

Gender and retention patterns among U.S. faculty

Aaron Clauset
@aaronclauset
Professor
Computer Science Dept. & BioFrontiers Institute
University of Colorado, Boulder
External Faculty, Santa Fe Institute

with Katie Spoon, Nicholas LaBerge, K. Hunter Wapman, Sam Zhang, Allison C. Morgan, Mirta Galesic, Bailey K. Fosdick & Daniel B. Larremore

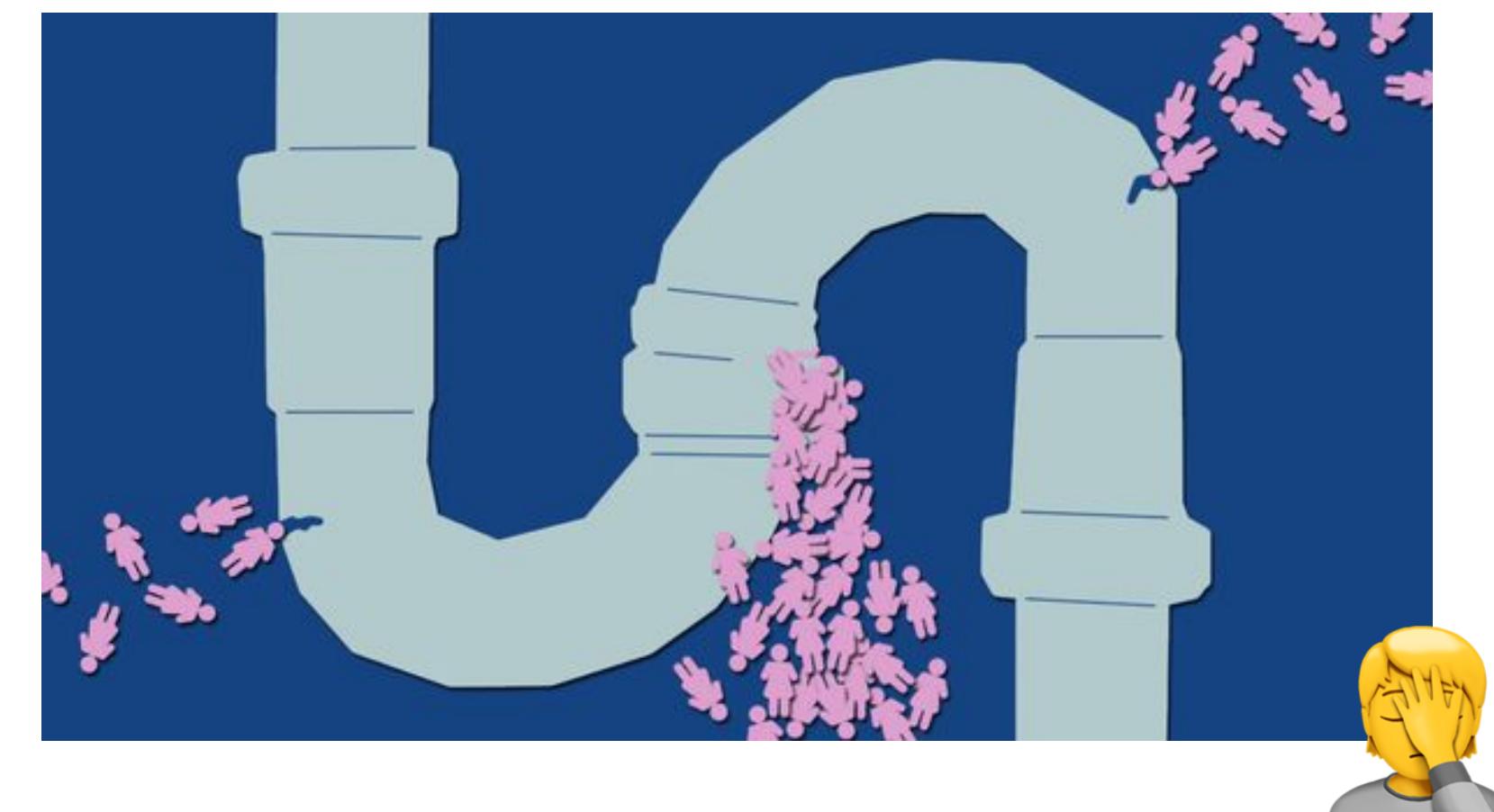
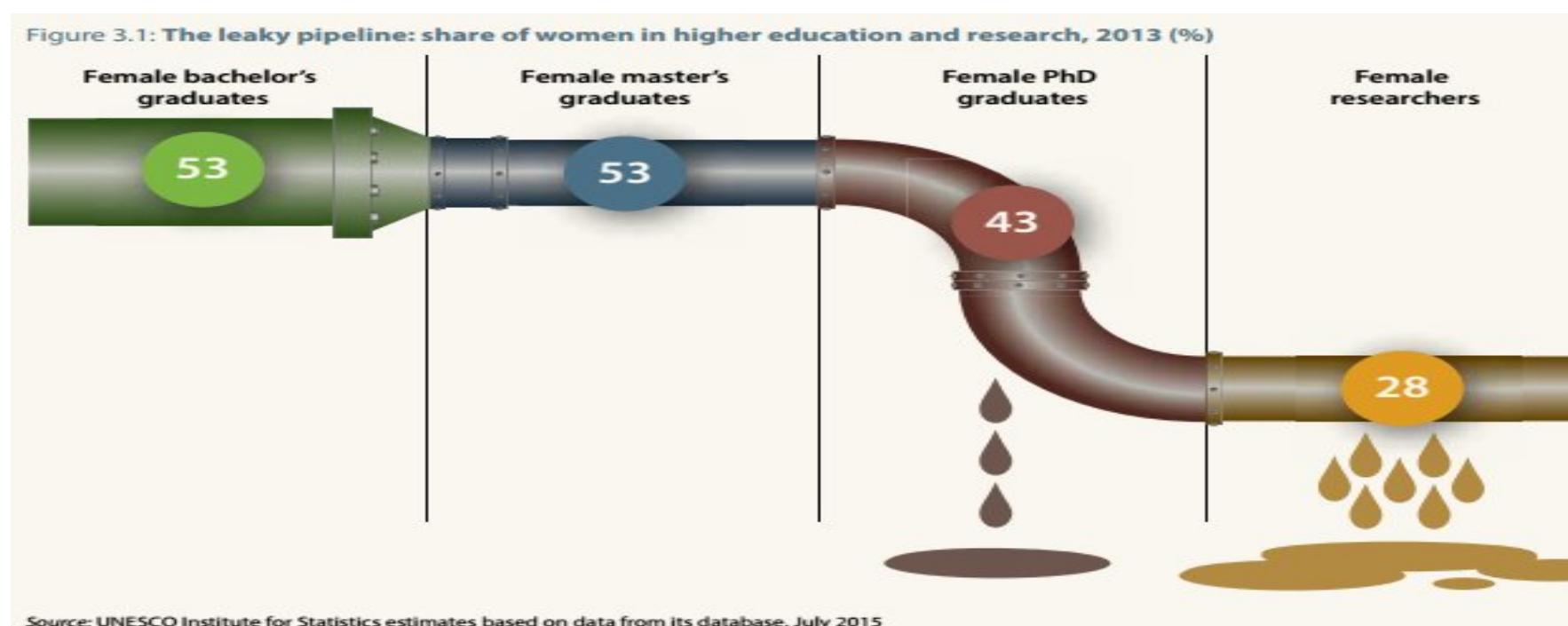
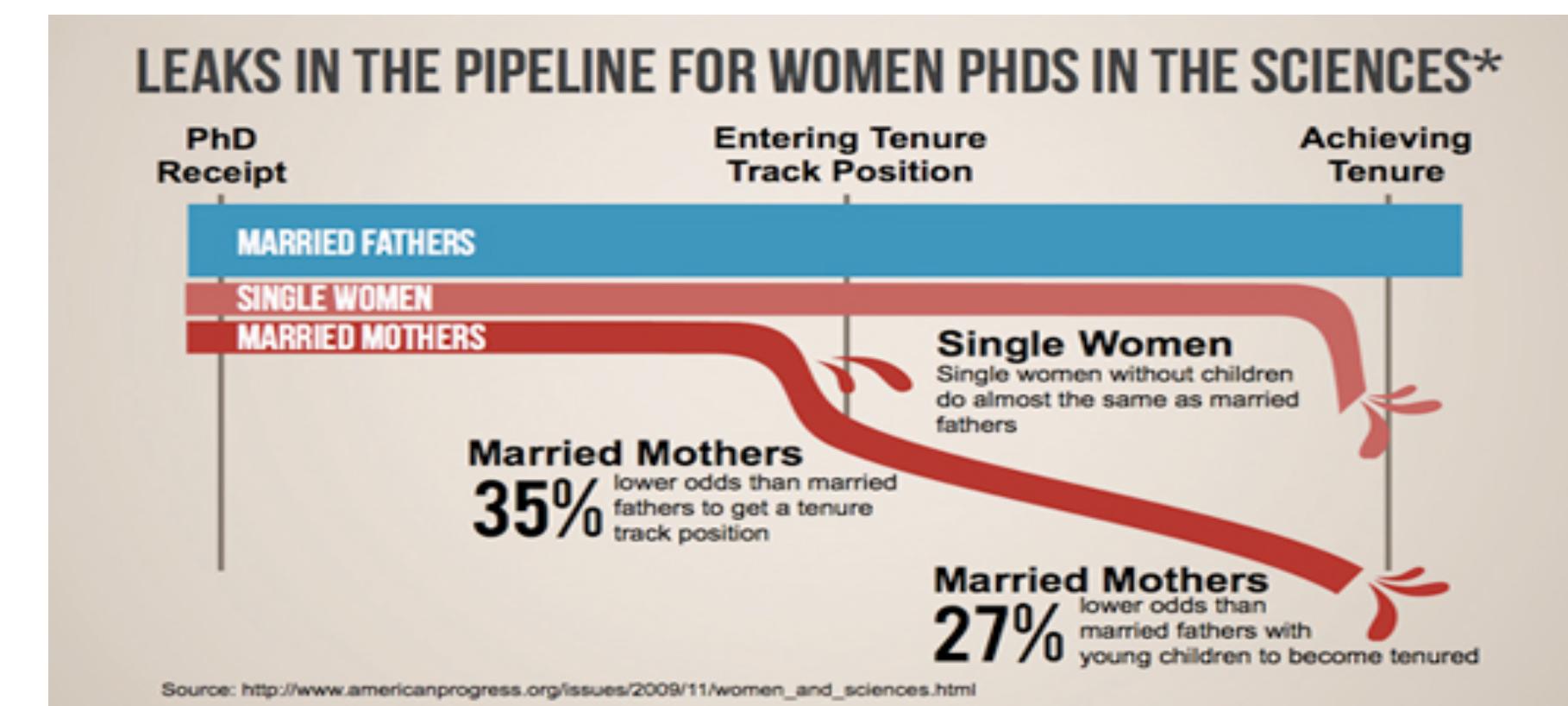
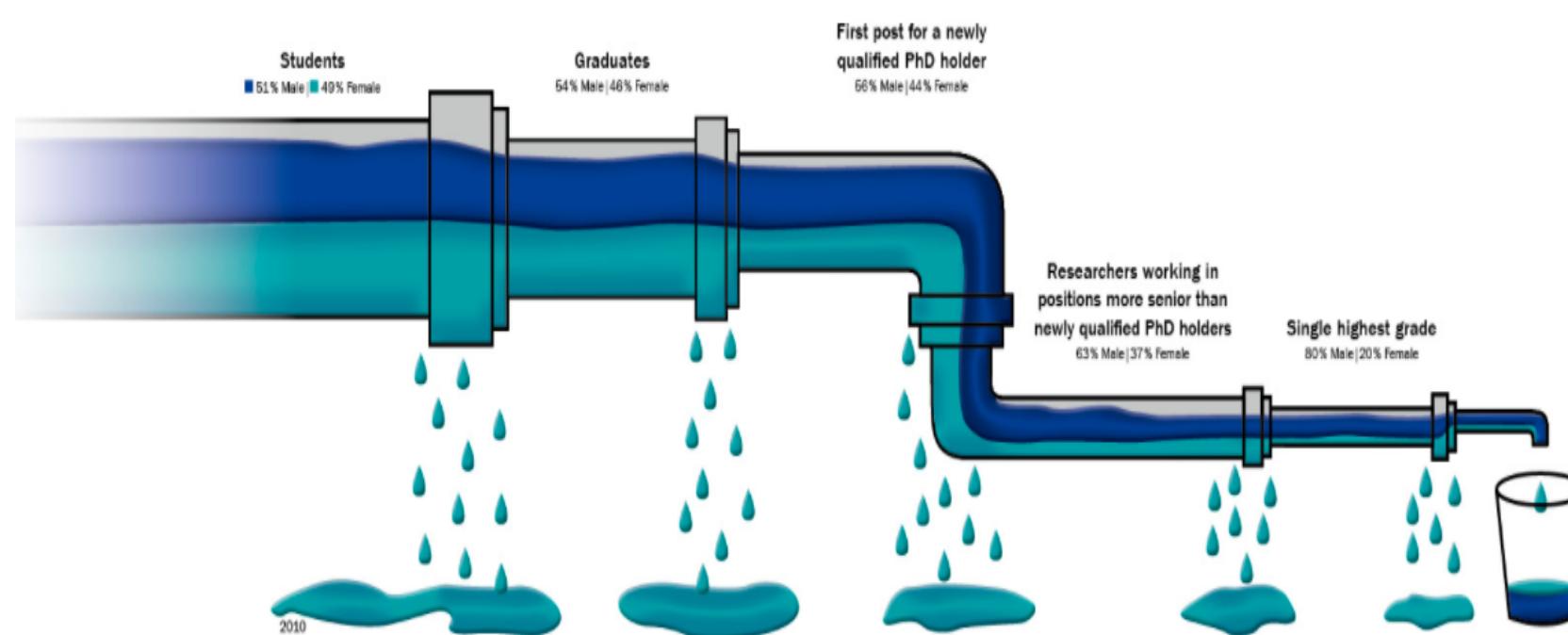


gender in higher education

- ▶ 40 years of leaky pipelines...

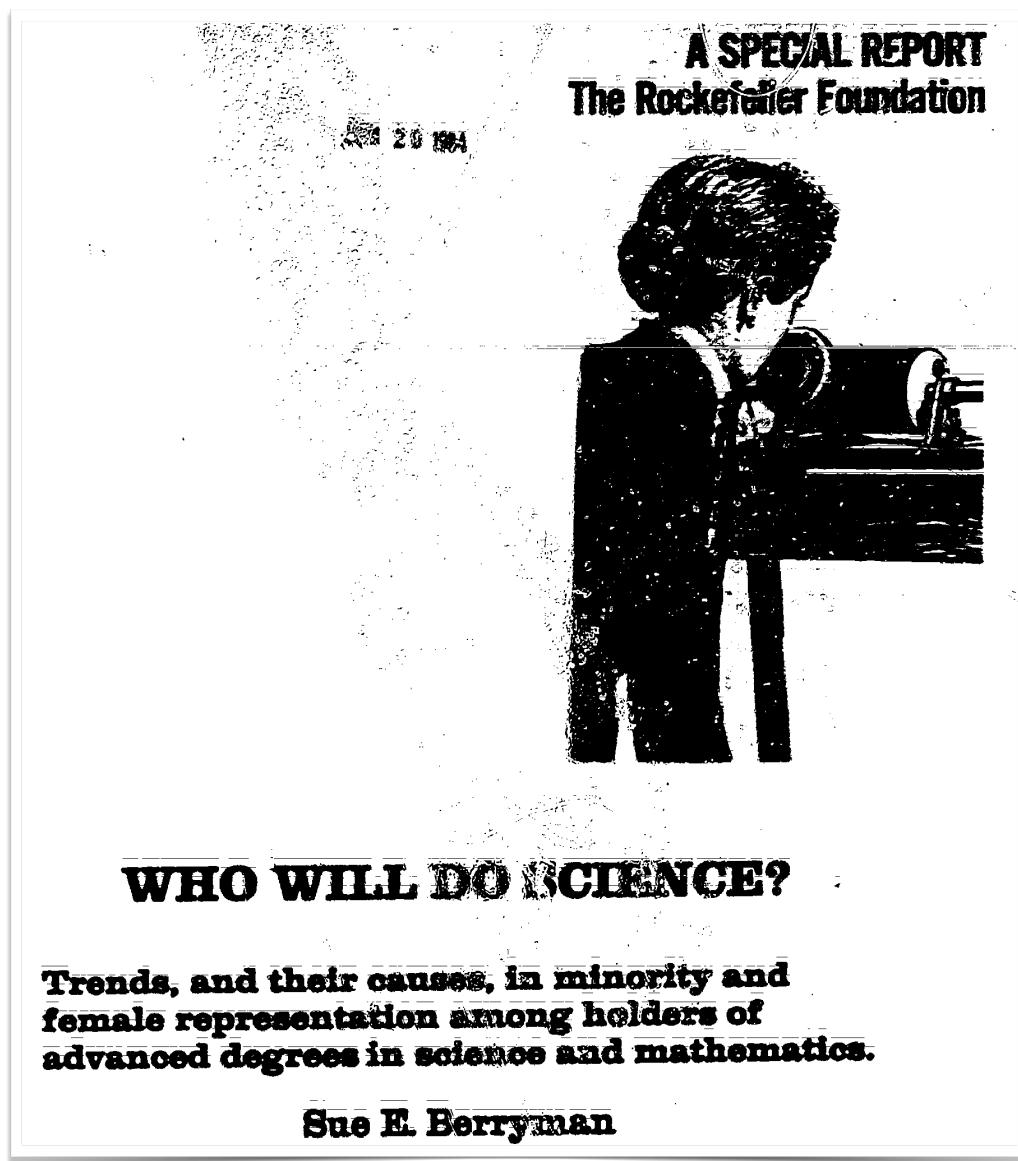
gender in higher education

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gender in higher education

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1983

OUT OF THE CLASSROOM: A CHILLY CAMPUS CLIMATE FOR WOMEN?

