

# Report of the Faculty Compensation Committee (FCC) for 2016-17

*Merlise Clyde, Jon Fjeld, Emma Rasiel, Joshua Socolar (Chair), Patrick Wolf,  
Kimberley Harris (Provost's Office, ex officio)*

## SUMMARY

The 2016 Salary Equity Study covered 932 individuals in tenure track positions in all Duke schools, including the Basic Sciences departments in the School of Medicine but not the Clinical Sciences departments. The latter were the subject of a different study carried out by a committee within the School of Medicine. The 932 faculty covered by the present study excludes 31 faculty who served in primarily administrative roles. The salary data represent 9-month base pay amounts (or equivalents for Divisions/Departments with 12 month appointments or part-time faculty). Supplementary pay such as summer salaries from grants, administrative pay, etc., was not available to the committee and thus was not included.

After adjusting for available background characteristics, which include departmental affiliation, rank, time-in-rank, and rank-at-hire:

- The FCC does not find statistically significant evidence for a systematic difference in the salaries of tenure track faculty by race or by gender at the ranks of Assistant, Associate, Full and Distinguished Professor with the following exception:
- For Distinguished Full Professors, the FCC finds that under-represented minority males have higher (median) salaries than Caucasian males. It should be noted, however, that the small sample size for under-represented minorities leads to substantial uncertainty for the estimate of the percent difference in salary.
- Discrepancies do exist between female and male salaries in population averages at the Division and University levels. The most likely explanation is that the discrepancies result from the combination of having different numbers of women relative to men in different departments and having substantially different salary scales for the different departments. In other words, having more males in higher paying departments leads to a higher average salary for men. The FCC did not reach consensus about whether this reflects a form of bias. The Academic Council and/or the Vice Provost for Faculty Advancement may wish to study the issue further, perhaps through comparative studies if department level data can be obtained from peer institutions. In any case, the AAUP and other aggregated data will continue to show salary discrepancies as long as the correlation persists.
- Results are similar to those obtained in previous years.

These findings are supported by standard Bayesian techniques employing a regression model that takes only the above-mentioned characteristics into account. The

model does not include measures of scholarly productivity, teaching load, or service activity. Similarly, the findings do not reflect any attempt to account for expected influences of market forces on salaries. One might argue, for example, that the higher salaries for under-represented minorities at the Distinguished Professor level should be expected due to higher demand for these scholars. Similar reasoning might suggest that higher salaries would be expected for female faculty, while there appears to be no evidence for such an effect. A meaningful analysis of such issues is beyond the scope of the charge given to the FCC.

The findings also do not reflect any assumptions regarding the sources of discrepancies in salaries between departments. The study does not speak to the question of whether market forces or the bases used at Duke for setting salaries in different departments are equitable. It seeks only to determine whether salaries for female faculty and for under-represented minority faculty are equitable in relation to white males when adjustments are made for existing departmental differences.

The slides delivered at the Academic Council meeting are appended below, followed by an appendix with tables showing the coefficient estimates and 95% posterior intervals for the regression models. An example interpretation of the results in the appendix is as follows: For an Assistant Professor in the department of African and African American Studies, the expected median salary of white males lies between \$84,202 and \$108,991 with 95% confidence. For white females, these numbers should be multiplied by a factor between 0.95 and 1.04 with 95% confidence.

# 2016-17 Faculty Salary Equity Report

March 23, 2017

# 2016-17 Faculty Salary Equity Study

- Study conducted every two years since 2002, excluding 2010.
- Examine Duke faculty salaries for statistical evidence of discrimination based on **gender** and/or **race**.
- Provide information to Provost/Deans about any individual salaries that appear anomalously low based on statistical models.

## Faculty Compensation Committee

---

Merlise Clyde	Statistical Science
Jon Fjeld	Fuqua
Emma Rasiel	Economics
David Siegel	Political Science
Joshua Socolar (chair)	Physics
Patrick Wolf	Biomedical Engineering
Kim Harris (ex officio)	Provost's office

---

# Overall Conclusions from Salary Equity Study

After adjusting for available background characteristics (Departments, Rank, Time-in-Rank, and Rank-at-hire)

- The FCC does not find statistically significant evidence for a systematic difference in the salaries of Tenure Track faculty by Race or Gender at the ranks of Assistant, Associate, Full and Distinguished Professors *with the following exception*
- For Distinguished Full professors, the FCC finds that Under-Represented Minority Males have higher (median) salaries than Caucasian Males, however the small sample size for URM leads to substantial uncertainty for the estimate of the percent difference in salary
- Results are similar to findings from previous years' analyses

