Internal Faculty Salary Study 2019-2020

Executive Summary

In the fall of 2019, the Office of Analytics & Institutional Effectiveness and Division of Human Resources were charged with conducting an internal equity review of all tenured and tenure track instructional faculty. We utilized a predictive data mining approach to explore factors influencing the salaries of Virginia Tech Instructional Faculty (VTIF) and construct a holistic understanding of compensation dynamics. The study examined gender and race/ethnicity as they related to pay at the University, as well as critically examining salary equity according to factors such as rank, discipline, time since terminal degree, along with several others. In agreement with the previous study in 2015, there was no discovery of gender or race/ethnicity as a principal driving factor in salaries. The 9-month equivalent base salary compensation for instructional faculty was best modeled, in order of importance, by college membership, rank, and status as an eminent scholar or distinguished professor. Models for total salary (which includes pay from supplemental contracts), were very similar with the exception that rank was of highest importance and college membership was second. Only results for 9-month equivalent base salary are provided in this report. While there is no evidence of systemic inequities in compensation due to demographic factors there is a marked skew in demographic composition within and between ranks. Females are less represented within each rank, with the gap intensifying as rank increases. A similar pattern can be observed for URM faculty. Whether these differences are the result of hiring practices, constraints in applicant pool composition, or higher turnover rates for select employees could not be determined with the dataset used in the current study.

Analytical Overview

The goal of the internal study is to determine if systemic compensation inequity exists based on gender and/or race/ethnicity for VTIF. Salary data (AY 2018-2019) for 1,424 full-time, tenured, and tenure-track instructional faculty were used in the analysis. Faculty housed outside of the academic colleges, within AREC's, and Extension Offices were specifically excluded. Also excluded were those on leave without pay, in the VTRP, and on severance. Boosted regression trees were used to model nine-month equivalent job salary, hereafter referred to as base salary. The predictive factors included in the model were gender, race/ethnicity, underrepresented minority status, years since earning highest degree, rank, tenure status, status as an eminent scholar, distinguished professor, dean, director, or department head, and home college.

Results

What factors are most predictive of Virginia Tech Instructional Faculty salary?

College, rank, and status as an eminent scholar or distinguished professor were identified as the most important variables when modeling base salary. The pattern of influence (partial dependence) for each of these variables is shown in Figure 1 and can be best understood as the

relative effect each attribute has when benchmarked against the overall average faculty profile. The effects of college can be described in three clusters. Compared to the overall average: 1) membership in the College of Business has a strong positive relative effect on salary, 2) membership in the College of Engineering, College of Science, and College of Veterinary Medicine has limited effect on salary, and 3) membership in the College of Agriculture & Life Sciences, College of Architecture & Urban Studies, College of Liberal Arts & Human Sciences, and College of Natural Resources has a negative relative effect on base salary.

In regard to academic rank, attaining the rank of Professor is associated with upshifts in compensation. Interestingly, at the institutional level, attaining the rank of Associate Professor showed no relative improvement in salary compared to Assistant Professor. This could be an artifact of salary compression between the lower ranks, which is compounded when individuals spend lengthy periods of time at the Associate Professor rank. As shown in Figure 2, the time in rank of Associate Professor is generally neutrally or slightly negatively correlated with base salary. Finally, as expected, status of Eminent Scholar or Distinguished Professor exerted a positive influence on base salary.

Is there any evidence of a gender influence on Virginia Tech Instructional Faculty salary?

The study population included 974 (68.4%) men and 450 (31.6 %) women. This is a 2.8% increase in female faculty from the previous study. None of the predictive data mining models suggested that gender had an overriding influence on VTIF salary at the institutional level, as patterns were more readily explained by college membership, rank, and status of Eminent Scholar or Distinguished Professor. Moreover, parsing the data and running the models by college also did not recover gender as an influential factor. In Figure 3, below, base salaries are compared by gender parsed by the two factors having the highest relative influence in the predictive model - college and rank. The median salary values and distributions for the Assistant Professor and Associate Professor rank are similar for males and females across colleges. However, several colleges show more observable differences between the median salary for males and females at the Professor rank. It is important to note that most (+90%) Eminent Scholars and/or Distinguished Professors are at the rank of Professor and most (+80%) of Professors are male.

