Faculty hiring and changing representation in academia

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"little in academia makes sense except in light of prestige"
this talk

who produces the scientific workforce?

who gets to be faculty?

changing representation in academia

🤔 (long term) how does faculty composition shape what discoveries are made?

difficult to answer, because it requires understanding how faculty identity variables shape what scientific activity gets done + what shapes “who works on what”?
who produces the scientific workforce?

faculty are special

- make scientific discoveries
- produce scholarship
- train future scientists
- have long, stable careers

who hires whose graduates as faculty?
who hires whose graduates as faculty?

faculty hiring is a *network*
- vertices are PhD-granting universities
- consumers ↔ producers
- $v$ hires from $u$, add an edge $u \rightarrow v$

to investigate, we hand-collected data
- Computer Science + History + Business
- PhD → faculty transitions for 19,000 faculty
- 461 PhD-granting departments
who hires whose graduates as faculty?

difficult to talk about hiring without talking about prestige

but not USNews rankings 😞

💡 we can use the network to infer prestige

here: minimum violation rankings, select ranking \( \pi \) that minimizes "rank violations" :

edges \((u, v)\) where \( \pi_v < \pi_u \)

interpretation: higher-ranked nodes have greater placement power

there are many ways to extract a ranking from a network:

*Minimum Violation Rankings (MVRs) are equivalent to solving the MINIMUM FEEDBACK ARC SET problem (NP-hard)*

prestige in the sense of Burris (2004) as a form of social capital; many papers have analyzed faculty hiring networks since, all showing similar results
who hires whose graduates as faculty?

first, check that these prestige rankings are useful
then, examine faculty hiring networks through the lens of prestige…
who hires whose graduates as faculty?
who hires whose graduates as faculty?

prestige $\pi$ correlates with USNews & NRC, but is more predictive of placement

✓ correlates with underlying social dynamics that shape the field

✓ uncertainty lowest among highest prestige nodes

✓ similar results, but different orderings for Business and History
explore the data yourself:
https://larremorelab.github.io/faculty
who hires whose graduates as faculty?

across hierarchy, enormous inequalities

- faculty production highly concentrated
- 18 departments (9%) \(\rightarrow\) 50% of all faculty
- most departments (75%) are net consumers [more faculty hired than produced]
- top 10 departments produce
  - 1.6x more than depts. 11-20
  - 3.1x more than depts. 21-30
who hires whose graduates as faculty?

most placements, far down hierarchy

Computer Science
- 80% move down
- 8% self-hires
- 12% move up
average = 47 steps down

a rich club:
- top 15% of depts. produce 68% of their own faculty
- and hire only 7% from outside top 25% of depts.

B
C
A

Relative change in rank from PhD, $\Delta \pi / n$

move 'up'
moves 'down'
top 15% of institutions
all other institutions

Computer Science
Business
History

Density

-0.4 -0.2 0 0.2 0.4 0.6 0.8 1

- 0.4 - 0.2 0 0.2 0.4 0.6 0.8 1

Density

Change in normalized rank from PhD, $\Delta \pi / n$

Computer Science
Business
History

-0.4 -0.2 0 0.2 0.4 0.6 0.8 1

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Density
who hires whose graduates as faculty?

hiring hierarchies tend to be very stable over time

- **model**: hire noisily by hierarchy, update hierarchy, repeat; track institution prestige "drift"
- **result**: institutions largely fixed within their original prestige quintile

![Diagram showing department origin and final ranking groups]
who hires whose graduates as faculty?

network organized as core and periphery: high ranked nodes are more central

quantifies how "close" all other nodes are to a place, across the network
who hires whose graduates as faculty?

network organized as core and periphery, homeland and colonies

prestige \( \rightarrow \) influence via doctoral placement

over research agendas, research communities, and departmental norms across a field

\[ \text{Mean geodesic distance / diameter} \]

Stanford 1 / 205
Colorado 56 / 205
York 151 / 205
UMass 25 / 205
SUNY Buffalo 75 / 205
UConn 100 / 205
Oregon St. 125 / 205
Montana St. 171 / 205
Brigham Young 181 / 205

Lee, Clauset, Larremore, EPJ Data Science 10 (2021)
who hires whose graduates as faculty?

- prestige is a structural variable in academia
- placement power $\pi$ quantifies reputation via outcomes (not inputs)
- reveals core-periphery structure of academia
  - faculty flow from core $\rightarrow$ periphery ("the colonies")
  - modest fraction stays inside core ("homeland")
  - small fraction flows "upstream"
  - these hierarchies extremely stable over time
- prestige $\rightarrow$ faculty production $\rightarrow$ hierarchy

one might argue that these strong prestige hierarchies reflect true meritocratic differences, but I think that's a hypothesis that needs to be proved, rather than disproved
who gets to be faculty?

U.S. academia has never been *representative* of the U.S. population
under-representation by race and gender are well studied

→ what about socioeconomic background?

- how does SES intersect with representing of other social identities?

