Senate-Administration Faculty Equity Review Workgroup
General Campus and Scripps Institute of Oceanography
Report – August 2017

1. Background and Charge

In December 2014, a Senate-Administration Faculty Equity Review workgroup was charged to review the General Campus/ SIO and Health Sciences pay equity studies and make recommendations regarding future studies. In May 2015, the workgroup issued an interim report, which highlighted three primary areas that the current workgroup needed to focus:

1. Convene campus experts in labor economics and statistics "to define and implement the next generation of faculty salary equity models" and explore the incorporation of "productivity measures into the model."
2. "Define a study of faculty rate of advancement in different departments." This analysis "should also provide information on any inequities based on gender and ethnicity."
    - Conduct a proof of concept on smaller subset
    - Possible variables to consider:
        - Years to tenure
        - Years to Full Professor
        - Years to Professor, Step VI
        - Years to Above Scale
3. "Recommend a structure of a faculty salary scatter plot and an individual history plot (both scale and market off-scale) to be included in faculty files as part of the academic review process."

In June 2016, the workgroup was reconvened with campus experts in labor economics and statistics (see Appendix for workgroup membership). The workgroup met five times during the year. During this time, two of the committee members, Peter Shearer and Kate Antonovics, performed their own analyses of salary data that were made available to the committee and gave several presentations describing their results. They were asked to write up their results and their report is here included as Section 2 of this document.

2. Analysis of UCSD Professor salaries with focus on gender differences

Introduction

In 2012, UC President Yudof asked the campuses to begin conducting salary equity studies of possible gender or race/ethnicity issues. In response, UCSD has now conducted two salary analyses, the most recent in 2016. These have been used to identify faculty with salaries that fall substantially below that predicted by a regression model that takes into account factors such as years from highest degree, etc., and flag them for possible spot compression adjustments.

Beginning in 2014, two successive Senate-Administration Faculty Equity Review Workgroups have been charged with reviewing the General Campus/SIO and Health Sciences pay equity studies and making recommendations regarding future studies. The raw data used in the most recent UCSD General Campus/SIO survey (excluding Heath Sciences) was made available to the Workgroup and two committee members (Peter Shearer and Kate Antonovics) conducted their own analyses of the data. This is a report summarizing their findings.

The UCSD regression model

This model was originally developed by Professor Mathew McCubbins (Political Science) and has been used for a number of UCSD pay equity studies starting in 2002. It performs nonlinear regression analysis to fit log salary as a function of a number of model parameters, which include gender, ethnicity, years from highest degree, years at UCSD, and department or division. The regression results indicate that women are currently paid about 5% less than men, after controlling for the other factors, while there are too few data to draw statistically significant conclusions about ethnicity differences.

The regression model is based on methods used in labor economics and has the advantage at this point that the same approach has been used in many successive studies, so that changes with time can be easily measured. However, the model does have some problems and limitations:

(1) It uses a single coefficient to adjust for average salary differences among departments and divisions, which does not properly account for differences in average advancement rate. This biases the results for divisions in which the average advancement rate is higher (e.g., Biology, SIO) or lower (e.g., Rady) than the UCSD average.

(2) It is based on least-squares regression that assumes a log-normal distribution of salaries. However, in some divisions there are a small number of anomalously high salaries (outliers) that bias the results by inflating the average salary above the bulk of the faculty.

(3) It operates largely as a "black box" that produces regression coefficients and their uncertainties, but does not provide plots showing how well the model fits the data, or insights regarding the origins of any salary inequities (e.g., starting salary, advancement rate, MOS, etc.).

To address these issues, we performed two independent analyses of the 2015–16 salary data for the general campus and SIO. Although these analyses used very different methods, our conclusions regarding gender differences are similar, which gives us confidence that our results are robust and reliable.

Peter Shearer's analysis

My strategy is to make plots of the salary data to identify trends and differences before deciding on a modeling strategy. Figure 1 shows 2015 UCSD salaries for 975 faculty (all 9-month equivalent) plotted as a function of years from highest degree. I focus on years from highest degree for two reasons: (1) Past UCSD regression analyses indicate that it is much more important than years at UCSD for predicting salary, and (2) It is a natural proxy for professional experience.

