

# Gender and retention patterns among U.S. faculty

*Keywords: gender, retention, prestige, social inequality, science of science*

## Extended Abstract

Despite broad interest in measuring, explaining, and mitigating gendered attrition in faculty careers, the practical complexity of studying the phenomenon across fields, institutions, and career ages has impeded a full accounting of its magnitude and variation. Past studies have focused primarily on assistant professors, and often utilize samples collected prior to 2010 that are either (i) nationally representative but field-specific, mostly in STEM fields, including medicine [1-3], or (ii) cross-field but institution-specific, mostly at higher-prestige institutions [4,5]. The emphasis on early-career women in retention, especially in STEM, has provided an extensive, but narrow understanding of gendered retention—women assistant professors in STEM make up just 15% of all tenure-track and tenured women in academia, and those at the most prestigious institutions make up an even smaller share.

Similar limitations apply to the large body of survey studies and ethnographies that provide detailed explanations for gendered retention patterns [6-8]. Most commonly, studies identify gendered difficulties maintaining work-life balance [6-8] as the primary reasons women leave academia. Other common explanations include reasons unique to a tenure-track career, e.g., difficulties obtaining research funding [7], as well as workplace climates that are “chilly” toward women [8]. Such studies yield valuable insight into the reasons for gendered faculty attrition, but both they and studies using administrative data provide limited insight into how attrition rates and reasons vary across fields, institutions, or career ages.

Here, we conduct a systematic investigation of faculty retention across the U.S. university system using a comprehensive employment census of 239,949 tenure-track or tenured faculty who were active in their roles between 2011-2020 across 111 academic fields at all 391 PhD-granting institutions [9]—spanning all domains of academia, including science, technology, engineering, mathematics, and medicine (STEM), the social sciences, the humanities, health, business, and education—along with 10,071 responses to a broad survey about faculty attrition of former and current tenure-track and tenured professors from within the larger faculty dataset, which provides deeper explanations of gendered effects in faculty retention.

We show that, across academia, women are more likely to leave their faculty jobs and less likely to be promoted than men at every career age and stage, but gendered attrition rates vary in magnitude across ranks, fields and institutions. These high-level gendered attrition rates are primarily driven by tenured women, especially full professors (Fig. 1A). Furthermore, these disparities are larger in non-STEM domains than in STEM domains at every rank (Fig. 1A). There are no STEM domains in which women assistant professors are more likely to leave than men over this time period, and we find that men are more likely to leave engineering than women, even though it has the greatest overrepresentation of men of any domain. In contrast, the largest gendered attrition gap is for full professors in non-STEM domains: women full professors in every non-STEM domain are more likely to leave than men (Fig. 1A).

We also find that gendered attrition varies substantially between higher- and lower-prestige institutions (Fig. 1B). In general, faculty from lower-prestige institutions are significantly more likely to leave academia than faculty from higher-prestige institutions—a faculty member at the least prestigious institution is 53%, 55% and 75% more likely to leave

at the assistant, associate, and full professor ranks, respectively, than a faculty member at the most prestigious institution (assistant:  $z = -12.7$ ,  $N = 376,366$ ,  $p < 0.001$ ; associate:  $z = -9.7$ ,  $N = 459,541$ ,  $p < 0.001$ ; full:  $z = -33.3$ ,  $N = 602,777$ ,  $p < 0.001$ ). However, this effect is even stronger for women, who are even more likely to leave lower-prestige institutions than men (increasing the gap by an additional 16%, 37% and 16% for assistant, associate, and full professors;  $p = 0.03$ ,  $p < 0.001$ , and  $p = 0.01$ , respectively).

The variability of gendered attrition rates across domains and career stages, and the lack of gendered rates in some domains and stages, highlights the complicated nature of gendered attrition. However, even for ranks, fields, and institutions where retention rates are similar for women and men, we show that the reasons faculty leave remain gendered, implying that attrition can be gendered even if the overall rate of attrition is not.

Although attrition rates vary across career age, field, and institution, we found that gender is the strongest predictor of feeling pushed out of a faculty position or pulled towards a better position, with women 52% more likely to be pushed ( $z = 7.4$ ,  $N = 6,091$ ,  $p < 0.001$ ), and 38% less likely to be pulled ( $z = -7.5$ ,  $N = 6,091$ ,  $p < 0.001$ ), than men. Pushes can originate from a variety of sources, that we also found are highly gendered. In particular, pushes related to workplace climate were the most relevant in tenured women's decisions to leave, rather than work-life balance or professional reasons. However, in the early-career, women in both STEM and non-STEM fields emphasized work-life balance, consistent with the literature that has mostly focused on early-career, pre-tenure faculty [1-8].

These results broadly quantify the systemic nature of gendered retention among faculty, and provide new insights into its variation across fields, institutions, and career age. To achieve equity in academia, departments and institutions will need to address the underlying reasons, across all career stages, that drive these unequal outcomes.