# Data Used in Study

- Data provided by David Jamieson-Drake and Kendrick Tatum (Provost's Office of Institutional Research)
- Salaries of 932 individuals in tenure track positions used for analyses
  - Excludes 31 faculty who were in primarily administrative roles
  - Excludes faculty who left the university during the year
  - Salary = 9 month base pay  
(or equivalent for Divisions/Departments with 12 month appointments or part-time faculty)
  - Excludes supplementary pay (Summer, Admin, etc.) which are not available in database
- Minor adjustments: work with David and Kendrick to verify and correct data where salaries were lower than expected (leaves or phased retirements with fractional salaries)

## Number of Positions by Gender and Race/Ethnicity

	Assistant	Associate	Professor	Distinguished
Male	103	134	238	175
Female	70	86	76	50

	Assistant	Associate	Professor	Distinguished
Caucasian	126	162	257	189
Asian	30	36	39	27
URM	17	22	18	9

Because of small sample sizes, we combine all faculty who self-identified as Black, Hispanic/Latinx, Native American, and multi-racial in a group labeled “URM”.

# Comparisons of Populations

- Compare Population Means (or Medians) by Gender and Race for each Rank
- Equity Ratio = Avg Female Salary/Avg Male Salary  $\times$  100
- Salaries aggregated over Division and Departments

## Hypothetical Example

Department	# F	# M	F (\$)	M (\$)	Equity Ratio
Dept A	20	20	100	100	100
Dept B	10	30	200	200	100
<b>Division</b>	<b>30</b>	<b>50</b>	<b>133</b>	<b>160</b>	<b>83</b>

Average salary in thousands of dollars



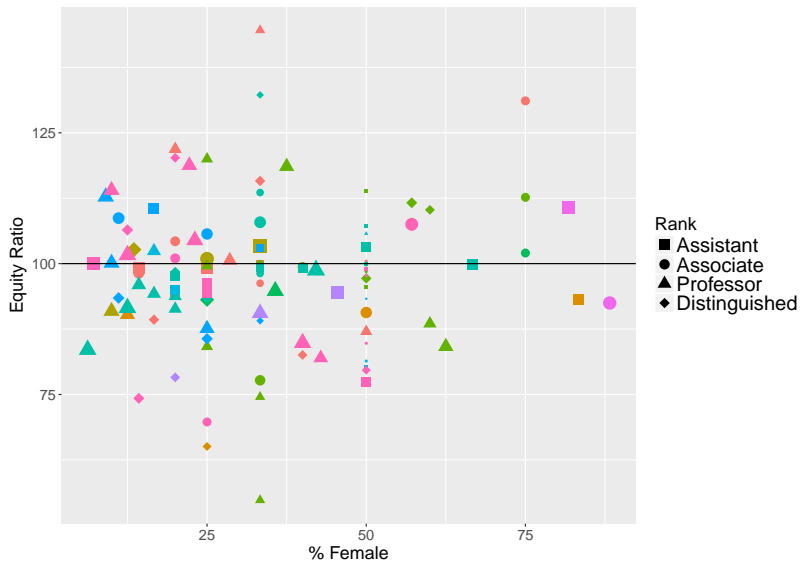
# AAUP Analysis FY 17

## AAUP Summary

Rank	n	Female %	Equity Ratio
Distinguished	196	23	92
Professor	291	24	94
Associate	195	41	91
Assistant	142	43	87

Excludes Basic Sciences, who are not included in the AAUP report

# Gender Equity Ratio by Department and Rank (all)



# Statistical Analysis

Ideally compare salaries of Males to Females or Caucasians to African Americans, Asians who have the same characteristics (Department, Rank, Time in Rank or Time since Degree. . . )

