish university to become *full-time* entrepreneurs.
- Add those who left academia to work full-time for a new small company (<10 employees) founded in the year they left academia
  - Add 200 individuals
  - 25% of these were verified owners of the firms they worked in
- 2,720 year-observations
- **U.S. SESTAT survey data**
- 322 similarly defined STEM individuals making the transition
- 1,045 year-observations for 1993, 1995, 1997, 1999, 2003, and 2006
- **Differences across countries have to be done with t-tests**

Variables

- Annual income from the Swedish tax register. Survey self-reported income from U.S. SESTAT
  - Wages, business earnings
- Employed at university, or employed by themselves / own a business and work full-time there
- Socio-demographic background; field of Ph.D., foreign born, gender, marital status, years since Ph.D., years at last employer, tenure-track position
- University quality: [R&D intensity (R&D/employee) or NRC score]

RESULTS:

Entry into Entrepreneurship

Measure	U.S.	Sweden
Bi-annual non-acad entrepreneurship rate	4.0%	2.5%
Bi-annual academic entrepreneurship rate	0.9%	1.1%
Relative entry rate	25%	44%

Linear Probability of Entrepreneurship

Panel logit	USA	Sweden
Medicine	.008** (.004)	-.006** (.002)
Engineering	.009*** (.003)	-.009** (.002)
Foreign born	-.004** (.002)	-.004** (.002)
Male	-.004* (.002)	.000 (.002)
Married	.001 (.002)	.003** (.001)
Years Experience	.002*** (.000)	.003** (.002)
Years last employer	-.002*** (.000)	-.005** (.002)
Tenure track=1	-.021*** (.003)	N/A
Log(wage)t-1	-.002 (.001)	-.008** (.002)
University quality	-.003*** (.001)	.003** (.001)
No observations	29,652	68,746

****significant at 1% level, * significant at 5% level.**

PRELIMINARY RESULTS

Private Returns Estimation

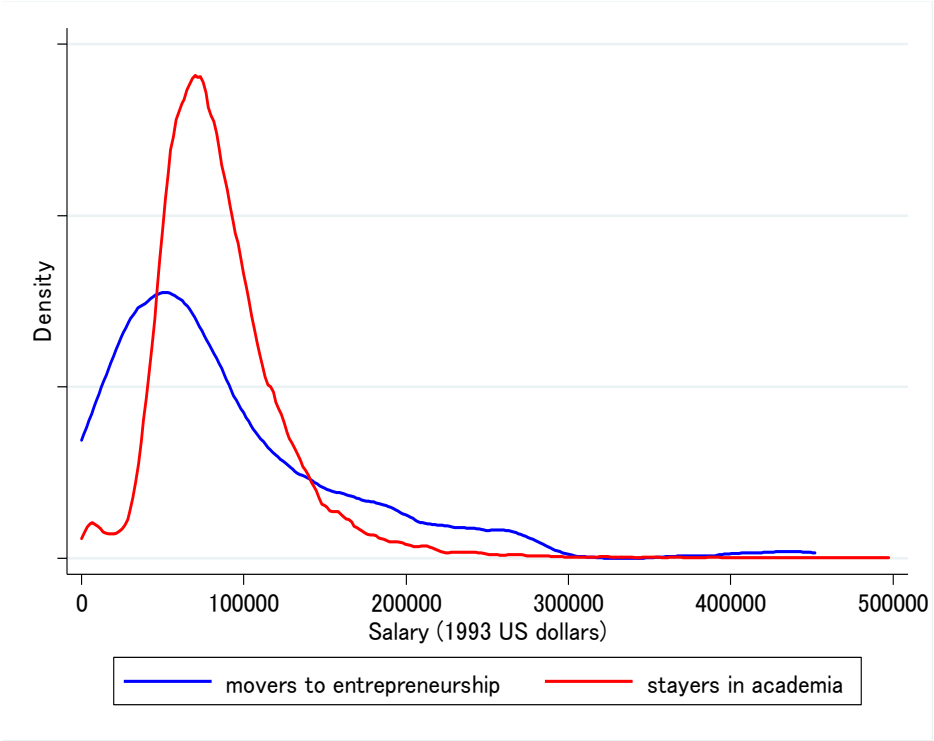
- Difference individual-fixed estimator on sample who become entrepreneurs