A visualization of gender composition by rank (Figure 4) shows decreasing representation of females as rank increases. Compared to the data presented in the 2015 report, these percentages for females comprising each rank are increasing - with the exception of the Professor rank. Advancement to Professor rank and the status of Eminent Scholar and/or Distinguished Professor is mostly highly correlated with the numbers of years since a faculty member's highest degree was attained and how many years they have worked at Virginia Tech. The average number of years since highest degree earned is 14.4 for females with an average of 10.3 years of employment at Virginia Tech. Comparatively, males have an average of 20.1 years since highest degree earned and 14.8 years of employment at Virginia Tech. Whether these differences are the result of hiring practices, constraints in applicant pool composition, or higher turnover rates for female employees could not be determined with the dataset used in the current study. Exploratory linear trend models for base salary (Figure 5) show similar (overlapping) projections between genders for most colleges when modeled as a function of years since highest degree earned.

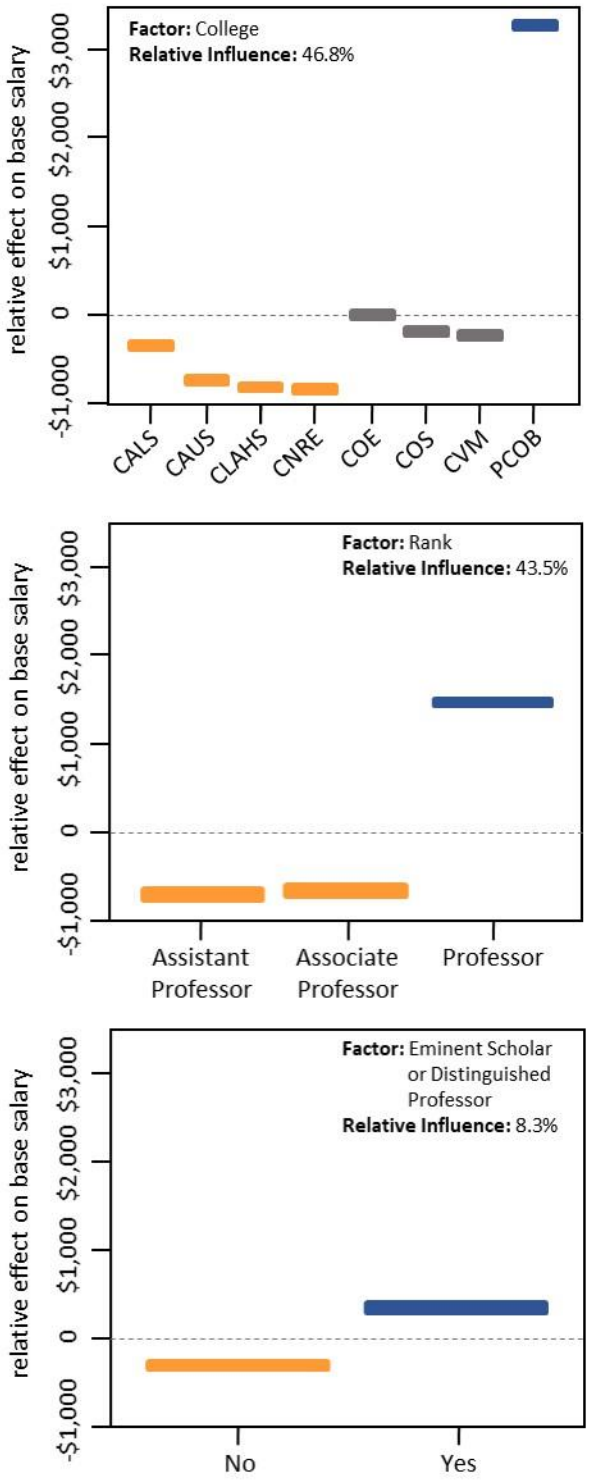

Figure 1: Plots showing the relative effects of the top three most influential factors predicting VTIF base salary when all other factors are held constant at their institutional averages.