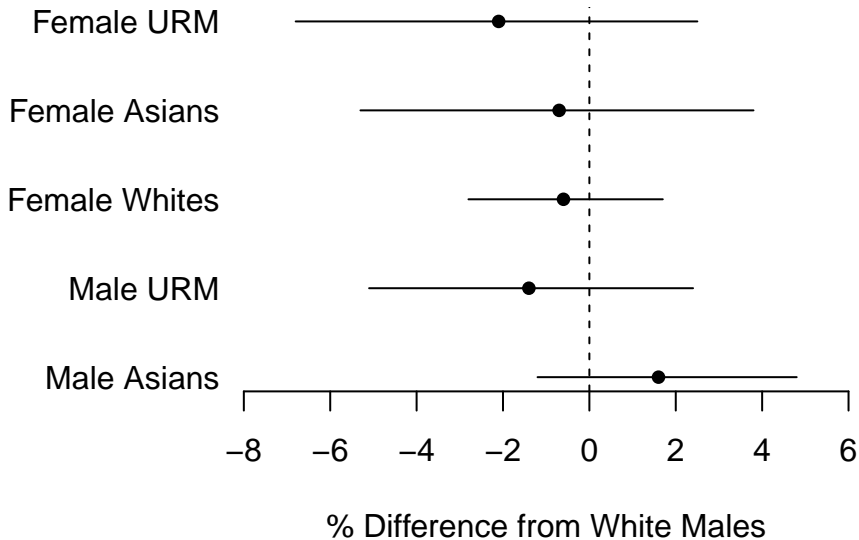
Use regression models to

- Remove differences in salary due to Department, Rank (Asst, Assoc, Full, Dist), Time-in-rank, Rank-at-hire
- After adjusting salaries to remove these effects, do **Race** and **Gender** explain residual differences in salary?
- Limitations: factors that influence salaries such as research productivity are not available in current database  
⇒ residual or unexplained variation

**Statistical Models:** Use robust regression techniques to minimize the influence of rare but extreme salaries in estimating population effects

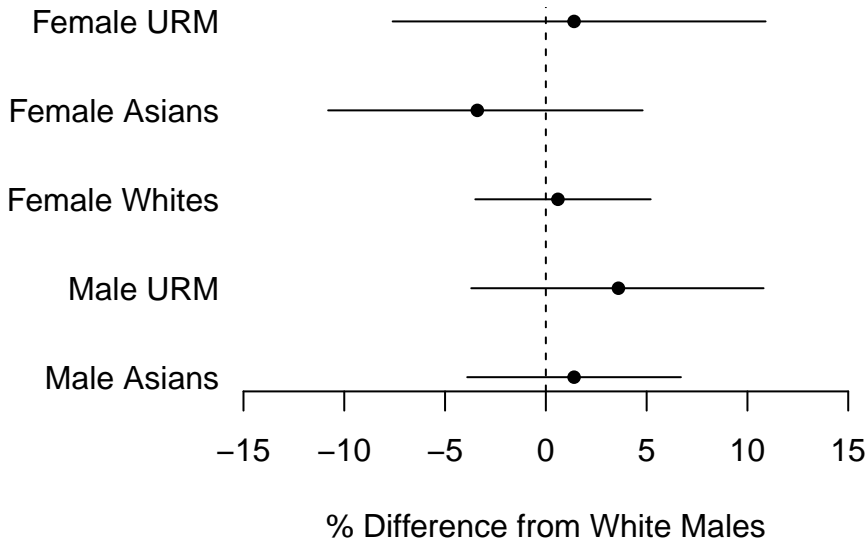
## Assistant Professors (n = 173)

- Model explains **94%** of the variation



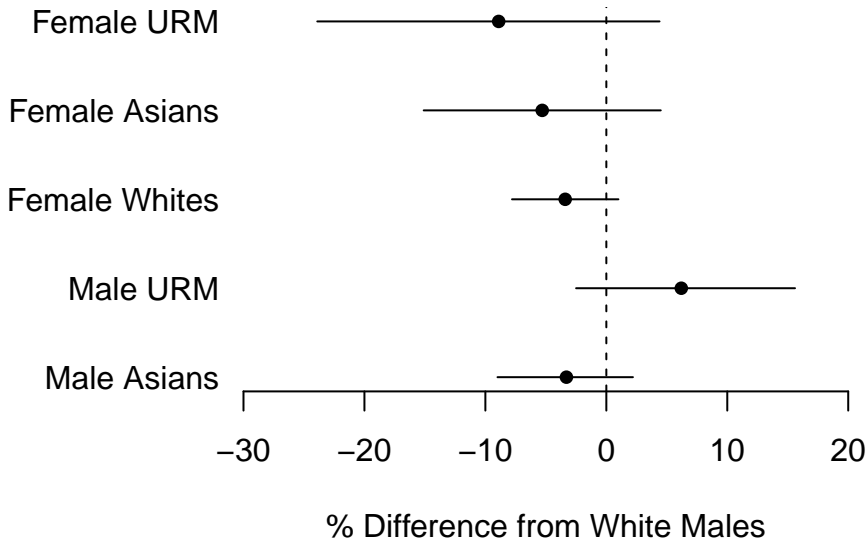
## Associate Professors (n = 220)

