Of Mice and Academics: Examining the Effect of Openness on Innovation

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Context

- Concern that upstream IPR may be counterproductive for research progress
  - E.g., EPFL – materials transfer agreements (Aebischer)
- David – conflict between norms of open science and IP
  - OS: rewards are reputational, etc., encourage citations
  - IP: rewards are due to right to exclude, which reduces citation activity

“Optimal” incentives for cumulative innovation

- Give first innovator IP rights
- After costs are sunk, take them away
- That’s what happened here – not an experiment that can be repeated very often
- But OS incentives (with public funding) deliver the first innovation regardless

Research question

- How does openness affect innovation?
  - Well-known tradeoff between incentives for first and second generation researchers
  - How does this operate in the case of academic biotechnology research?
- Two parts to paper:
  - Use a simple model to derive predictions
  - Test them using a large panel of sci papers and D in D methodology
    - confirmation rather than rejection

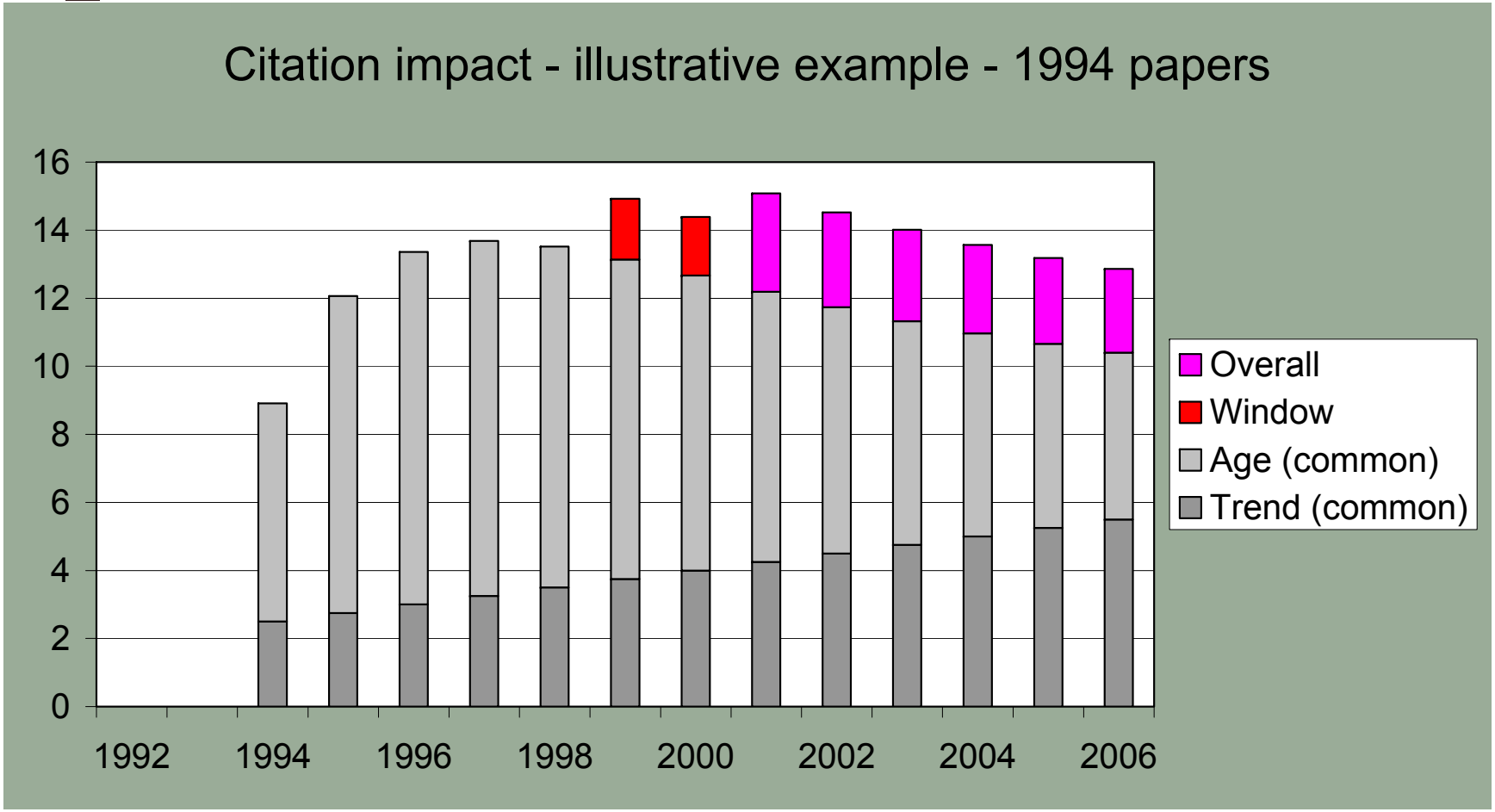
Model predictions

- Lowering cost of access to research inputs is expected to
  - Increase quantity of follow-on research
    - At a point in time
    - Over time
  - Increase diversity of follow-on research
    - More researchers
    - Different types of research
  - Increase basic research relative to applied
- Did we need the model to make these predictions? (I am not convinced)

Empirical evidence

- Well-executed and very compelling
  - Relates annual citations received by papers that cite or do not cite mice which have been made open access in 1998.
  - Breaks it down:
    - Cites from new v prior researchers
    - Cites from new v prior institutions
    - Cites with new v prior keywords
    - Cites in new v prior journals
  - Fairly large impacts, all in the right direction

Sample plot


Citation impact - illustrative example - 1994 papers
16
14
12
10
8
6
4
2
0
1992
1994
1996
1998
2000
2002
2004
2006
Overall
Window
Age (common)
Trend (common)

Comments and suggestions