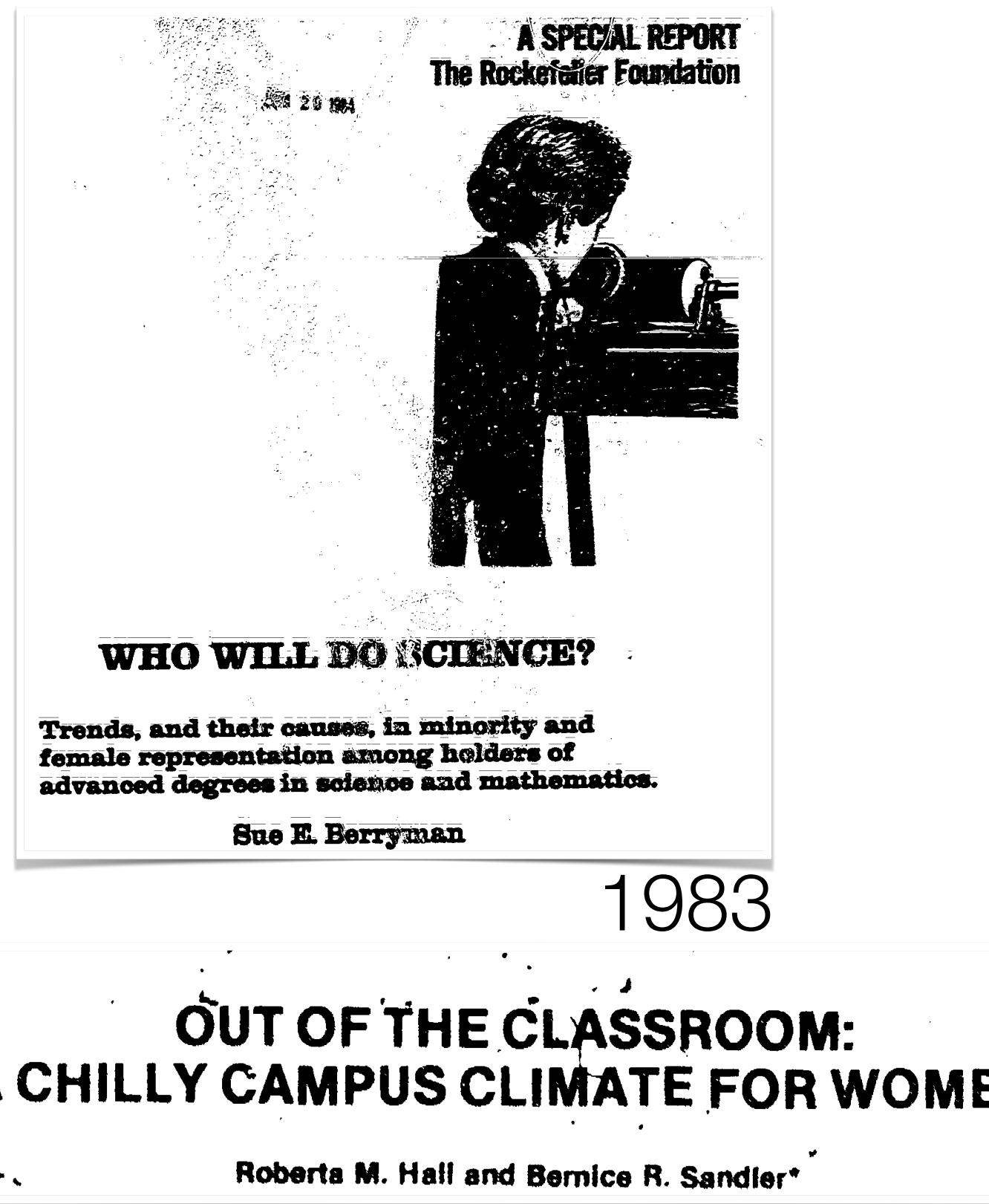
Robert M. Hall and Bernice R. Sandler*

1984

- 1970-80s: "pipeline" analyses
women's representation in higher ed
gendered major choices, retention
- 1984: higher ed *climate* is gendered

gender in higher education

▶ 40 years of leaky pipelines...



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- 1982: "leaky pipeline" for *URMs*

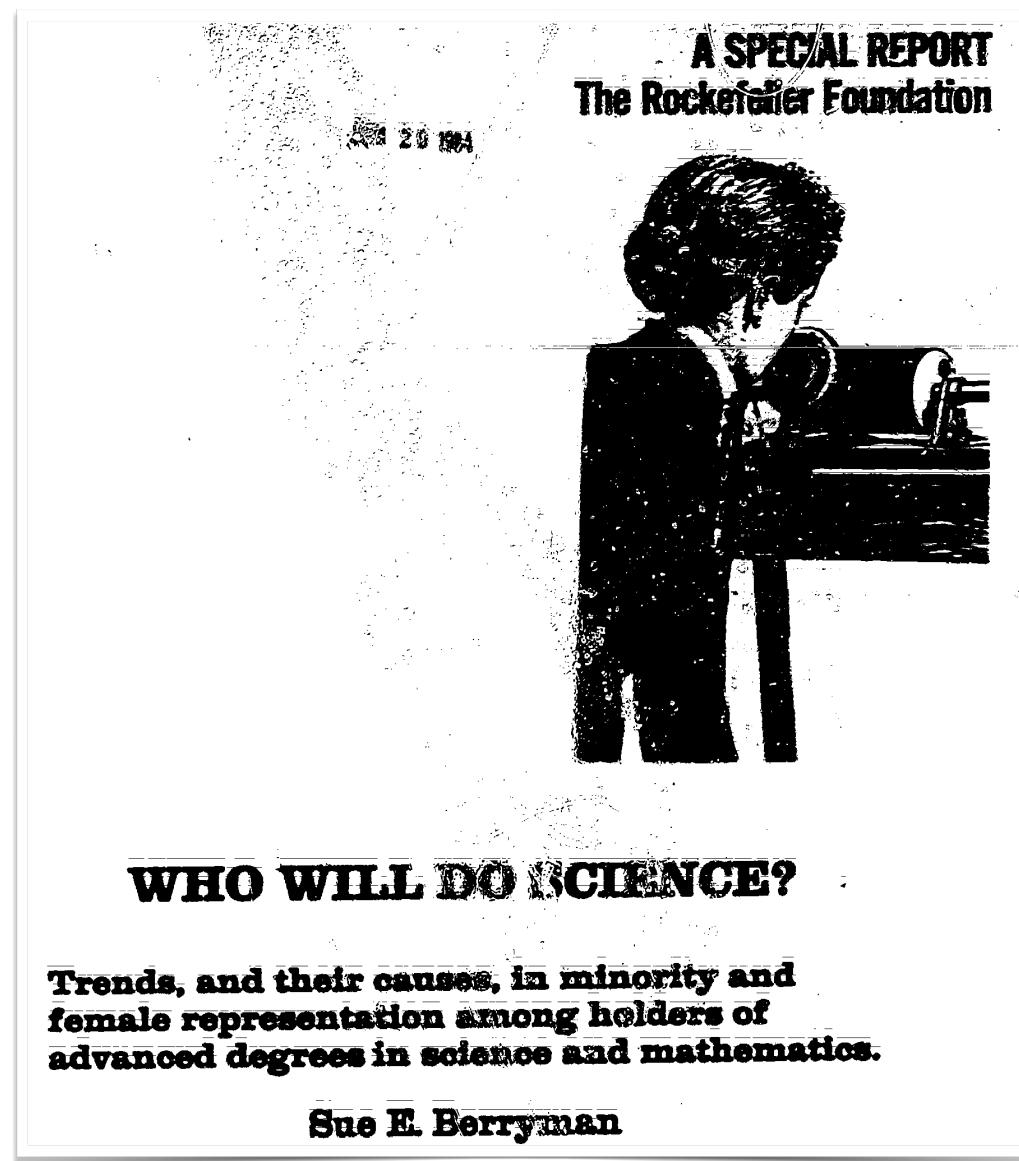
Alexander Astin (1982) compares the educational system in the U.S. to a **leaking pipeline** which loses "disproportionately large numbers of **minority students**" along the way, creating retention rates of 50 to 75 percent lower for U.S. minorities than for Whites.

Mason & Ross (1990)

1984

gender in higher education

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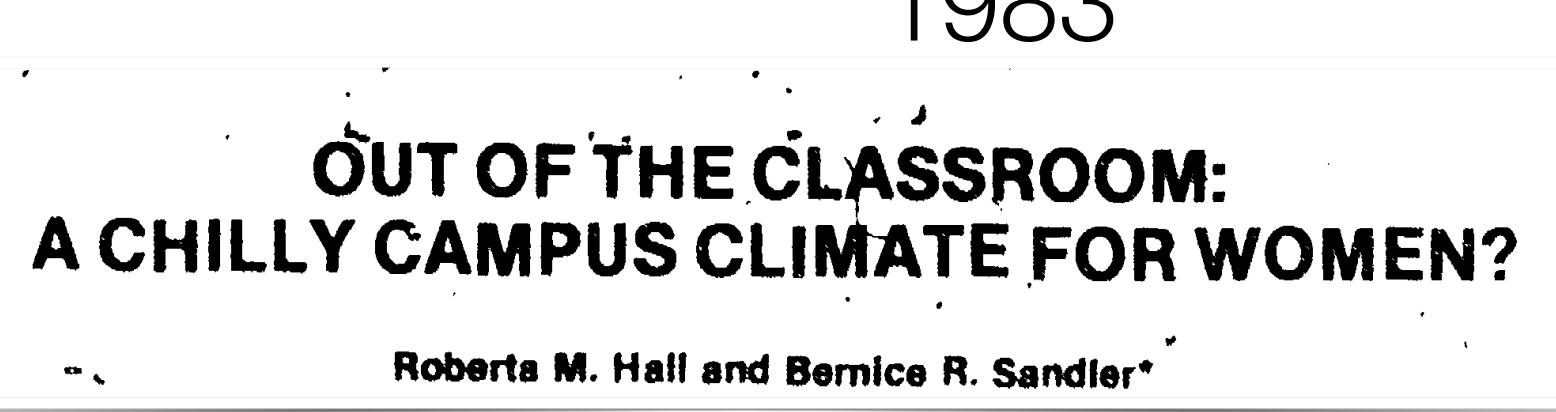
1983

AAAS Presidential Lecture: Voices from the Pipeline

SHEILA E. WIDNALL

1988

- 1970-80s: "pipeline" analyses
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- 1984: higher ed *climate* is gendered
- 1982: "leaky pipeline" for *URMs*
- 1988: gendered retention in PhDs
highlights climate, support



1984

Roberta M. Hall and Bernice R. Sandler*

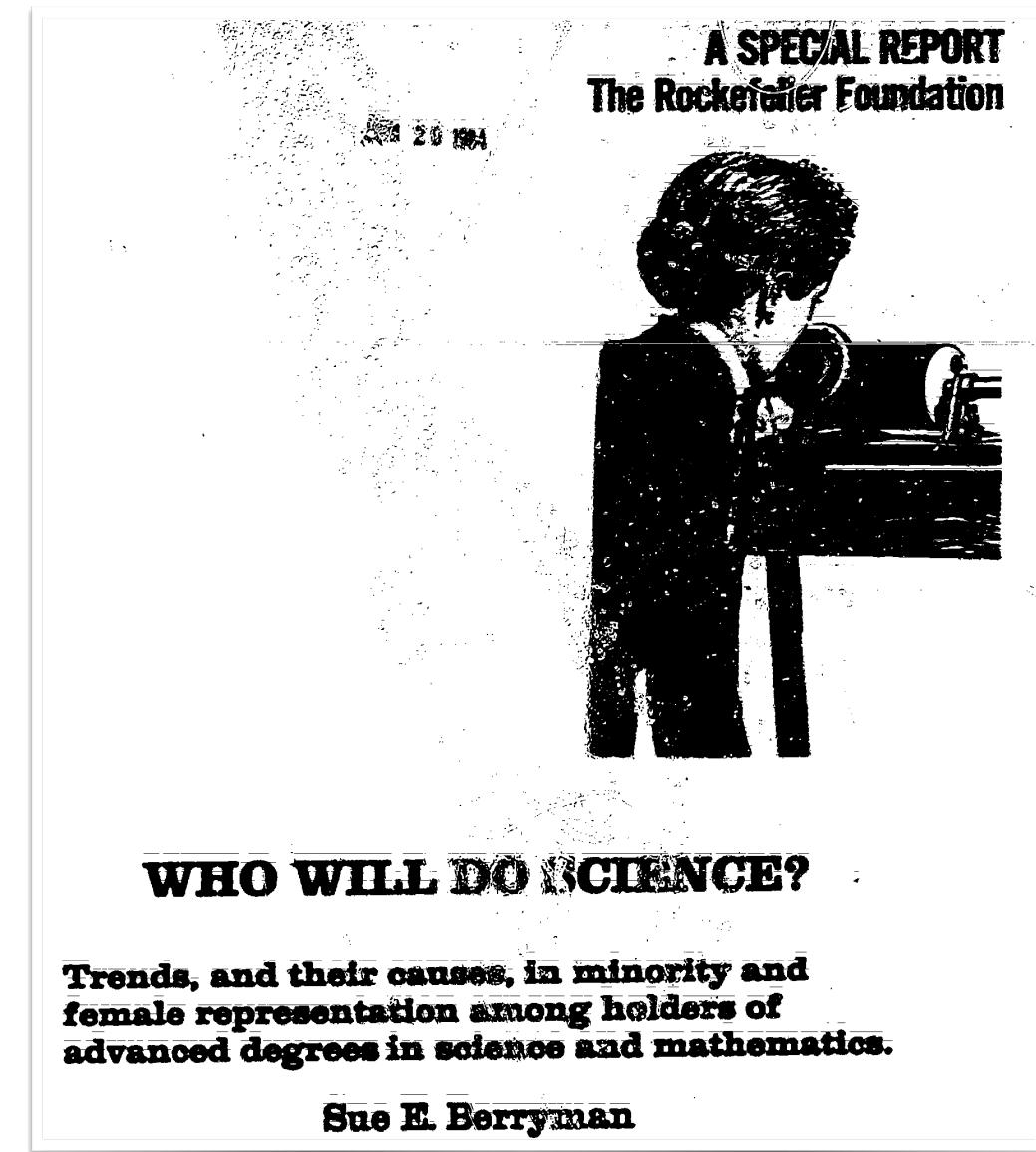
pipeline analyses: Vetter et al. (1975, 1978) & Berryman (1983) & Widnall (1988)

gendered climate: Hall & Sandler (1984)

"leaky pipeline" of Black students: Astin (1982)

gender in higher education

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1983

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SCIENCE EDUCATION The Pipeline Is Leaking Women All the Way Along

1993

Fixing the Leaky Pipeline: Women Scientists in Academia^{1,2}

A. N. Pell

1996

- 1970-80s: "pipeline" analyses women's representation in higher ed gendered major choices, retention
- 1984: higher ed *climate* is gendered
- 1982: "leaky pipeline" for *URMs*
- 1988: gendered retention in PhDs highlights climate, support
- 1993: "leaky pipeline" for women
- 1996: gendered *faculty* retention

pipeline analyses: Vetter et al. (1975, 1978) & Berryman (1983) & Widnall (1988)

gendered climate: Hall & Sandler (1984)

"leaky pipeline" of Black students: Astin (1982)

"leaky pipeline" of women: Rosser in Alper (1993)

women faculty retention: Pell (1996)

gendered faculty attrition

- ▶ **faculty literature is deep and messy**

gendered faculty attrition

► faculty literature is deep and messy

no / few gendered differences

CULTURE, CLIMATE, AND CONTRIBUTION:
Career Satisfaction Among Female Faculty

Louise August*** and Jean Waltman*

Research in Higher Education (2004)

Women in Academic Science: A Changing Landscape

Stephen J Ceci¹, Donna K Ginther², Shulamit Kahn³, Wendy M Williams⁴

Psych. Science in the Public Interest (2014)

Exploring Gender Bias in Six Key
Domains of Academic Science:
An Adversarial Collaboration

Stephen J. Ceci¹, Shulamit Kahn²,
and Wendy M. Williams¹

Psych. Science in the Public Interest (2023)
this study doesn't consider faculty attrition; across 6 other measures
of gender disparities in academia, it largely finds no / few differences

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real gendered differences

Trends in the Representation of Women Among US Geoscience Faculty From 1999 to 2020: The Long Road Toward Gender Parity

Meghana Ranganathan, Ellen Lalk, Lyssa M. Freese, Mara A. Freilich, Julia Wilcots, Margaret L. Duffy

American Geophysical Union (2021)

Competing Risks Analysis of Promotion and Attrition in Academic Medicine: A National Study of U.S. Medical School Graduates

Donna B Jeffe¹, Yan Yan, Dorothy A Andriole

Academic Medicine (2019)

**Gender Differences in Academic Medicine:
Retention, Rank, and Leadership Comparisons From the National Faculty Survey**

Phyllis L Carr¹, Anita Raj, Samantha E Kaplan, Norma Terrin, Janis L Breeze, Karen M Freund

Academic Medicine (2018)

gendered faculty attrition

▶ faculty literature is deep and messy = 100s of papers

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Psych. Science in the Public Interest (2023)

it's complicated

**Survival Analysis of Faculty Retention in Science and
Engineering by Gender**

DEBORAH KAMINSKI AND CHERYL GEISLER

Science (2012)

**Retention and promotion of women and underrepresented
minority faculty in science and engineering at four large
land grant institutions**

Marcia Gumpertz , Raifu Durodoye, Emily Griffith, Alyson Wilson

PLOS One (2012)

**Women in Academic Economics: Have We
Made Progress?**

Donna K. Ginther
Shulamit Kahn

American Economic Association (2021)

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▶ **faculty literature is deep and messy = why?**

no / few gendered differences

it's complicated

real gendered differences



real limitations

gendered faculty attrition

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real limitations

- faculty attrition is hard to study (small numbers & confounding factors)
- study either rates (admin data) or reasons (qual & small)
- most studies are (1) single/few institutions or (2) single point in time or (3) single/few academic fields
- typically (1) Assistant Professors, (2) elite institutions, (3) STEM fields → (only 15% of all tenure-track U.S. faculty!)

gendered faculty attrition

▶ faculty literature is deep and messy = why?