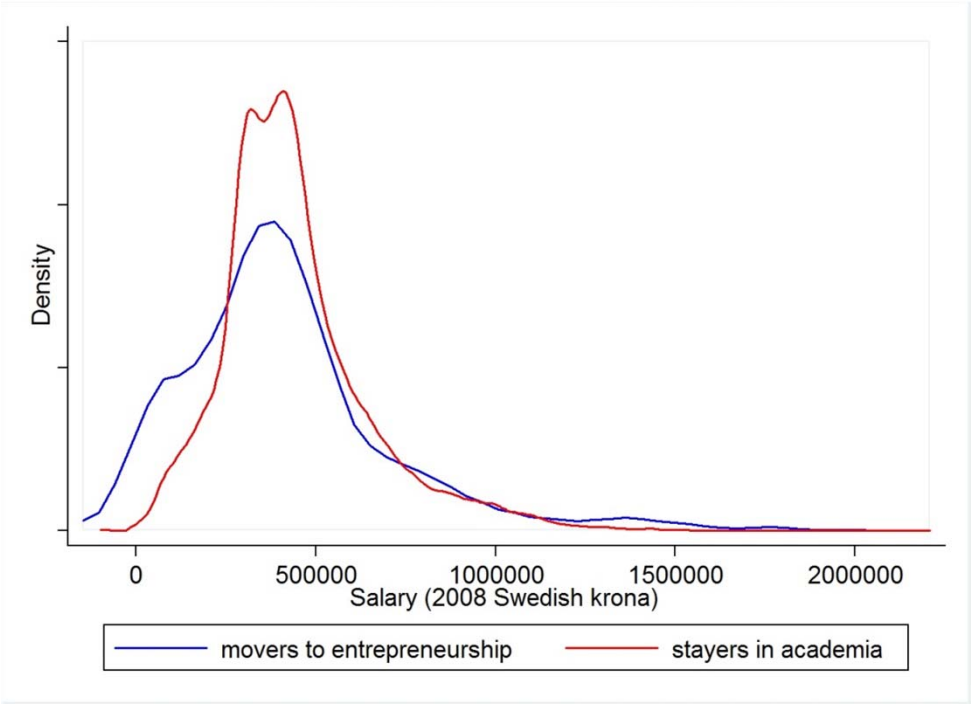
$$y_{it} = \alpha + E_{it}(\beta + \delta X_{it}) + \theta_i + \tau_t + \varepsilon_{it}$$

E	=1 for years when entrepreneur, =0 else
Y	log(earnings)
X	covariates
θ	individual-fixed effects
τ	time-fixed effects

- Estimate the effect of covariates on the *difference in income* between entrepreneurship and employment *for a given individual*
- Since we cannot put both samples together, we compare estimates of *β* across the two samples, and *β* for academic entrepreneurs with *β* for Ph.D.'s *not* originating from university employment