- Model explains **83%** of the variation



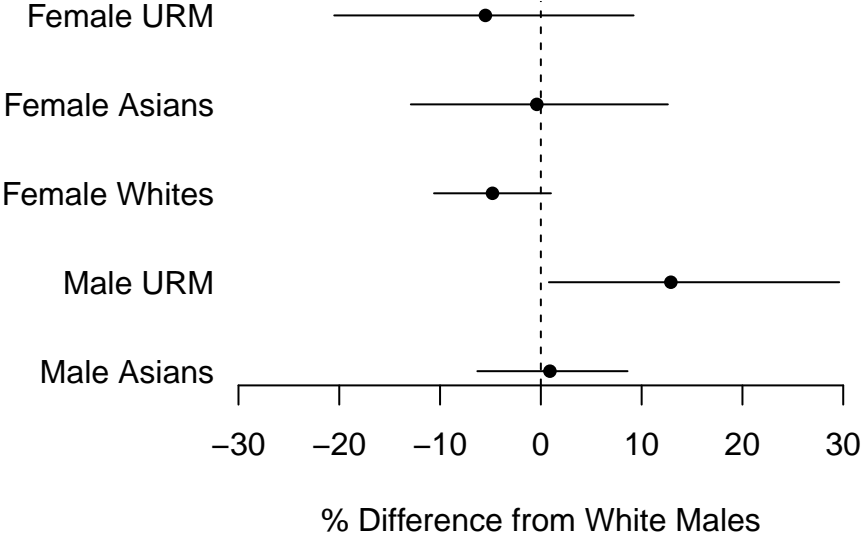
## Statistical Model Full Professors (n = 314)

- Model explains **69%** of the variation



# Distinguished Professors (n = 225)

- Model explains **64%** of the variation



## Overall Conclusions from Salary Equity Study

After adjusting for available background characteristics (Departments, Rank, Time-in-Rank, and Rank-at-hire)

- The FCC does not find statistically significant evidence for a systematic difference in the salaries of Tenure Track faculty by Race or Gender at the ranks of Assistant, Associate, Full and Distinguished Professors *with the following exception*
- For Distinguished Full professors, the FCC finds that Under-Represented Minority Males have higher (median) salaries than Caucasian Males, however the small sample size for URM leads to substantial uncertainty for the estimate of the percent difference in salary
- Results are similar to findings from analyses from previous years

The FCC notes, however, that discrepancies exist in population averages at the Division and University levels, with the most likely explanation attributed to the number of men relative to women at the department level



# Trends

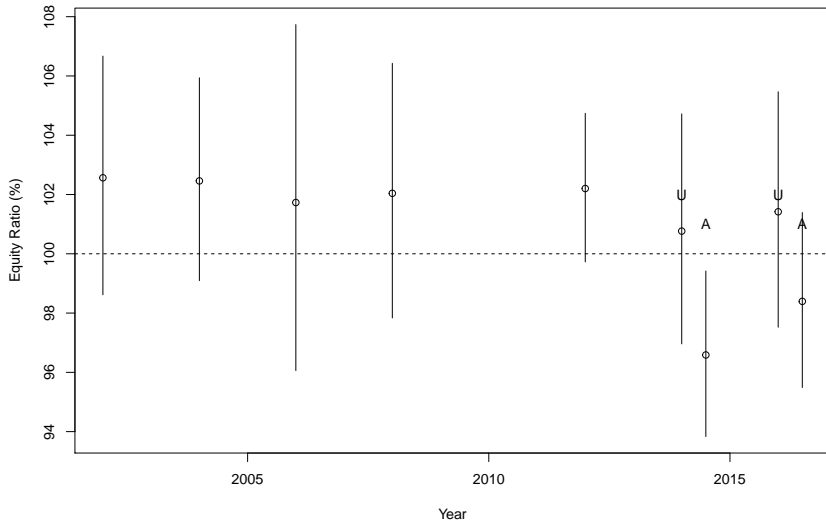
We report interval estimates over time from previous studies

Comments:

- Methodology changed in 2012 (robust regression) and 2014 (additional race categories for Asian and URM)
- for assistant professors, we expect that 7/8 of the observations are common in adjacent plots, so without major salary interventions, intervals in adjacent time periods should be similar