no / few gendered differences

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real gendered differences

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evident consensus

- *work-life balance* is dominant cause (eg parenthood)
- *pre-tenure years* most important

study design

- ▶ combine **broad faculty employment data** with **social survey of faculty**



attrition rates

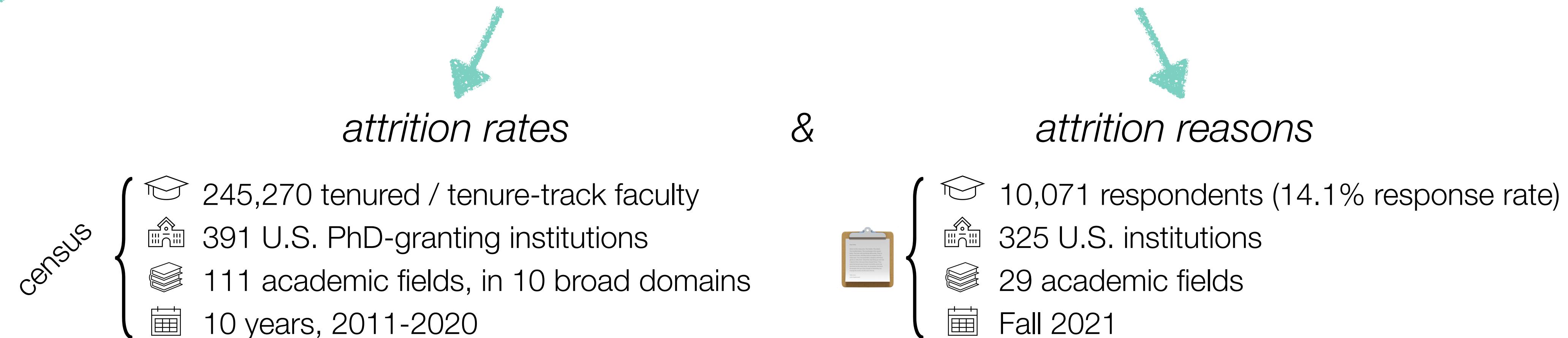
&



attrition reasons

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from Academic Analytics Research Center **AARC**

questions about stress & reasons for leaving

- ▶ all institutions, cross-disciplinary, longitudinal, all faculty ranks

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attrition rates

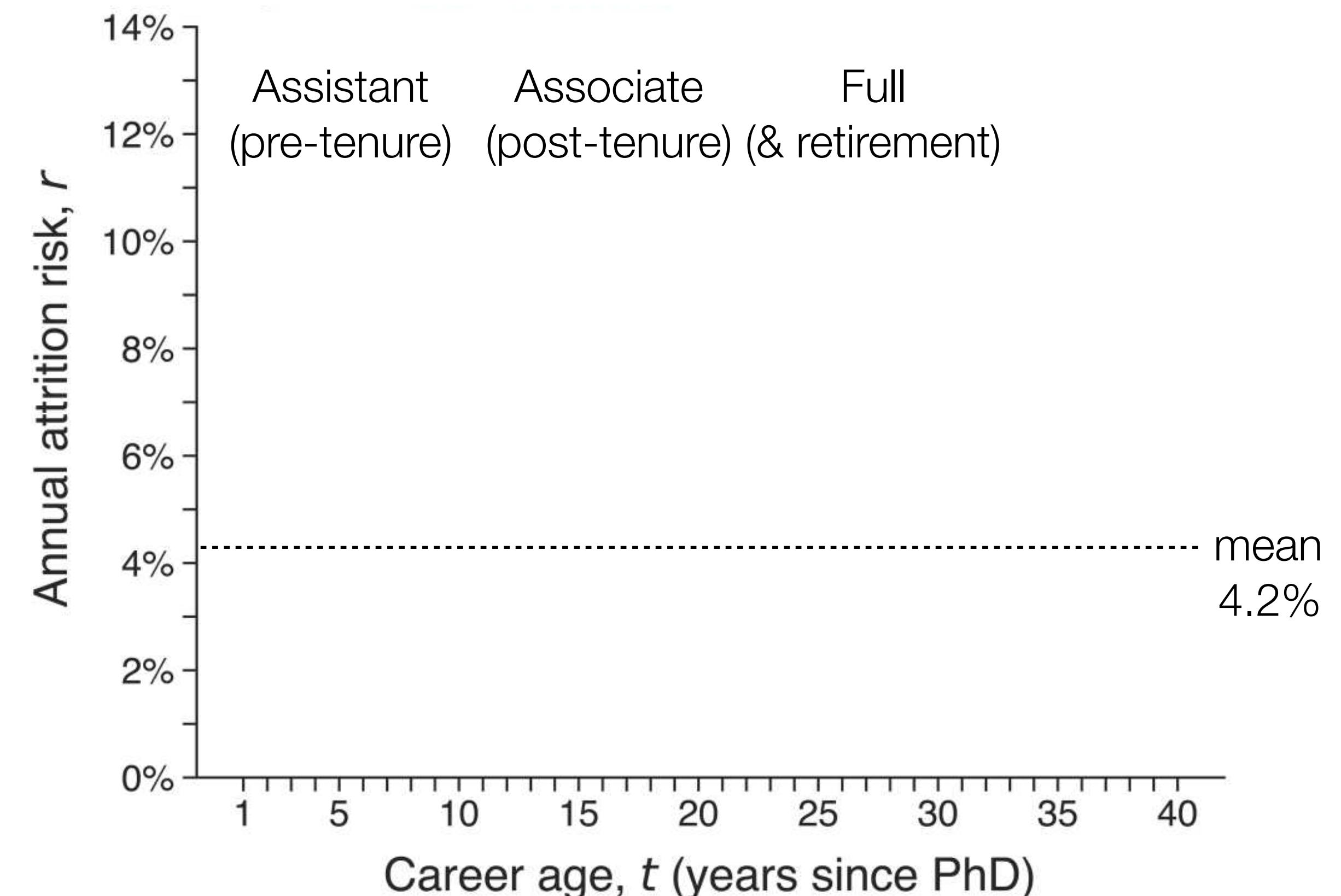
- census {
- 🎓 245,270 tenured / tenure-track faculty
 - 🏢 391 U.S. PhD-granting institutions
 - 📚 111 academic fields, in 10 broad domains
 - 📅 10 years, 2011-2020

from Academic Analytics Research Center **AARC**

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attrition over a career

- ▶ "all-cause" attrition risk $r = (\# \text{ who left}) / (\# \text{ who could have left})$ over all faculty in all fields

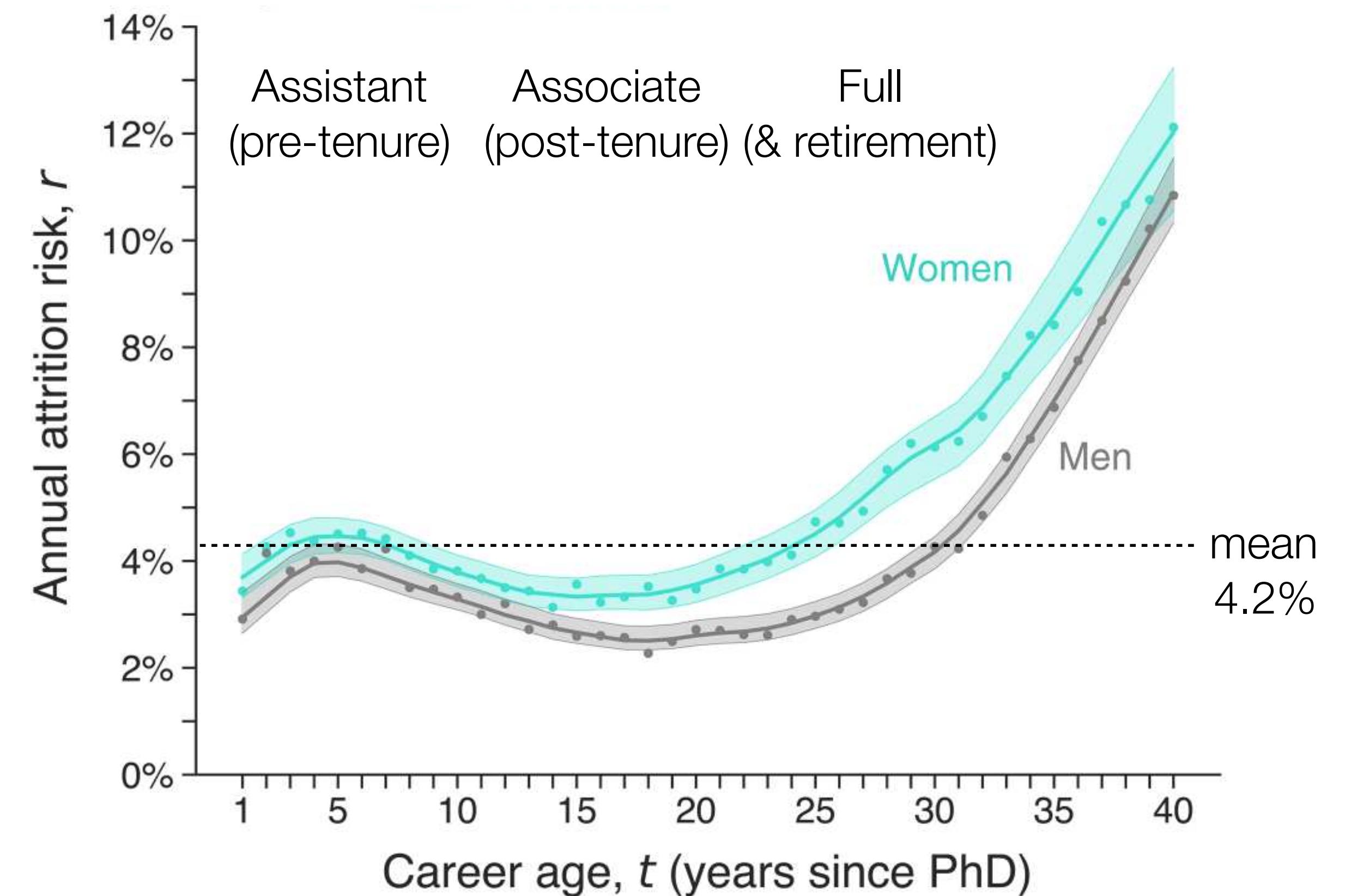


attrition over a career

- ▶ "all-cause" attrition risk $r = (\# \text{ who left}) / (\# \text{ who could have left})$ over all faculty in all fields
at every career age, women are more likely to leave than men

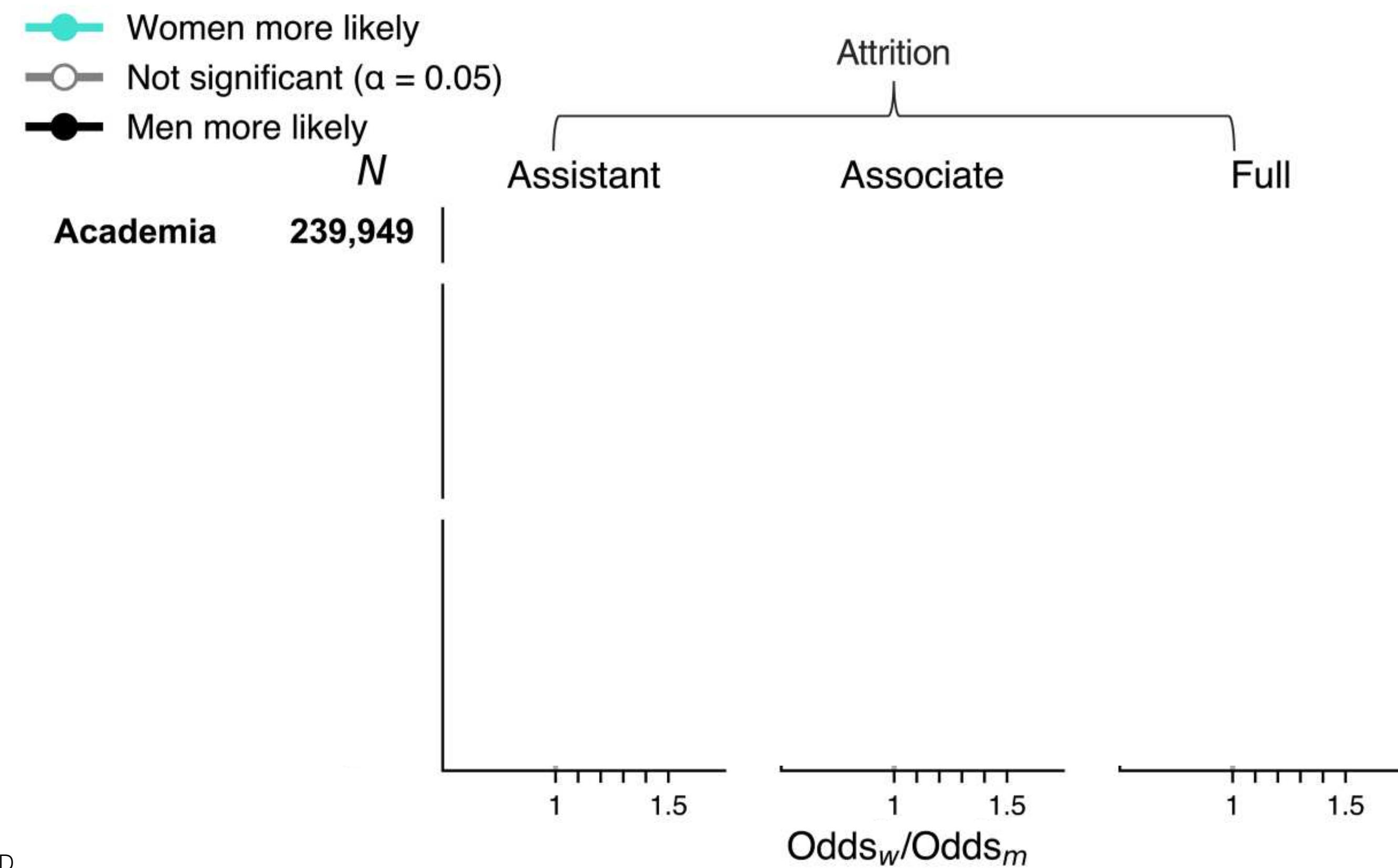
imagine 50-50 cohort in year $t = 0$
21 years for 50% of men to leave
17.5 years for 50% of women to leave

- but! these rates aggregate over many factors:
different fields, ranks, prestige, etc.
let's disaggregate...



how heterogeneous is attrition?

- ▶ logistic regression to estimate annual attrition odds-ratio*
by (1) career stage, (2) STEM / non-STEM, and (3) domain

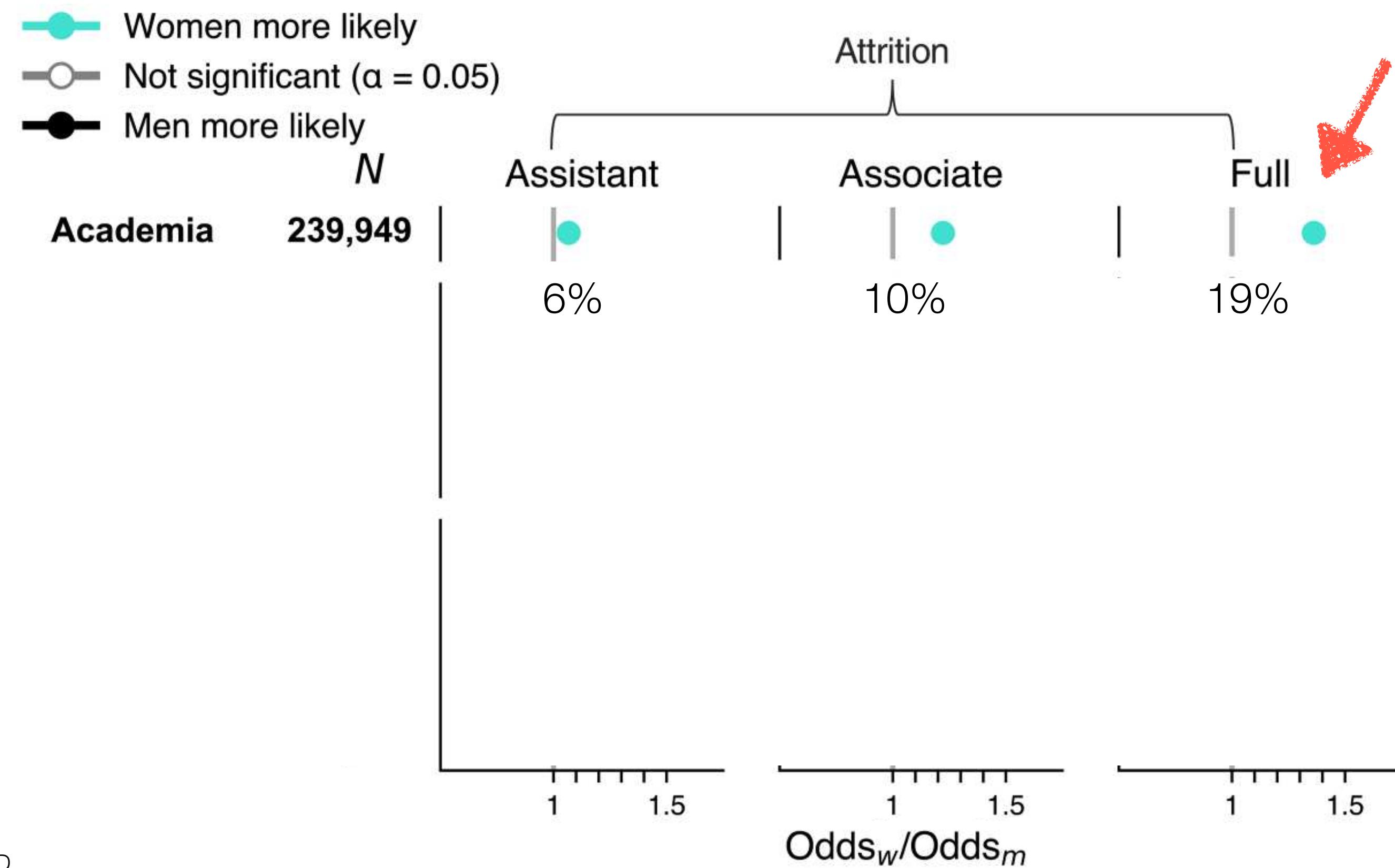


* regression covariates: career age, doctoral degree year, employer prestige (which accounts for mean productivity), US/non-US PhD
N = 239,949 faculty; adding field-level fixed effects eliminates gendered attrition for assistant professors, but not for other ranks; ~5k faculty lacking all covariates omitted

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*gendered attrition largest among
full professors*