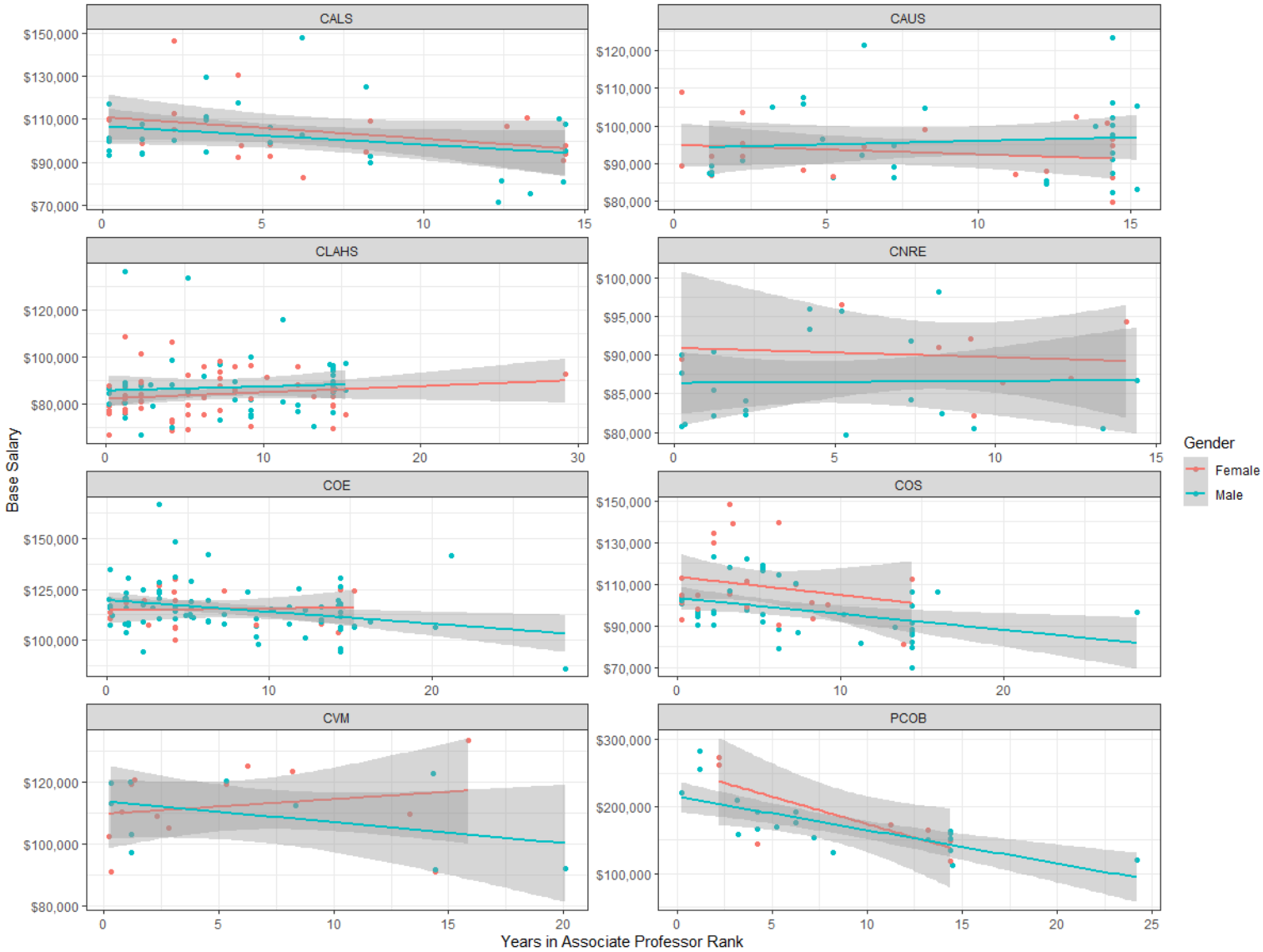

Figure 2. Exploratory Linear trend models with 95% confidence intervals for base salary based on *years in Associate Professor rank*. Data are sliced by college and analyzed by gender. Salary scales are not fixed.