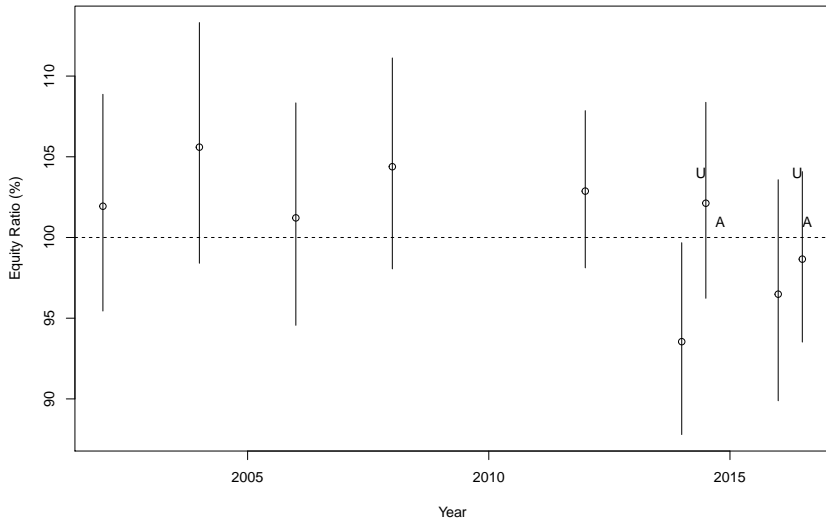
# Trend Assistant Professors Race

Non-Caucasians as a % of Caucasians



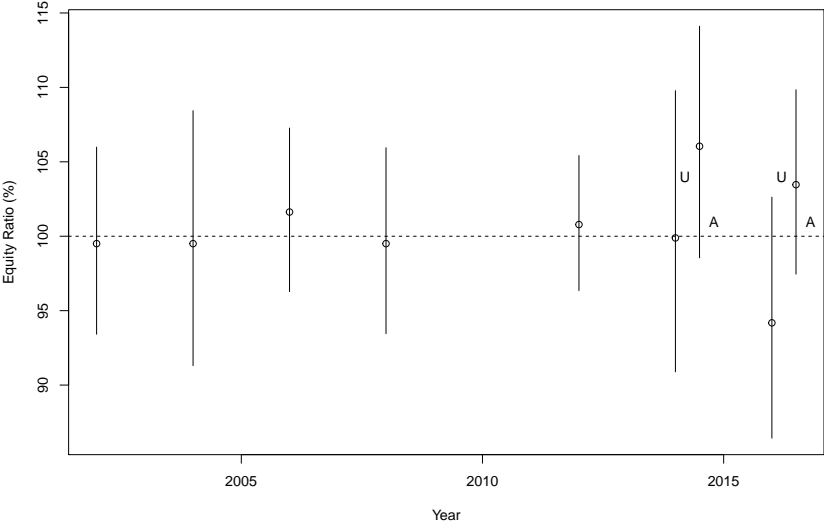
# Trend Associate Professors Race

Non-Caucasians as a % of Caucasians



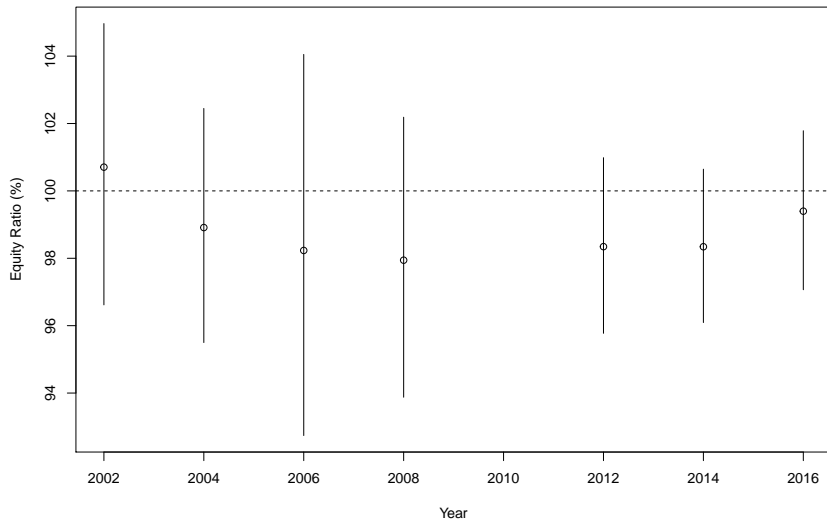
# Trend Full Professors Race

Non-Caucasians as a % of Caucasians



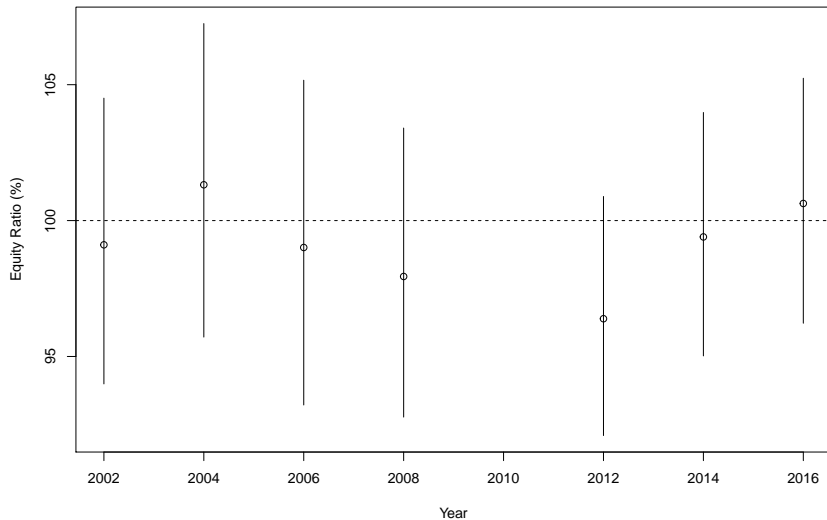
# Trend Assistant Professors Gender

Female as a % of Male



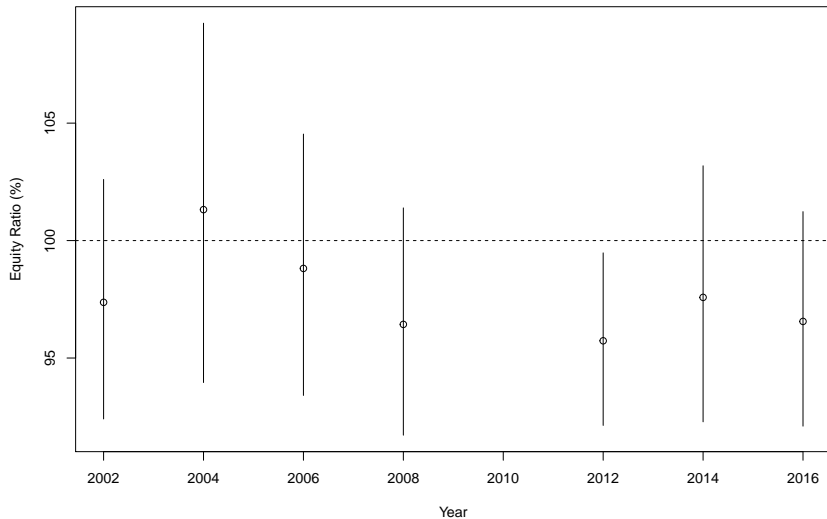
# Trend Associate Professors Gender

Female as a % of Male



# Trend Full Professors Gender

Female as a % of Male



# 2016-17 Salary Equity Study Appendix

Exponentiated coefficients and 95% credible intervals for parameters for salary estimation by each rank.

## Assistant Professors

Covariate	Estimate	95% CI
Female, Asian	0.99	(0.95, 1.04)
Female, URM	0.98	(0.93, 1.02)
Male, URM	0.99	(0.95, 1.02)
Male, Asian	1.02	(0.99, 1.05)
Female, Caucasian	0.99	(0.97, 1.02)
African & African American Studies	96239	(84202,108991)
Art, Art History & Visual Studies	89104	(78314,100016)
Biochemistry	117474	(109731,124332)
Biology	87565	(82936,92220)
Biomedical Engineering	107560	(100780,114702)
Biostatistics & Bioinformatics	148356	(135222,160653)
Cell Biology	116890	(109288,125689)
Chemistry	94916	(90620,100272)