OR >1: women more likely to leave vs. OR < 1: men more likely to leave

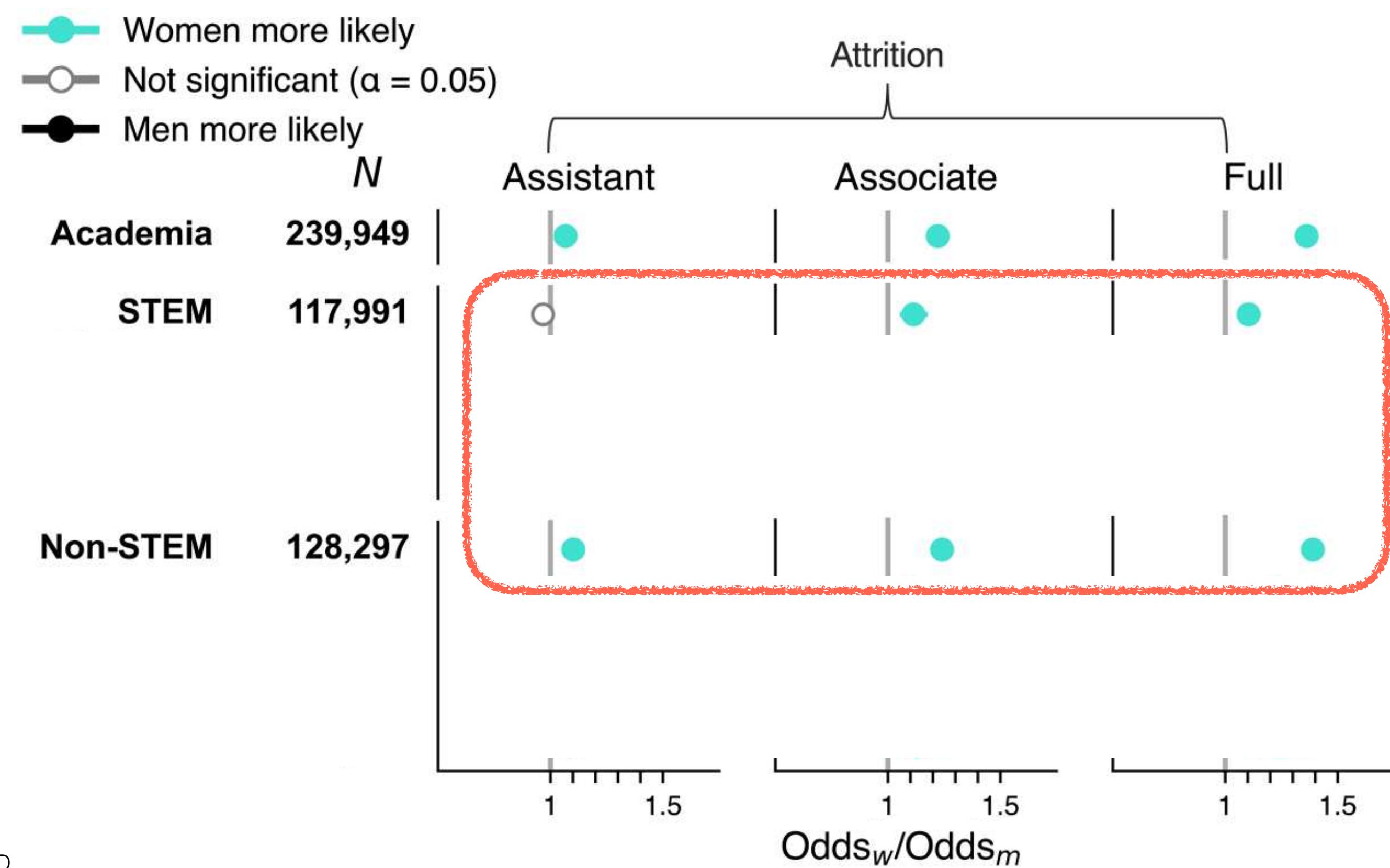
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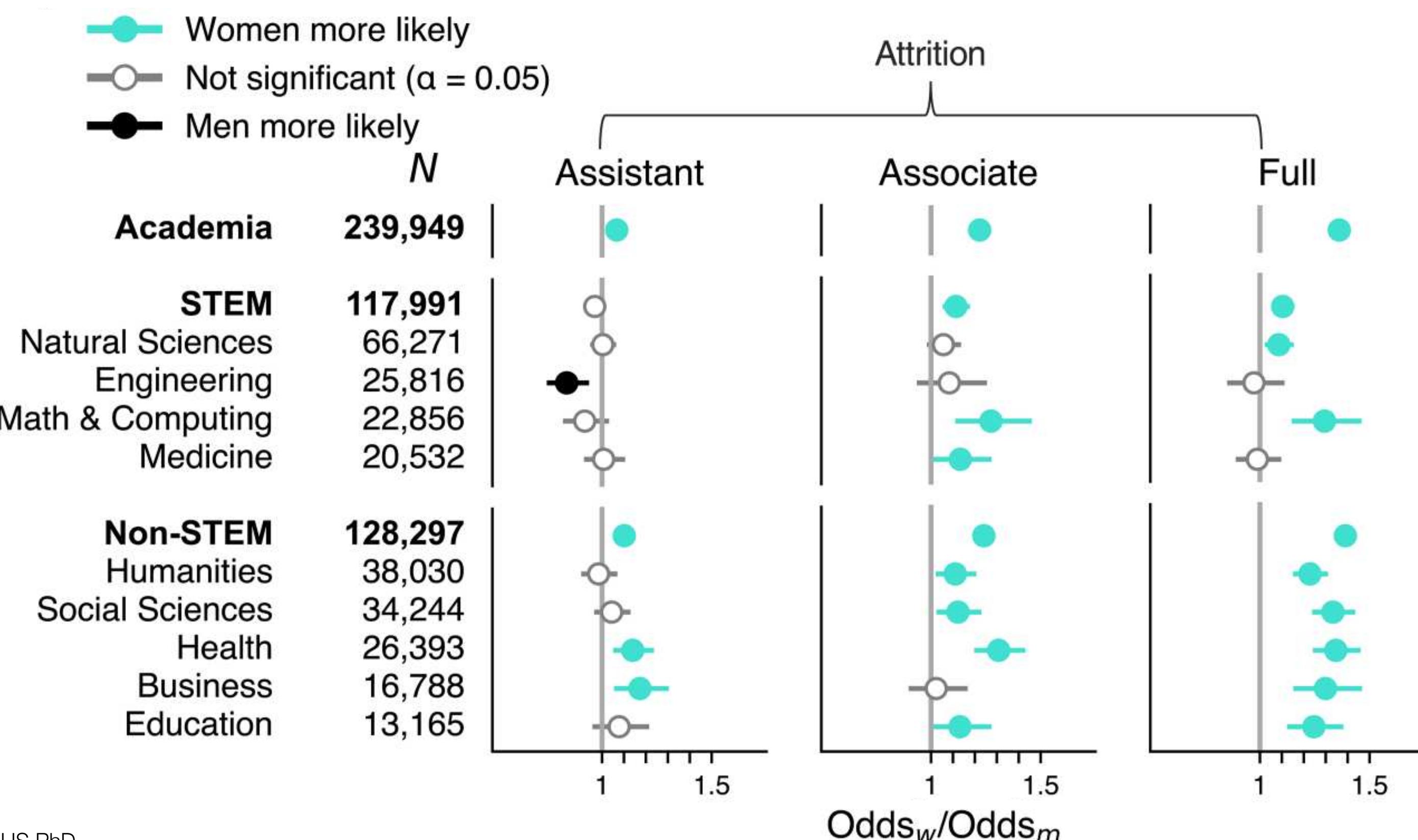
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- remember this
- ★ note : untenured men in Engineering
 - all domains show some evidence of gendered attrition, but varies by rank & field
 - this variability may explain some contradictory results in literature



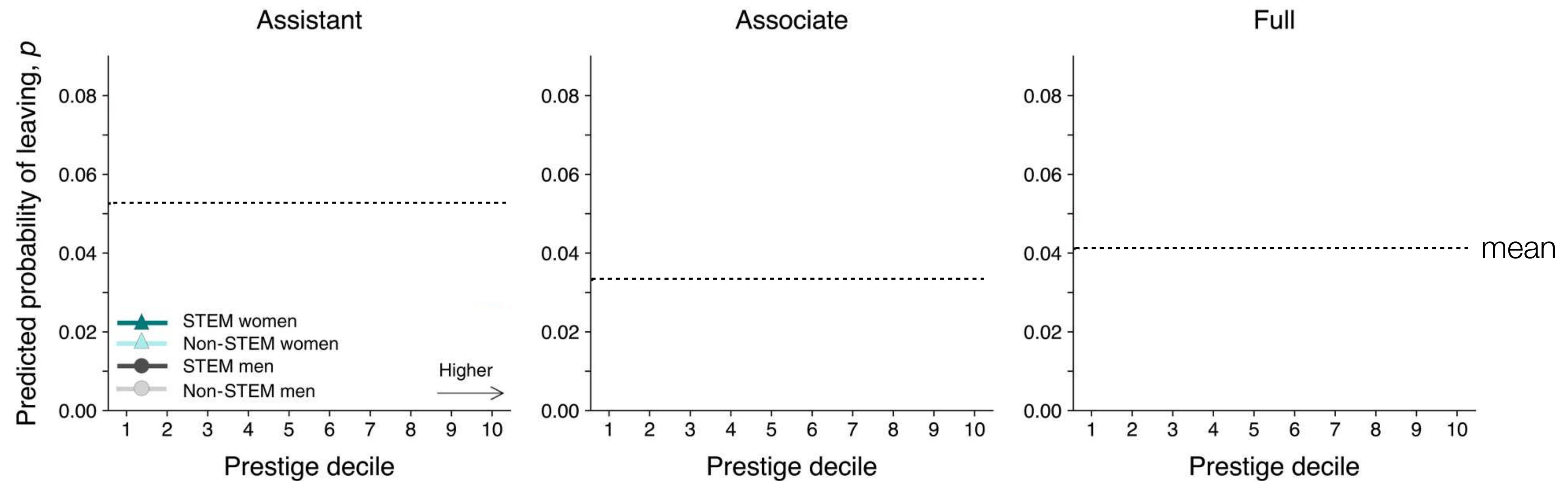
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how heterogeneous is attrition?

▶ does prestige matter?

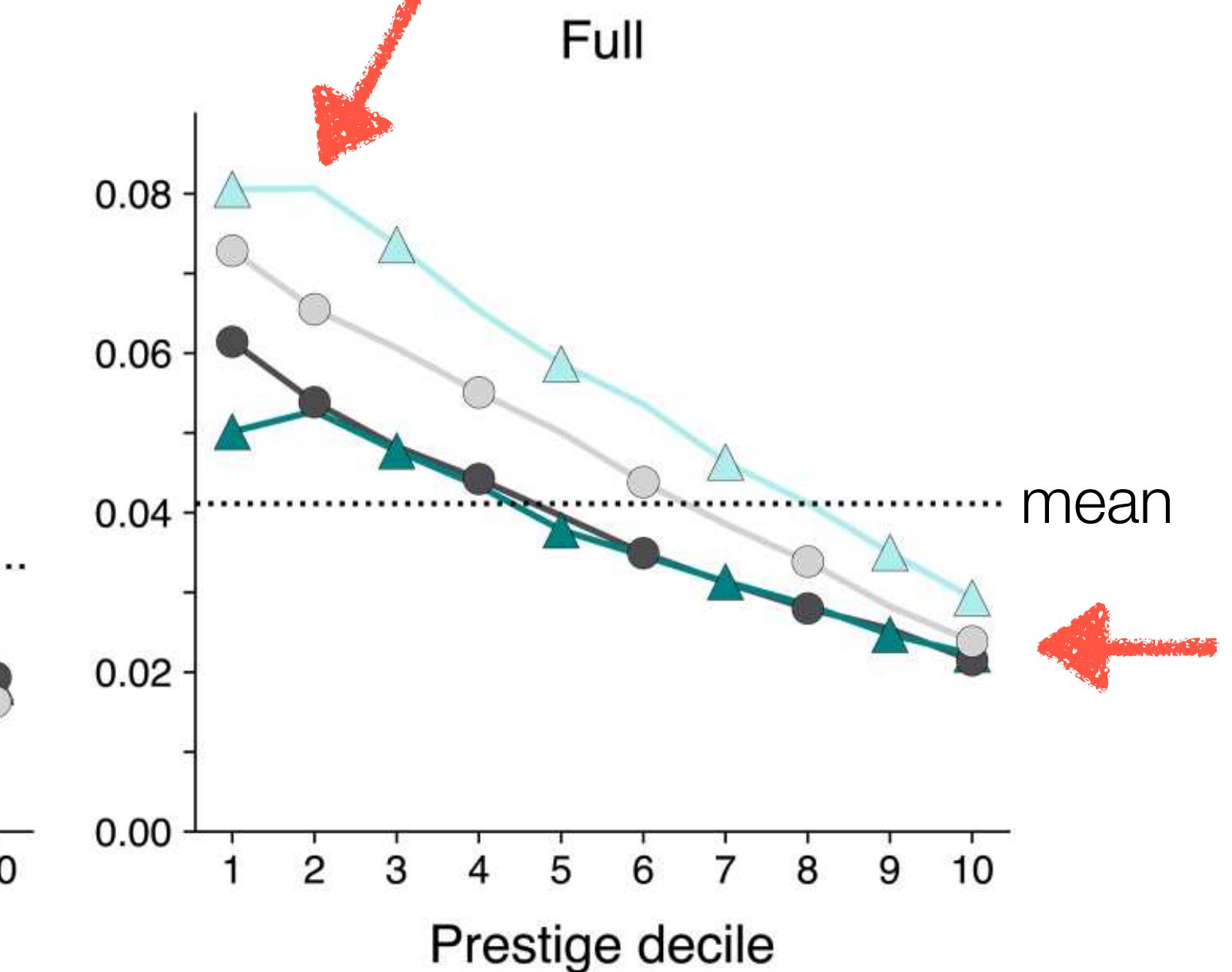
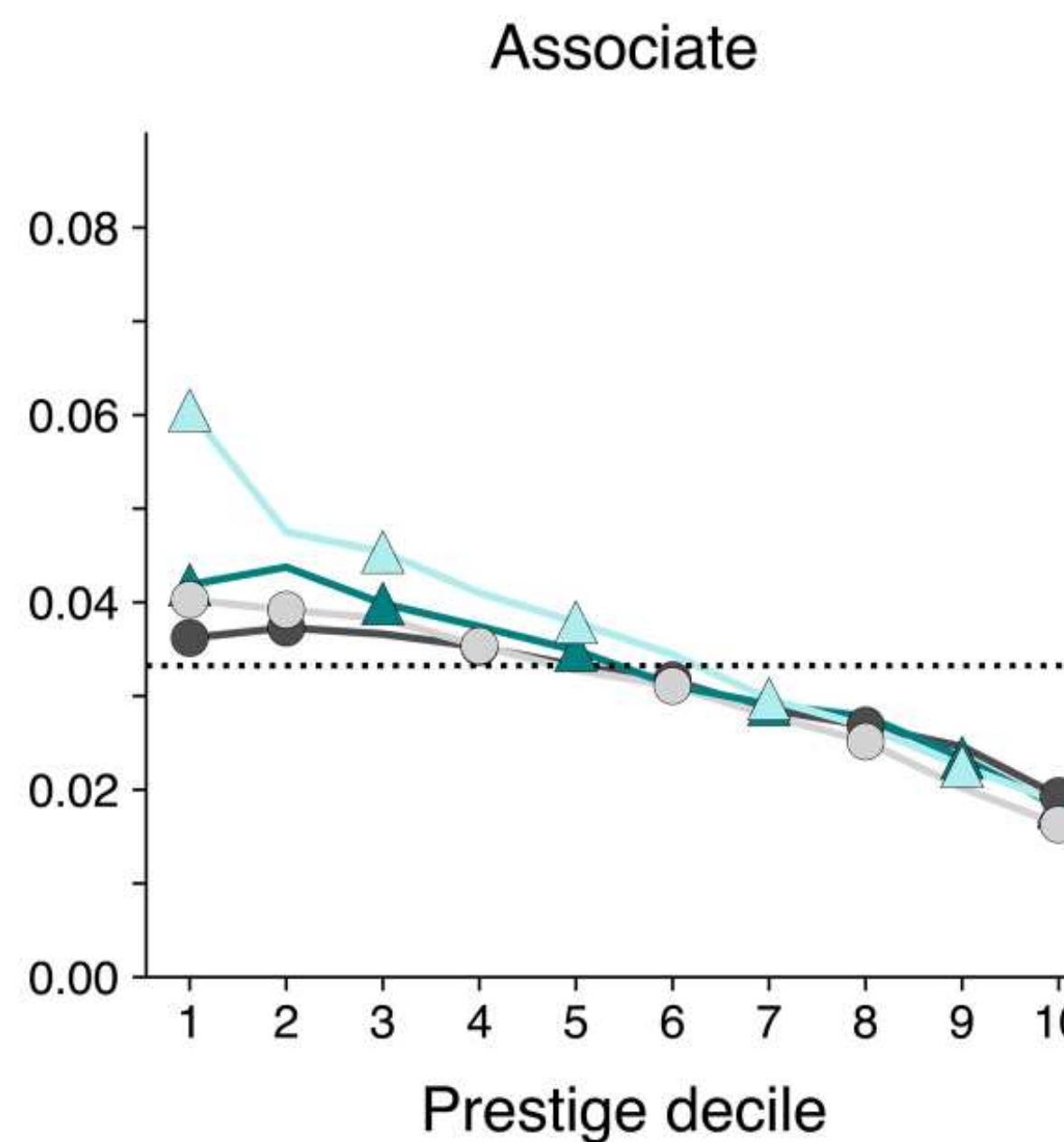
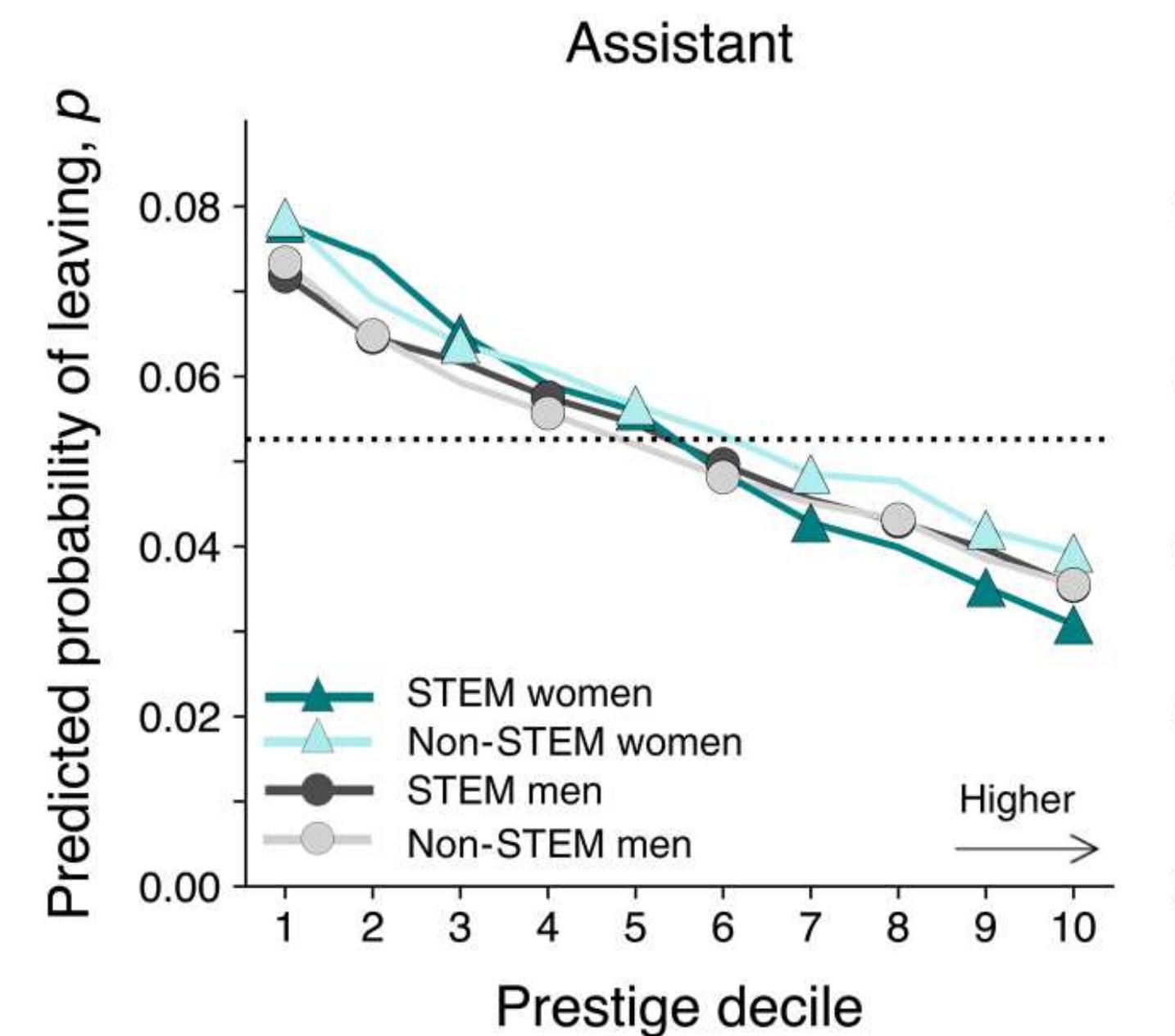


how heterogeneous is attrition?

- ▶ does prestige matter? — very much

gendered attrition largest among full professors
! *non-STEM faculty low-prestige institutions*

- faculty at least prestigious = 2.5x, 3.0x, 3.3x more likely than faculty at most prestigious



study design

- ▶ combine **broad faculty employment data** with **social survey of faculty**



attrition reasons



{	10,071 respondents (14.1% response rate)
	325 U.S. institutions
	29 academic fields
	Fall 2021

questions about stress & reasons for leaving

- ▶ all institutions, cross-disciplinary, longitudinal, all faculty ranks

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rates ≠ reasons

men and women could leave at different rates for same reasons

or

same rates for different reasons



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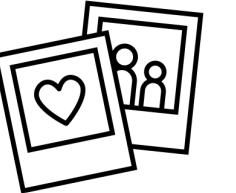
▶ combine **broad faculty employment data** with **social survey of faculty**

■ reasons for leaving (former faculty) or potentially leaving (current faculty)



Professional reasons

- expectations of productivity
- obtaining external funding
- expectations to work on specific topics
- lack of recognition
- salary
- low acceptance rates at journals
- poor admin support (eg, in grant writing)



Work-life balance reasons

- caring responsibilities (children, partner, parents, etc.)
- partner's career
- lack of time for interests outside of work
- long hours
- personal issues (divorce, illness, etc.)