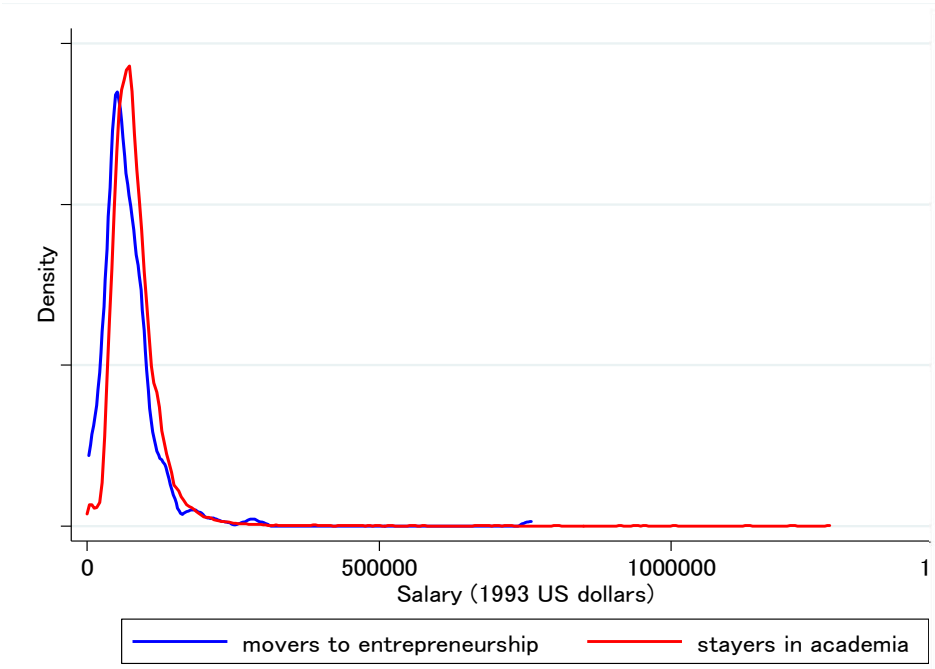
Log(Earnings) Density

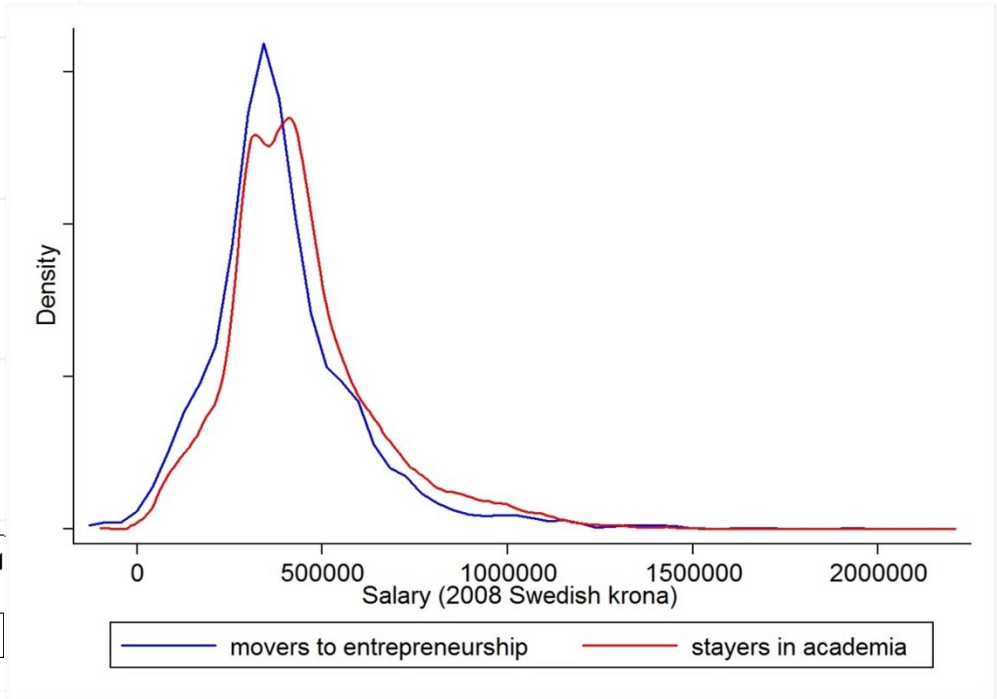




Negative earnings comparisson

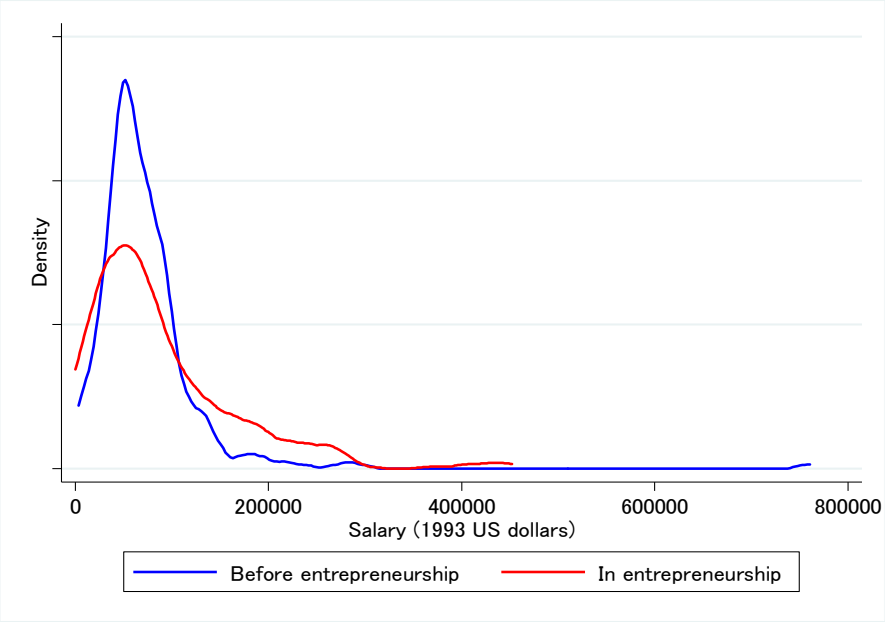
Log(Earnings) Density
prior to moving for those who move versus those who stay