Classical Studies	75991	(69783,83210)
Computer Science	108259	(102062,114280)
Cultural Anthropology	86895	(79370,94475)
Divinity School	71735	(67921,75999)
Economics	163533	(158571,168296)
Electrical and Computer Engineering	108364	(101204,116101)
English	81563	(76176,87563)
Environmental Science and Policy	109684	(102765,115740)
Evolutionary Anthropology	99640	(91276,108543)
Fuqua School of Business	198233	(190087,206053)
Germanic Languages	78802	(72486,85870)
History	81903	(77035,86588)
Immunology	115601	(105607,125074)
Literature	80309	(69816,91377)
Marine Science and Conservation	110341	(97673,124149)
Mathematics	102033	(93780,110470)
Mechanical Engineering and Materials Science	102970	(93514,112300)
Molecular Genetics and Microbiology	118595	(113593,124055)
Music	69682	(59696,79726)
Neurobiology	117448	(112441,122363)
Pharmacology & Cancer Biology	114828	(108747,120872)
Philosophy	90498	(80441,101742)
Physics	91188	(85020,96983)
Political Science	98374	(92047,104963)
Psychology and Neuroscience	89051	(83652,94417)
Religion	91391	(83254,101255)
Romance Language	77577	(72466,82938)
Sanford School of Public Policy	105015	(100607,110136)
School of Nursing	107912	(103166,113126)
Slavic and Eurasian Studies	95910	(84320,107475)
Sociology	105185	(96154,114177)