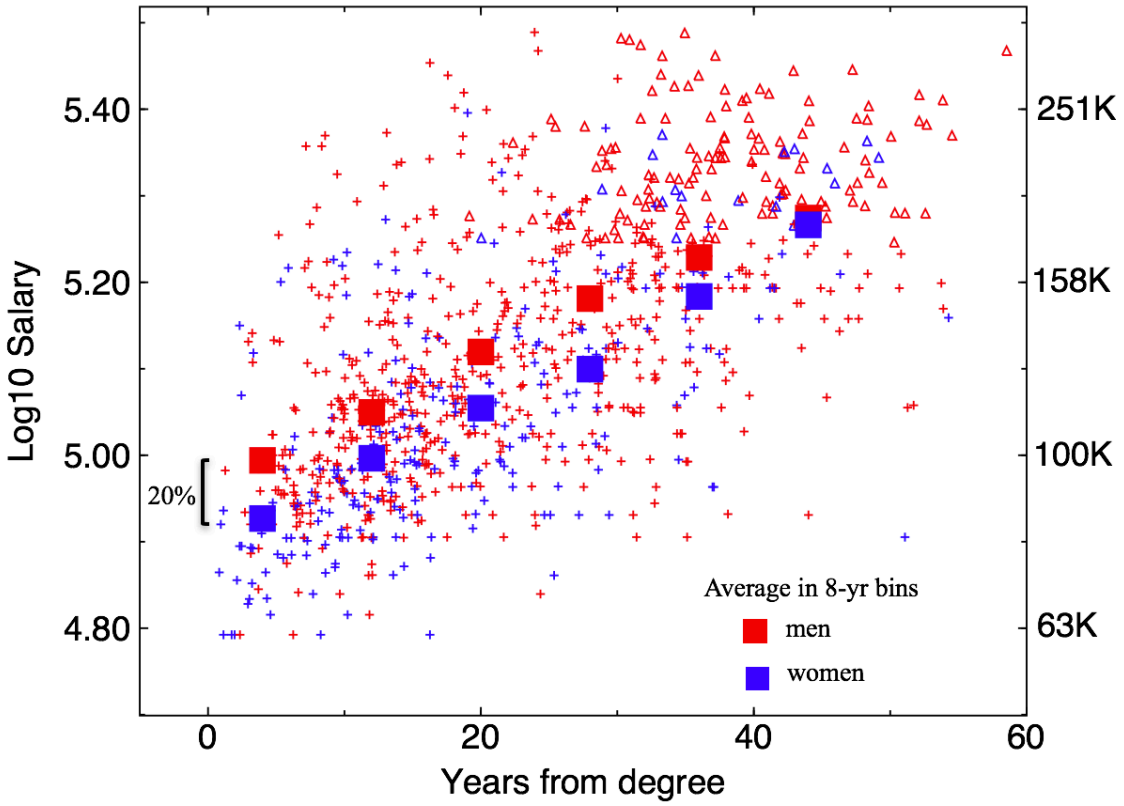

Figure 1. UCSD annual log salary versus years from highest degree. Women are shown in blue and men in red. Above Scale (AS) salaries are plotted as triangles. The solid squares show average values within 8-year time intervals.

Several trends are apparent in Figure 1. UCSD salaries have huge variations (factors of 2 or more) even at similar career stages. Average log salary grows roughly linearly with years from degree. On average, women across UCSD are paid about 20% less than men with similar years of experience. However, much of this gap can be explained by variations in average salary among different divisions at UCSD.

These divisional differences are shown in Figure 2. The STEM fields, Economics, GPS, and the Rady School are more highly paid, and tend to have proportionally more men. This explains most of gender salary gap, but not all of it, as the male averages (red squares) tend to be above the female averages (blue squares) in many cases.

