

# 2019 Re-Analysis of Gender Pay Inequity at UNC Chapel Hill

UNC's Committee on the Status of Women (COSOW)  
COSOW Co-Chairs: Elizabeth Dickinson and Brent Wissick

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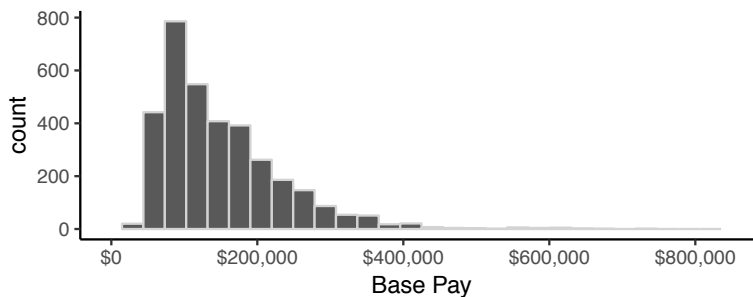
## Introduction

The Committee on the Status of Women (COSOW) invited me to review UNC-Chapel Hill's 2016-2017 Report of gender pay equity among its faculty. This memo summarizes the results of my examination.

By way of introduction, I want to emphasize that the authors of the UNC report conducted their analysis thoughtfully, carefully, and with integrity. I saw nothing in their report that suggests the analyses were designed to support a pre-conceived conclusion with their investigation. Furthermore, the University has supported COSOW's efforts to continue investigating gender pay equity issues at UNC.

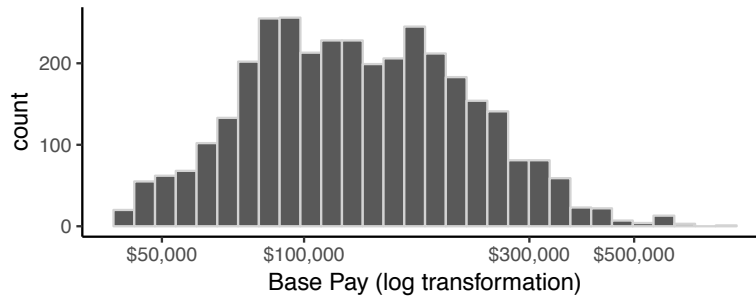
I approached this research into gender pay inequity by identifying three areas where the authors of the UNC Report made decisions that could paint an inaccurate and/or incomplete portrait of gender pay inequity.

First, the UNC report estimated the effects of gender pay inequity using un-transformed salary data. This is potentially problematic because the faculty salary data are *right skewed*, i.e., a few faculty earn much more than most of their peers.



The right skew in the salary data may distort one's conclusions because the highest paid employees will have an outsize influence over a regression model's estimates. This is a common problem associated with studying salary data. The rec-

ommended solution is to log-transform the salary data before conducting any analyses. The distribution of the log-transformed data limits the potential influence of these outliers.



In addition to reducing the potentially outsize influence of high-earning faculty, using log transformed salary data is a better fit for research on gender pay inequity. Models that use non-transformed salary data estimate the average dollar salary difference between men and women. These models assume that gender differences are constant, regardless of how much or how little the faculty members earn. In contrast, models that use log-transformed data estimate the *average percent salary difference* between men and women. This is a more reasonable approach because gender-based salary differences in higher earning positions will likely be proportionally larger than gender-based salary differences in lower earning professions.

Second, the UNC report adopted a limited perspective on how covariates can reveal the mechanisms that create and perpetuate gender pay inequity. The UNC report conceptualized gender pay inequity as the difference in salary that exists after “controlling” for other potential covariates. This strategy ignores the possibility that covariates may reveal *why* gender pay inequity exists. For example, treating department as a control variable could hide gender differences that are created if departments are paid differently because of their gender makeup. Similarly, treating position as a control variable could hide gender differences if women are not being promoted into higher paying positions. Adopting a more nuanced perspective on these variables may help reveal both the extent of gender differences at UNC and some of the mechanisms that drive these differences. This is the most important difference between my examination and the UNC report.