SES is one of many social identity variables that intersect with the probability of becoming faculty, including race and ethnicity, gender, sexual orientation, etc.
study design

combine information on faculty field, institution, SES and U.S. population comparisons

survey (2017-2020)

- \( n=7218 \) tenure track faculty [a 15.4% response rate]
- U.S. research intensive institutions (PhD-granting)
- 8 diverse academic fields

reference populations

- NSF Survey of Earned Doctorates (SED)
- US Census (1940-2020)

institutions (\( n=450 \))

- prestige (ranking)

- This survey is about patterns in faculty hiring, advancement, and productivity in the North American academic system.
- It is currently open only for tenured or tenure-track faculty in business or history.
- The survey has 2 parts:
  - Part 1: Questions on sociodemographic characteristics (1-2 minutes)
  - Part 2: Questions on your experience as faculty (10-12 minutes)
- There is a $500 cash lottery for participants. The winner will be informed by email.
- Personally identifiable information will be kept confidential.
- This study is IRB approved.

The study "Understanding the Network Structure and Dynamics of the Academic Scientific Workforce" (CU IRB protocol no. 16-0441) is conducted by researchers from the University of Colorado at Boulder and the Santa Fe Institute. This study is supported by the NSF programs Science of Science & Innovation Policy, and the Science of Broadening Participation (SBE award 1633791).

Your participation is voluntary and you may stop at any time. Your answers will be used only in this study, except as required by law.
socioeconomic roots of faculty

faculty tend to come from highly educated families

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Survey of Earned Doctorates (NSF) | ← 25.2 → 14.0 23.1 26.0 11.8 |
U.S. Population (Census)           | 8.7 10.5 35.6 23.1 14.6 6.5 0.9  

percent faculty parents highest educational attainment
percent reference population highest educational attainment
socioeconomic roots of faculty

Faculty tend to come from highly educated families:

- Half (51.8%) of all faculty have a parent with a master’s degree or higher.
- A quarter (22.2%) have a parent with a PhD.

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The distributions of parents’ highest education are similar across the disciplines surveyed, suggesting that despite disciplinary differences in scholarship, funding, and culture, having a parent with a PhD is universally advantageous for becoming a professor. The rates at which parents of faculty have a college education or higher have also slightly increased over time, which mirrors broader social trends in the U.S. population.
socioeconomic roots of faculty

faculty tend to come from highly educated families

- half (51.8%) of all faculty have parent with MS or PhD
- quarter (22.2%) have parent with PhD • 2x PhD holders, 25x US population
- it’s universal (not field or domain specific)

more education • more likely as faculty parents
socioeconomic roots of faculty
disproportionately from urban areas & wealthier ZIP codes
- likely caused by having higher SES parents

![Chart showing distribution of average income and professors per capita.](image)

Can you spot the urban centers?
socioeconomic roots of faculty

parental education correlates with career support + encouragement

- 5-pt scale of support received from parents
- $\mu = 4.6$ (PhD parents) vs. $\mu = 3.9$ (non-PhD parents)
- support independent of faculty gender

social support likely *one of many* mechanisms by which SES shapes likelihood of becoming faculty
socioeconomic roots of faculty

PhD parents correlates with more prestigious faculty jobs

- faculty at elite universities are 2x more likely to have PhD parents than faculty at other universities (50x more than U.S. population!)
socioeconomic roots of faculty

PhD parents correlates with more prestigious faculty jobs
- faculty at elite universities are 2x more likely to have PhD parents than faculty at other universities (50x more than U.S. population!)
- this effect has been stable for past 50 years

why should having PhD parents, or not, influence how prestigious the faculty job a person gets?
who gets to be faculty?

"Talent is equally distributed but opportunity is not" — Leila Janah

- high SES backgrounds are *dramatically* over-represented in academia
- faculty are 25x more likely than U.S. pop to have PhD parents — 50x if at elite university — 2x compared to PhD holders in general
- raised in more urban and slightly more wealthy ZIP codes
- faculty with PhD parents receive more social support for faculty career + more likely to hold jobs at elite institutions ➔ structural barrier to diversifying academia
- race matters: White faculty 1.4x more likely to have PhD parents than Black or Hispanic faculty ➔ generational impediment to diversifying academia

🤔 *what impact is this having on our collective scholarship?*
faculty hiring and representation

"little in academia makes sense except in light of prestige"

- faculty play a special role in science, but
  - prestige drives who hires whose graduates as faculty
  - top 20% of departments generate 80% of all faculty (universally!)
  - placement power is influence, via doctoral placement
- high SES backgrounds are dramatically over-represented among faculty
  - having PhD parents also correlates with more prestigious jobs
  - structural and generational barriers to diversifying academia

prestige in the sense of Burris (2004) as a form of social capital
faculty hiring and representation

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- but! elite department’s placement power drives the composition of the field
  - system-wide diversification efforts turn on who elite departments train

prestige in the sense of Burris (2004), as a form of social capital
The faculty job market plays a fundamental role in shaping nearly 19,000 regular faculty in three disparate discipline variables that encompass differences in both scholastic merit and non-scholastic traditions, which provide a gateway towards greater occupational opportunity and reflect profound social inequality shapes nearly every competition that overwhelmingly favors more prestigious institutions. These results — mechanize social inequality — highlight the reinforcing effects of a prestige-based faculty hiring system, and the reinforcing hierarchies in faculty hiring networks is a mixture of global and local, which are well documented. Systematic inequality and hierarchy in faculty hiring networks Systematic inequality and hierarchy in faculty hiring networks — highlight the reinforcing effects of a prestige-based faculty hiring system, and the reinforcing hierarchies in faculty hiring networks is a mixture of global and local, which are well documented. 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fin

papers, code, data

https://aaronclauset.github.io

image by Meredith Miotke for Quanta Magazine