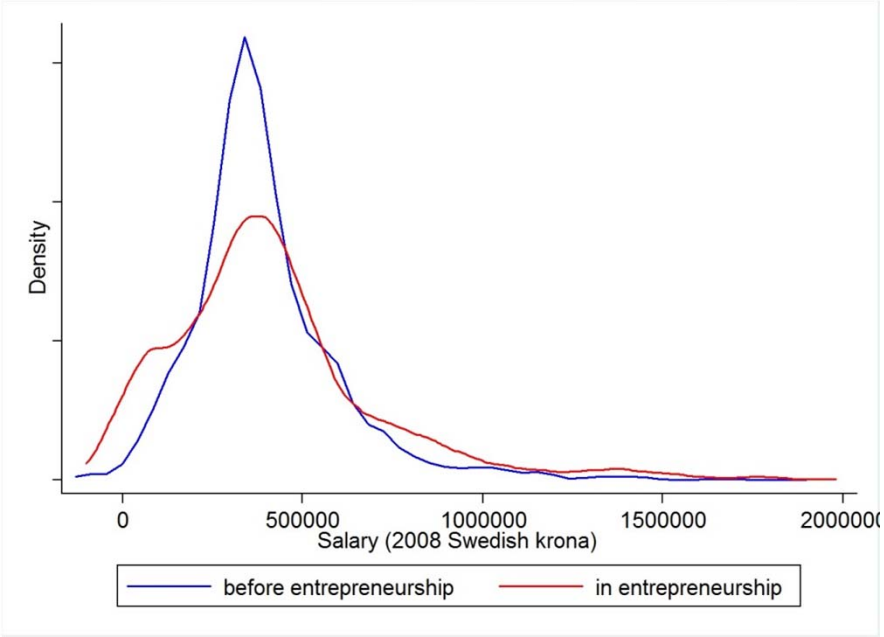




Stayers are on average better paid

Log(Earnings) Density
before and after moving
only for those moving





Returns to Academic Entrepreneurship

Fixed effects panel data OLS	USA	USA	Sweden	Sweden
Entrepreneur	-0.151** (0.077)	-0.333 (0.574)	-0.097* (.026)	-0.031 (.131)
Ent*Medicine		0.381 (0.274)		-0.110 (0.123)
Ent*Engineering		0.260 (0.269)		-.102 (.090)
Ent*Foreign born		0.493*** (0.207)		-0.343** (.160)
Ent*Male		0.071 (0.247)		-0.092 (.097)
Ent*Married		0.149 (0.206)		-0.009 (.097)
Ent*Years Experience		-0.040*** (0.012)		-.006 (.006)
Ent*Years at last employer		0.018 (0.019)		.0022 (.023)
Ent*Tenure Track		0.048 (0.235)		N/A
Ent*University Quality		0.101 (0.162)		.068 (.064)
Number observations	1,016	605	2,578	2,578

****significant at 1% level, * significant at 5% level.**

Next step

- Use coarsened exact matching to reduce potential imbalance in covariates between entrepreneurs and the control group
- Estimate $y_{it} = \alpha + E_{it}(\beta + \delta X_{it}) + A(\gamma + lE_{it}) + \theta_i + \tau_t + \varepsilon_{it}$
- Test against omitted variable bias

Main Results

Measure	U.S.	Sweden
Bi-annual academic entrepreneurship rate	0.9%	1.1%
Bi-annual non-acad. entrepreneurship rate	4.0%	2.5%
Relative entry rate	25%	44%
Earnings difference academics to entr	-15.1%	-9.7%
Earnings difference non-academics to entrepreneurs	-16.0%	-12.1%
Two-year failure rate	40%	46%
Non-academic failure rate	n.a.	32%
Percent returning to academia	33%	61%

Summary of Findings

- **There is a higher relative rate of entry into entrepreneurship by academics in Sweden than in the U.S.**
- **For academics, entrepreneurship does not pay well**
  - Returns between 10% to 15% lower than staying employed
  - Income risk is three times higher
- **Academics in less attractive employment positions are more likely than others to become entrepreneurs…**
  - with lower wage, and not on tenure track position
- **… but fare equally well in entrepreneurship**
- **Entrepreneurship spells are very short**
  - over 40% exit within two years
  - many – in particular in Sweden – return to academia

Inferences

- The market for academic entrepreneurship seems privately risky, but liquid and highly mobile
- Professors respond to economic incentives
- Signs of over-entry in both the U.S. and Sweden?
  - Financial encouragement of academic entrepreneurship beyond existing efforts needs to make plausible substantial social returns
- In both countries there is selection from the bottom of the ability distribution
  - Stimulating younger, tenure-track academics should produce greater marginal benefits for society than general incentives for all academics
- Consulting and advisory roles may be more efficient than full-time efforts

Policy Advice

- Abolishing the Professor's Privilege in Sweden would likely lead to less – not more – academic entrepreneurship
- Consider improving the screening process to support fewer academic entrepreneurs but with higher quality projects, or more loose affiliations (not full-time) to business
- Do not expect great economic outcomes from academic entrepreneurs

EXTRA

Returns to non-Academic Entrepreneurship

Fixed effects panel data OLS	USA	USA	Sweden	Sweden
Entrepreneur	-0.160** (0.027)		-0.121*** (.026)	
Ent*Medicine				
Ent*Engineering				
Ent*Foreign born				
Ent*Male				
Ent*Married				
Ent*Years Experience				
Ent*Years at last employer				
Ent*Tenure Track				
Ent*University Quality				
Number observations	1,650		1,943	

Legend: **significant at 1% level, * significant at 5% level.

What are the private benefits?

- The private returns to entrepreneurship turn out to be negative, between -5% to -15% per year (e.g. Hamilton, 2000; Woodward and Hall, 2013)
  - People would be better off remaining employed