Gender and retention patterns among U.S. faculty

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gender in higher education

40 years of leaky pipelines...

Figure 3.1: The leaky pipeline: share of women in higher education and research, 2013 (%)
gender in higher education

40 years of leaky pipelines...

- 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...

- 1970-80s: "pipeline" analyses women’s representation in higher ed, gendered major choices, retention
- 1984: higher ed climate is gendered
- 1982: "leaky pipeline" for URM
- 1988: gendered retention in PhDs, highlights climate, support
Women of the Association of American Colleges.

FACILITATING CHANGE


WHO WILL DO SCIENCE?
Trends, and their causes, to minority and female representation among holders of advanced degrees in science and mathematics.
Sue R. Berryman

AAAS Presidential Lecture:
Voices from the Pipeline
SHEILA E. WIDNALL

Science Education
The Pipeline Is Leaking Women All the Way Along

Fixing the Leaky Pipeline: Women Scientists in Academia
A. N. Pell

Out of the Classroom:
A Chilly Campus Climate for Women?
Roberta M. Hall and Bernice R. Sandler

1983

1988

1993

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
The literature on women in science, both scholarly and popular, portrays academic sexism today as an omnipresent, pervasive force in the daily lives of tenure-track women in science, technology, engineering, and mathematics (STEM) fields. Throughout this article, we highlight quotes from prestigious journals and other outlets alleging such bias and the contexts in which it is said to occur. In response to these claims, we evaluated the scholarly evidence over a 20-year time frame—2000 to 2020—to reveal the areas of the academy in which gender bias has been addressed, as well as the areas in which it persists. First, however, we briefly describe the authors’ background positions in the preference to familiarize readers with the adversarial nature of our collaboration.

Abstract
We synthesized the vast, contradictory scholarly literature on gender bias in academic science from 2000 to 2020. In the most prestigious journals and media outlets, which influence many people’s opinions about sexism, bias is frequently portrayed as an omnipresent factor limiting women’s progress in the tenure-track academy. Claims and counterclaims regarding the presence or absence of sexism span a range of evaluation contexts. Our approach relied on a combination of meta-analysis and analytic dissection. We evaluated the empirical evidence for gender bias in six key contexts in the tenure-track academy: (a) tenure-track hiring, (b) grant funding, (c) teaching ratings, (d) journal acceptances, (e) salaries, and (f) recommendation letters. We also explored the gender gap in a seventh area, journal productivity, because it can moderate bias in other contexts. We focused on these specific domains, in which sexism has most often been alleged to be pervasive, because they represent important types of evaluation, and the extensive research corpus within these domains provides sufficient quantitative data for comprehensive analysis. Contrary to the omnipresent claims of sexism in these domains appearing in top journals and the media, our findings show that tenure-track women are at parity with tenure-track men in three domains (grant funding, journal acceptances, and recommendation letters) and are advantaged over men in a fourth domain (hiring). For teaching ratings and salaries, we found evidence of bias against women; although gender gaps in salary were much smaller than often claimed, they were nevertheless concerning. Even in the four domains in which we failed to find evidence of sexism disadvantaging women, we nevertheless acknowledge that broad societal structural factors may still impede women’s advancement in academic science. Given the substantial resources directed toward reducing gender bias in academic science, it is imperative to develop a clear understanding of when and where such efforts are justified and of how resources can best be directed to mitigate sexism when and where it exists.

Keywords
gender bias, tenure track, grants, hiring, salary/pay gap, academic letters of reference, teaching ratings, publication/productivity, women’s underrepresentation in science, women in STEM, adversarial collaborations
gendered faculty attrition

faculty literature is deep and messy = why?

- no / few gendered differences
- it's complicated
- real gendered differences

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!)

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

for instance, see Morgan et al. "The unequal impact of parenthood in academia" (2021)
study design

To investigate whether this consensus holds at scale…

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

**attrition rates**

- 245,270 tenured / tenure-track faculty
- 391 U.S. PhD-granting institutions
- 111 academic fields, in 9 broad domains
- 10 years, 2011-2020

**attrition reasons**

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

from **Academic Analytics Research Center**. AARC

questions about stress & reasons for leaving
self-reported gender, race, parenthood

► all institutions, cross-disciplinary, longitudinal, all faculty ranks
do women and men leave at different rates?