Third, the UNC report limited its scope by looking at only one year of faculty data and by excluding schools from its analysis. Including salary data from multiple years can help reveal whether any gender differences are increasing or decreasing and, if so, what is driving those changes. Incorporating data from all of the schools will provide insight into gender pay inequity across all of UNC.

## Method

I obtained most of the data for this examination by submitting Public Records Request #18-475. UNC responded to my request by sending me the *base salary, age, school, department, and position* of all 4,681 people employed as UNC-Chapel Hill faculty members between 2014 to 2017. The data start at 2014 because that is when the University switched to its current version of PeopleSoft. The data end at 2017 because, at the time of my request, the 2018 data were not yet available.

UNC was not able to share the gender of each faculty member with me. As gender is critical to this investigation, I estimated each faculty member's *gender* with a two-step approach. First, I looked up how frequently the person's name is used by men versus women in two databases: (1) the social security administration baby names database from 1950 - 2012; and (2) the genderize.io database of social network profiles. I coded a faculty member as male if their name was, on average, used by men more than 97% of the time; I coded a faculty member as female if their name was, on average, used by women more than 97% of the time. In this first step, I also only coded people's gender if their name appeared in the gender databases at least ten times. This process identified the most likely gender for 3,794 of the 4,681 faculty members. The 887 faculty who did not meet the 97% threshold were categorized as having gender-ambiguous names.

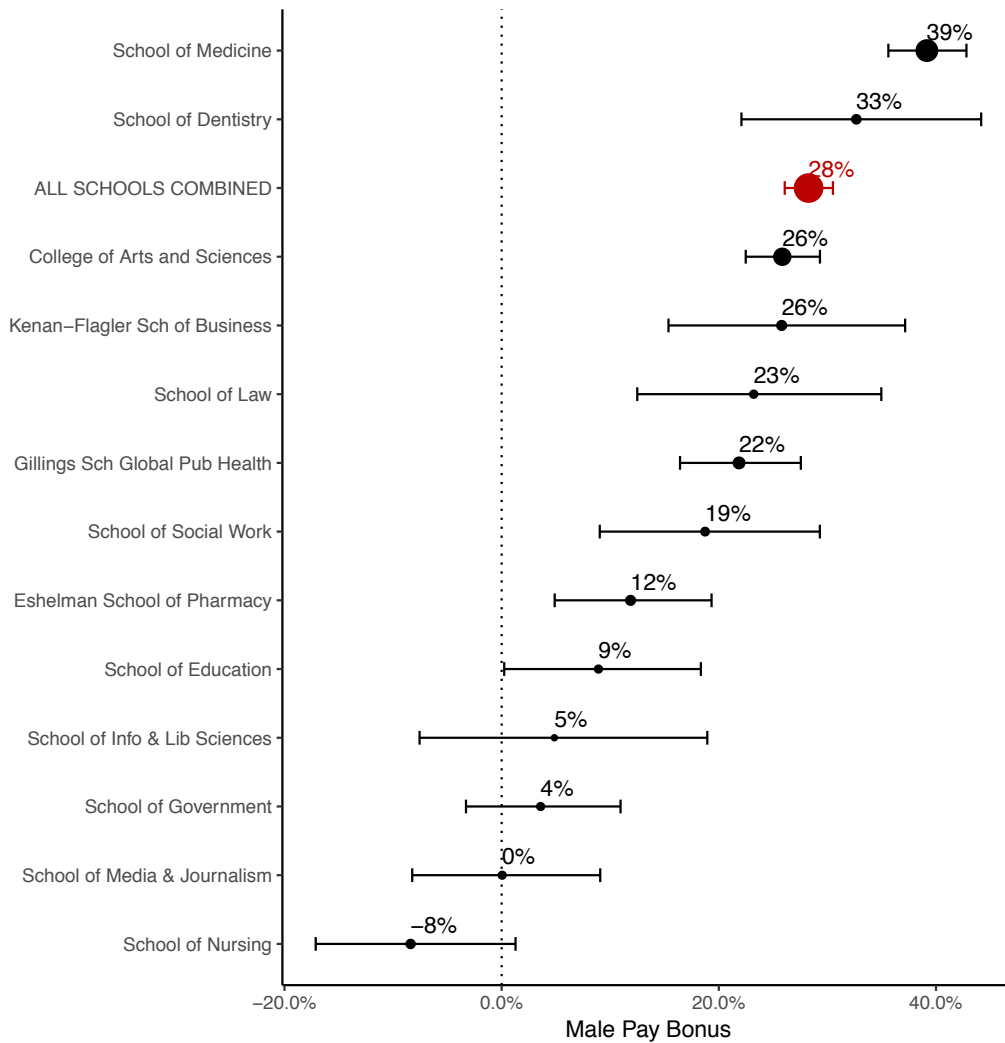
Second, I conducted a Google Search of all 887 faculty members with gender-ambiguous names. I then coded the faculty member as male or female using the faculty member's picture and pronoun use. I coded the most likely gender for 866 of the remaining faculty in this way. The 21 faculty (0.4% of the 4,681 faculty represented in the study) who had a gender-ambiguous name and no gendered web presence were dropped from the analyses.