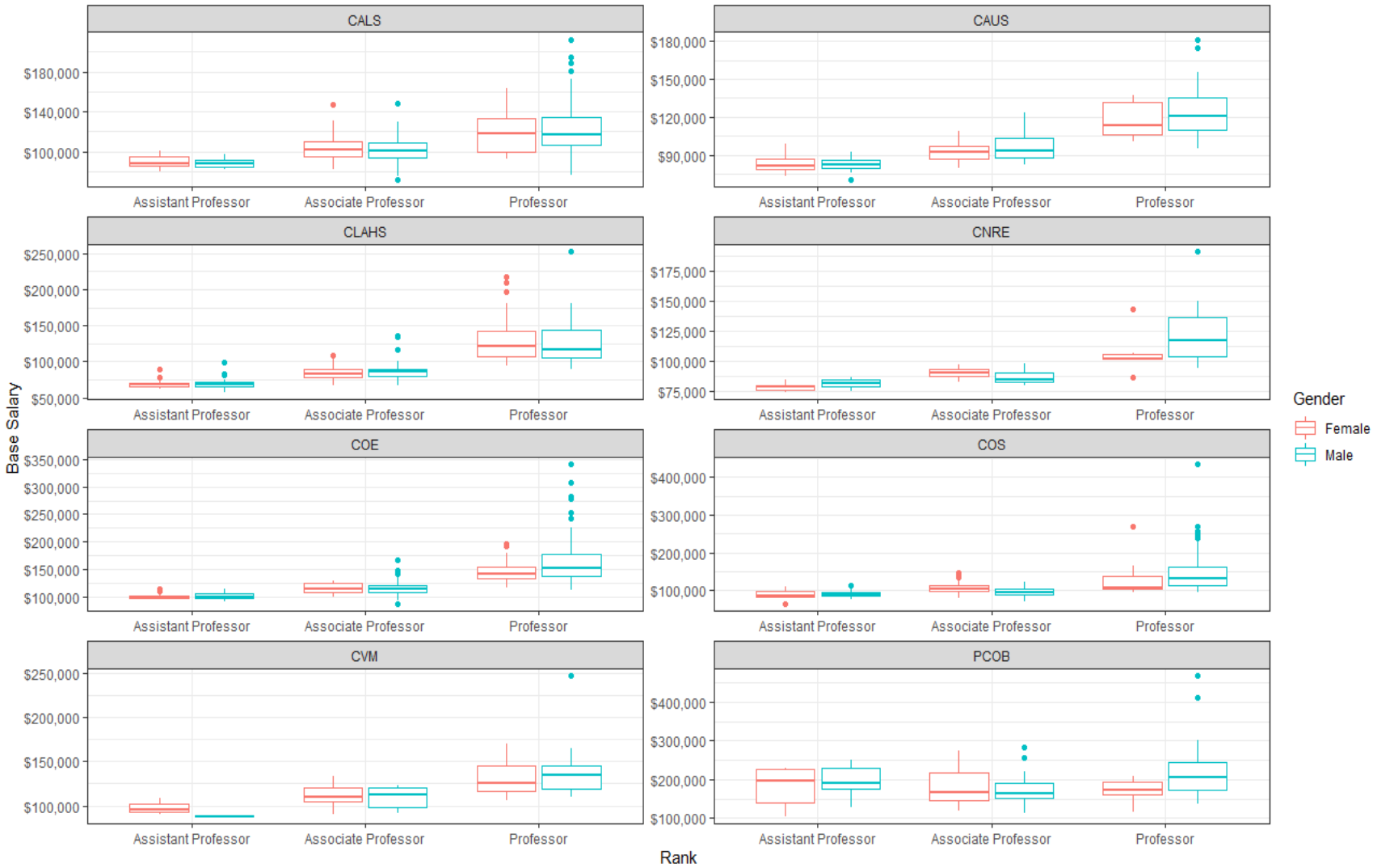

Figure 3. Boxplots showing the distributions of base salary by college, rank, and gender. Note the salary scale varies between colleges. The median is the thicker, colored line and boxes bound the 25th and 75th percentiles.