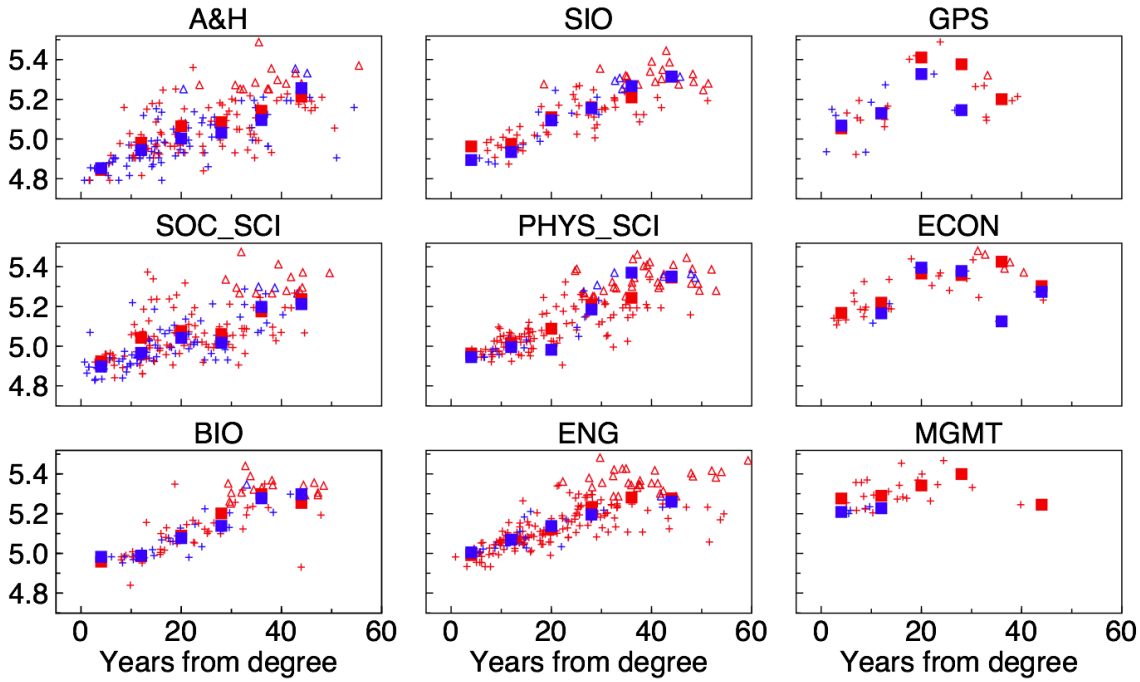

Figure 2. Divisional plots of UCSD annual log salary versus years from highest degree. Women are shown in blue and men in red. The solid squares show average values within 8-year time intervals. (A&H: Arts and Humanities, ENG: Engineering, MGMT: Rady)

Modeling strategy and results

How should these data be modeled? The current UCSD regression model fits the salary versus years-from-degree trends with both linear and quadratic terms, but includes only a single coefficient per division to account for average salary differences among divisions. This is clearly inadequate because the slopes shown in Figure 2 also vary, for example SIO shows a greater salary increase with time than Engineering or Management. But even if separate fits are performed for the data in each Division, there are limitations to the linear+quadratic approach, as such smooth functions may not fully account for the structure seen in these plots.

As an alternative to regression analysis for model coefficients, a simple approach is to compare faculty salaries to the average salary of their contemporaries. Figure 3 shows 8-year running mean salaries for the nine divisions. The residual salary for an individual faculty member is defined as the difference between their log salary and this running mean, i.e., any salary difference between them and their divisional contemporaries within 4 years of their degree date. It should be noted that the 8-year averaging interval is somewhat arbitrary, but the results described here are not particularly sensitive to this choice, i.e., using a 6-year or 10-year interval yields virtually the same divisional and gender differences.