It is possible that the strategy I use will mis-gender a few of the UNC faculty. The algorithms I use have the potential to mis-classify people who have highly-gendered names that do not match their actual gender. The web-presence search may also be flawed if people's pictures and/or pronoun use is not reflective of their gender. This is a particular concern for transgender people who may have transitioned after their web-presence was established. Taken together, these possible errors of mis-gendering are most likely too rare to affect the regression models or my conclusions. I mention these potential limitations in an effort to be as transparent as possible about the methods used to code faculty members as male or female.

# Analysis

## Is there a gender pay gap at UNC?

I began analyzing the faculty data by measuring the pay gap between male faculty members and female faculty members without including any covariates. This simple calculation reveals that men on the UNC faculty earn 28% more than women. A further investigation revealed that gender pay inequity varies across the UNC campus. As the graph below shows, gender inequity is highest at the medical school and lowest (non-existent) at the school of nursing. The magnitude of the gender pay gap invites further analyses into why such a large gender pay gap exists.



## What drives the gender pay gap at UNC?

We can explore why a gender pay gaps exist at UNC by studying the covariates of gender and salary. The UNC report conceptualized covariates of gender and salary as inferentially irrelevant “control variables”; its models ask whether men and women with identical backgrounds, experience, track, rank, title, and department tend to be paid differently. To justify this analytical decision, the UNC Report argues that these covariates should be controlled for because they “*should* be related to salary.” The problem, however, is that covariates that “*should* be related to salary” would not *also* be related to a person’s gender absent *bias*. In the most extreme case, one could imagine a school where every high-paying position was only available to men. In this example, an analysis that “controlled” for a person’s position would erroneously conclude that no pay discrimination existed. That would be a mistake.