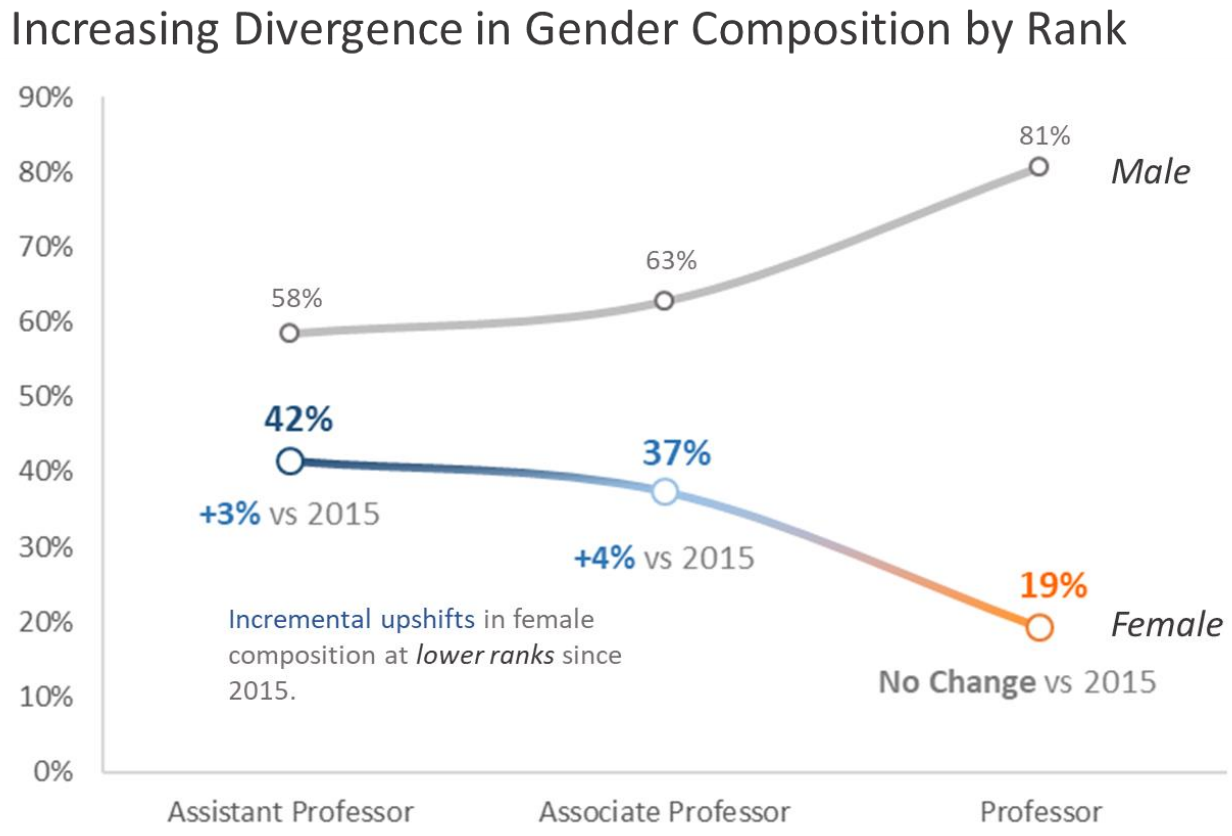

Figure 4: The relative gender composition by instructional rank with comparison to data from 2015 report.