## References

- [1] Deborah Kaminski and Cheryl Geisler, "Survival analysis of faculty retention in science and engineering by gender." *Science* **335**, 864–866 (2012).
- [2] Phyllis L. Carr, Anita Raj, Samantha E Kaplan, Norma Terrin, Janis L. Breeze, and Karen M. Freund, "Gender differences in academic medicine: Retention, rank, and leadership comparisons from the national faculty survey." *Academic Medicine* **93**, 1694 (2018).
- [3] Marcia Gumpertz, Raifu Durodoye, Emily Griffith, and Alyson Wilson, "Retention and promotion of women and underrepresented minority faculty in science and engineering at four large land grant institutions." *PLOS One* **12**, e0187285 (2017).
- [4] Louise August and Jean Waltman, "Culture, climate, and contribution: Career satisfaction among female faculty." *Research in Higher Education* **45**, 177–192 (2004).
- [5] Ann Burnett, Canan Bilen-Green, Christi R. McGeorge, and Cali L. Anicha, "Examining the complexities of faculty attrition: An analysis of STEM and non-STEM faculty who remain and faculty who leave the institution." *Journal of Women and Minorities in Science and Engineering* **18**, 1-19 (2012).
- [6] Francine M. Deutsch and Beier Yao, "Gender differences in faculty attrition in the USA." *Community, Work & Family* **17**, 392–408 (2014).
- [7] Rachel B. Levine, Fenny Lin, David E. Kern, Scott M. Wright, and Joseph Carrese, "Stories from early-career women physicians who have left academic medicine: A qualitative study at a single institution." *Academic Medicine* **86**, 752–758 (2011).
- [8] Susan K. Gardner, "'I couldn't wait to leave the toxic environment': A mixed methods study of women faculty satisfaction and departure from one research institution." *NASPA Journal About Women in Higher Education* **5**, 71–95 (2012).
- [9] K. Hunter Wapman, Sam Zhang, Aaron Clauset, and Daniel B Larremore, "Quantifying hierarchy and dynamics in U.S. faculty hiring and retention." *Nature* **610**, 120-127 (2022).

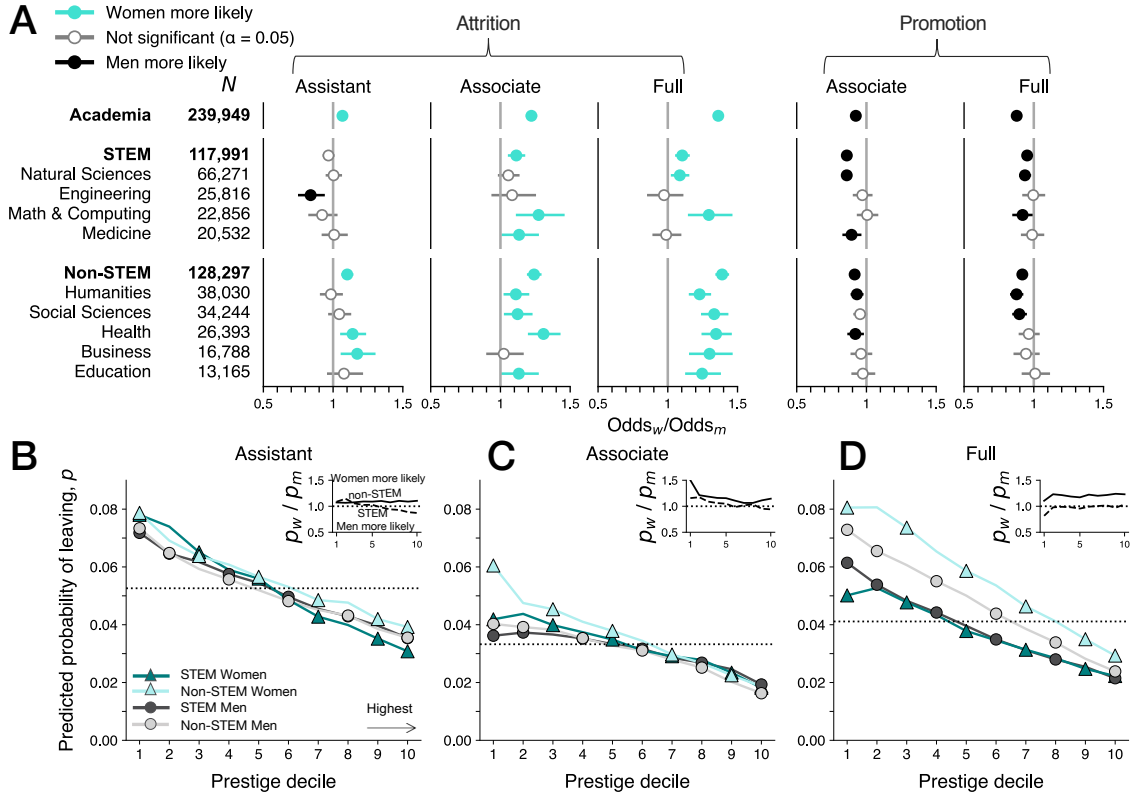


Figure 1. **(A)** Time-averaged attrition and promotion odds ratios, split by academic rank, controlling via logistic regression for career length, employer prestige and doctoral degree (domestic vs. international), with 95% confidence intervals and statistical significance assessed via a z-test. Since our dataset is a census, error bars represent variability in underlying mechanisms rather than uncertainty in the odds we observe. Individuals with appointments in multiple domains (12.8% of faculty) are counted in each domain. **(B-D)** Average predicted probability of leaving from the model in Fig. 1A, split by academic rank and across prestige decile, with 10 representing the most prestigious and 0 the least prestigious employer, for women and men in STEM vs. non-STEM domains. Dotted horizontal lines represent the average probability of leaving for all professors at that rank. Inset:  $p_{\text{women}} / p_{\text{men}}$  across prestige decile, for STEM (dashed) vs. non-STEM (solid) domains.