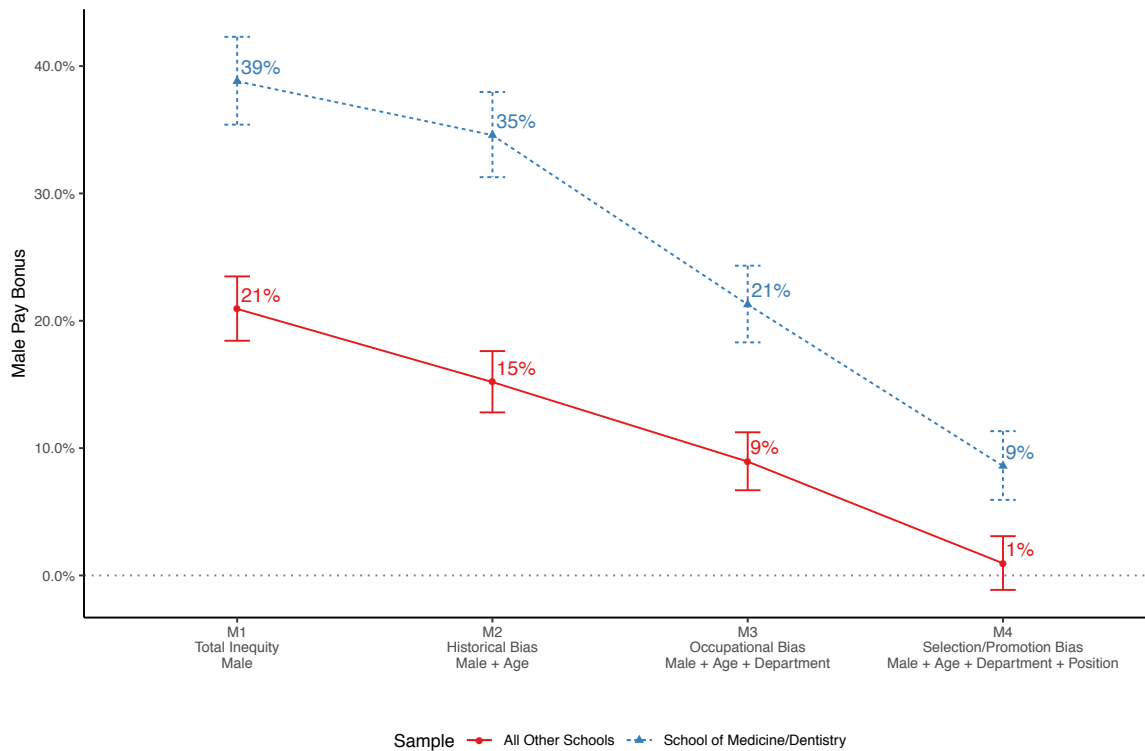
I argue that we can use covariates to identify why gender pay inequity exists. I focus on three covariates that are theoretically meaningful:

1. **Age.** Age is a reasonable proxy for experience in academia; older faculty have had more opportunities to receive raises and to be promoted into higher paying positions. Age may be correlated with gender because women were not always welcomed into academia. The extent to which including *age* in a regression model reduces the effects of gender will reflect the extent to which *historical bias* is responsible for the gender pay gap at UNC.
2. **Department.** UNC faculty are organized within departments depending on their specialty. Economic forces may lead members of some departments to be paid more than others. Supply constraints may increase salaries when there are relatively few faculty in a high demand field. Similarly, external demand may increase salaries when faculty in a field have lucrative opportunities outside of academia. Gender differences in department membership may be explained by the potentially different interests of men and women and/or by structural forces that may keep men and women out of certain fields (e.g., not wanting to be the only person of your gender in a doctoral program). The extent to which including *department* in a regression model reduces the effects of gender reflects the extent to which *occupational bias* is responsible for the gender pay gap at UNC.
3. **Position.** University faculty have job titles that indicate their track (tenure-track versus fixed term) and their rank within that track. At UNC, tenure-track positions tend to pay more than fixed term positions. Within a

track, faculty who have been promoted to higher ranks tend to be paid more than lower ranks. Why, however, would women be less likely than men to hold more lucrative positions? One explanation is that men may prefer tenure-track positions and promotions, while women prefer un-tenured lower-rank appointments. This explanation is unlikely given the many benefits of tenure and promotions at UNC. A more likely explanation is that men are more likely than women to be hired onto the tenure track and promoted to higher ranks, be it for structural or personal reasons. The extent to which including *track* in a regression model reduces the effects of gender will reflect the extent to which *selection-promotion bias* is responsible for the gender pay gap at UNC.

I estimate the effects of historical discrimination, occupational bias, and selection-promotion bias by fitting a series of regression models. The base model, Model 1, estimates the *male pay bonus* while including dummy variables to control for potential pay differences in schools. Model 2 adds the age variable as a covariate. I measure *historical bias* as the extent to which including age reduces the male pay bonus. Model 3 adds information about the faculty's department memberships, estimating *occupational bias*. Model 4 adds information about faculty member's position, revealing the effects of *selection-promotion bias*.