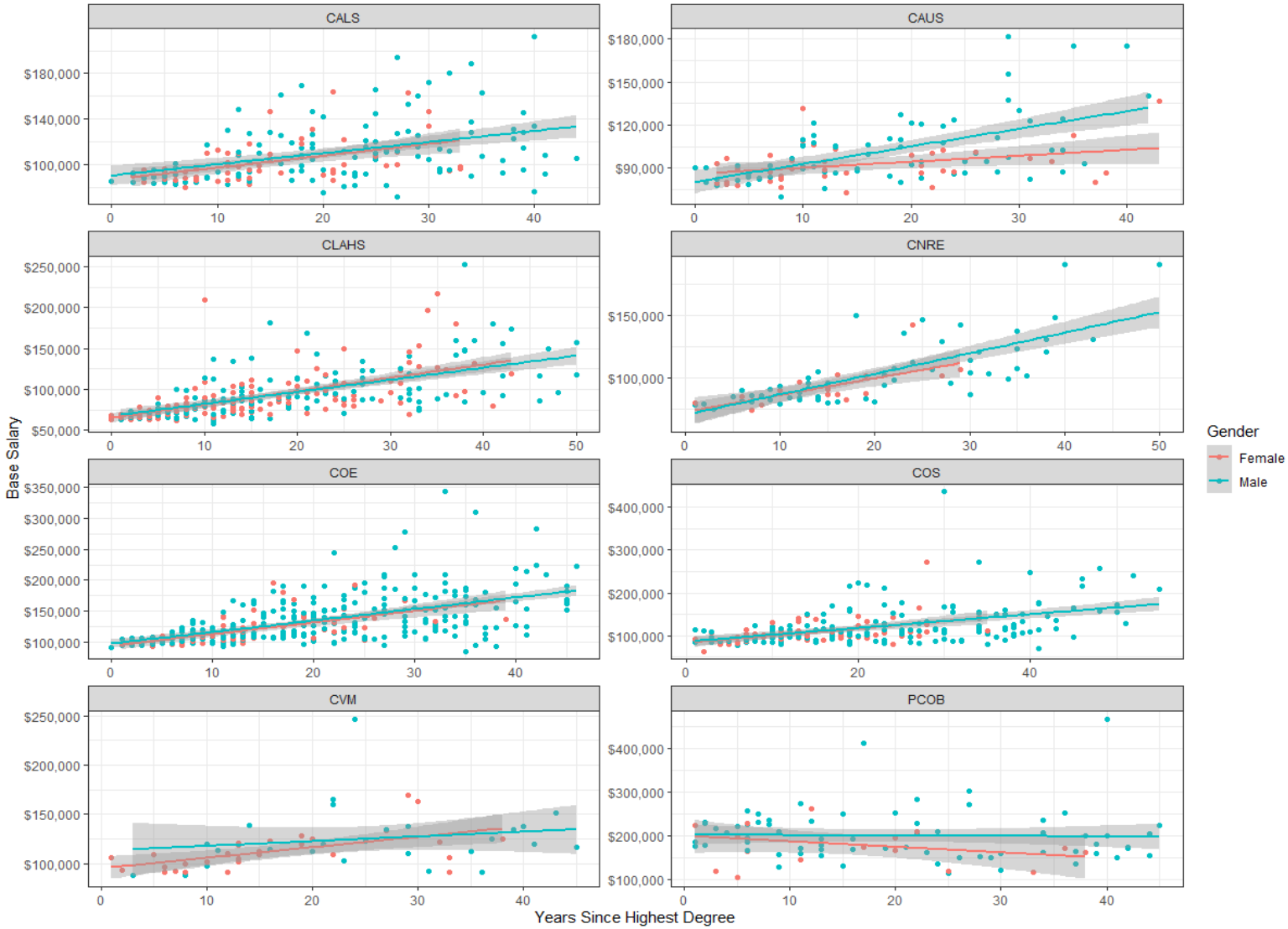

Figure 5. Exploratory linear trend models with 95% confidence intervals for base salary based on *years since highest degree* earned. Data are sliced by college and analyzed by gender. Note salary scales are not fixed and in most colleges the model for females is truncated due to lower times since highest degree earned.

Is there any evidence of a race/ethnicity influence of Virginia Tech Instructional Faculty Salary?

In 2019, 113 (7.9%) faculty members were from underrepresented racial or ethnic groups. This is a 0.3% increase compared to the prior study. None of the predictive data mining models suggested that being an underrepresented minority (URM) had a systemic influence on VTIF salary at the institutional level. As with gender, parsing the data and running the models by college also did not expose an influence of URM status on salary. In Figure 6, below, base salaries are compared by underrepresented minority membership parsed by Rank. Not all colleges have underrepresented minority membership at all ranks; therefore, we did not parse the data at that level. While general salary distributions were similar, the frequency of outliers was much higher for non-URM within each rank.