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from Academic Analytics Research Center AARC
attrition over a career

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

over all faculty in all fields

non-academic job
retirements
didn’t get tenure
moved abroad
etc…

mean 4.2% is for career age $t \leq 40$ years
$N = 245,270$ faculty
attrition over a career

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

mean 4.2% is for career age $t \leq 40$ years
$N = 245,270$ faculty

\[
\begin{array}{ccc}
\text{Assistant} & \text{Associate} & \text{Full} \\
(\text{pre-tenure}) & (\text{post-tenure}) & (\& \text{retirement}) \\
\end{array}
\]
attrition over a career

"all-cause" attrition risk \( r = \frac{\# \text{ who left}}{\# \text{ who could have left}} \)

at every career age, women are more likely to leave than men

but! these rates aggregate over many factors: different fields, ranks, prestige, etc.

let’s disaggregate…

mean 4.2% is for career age \( t \leq 40 \) years

\( N = 245,270 \) faculty
how heterogeneous is attrition?

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

Greater than 1: women are more likely to leave

Less than 1: men are more likely to leave

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

* 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
how heterogeneous is attrition?

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

gendered attrition largest among full professors

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

gendered attrition largest among full professors non-STEM faculty

* 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

OR >1: women more likely to leave vs. OR < 1: men more likely to leave
how heterogeneous is attrition?

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

**gendered attrition largest among**

*full professors*

**non-STEM faculty**

There are **no** STEM domains where women assistant profs are more likely to leave than men

* regression covariates: career stage, 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
how heterogeneous is attrition?

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

gendered attrition largest among full professors non-STEM faculty

In contrast, women full profs in every non-STEM domain are more likely to leave than men

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

* 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
how heterogeneous is attrition?

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

**gendered attrition largest among**

- full professors
- non-STEM faculty

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

* 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
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 to leave than faculty at most prestigious

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nothing makes sense in academia except in the light of prestige...
study design

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

**rates ≠ reasons**
- men and women could leave at different rates for same reasons
- or
- same rates for different reasons

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

questions about stress & reasons for leaving
self-reported gender, race, parenthood

social survey sent to 71,449 faculty from 29 diverse fields within the AARC frame; Colorado IRB protocol 21-0293
push & 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”
push & pull

who feels pushed out vs. pulled to better opportunities?

pushes > pulls, but women feel pushed at greater rates than men
**push & pull**

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

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

- women’s odds of feeling pushed: 44% higher than men
- women’s odds of feeling pulled: 39% lower than men

- gender predicts* push vs. pull
- very few differences across domains

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* 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

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What types of pushes?

- [Graphs showing fraction who felt pushed vs. career age and STEM status]
- [Graphs showing left or would leave due to push vs. career age and STEM status]
reasons for leaving

Professional
Productivity, funding, salary, admin. support, etc.

Work-life balance
Caring responsibilities, long hours, partner’s career, etc.

Workplace climate
Dysfunctional leadership, lack of fit or belonging, harassment, etc.

reasons are highly gendered:
e.g., professional vs climate work-life balance not strongly gendered
→ contrasts past literature

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
reasons for leaving, hypothetical

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N = 7,195 current faculty

all reasons derived from literature on faculty leaving academia (see paper supplement for details)
reasons for leaving, hypothetical

Professional
Productivity, funding, salary, admin. support, etc.

Work-life balance
Caring responsibilities, long hours, partner’s career, etc.

Workplace climate
Dysfunctional leadership, lack of fit or belonging, harassment, etc.

Professional: higher for all early-career faculty and late-career STEM faculty
reasons for leaving, hypothetical

Professional
Productivity, funding, salary, admin. support, etc.

Work-life balance
Caring responsibilities, long hours, partner's career, etc.

Workplace climate
Dysfunctional leadership, lack of fit or belonging, harassment, etc.

Work-life balance: higher for all early-career faculty (especially women), falls sharply over time
reasons for leaving, hypothetical

Professional
Productivity, funding, salary, admin. support, etc.

Work-life balance
Caring responsibilities, long hours, partner’s career, etc.

Workplace climate
Dysfunctional leadership, lack of fit or belonging, harassment, etc.

Climate: consistently higher for women, regardless of career age

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.
conclusions

women faculty leave academia at higher rates than men
- rates vary by domain & career stage
- in 37% of domains/stages, women’s rates = men’s 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

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  - rates vary by domain & career stage
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  - regardless of rates, women leave for different reasons than men
    - they feel pushed out, esp. by their workplace climates

*Under the person-environment fit theoretical framework (53–59), our findings indicate that gender in congruences are real, substantial, and universal in academia, even in disciplines with larger proportions of women, such as health and education. The dominant in congruences 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).*

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

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

*paragraph from Spoon et al. "Gender and retention patterns among U.S. faculty" (2023)*

tenured women represent 61% of all women faculty
women faculty leave academia at higher rates than men

- rates vary by domain & career stage
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contrast with past work

- work-life balance is not dominant cause (eg parenthood)
- pre-tenure years not most important

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.
conclusions

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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

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- **contrast with past work**
  - *work-life balance* is not dominant cause (eg parenthood)
  - *pre-tenure years* not most important

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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?*
Gender and retention patterns among U.S. faculty

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References and Collaborators

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