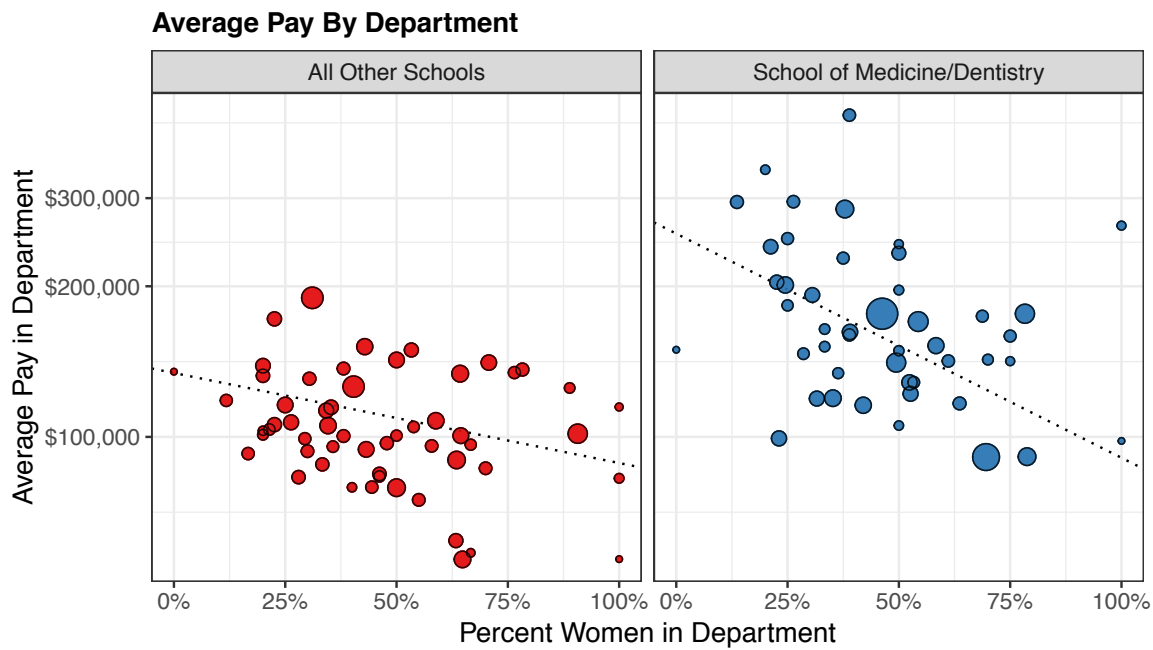
Looking across these models, I am interested in is how adding covariates affect the pay bonus associated with being male. The critical information is the extent to which including a covariate *lowers* pay inequity, as this reveals the magnitude of the mechanism's effect.



The graphs above show that historical bias, occupational bias, and selection/promotion bias all contribute to the gender pay gap at UNC. I analyzed data from the School of Medicine and Dentistry separately from all of the other schools because preliminary analyses suggested the data from these schools followed different trends.

*Historical bias.* The gender pay gap at UNC exists, in part, because older faculty are paid more and are more likely to be male. It is important to acknowledge that historical bias explains a portion of the gender-pay gap because there are no reasonable mechanisms through which UNC could remove this effect. Absent firing every senior faculty member—which, in itself, would be discriminatory—policy changes made today will take decades before removing the effects of historical bias.