Covariate	Estimate	95% CI
Statistical Science	105771	(99655,112373)
Theater Studies	75233	(64713,85570)
Womens Studies	91555	(81486,103924)

## Associate Professors

Covariate	Estimate	95% CI
Female, Asian	0.97	(0.89, 1.05)
Female, URM	1.01	(0.92, 1.11)
Male, URM	1.04	(0.96, 1.11)
Male, Asian	1.01	(0.96, 1.07)
Female, Caucasian	1.01	(0.96, 1.05)
8-15 years in rank	1.00	(0.95, 1.05)
16-23 years in rank	0.91	(0.85, 0.98)
24-31 years in rank	0.94	(0.85, 1.02)
32 or more years in rank	0.93	(0.77, 1.08)
First Position at this rank	1.05	(1.01, 1.09)
African & African American Studies	142748	(118455,165628)
Art, Art History & Visual Studies	113947	(97776,132208)
Asian and Middle Eastern Studies	94497	(84838,105821)
Biochemistry	136455	(113592,155513)
Biology	101262	(92120,110382)
Biomedical Engineering	125124	(114359,136970)
Biostatistics & Bioinformatics	166937	(140881,192816)
Cell Biology	126395	(113218,140826)
Chemistry	108173	(97488,121226)
Civil and Environmental Engineering	119275	(106285,130430)
Classical Studies	103446	(88504,117579)
Computer Science	124678	(110321,141304)
Cultural Anthropology	105814	(86751,122320)
Department of Religious Studies	112452	(94764,132336)
Divinity School	91945	(83818,100975)
Earth and Ocean Sciences	119206	(100784,138099)
Economics	251537	(229095,273223)
Electrical and Computer Engineering	130686	(120956,141146)
English	121495	(107304,136413)
Environmental Science and Policy	127078	(113066,139956)
Evolutionary Anthropology	125699	(100385,149240)
Fuqua School of Business	214828	(202567,228911)
Germanic Languages	109345	(93196,125090)
History	102937	(94746,111471)
Immunology	128366	(110996,144702)
Law School	182549	(158674,203710)
Literature	102868	(87062,118815)
Marine Science and Conservation	126197	(113857,138015)
Mathematics	116226	(101160,131623)
Mechanical Engineering and Materials Science	121785	(110825,133997)
Molecular Genetics and Microbiology	134837	(123968,146966)
Music	88965	(74379,102107)
Neurobiology	139896	(121399,158023)
Pharmacology & Cancer Biology	126763	(102278,151234)

Covariate	Estimate	95% CI
Physics	100038	(87866,111705)
Political Science	140968	(125935,155387)
Psychology and Neuroscience	103602	(90680,116987)
Romance Language	112463	(99571,125867)
Sanford School of Public Policy	121502	(108608,136443)
School of Nursing	133336	(122860,143622)
Slavic and Eurasian Studies	123590	(99266,149186)
Sociology	133013	(111700,152279)
Statistical Science	114185	(99616,128068)
Womens Studies	109834	(93301,127035)