Workplace climate reasons

- dysfunctional leadership
- feeling need to prove myself
- lack of belonging / fit in my department
- lack of belonging / fit in my institution
- lack of belonging / fit in my academic field
- harassment or discrimination
- how competitive academia is (criticism, comparisons, rejections, etc.)

■ left / would leave for a push or pull?

- (push) "I am unhappy, stressed, or otherwise less than satisfied with my current position"
- (pull) "I am drawn to, excited by, or otherwise attracted to a different position"
- (neither) wanted to retire / would not leave

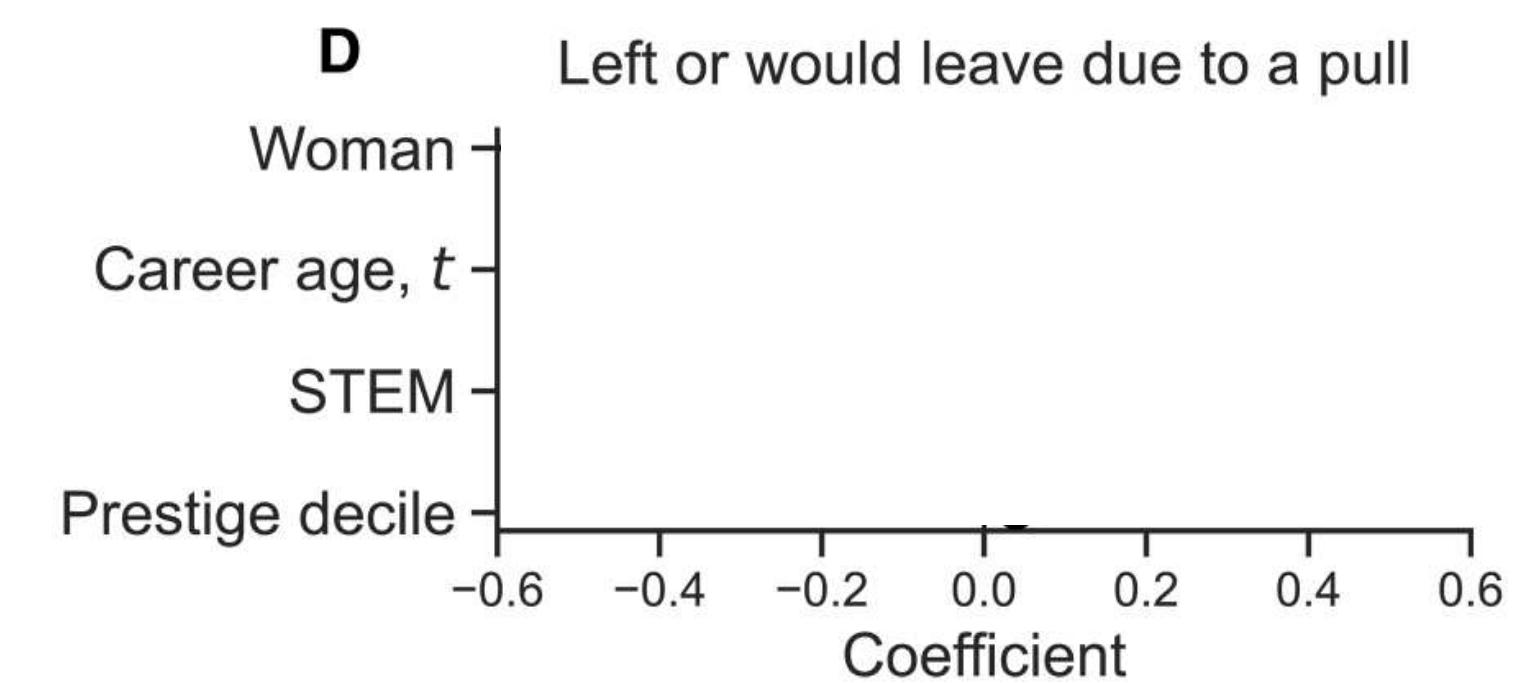
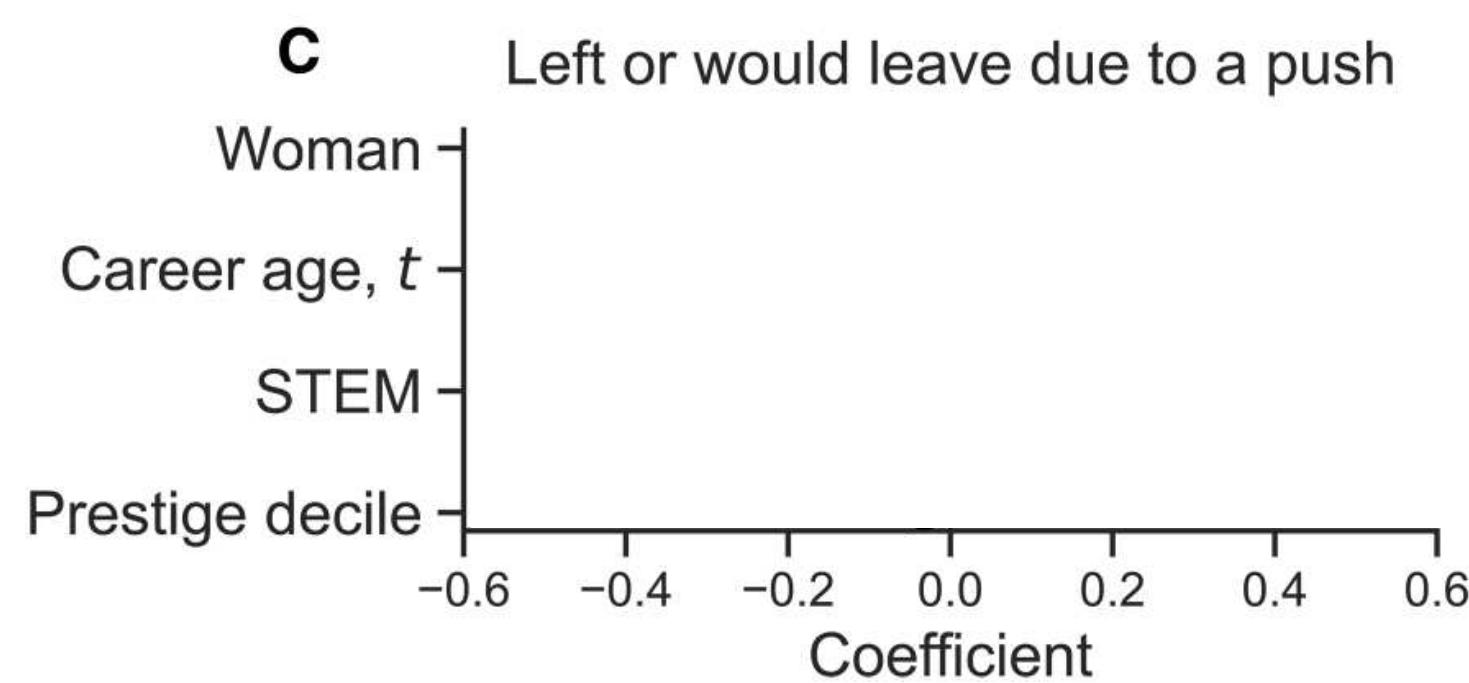
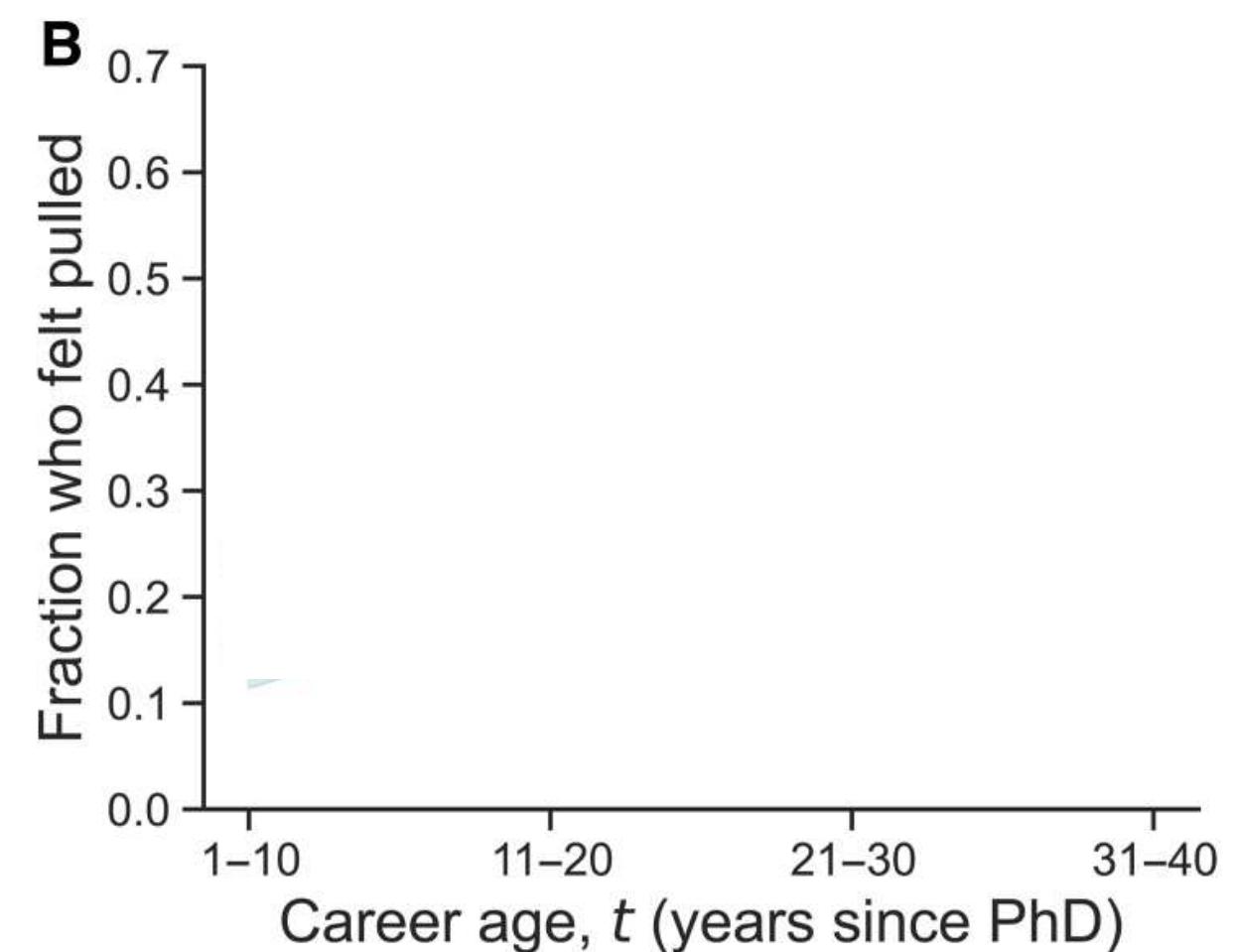
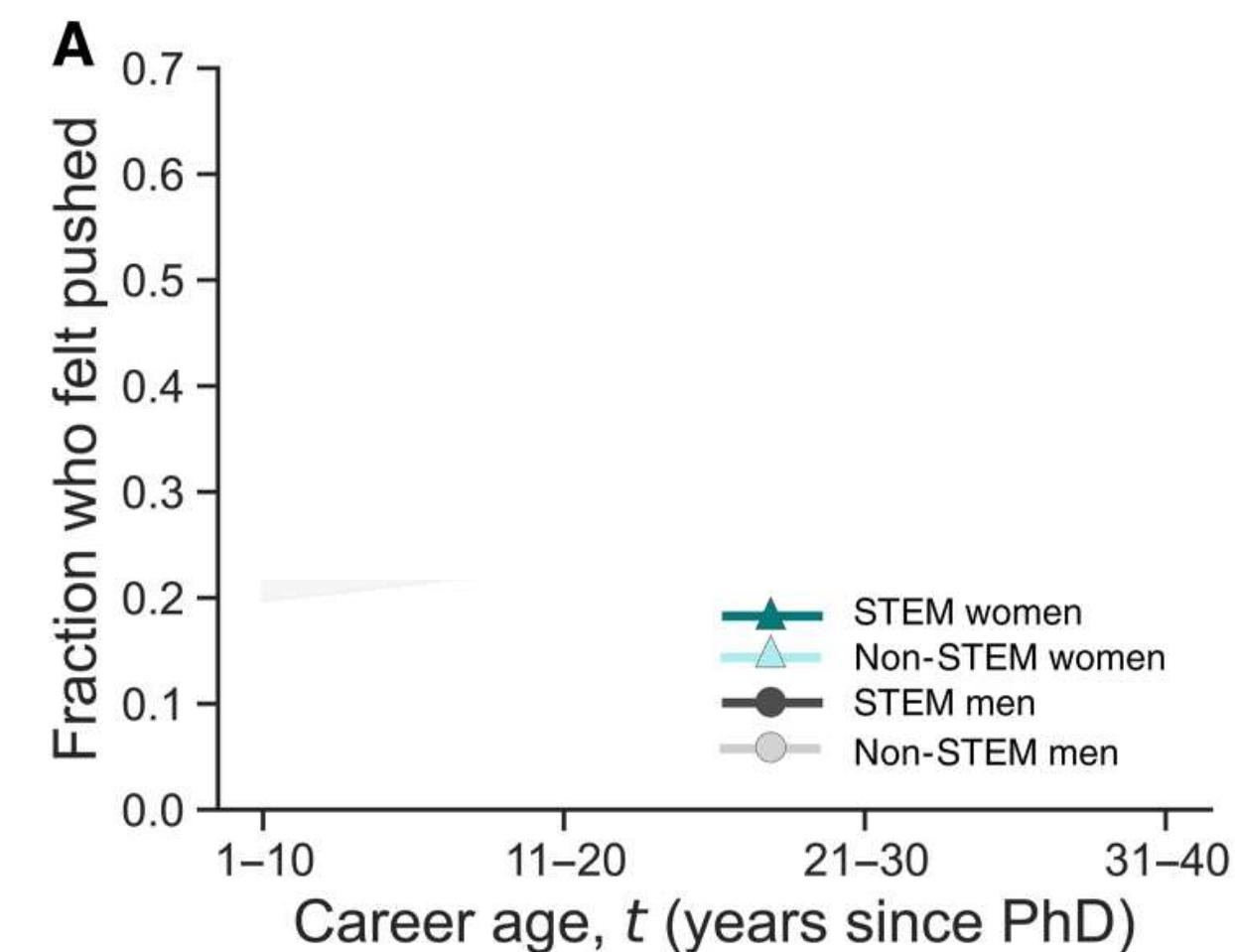
survey design: all participants were asked questions about how often they experienced the above stressors from 3 categories

former faculty were also asked to check boxes for specific stressors contributed to decision to leave

then, current faculty were asked how much each of 3 categories would influence a hypothetical decision to leave

push & pull

▶ who feels pushed out vs. pulled to better opportunities?