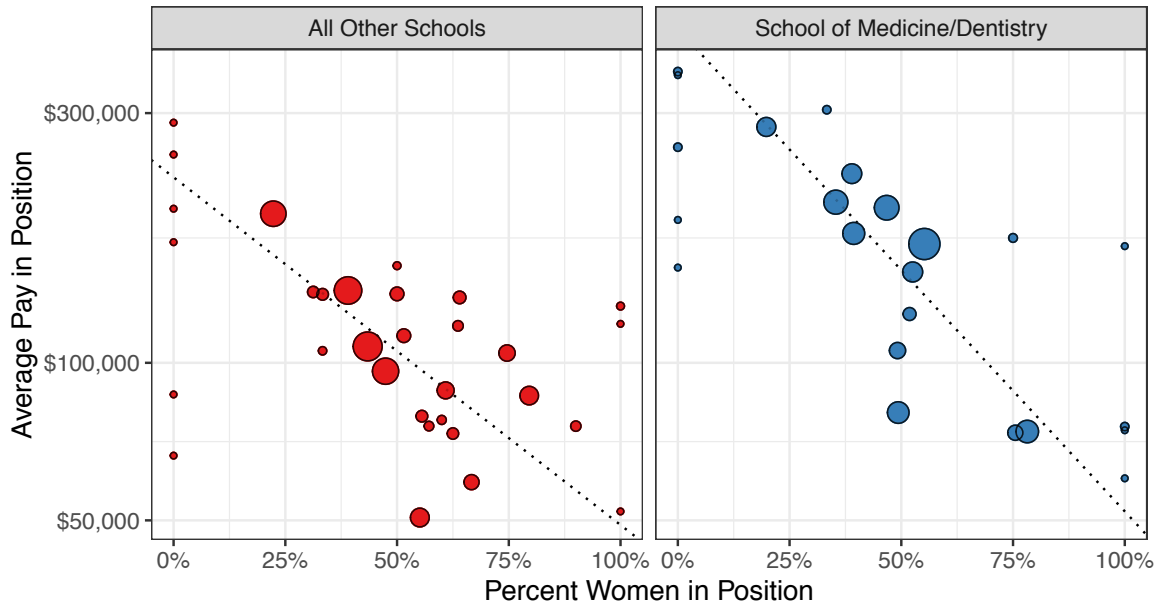
*Occupational bias.* All of UNC’s schools show clear and unequivocal evidence of occupational bias. The magnitude of this bias effect is almost twice as large in the Schools of Medicine and Dentistry than in the other schools at UNC. The graphs below show how average pay per department (calculated as the exponentiated mean of log-salary) varies as a function of the percent of women in a department. Higher-paying departments tend to have more male than female faculty.



*Selection-promotion bias.* The data show clear and unequivocal evidence of selection/promotion bias at UNC. Again, the magnitude of the estimate is almost twice as large in the Schools of Medicine and Dentistry than in the other schools at UNC. A graph of average pay per positions (calculated as before) against the percentage of women in a department explains this trend in the regression model. At UNC, men are more likely to be selected and promoted into higher-paid positions. This aligns with previous findings from the 2012 COSOW "Women in Leadership Assessment," which can be found at: <http://facultygov.sites.unc.edu/files/2010/10/CSW2013.pdf>.