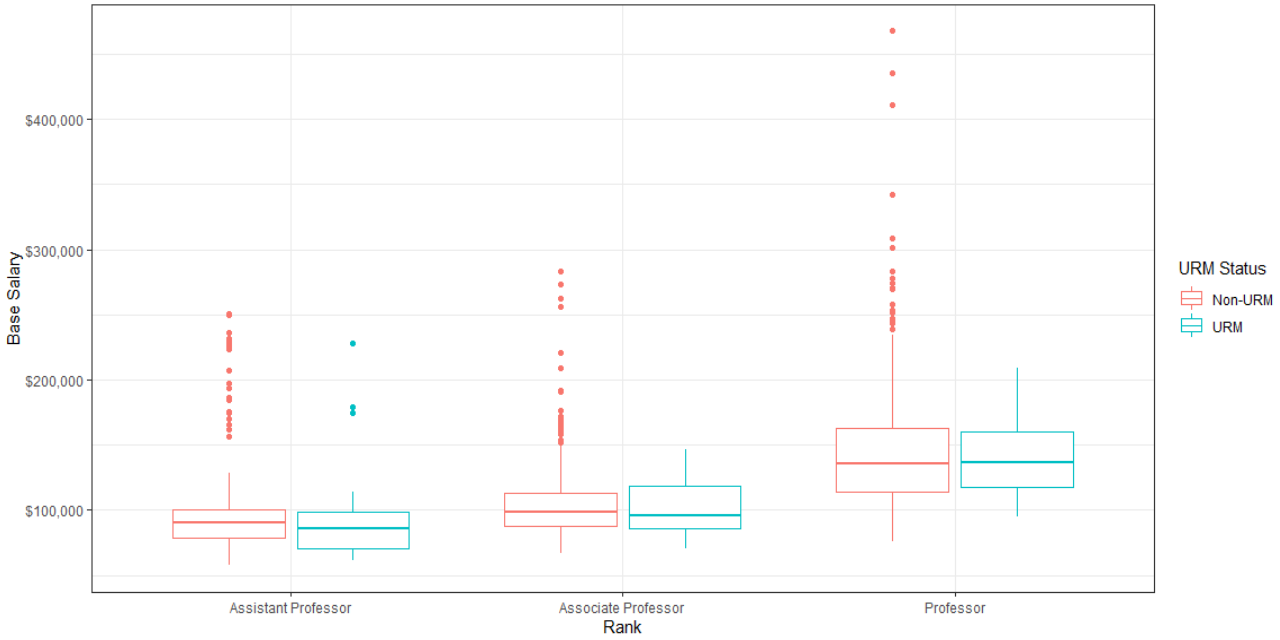

Figure 6. Boxplots showing the median and quartile distributions of base salary by URM membership. The median is the thicker, colored line and boxes bound the 25th and 75th percentiles.

A visualization of URM composition by rank (Figure 7) shows decreasing representation of URM as rank increases. There has been minimal change in composition at the Assistant Professor rank since 2015. The most recent data show a decline in URM composition at the Associate Professor rank but a reciprocal increase at the Professor rank. Advancement to Professor rank is mostly highly correlated with the numbers of years since a faculty member's highest degree was attained. Similar to differences in gender, the average number of years since highest degree earned is 15.6 for URM and 18.5 for non-URM faculty. An exploratory linear trend model (Figure 7) for base salary, which was developed based on years since highest degree earned, showed similar compensation patterns between the groups. Due to overall low representation, this model is not parsed by college membership which is an important factor in explaining salary patterns.

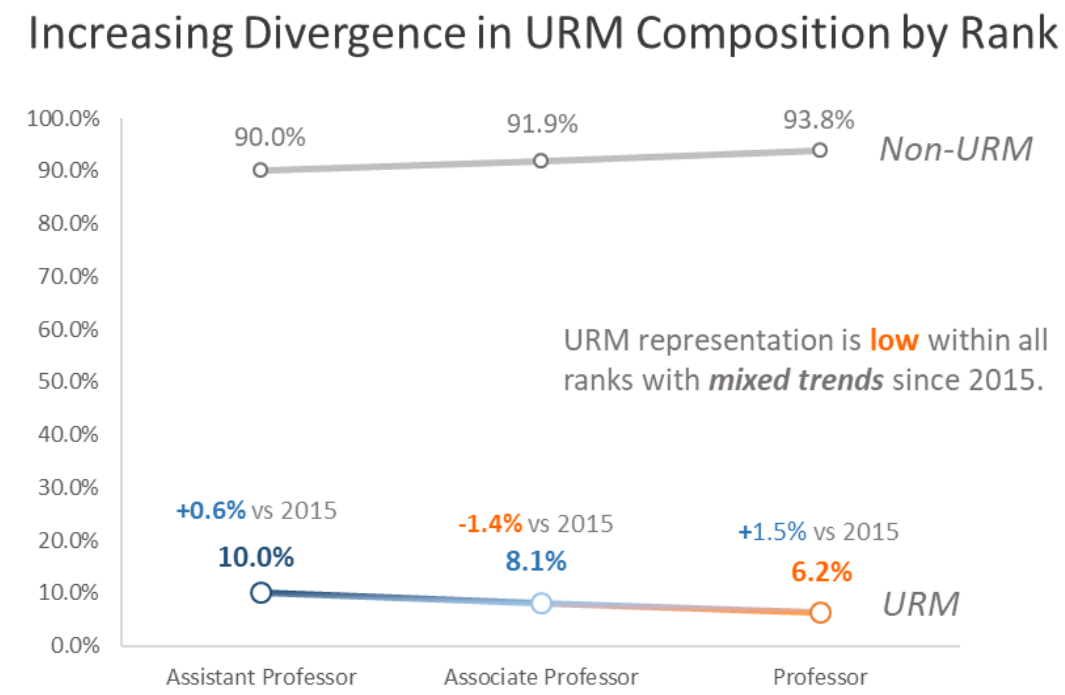

Figure 7: The relative underrepresented minority composition by instructional rank with comparison to data from 2015 report.