## Full Professors

Covariate	Estimate	95% CI
Female, Asian	0.95	(0.85, 1.05)
Female, URM	0.91	(0.76, 1.04)
Male, URM	1.06	(0.97, 1.16)
Male, Asian	0.97	(0.91, 1.02)
Female, Caucasian	0.97	(0.92, 1.01)
8-15 years in rank	1.04	(1.00, 1.08)
16-23 years in rank	0.99	(0.93, 1.05)
24-31 years in rank	0.96	(0.89, 1.04)
32 or more years in rank	0.97	(0.88, 1.06)
First Position at this rank	1.18	(1.13, 1.24)
African & African American Studies	159397	(131420,189838)
Art, Art History & Visual Studies	165439	(139229,196154)
Asian and Middle Eastern Studies	122814	(101907,144359)
Biochemistry	160391	(139434,182664)
Biology	124965	(115785,134842)
Biomedical Engineering	160912	(144437,177401)
Biostatistics & Bioinformatics	206881	(174524,237756)
Cell Biology	149436	(122158,180618)
Chemistry	137852	(121330,155461)
Civil and Environmental Engineering	149962	(133573,166287)
Classical Studies	130458	(113398,149198)
Computer Science	144516	(128965,160191)
Cultural Anthropology	169914	(150373,190903)
Department of Religious Studies	126027	(107592,143193)
Divinity School	105778	(95141,116349)
Earth and Ocean Sciences	141164	(122790,160122)
Economics	241574	(217955,264633)
Electrical and Computer Engineering	180055	(160854,198697)
English	153588	(134533,173181)
Environmental Science and Policy	160179	(140576,178839)
Evolutionary Anthropology	133343	(116699,149013)
Fuqua School of Business	215921	(192700,241021)
History	141659	(127850,157843)
Immunology	167520	(136445,199797)
Law School	213231	(194116,232148)
Literature	198757	(170181,226621)
Marine Science and Conservation	147303	(121451,175295)

Covariate	Estimate	95% CI
Mathematics	145318	(134619,157336)
Mechanical Engineering and Materials Science	176881	(161717,195604)
Molecular Genetics and Microbiology	182488	(152701,215523)
Music	117714	(101329,134465)
Pharmacology & Cancer Biology	174025	(155147,196250)
Philosophy	138019	(115939,163327)
Physics	121264	(111810,130520)
Political Science	178293	(162443,193533)
Psychology and Neuroscience	160818	(146458,174019)
Romance Language	148816	(132330,164248)
Sanford School of Public Policy	179963	(161701,196301)
School of Law	237200	(180255,294205)
School of Nursing	176255	(130790,214940)
Slavic and Eurasian Studies	144322	(111190,179593)
Sociology	177348	(157486,196397)
Statistical Science	179274	(157976,204932)
Womens Studies	129429	(103722,154578)

## Distinguished Professors

Covariate	Estimate	95% CI
Female, Asian	1.00	(0.87, 1.13)
Female, URM	0.95	(0.80, 1.09)
Male, URM	1.13	(1.01, 1.30)
Male, Asian	1.01	(0.94, 1.09)
Female, Caucasian	0.95	(0.89, 1.01)
8-15 years in rank	1.01	(0.96, 1.08)
16-23 years in rank	1.01	(0.95, 1.08)
24-31 years in rank	0.97	(0.90, 1.04)
32 or more years in rank	0.96	(0.87, 1.05)
First Position at this rank	1.09	(1.04, 1.15)
Art, Art History & Visual Studies	179208	(153691,208958)
Asian and Middle Eastern Studies	192818	(141181,243505)
Biochemistry	221894	(188366,256008)
Biology	167034	(143956,192554)
Biomedical Engineering	197985	(174274,220627)
Cell Biology	242205	(210686,276638)
Chemistry	232628	(201839,266051)
Civil and Environmental Engineering	198970	(162248,237868)
Computer Science	224746	(197224,253576)
Cultural Anthropology	217498	(160387,273001)
Divinity School	160031	(128981,199390)
Earth and Ocean Sciences	206816	(157428,256276)
Economics	302438	(263147,345507)
Electrical and Computer Engineering	221664	(193296,249725)
English	222679	(191564,249486)
Environmental Science and Policy	196619	(173197,222223)
Evolutionary Anthropology	193333	(143669,242186)
Fuqua School of Business	316660	(292644,339069)
History	199970	(169194,232984)

Covariate	Estimate	95% CI
Immunology	227965	(183587,272997)
Law School	276273	(254034,301341)
Literature	243480	(206730,282704)
Marine Science and Conservation	194334	(156577,234112)
Mathematics	235531	(198866,283286)
Mechanical Engineering and Materials Science	213161	(180143,247306)
Molecular Genetics and Microbiology	261223	(219253,301645)
Music	176430	(137017,217501)
Neurobiology	264369	(218348,317709)
Pharmacology & Cancer Biology	232122	(199561,269489)
Philosophy	168486	(143288,194115)
Physics	176597	(139645,216979)
Political Science	269016	(233927,305085)
Psychology and Neuroscience	215041	(182023,246010)
Religion	192209	(145187,243935)
Sanford School of Public Policy	215298	(178456,253551)
School of Law	252649	(189918,331872)
School of Nursing	228693	(187115,272079)
Slavic and Eurasian Studies	178730	(129019,236781)
Sociology	212195	(179526,248742)
Statistical Science	247965	(211131,292887)
Womens Studies	231110	(179050,294916)