- Paper needs more explanation of exactly what was estimated and why
- Discussion of any effects due to avoidance of “visibility”
- Separate trends for the two groups – plot?
- To what extent are there false “new” cites due to spelling errors?
  - probably does not affect the D in D
- Identification problem for age, year, fixed paper effects (next slides)

The identification problem

- Want to measure citations as a function of age of the article, publication date (or fixed effect), and time period (current year)
- Well-known that the identity
  - age = year (period)-year of birth(pub. date) implies all 3 cannot be identified in a linear model
- Less well-known that identification can be achieved in a dummy variable model by dropping a small number of variables
  - Berndt and Griliches (*J of Econometrics 1991*)
  - Hall, Mairesse, Turner (*EINT 2007*)

Models

saturated: $p_{it} = a_{ct} + \varepsilon_{it}$

threeway: $p_{it} = \alpha_c + \beta_t + \gamma_a + \varepsilon_{it}$

twoway: $p_{it} = \alpha_c + \beta_t + \varepsilon_{it}$

and so forth....

where i = 1,…,N papers

t = 1,…,T years

c = 1,…,C pub date (or fixed effect)

a = t-c (age)

Saturated model

Pub. Date: Year ↓	1	2	3
10	$a_{10,1}$	$a_{10,2}$	$a_{10,3}$
11	$a_{11,1}$	$a_{11,2}$	$a_{11,3}$
12	$a_{12,1}$	$a_{12,2}$	$a_{12,3}$
13	$a_{13,1}$	$a_{13,2}$	$a_{13,3}$
14	$a_{14,1}$	$a_{14,2}$	$a_{14,3}$

Identification

- Oneway – all dummies are identified (but no intercept)
- Twoway – drop one dummy
- Threeway – drop two dummies
- Threeway where $a = t\text{-}c$:
  - Drop one additional dummy! (Berndt and Griliches 1991)
- How robust are the results to the choice of dummy to drop?

Suggestion for further work

- Belenzon finds positive feedback effects to firm *j* from:
  - pat (firm j) → pat (firm i) → pat (firm j)
  - In this context, how are second generation cites by original researcher affected?
  - Does he/she benefit more from reverse spillovers?

Wider applicability?

- Publicly funded science
  - Downstream sources of revenue for funding unlikely or remote or highly risky
  - Benefits of diversity high, incentive effects not greatly harmed (since they are mostly reputational)
- Private R&D?
  - IBM's 500 patents