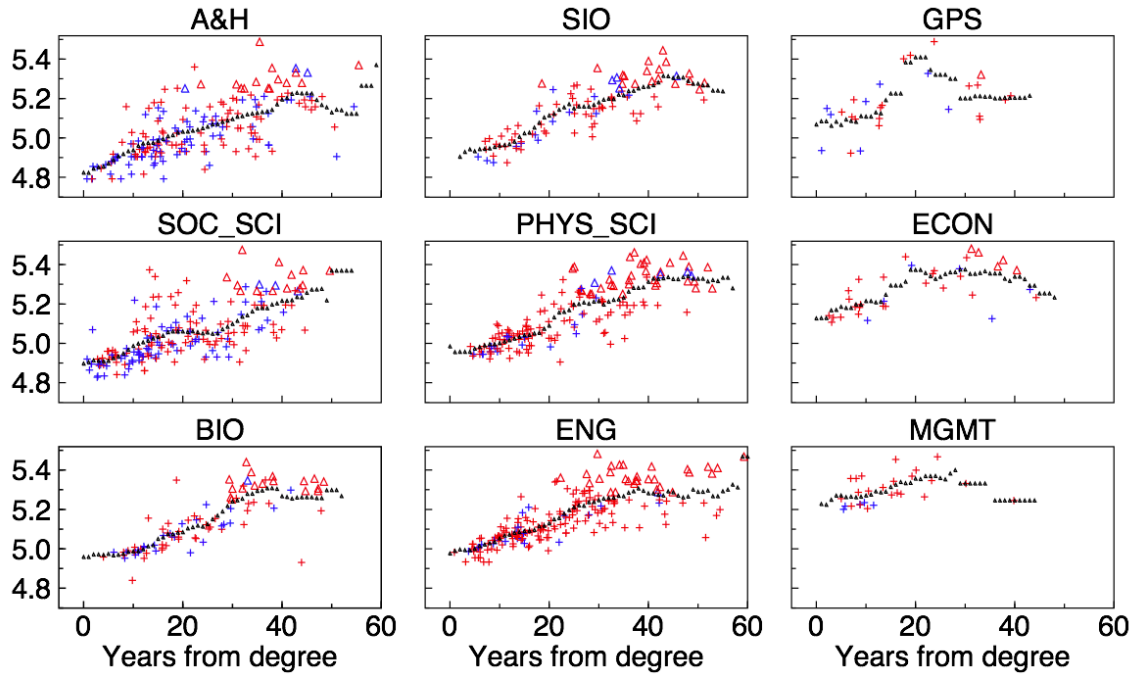

Figure 3. Divisional plots of UCSD annual log salary versus years from highest degree. Women are shown in blue and men in red. The small black crosses show the 8-year running mean.

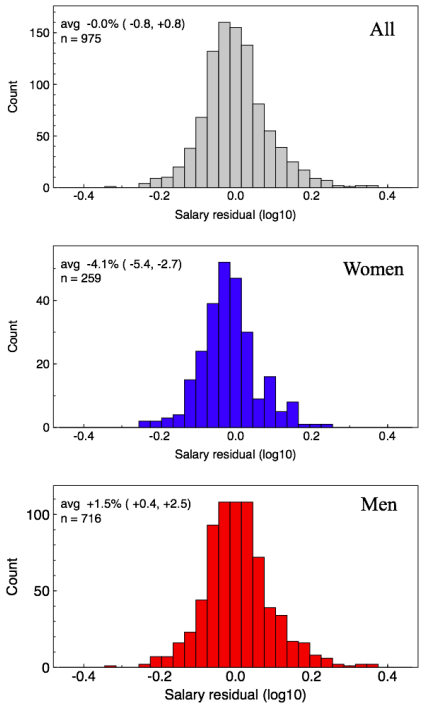

Figure 4. Histograms of log salary residual (log salary minus log salary of contemporaries), for all of UCSD (top), women (middle), and men (bottom). Average residuals and their 90% uncertainty intervals based on bootstrap resampling are labeled in the upper left of each panel.

Figure 4 plots histograms of the resulting residual salaries. UCSD women are paid an average of 4.1% less than their contemporaries (within 4 years of the same degree date) within the same division and men are paid an average of 1.5% more. This gender gap of

5.6% is statistically significant and is caused in part by a more skewed salary distribution for men, in which a small number have anomalously high salaries (note that all the faculty with salaries more than twice the average salary are men).