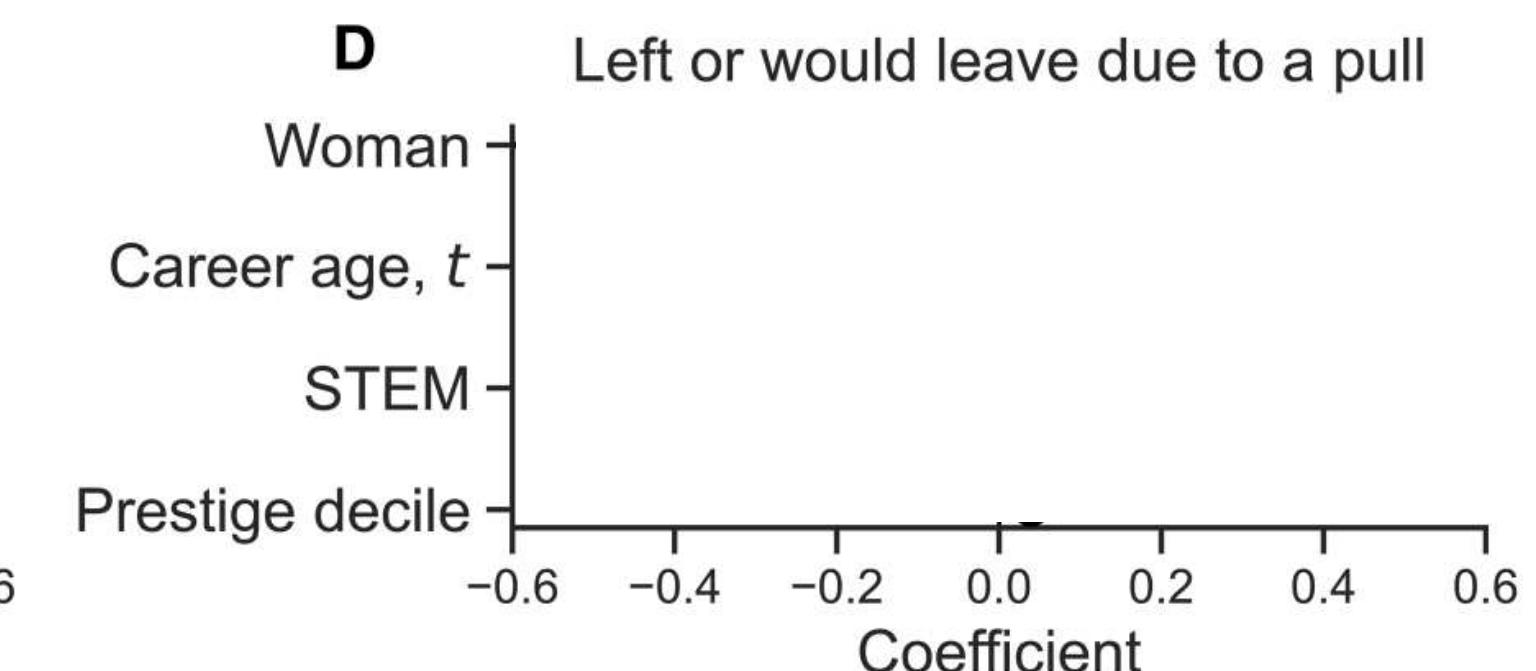
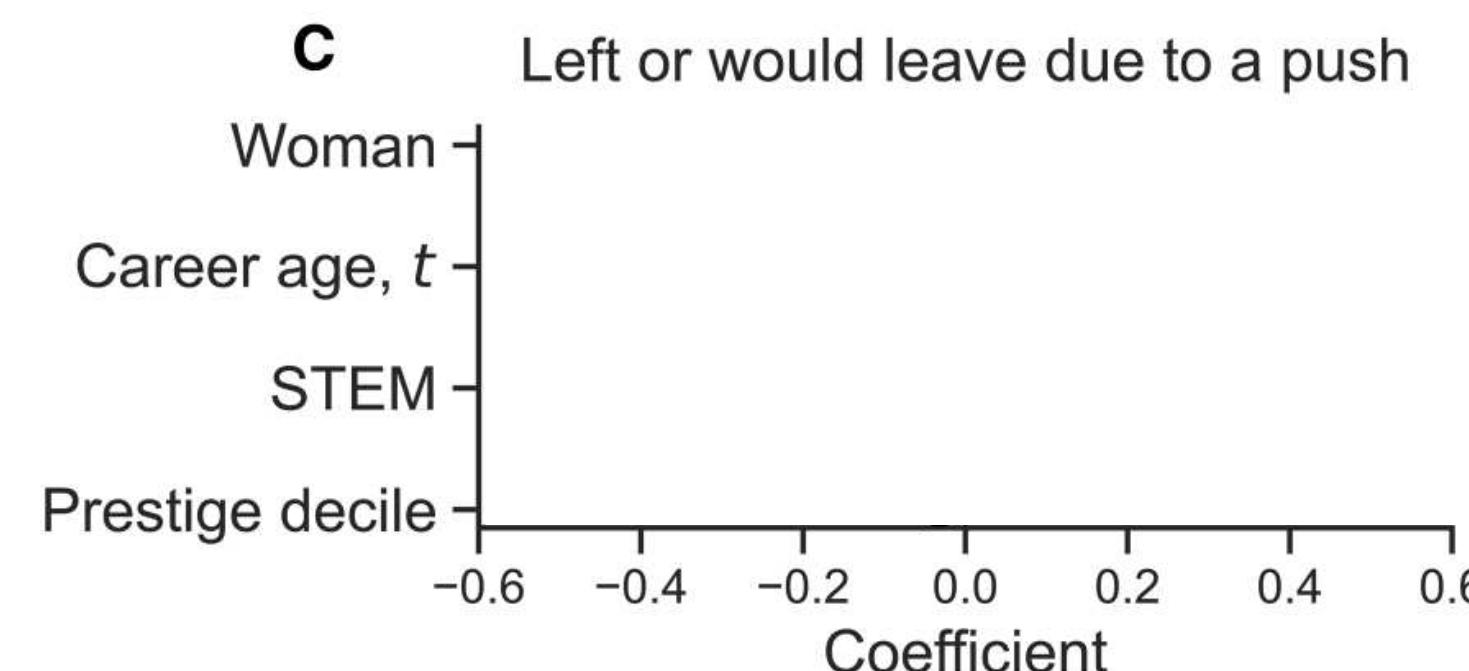
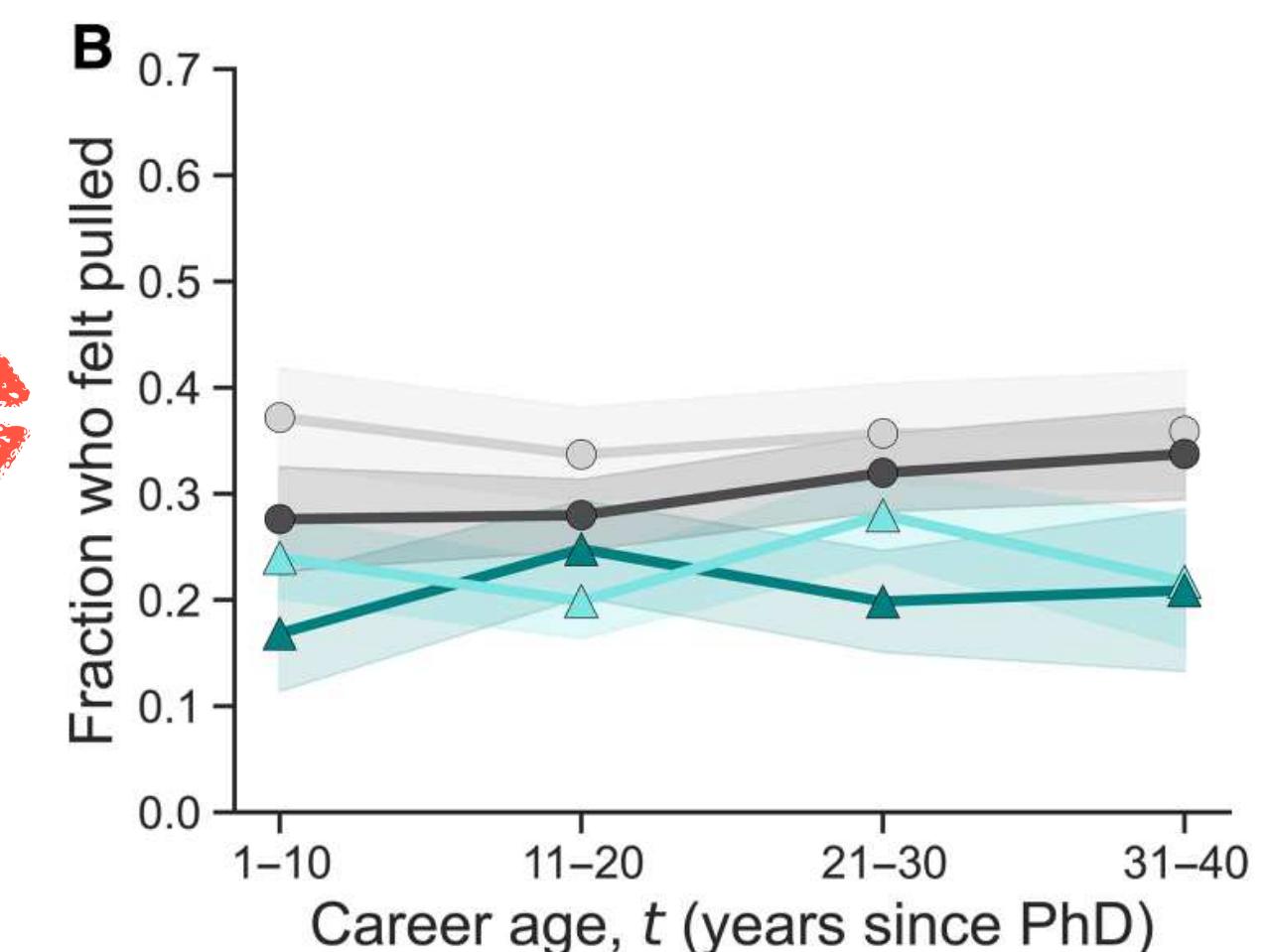
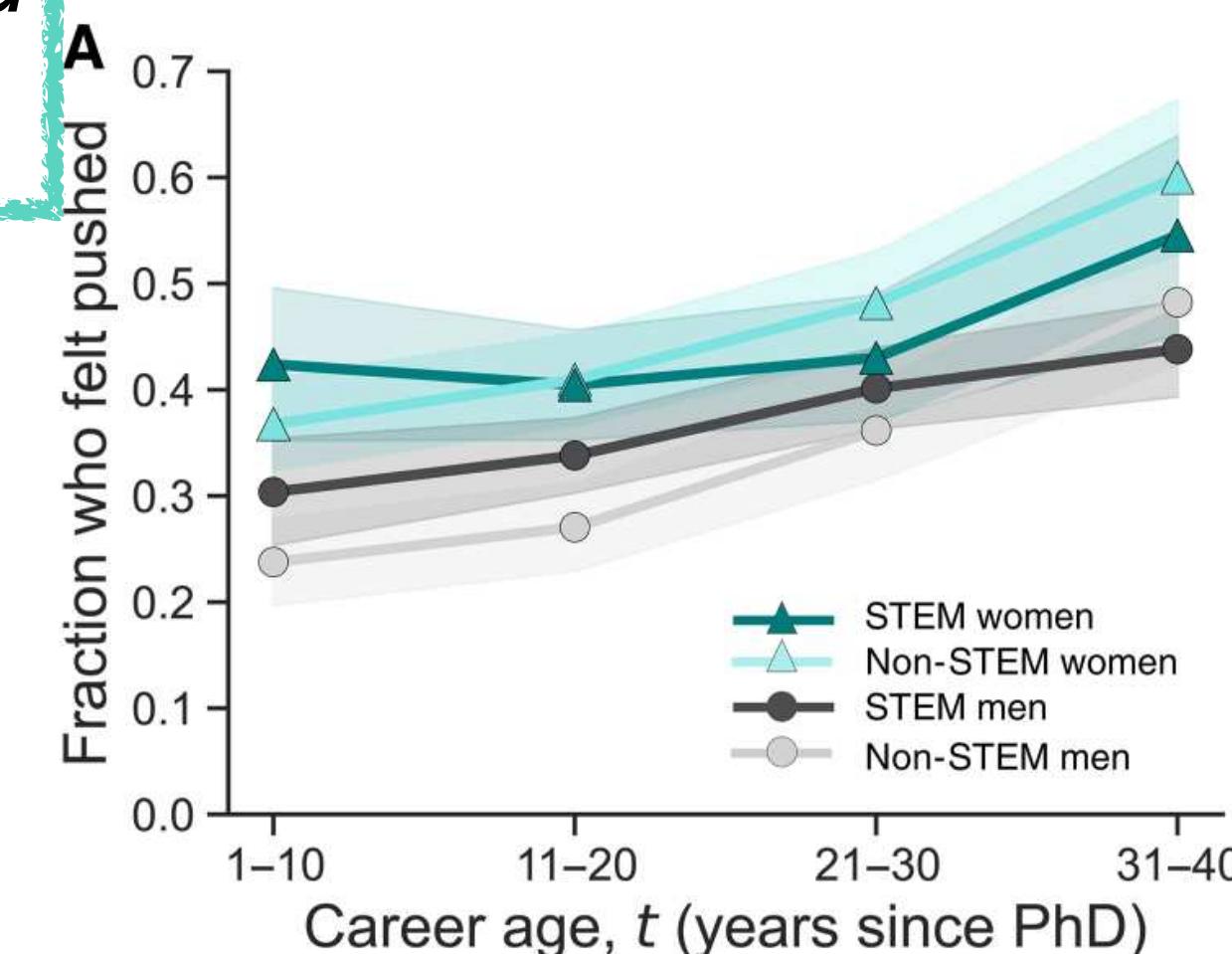
push & pull

- ▶ who feels pushed out vs. pulled to better opportunities?