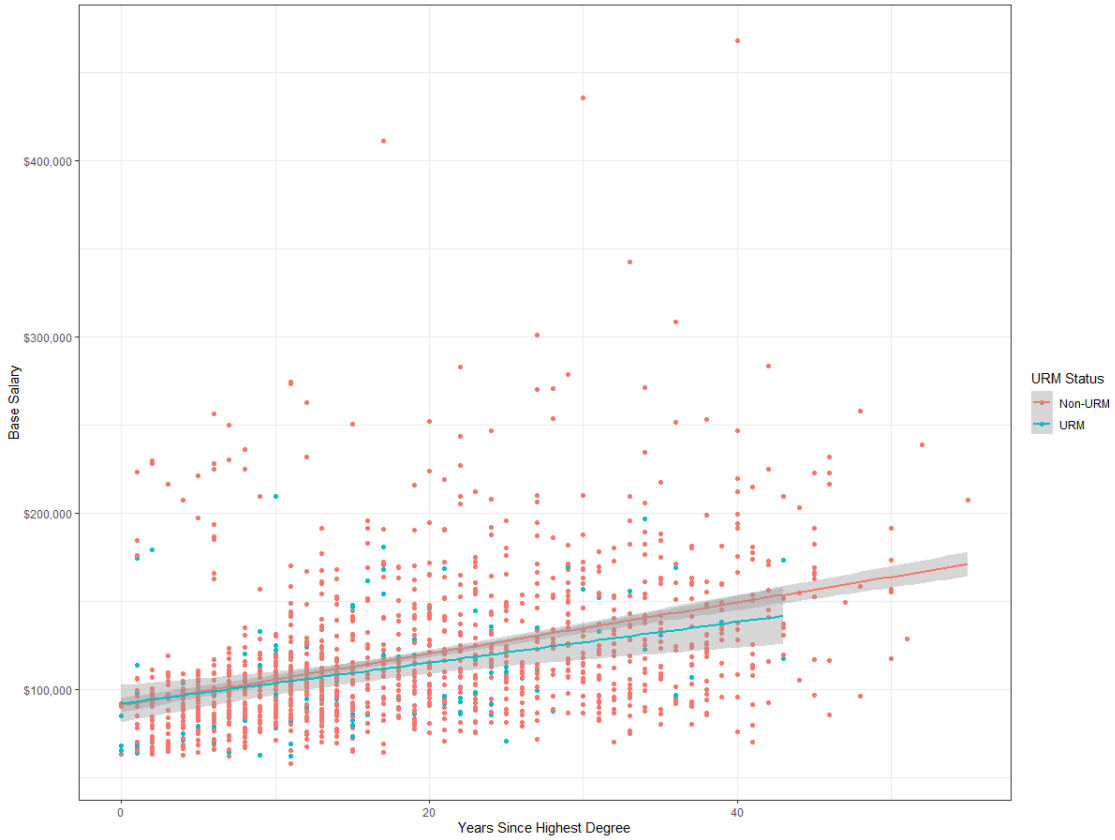

Figure 6. Exploratory linear trend models with 95% confidence intervals for base salary based on *years since highest degree* earned. Data are analyzed by URM status.

Conclusions

In agreement with the previous study, there was no discovery of gender and/or race/ethnicity as a systemic driving factor in VTIF base salaries. The base salary compensation for instructional faculty was best modeled, in order of importance, by college membership, rank, and status as an eminent scholar or distinguished professor. While there is no evidence of systematic inequities in compensation due to demographic factors there is a marked skew in gender and URM status composition within and between ranks. Both groups are less represented within each rank, with the gap intensifying as rank increases. Whether these differences are the result of hiring practices, constraints in applicant pool composition, or higher turnover rates for select employees could not be determined with the dataset used in the current study.