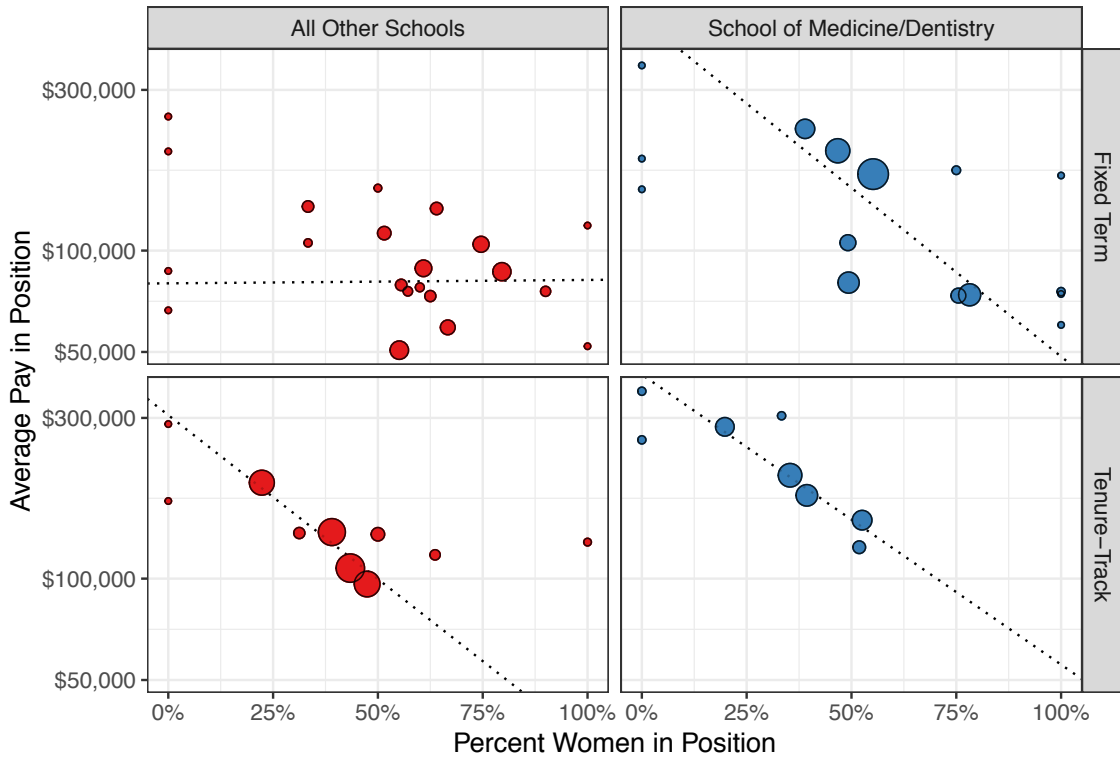


### Average Pay By Position



As a supplemental analysis, I investigated whether selection-promotion bias exists among both fixed term and tenure-track faculty.

### Average Pay By Position

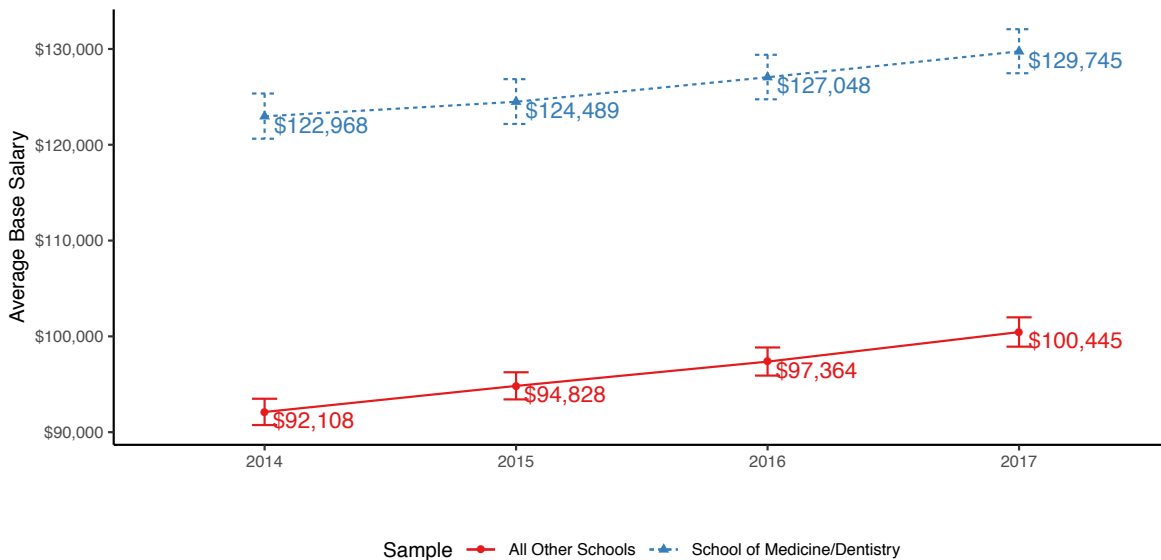


Splitting the population by track reveals an interesting trend: while selection-promotion bias creates gender pay inequity among both fixed term and tenure track faculty at the Schools of Medicine and Dentistry, selection-promotion bias only creates gender pay inequity within the tenure-track faculty at the other UNC schools. I confirmed this trend with supplemental regression analyses. While women are more likely to be fixed-term faculty, men and women in fixed-term positions are equally likely to be promoted to different positions outside of the School of Medicine and Dentistry. In all other sub-populations, men are more likely to be selected or promoted to higher-paying positions than women.