pushes > pulls, but women feel pushed at far greater rates than men

! women's odds of feeling pushed:
44% higher than men

women's odds of feeling pulled:
39% lower than men



push & pull

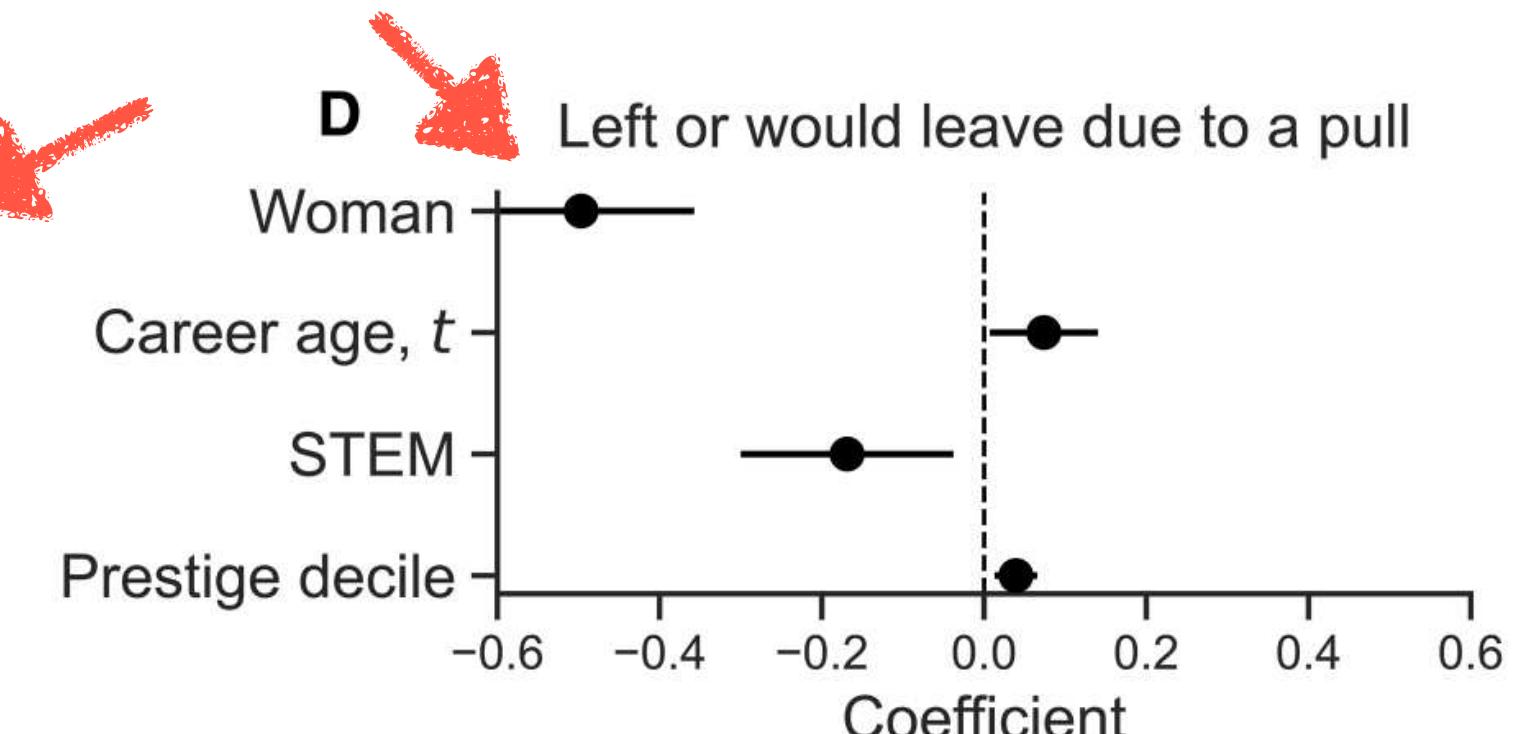
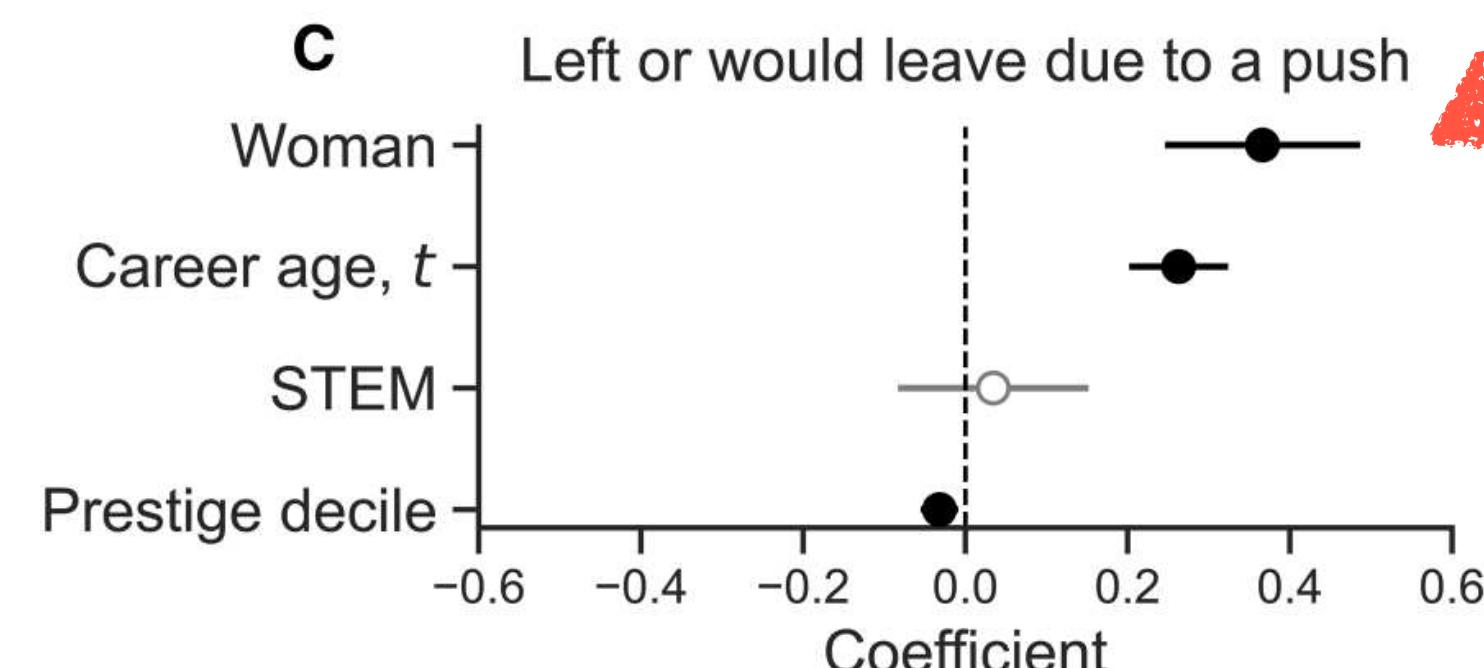
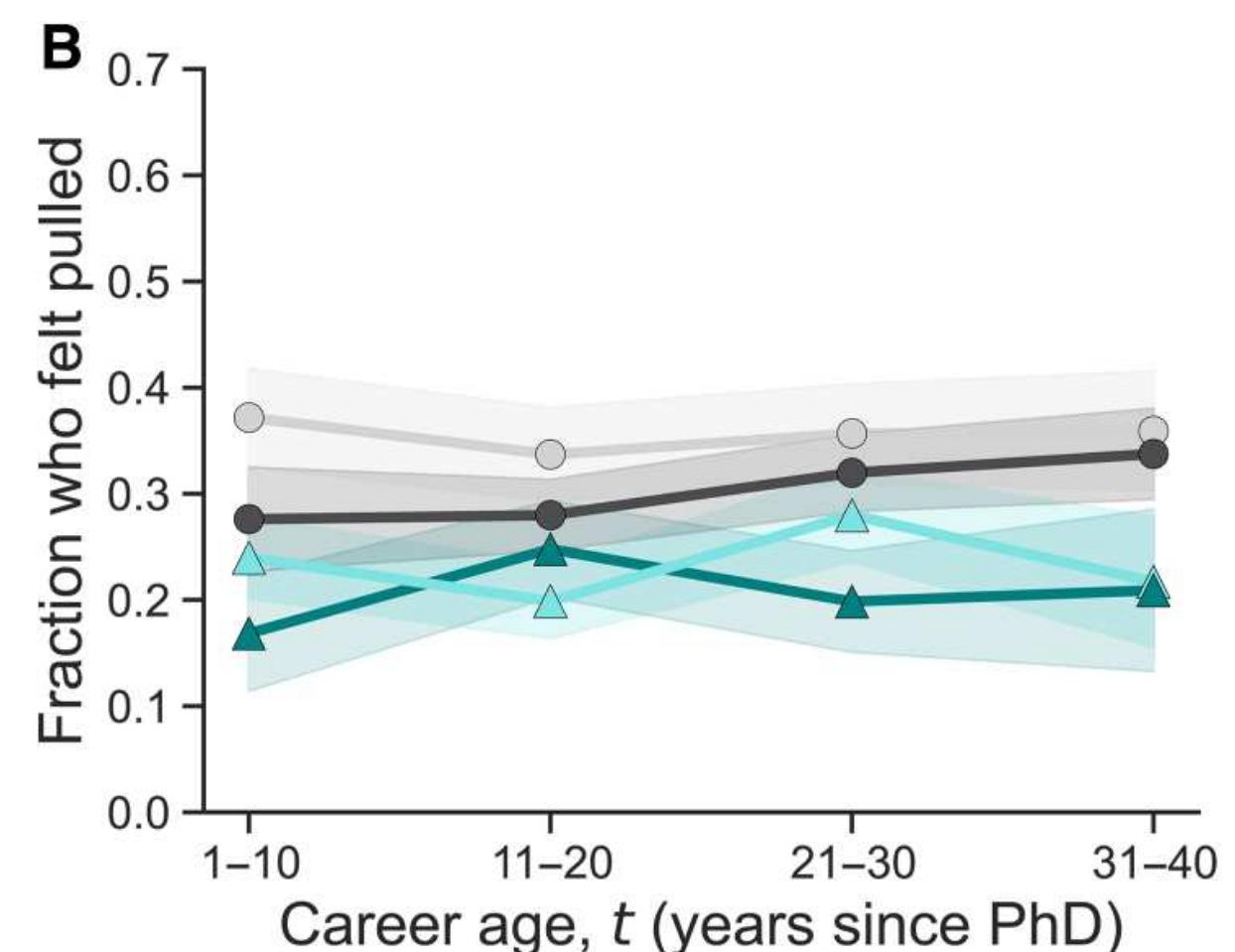
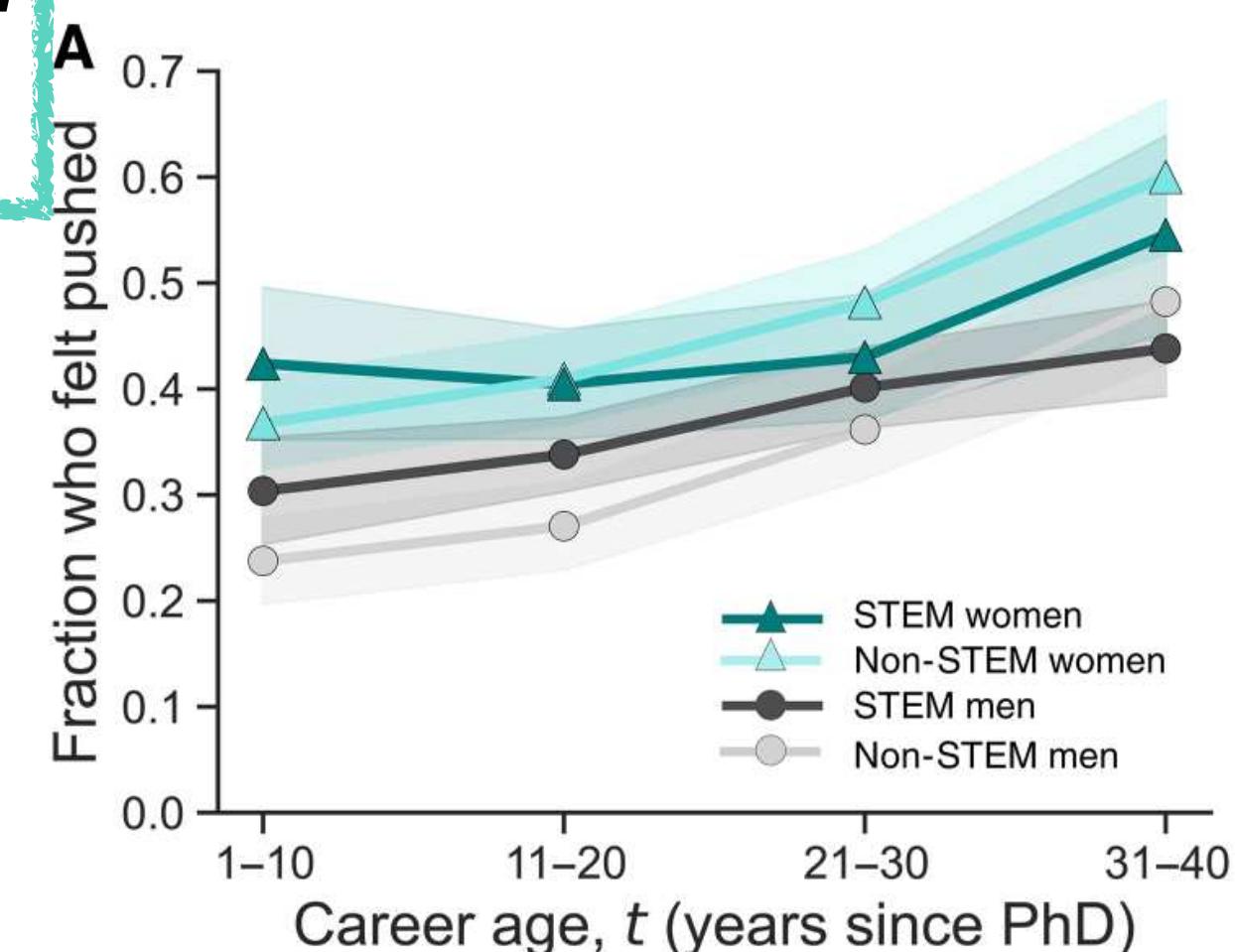
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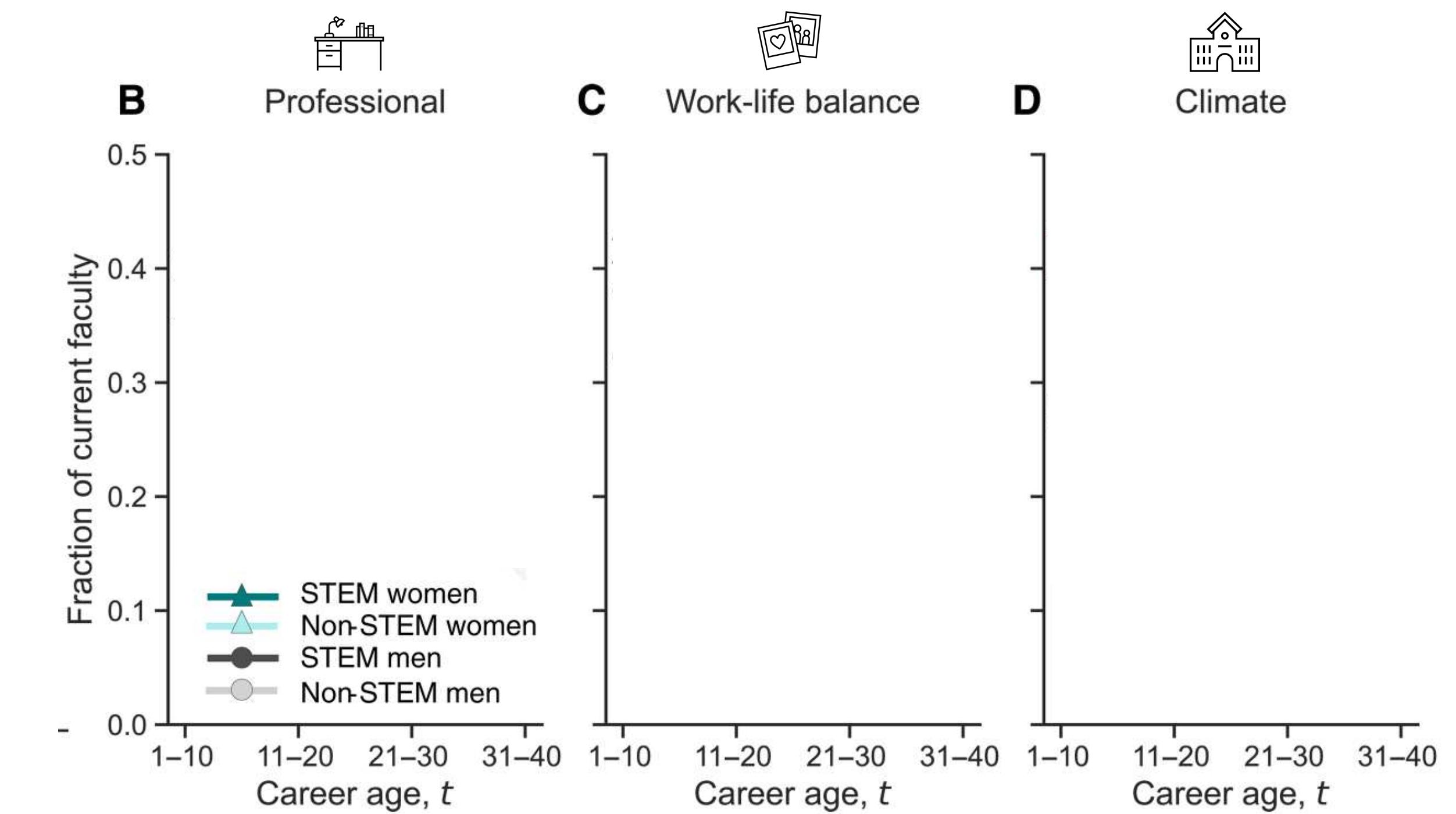
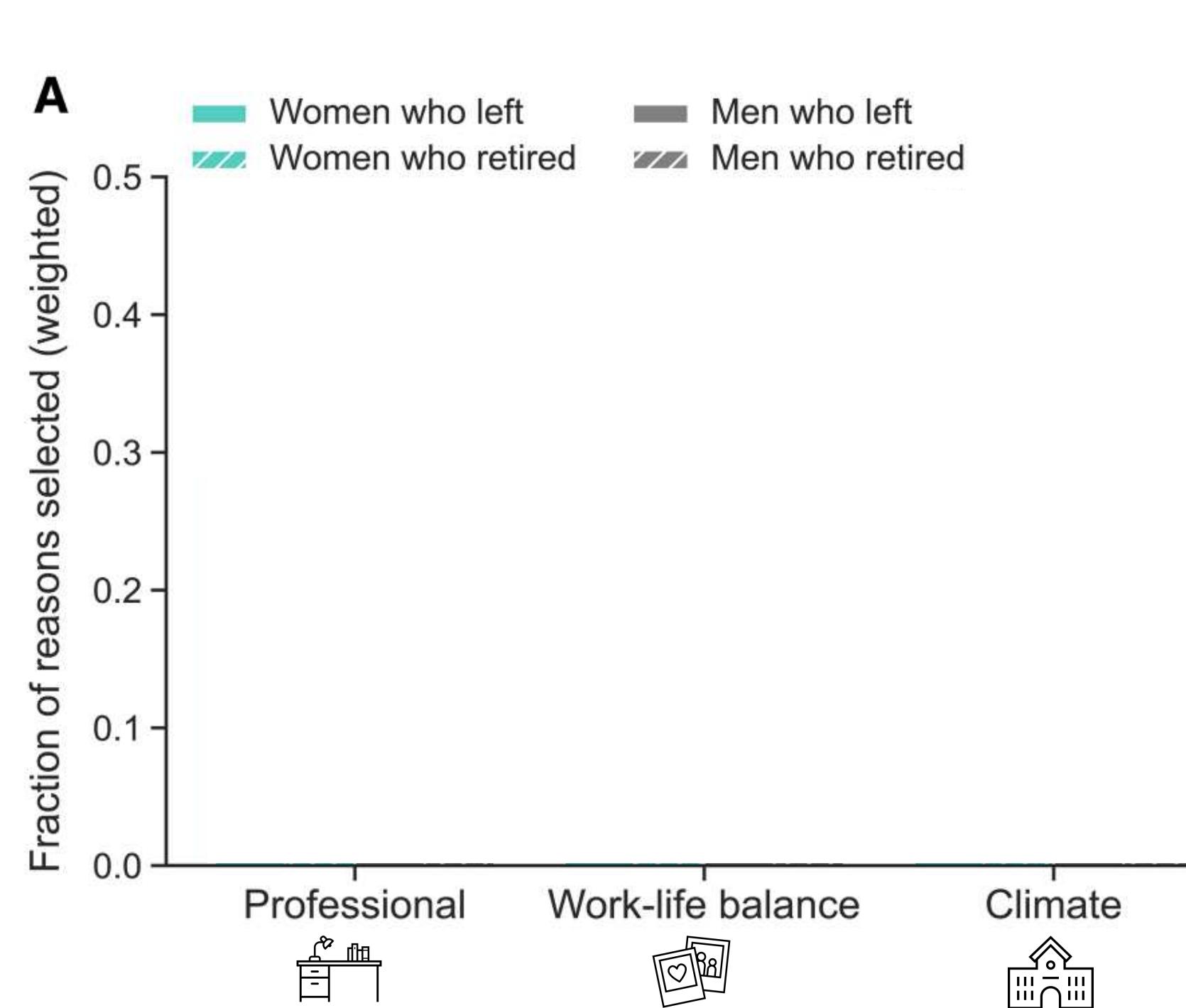
gender predicts* push vs. pull



* multiple regression, adjusting for career age, STEM/non-STEM, employment prestige
self-reported race was not a significant predictor of push vs. pull (but, small samples)
self-identified parents with in-home children were 45% more likely to feel pulled
N = 4,919 faculty respondents

reasons for leaving

- ▶ 3 broad categories: professional / work-life / climate incongruencies

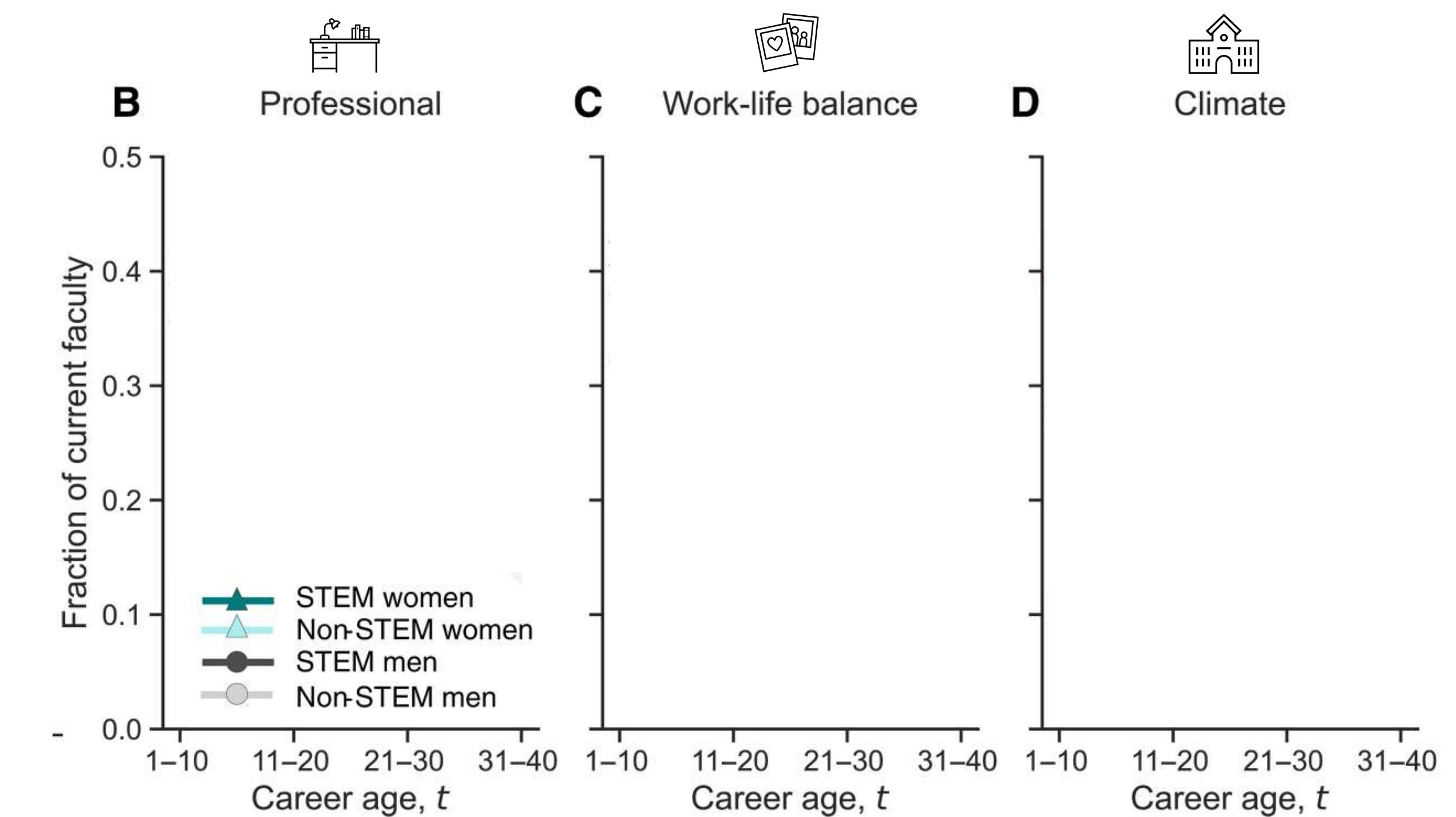
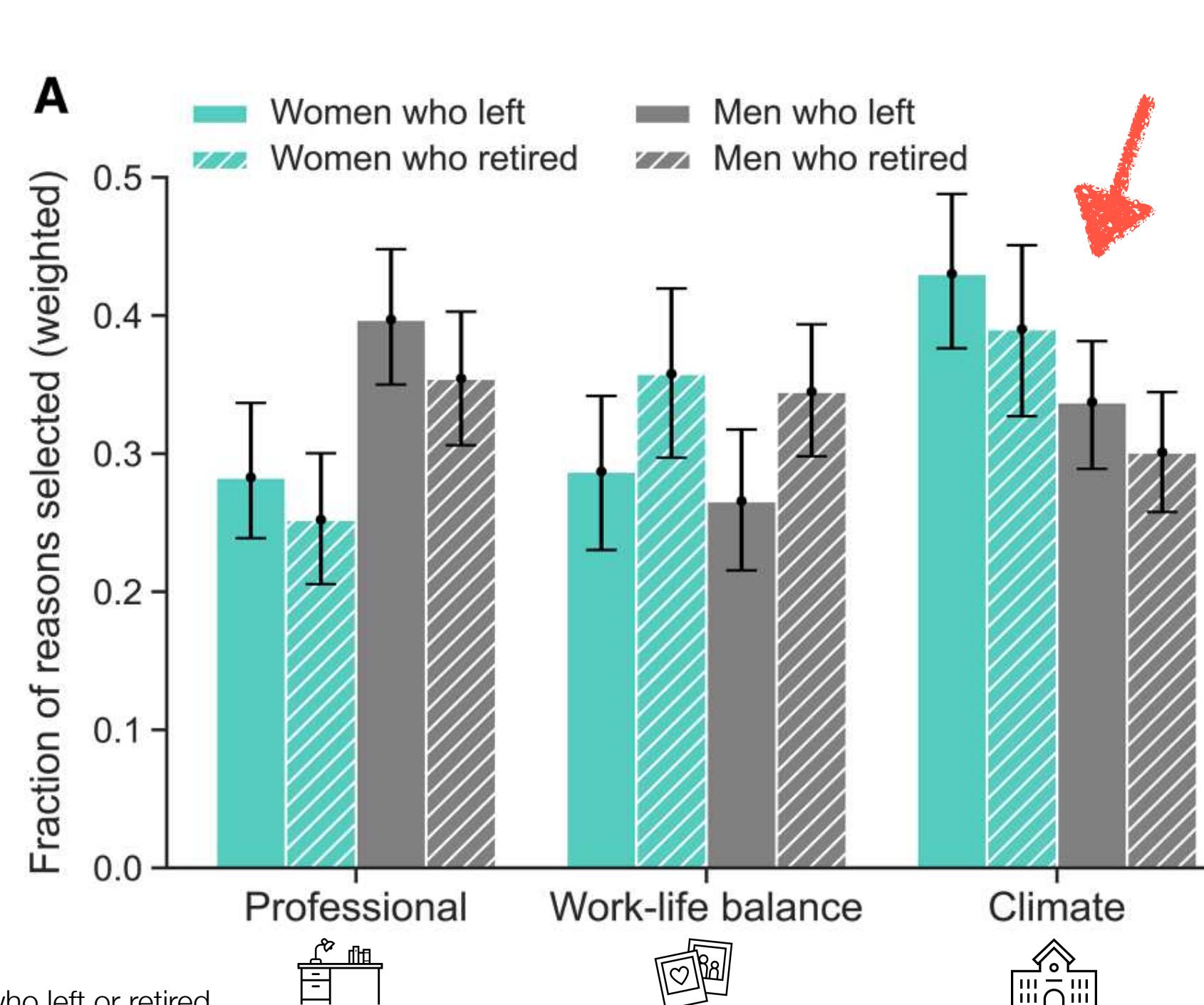


reasons for leaving

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reasons are *highly* gendered: eg, professional vs climate

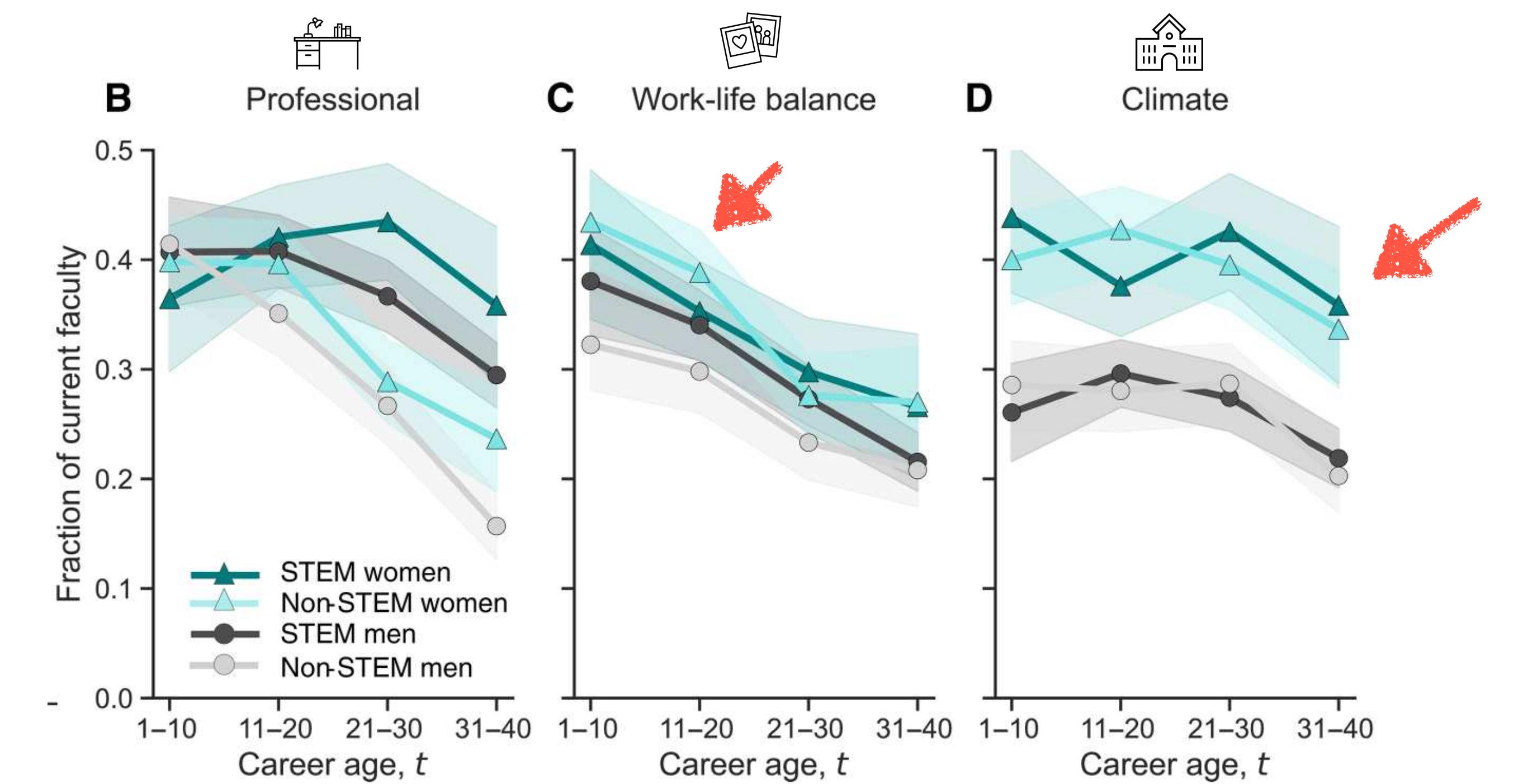
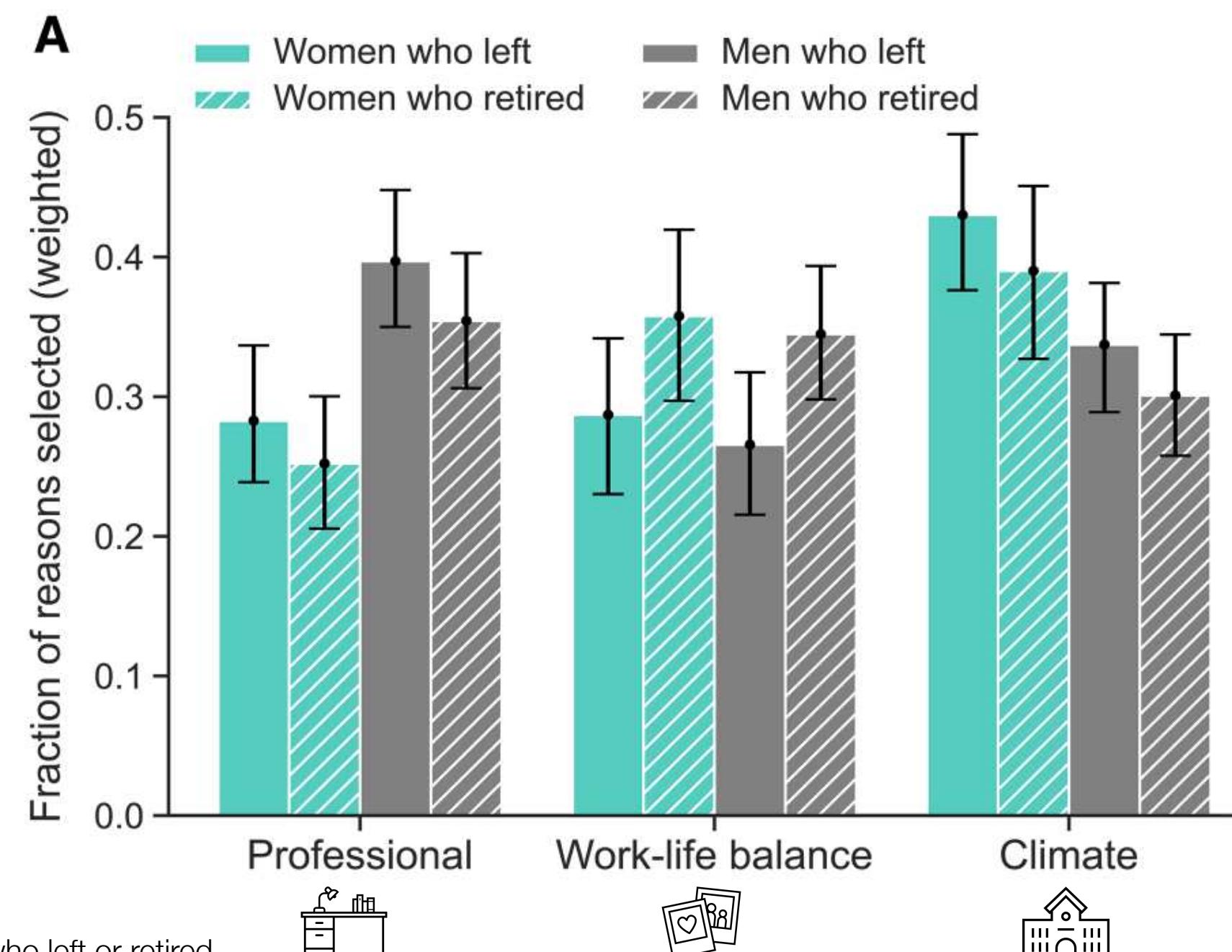
work-life balance reasons *not* strongly gendered → contrasts past literature



reasons for leaving

- ▶ 3 broad categories: professional / work-life / climate incongruencies

reasons are *highly* gendered: eg, professional vs climate
work-life balance reasons *not* strongly gendered → contrasts past literature
climate highly gendered *regardless of career age*



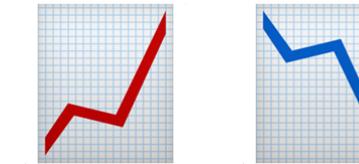
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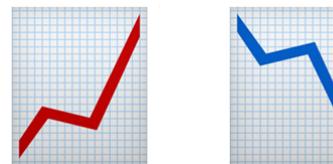


- with rates that vary by domain & career stage — 37% of domain/stages, women rates = men rates
effect is largest among (1) tenured women in (2) non-STEM at (3) lower-prestige schools

understanding causes of this variability & whether it persists over time is crucial open question

conclusions

► women faculty universally leave academia at higher rates than men



- with rates that vary by domain & career stage — 37% of domain/stages, women rates = men rates
effect is largest among (1) tenured women in (2) non-STEM at (3) lower-prestige schools
- regardless of *rates*, women leave for different *reasons* than men →
they feel pushed out, esp. by their workplace climates



- pre-tenure men in *Engineering* leave at higher rates than pre-tenure women
- but the women report feeling pushed out

Under the person-environment fit theoretical framework (53–59), our findings indicate that gender incongruences are real, substantial, and universal in academia, even in disciplines with larger proportions of women, such as health and education. The dominant incongruences for women arise from workplace climate, including dysfunctional leadership, feelings of not belonging to the department or university, harassment and discrimination. As a result, workplace climate is a major reason that women faculty leave academia, at every career age, but especially for tenured women (Fig. 4 and fig. S7). Such incongruences highlight the way departmental and institutional policies and norms tend to reflect, accommodate, and reinforce the traditional overrepresentation of white men from more privileged backgrounds, thereby driving gendered attrition over a career and inducing a substantial, asymmetric loss of overall talent and scholarship (5).

efforts to address gendered attrition must focus on gendered reasons for leaving rather than gendered rates
this will require new measurement instruments for climate

conclusions

► women faculty universally leave academia at higher rates than men



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► contrast with past work

- *work-life balance* is **not** dominant cause (eg parenthood) →
 - strong effect in early career, but falls off with age
 - only marginally gendered (shifting gender norms? policy progress?) — BUT *discrimination* around motherhood remains an issue (classified as "climate" in our study)



study limitations (many) :

the employment data span 2011-2020, which excludes the disproportionate effects of COVID on women, while the survey was in 2021, which may include them

all data is for tenured and tenure-track faculty only, and omits all non-TT faculty

the employment data does not include self-identified race/ethnicity labels, which precludes any intersectional analysis there

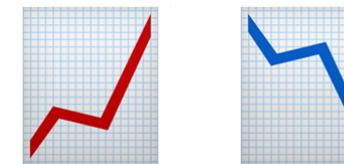
the survey data does include those labels, but the same size is too small to support well-powered statistical analyses

the survey also relied on retrospective assessments from former faculty, and prospective assessments of current faculty

survey respondents: full professors slightly over-represented, assistant professors slightly under-, higher-prestige slightly over. cannot assess other characteristics, eg, parenthood status, SES, etc.

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► contrast with past work

- *work-life balance* is **not** dominant cause (eg parenthood)
- *pre-tenure years* **not** most important → • pre-tenure gendered attrition only in specific fields
• things *get worse* after tenure — focusing on tenure is a red herring



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- *pre-tenure years* **not** most important

social biases (eg gendered attrition) shape the *composition* of the scientific workforce

that composition shapes the *rate and type of scientific discoveries*

things have improved in 40 years, but we have WORK to do yet

what interventions can mitigate climate-induced incongruences?

references & collaborators

SCIENCE ADVANCES | RESEARCH ARTICLE

SOCIAL SCIENCES

Gender and retention patterns among U.S. faculty

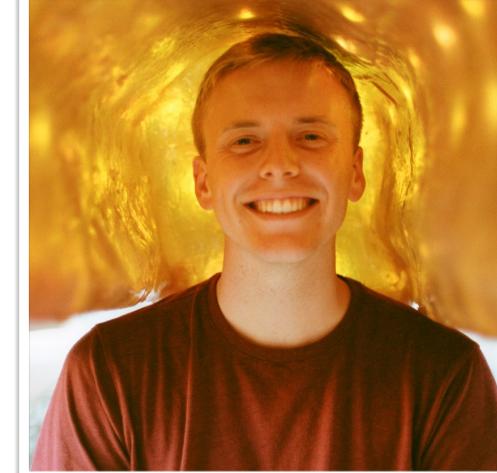
Katie Spoon^{1*}, Nicholas LaBerge¹, K. Hunter Wapman¹, Sam Zhang², Allison C. Morgan¹, Mirta Galesic³, Bailey K. Fosdick⁴, Daniel B. Larremore^{1,5}, Aaron Clauset^{1,3,5*}

Science Advances 9(42) adi2205 (2023)

▶ thank you to all of our survey participants for their time and contributions



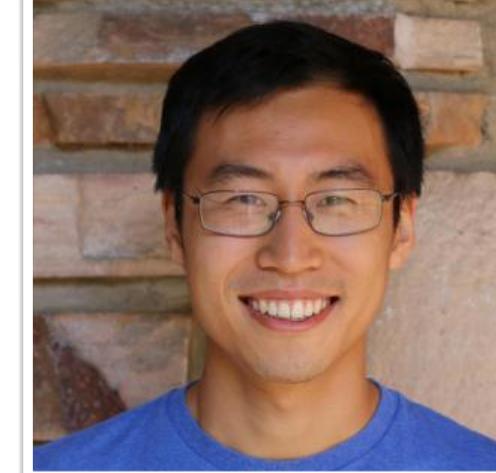
Katie Spoon
(Colorado)



Nick LaBerge
(Colorado)



K. Hunter Wapman
(Colorado)



Sam Zhang
(Colorado)



Dr. Allison Morgan
(now: Code for America)



Prof. Mirta Galesic
(Santa Fe)



Prof. Bailey Fosdick
(CU Anschutz)



Prof. Daniel Larremore
(Colorado)

Funding:



references & collaborators

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Labor advantages drive the greater productivity of faculty at elite universities

Sam Zhang^{1*}, K. Hunter Wapman², Daniel B. Larremore^{2,3}, Aaron Clauset^{2,3,4*}

Science Advances **8**, eabq7056 (2022)

Quantifying hierarchy and dynamics in US faculty hiring and retention

<https://doi.org/10.1038/s41586-022-05222-x> K. Hunter Wapman¹, Sam Zhang², Aaron Clauset^{1,3,4} & Daniel B. Larremore^{1,3}

Nature **610**, 120–127 (2022)

SCIENCE ADVANCES | RESEARCH ARTICLE

SCIENTIFIC COMMUNITY

The unequal impact of parenthood in academia

Allison C. Morgan^{1*}, Samuel F. Way¹, Michael J. D. Hoefer¹, Daniel B. Larremore^{1,2}, Mirta Galesic³, Aaron Clauset^{1,2,3*}

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Untangling the network effects of productivity and prominence among scientists

Weihua Li^{1,2,3,4}, Sam Zhang⁵, Zhiming Zheng^{1,2,3,4}, Skyler J. Cranmer⁶ & Aaron Clauset^{1,7,8,9}

Nature Communications **13**, 4907 (2022)

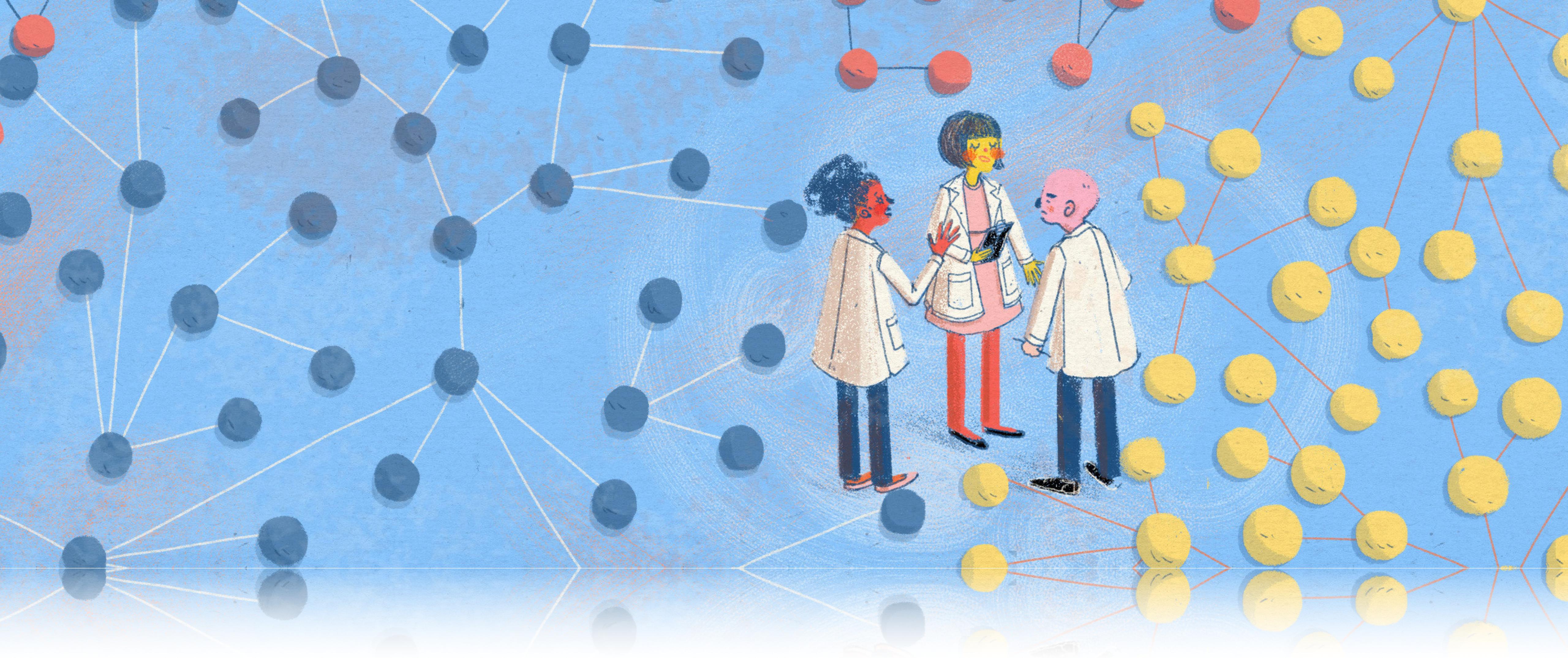
BY NICHOLAS LABERGE, K. HUNTER WAPMAN,
ALLISON C. MORGAN, SAM ZHANG, DANIEL B. LARREMORE,
AND AARON CLAUSSET

Subfield Prestige and Gender Inequality among U.S. Computing Faculty

CACM **65**, 46–55 (2022)

Funding:





fin



papers, code, data

<https://aaronclauset.github.io>