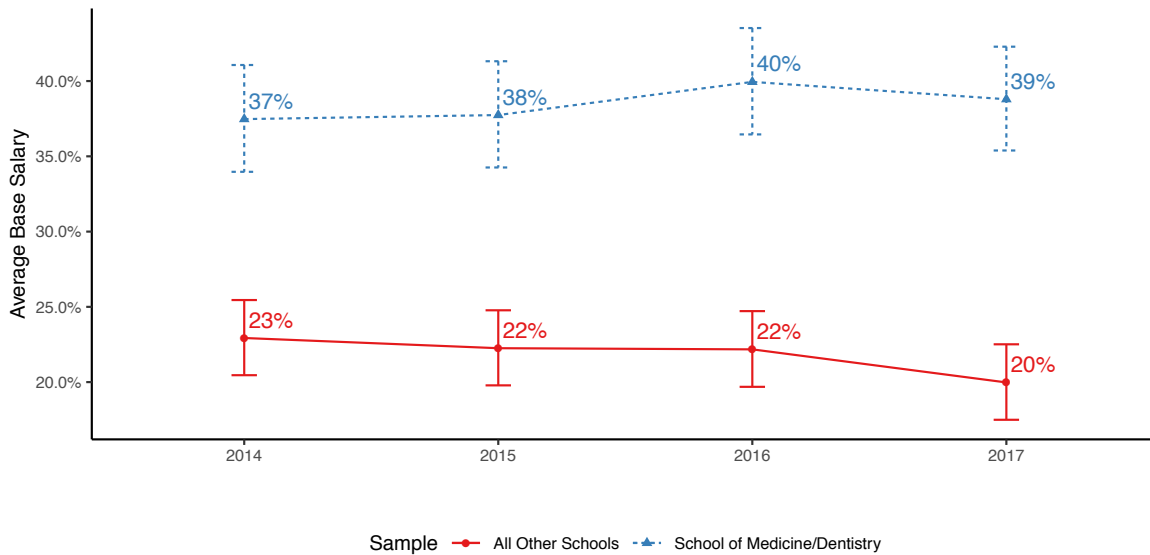
## Trends Over Time

The analyses above describe the state of gender pay equity at UNC in 2017. In this section, I review trends in salary and gender pay inequity between 2014 and 2017 to see whether gender pay equity issues are stable, improving, or getting worse.

I first estimated the average salary for UNC faculty between 2014 and 2017 (computed, as before, as the exponentiated average of log-transformed salaries). The graph below shows that salaries have increased steadily since 2014.



I then estimated the gender pay equity rate for 2014 through 2017.



The graph shows that there has been little overall change in gender pay equity over time. The male pay bonus has seen a small increase in the Schools of Medicine and Dentistry and a small decrease in the other schools at UNC. We would need more years of data to detect meaningful trends in gender pay equity over time.

## Conclusion

My analysis of gender pay equity at UNC-Chapel Hill led me to reach the following conclusions.

- Gender pay inequity is a significant and ongoing problem at UNC-Chapel Hill. Men on the faculty were paid, on average, 28% more than women in 2017.
- Gender pay inequity is a larger problem in the medical and dental schools (average bonus for men: 39%) than in the other schools at UNC (average bonus for men: 20%).
- Most gender pay inequity can be explained by (1) historical bias, i.e., that older faculty are paid more and are more likely to be male; (2) occupational bias, i.e., that higher paying departments tend to hire more men; and (3) selection-promotion bias, i.e., that men are more likely than women to be hired and promoted into higher-earning positions.
- There is evidence of selection-promotion bias contributing to gender pay inequity among fixed-term faculty in the medical and dental schools, but not among fixed-term faculty in the other schools at UNC.

- There is no University-wide trend of gender pay equity issues improving over time.

I hope this re-investigation of gender pay equity at UNC-Chapel Hill promotes further discussions on this ongoing problem.