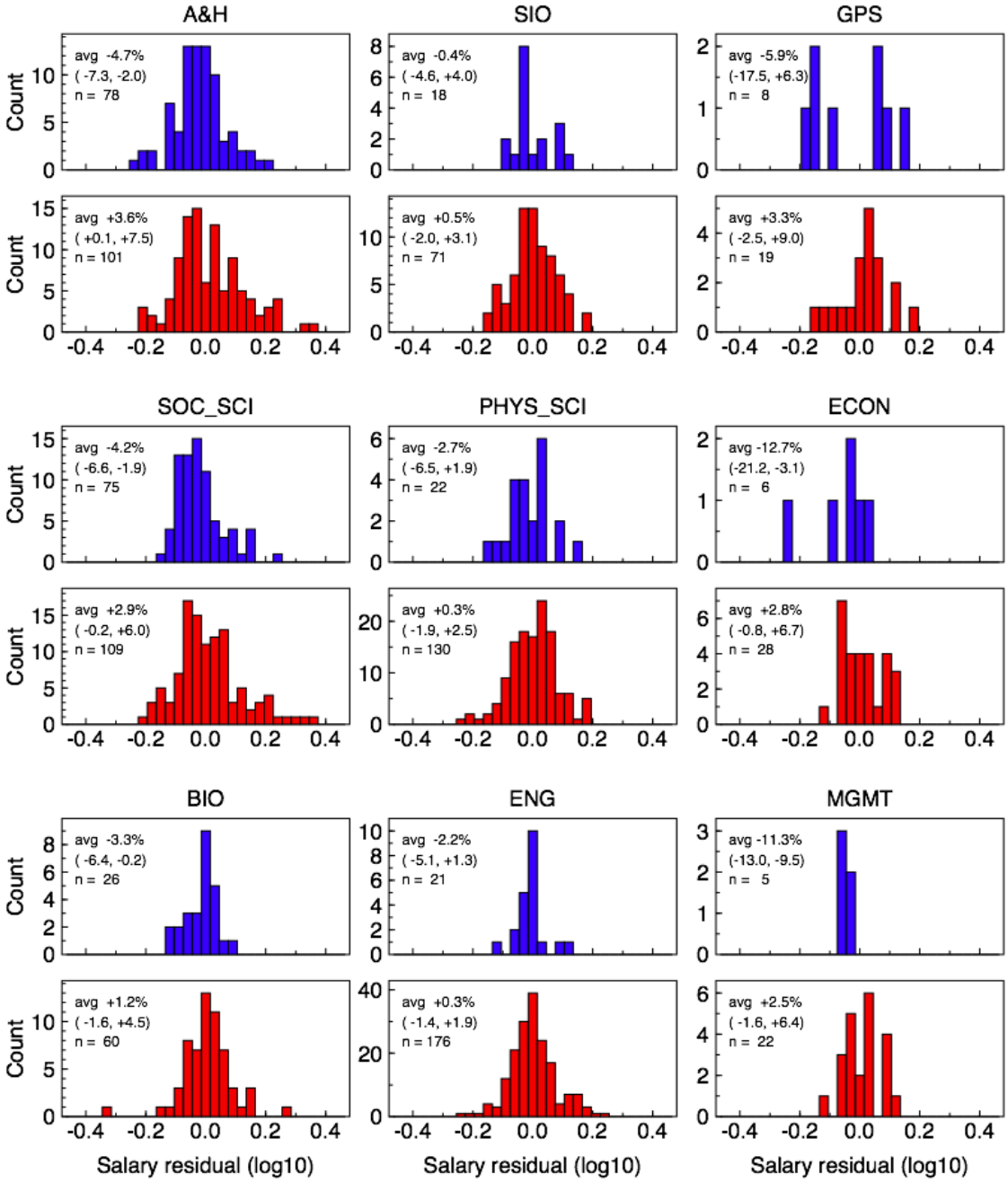

Figure 5. Histograms of log salary residual based on average salaries by division and gender (blue=women, red=men). Average residuals and their 90% uncertainty intervals based on bootstrap resampling are labeled in the upper left of each panel.

Similar plots for the different divisions are shown in Figure 5. Comparing faculty at similar years from degree, it is noteworthy that *all* UCSD divisions pay women less on average than men. There is a large, statistically significant gender gap in salaries of Arts

& Humanities and Social Science (8.3% and 7.1% respectively), a large gap of marginal statistical significance for Biology, GPS, Economics, and Management (4.5%, 9.2%, 15.5%, and 13.8%, respectively), and a small gap of no statistical significance for Engineering, Physical Science, and SIO (2.5%, 3.0%, and 0.9%, respectively). Note the most anomalously high male salaries are concentrated in Arts & Humanities and Social Science. These outliers will lead to high salary averages that may not be representative of the bulk of the faculty.

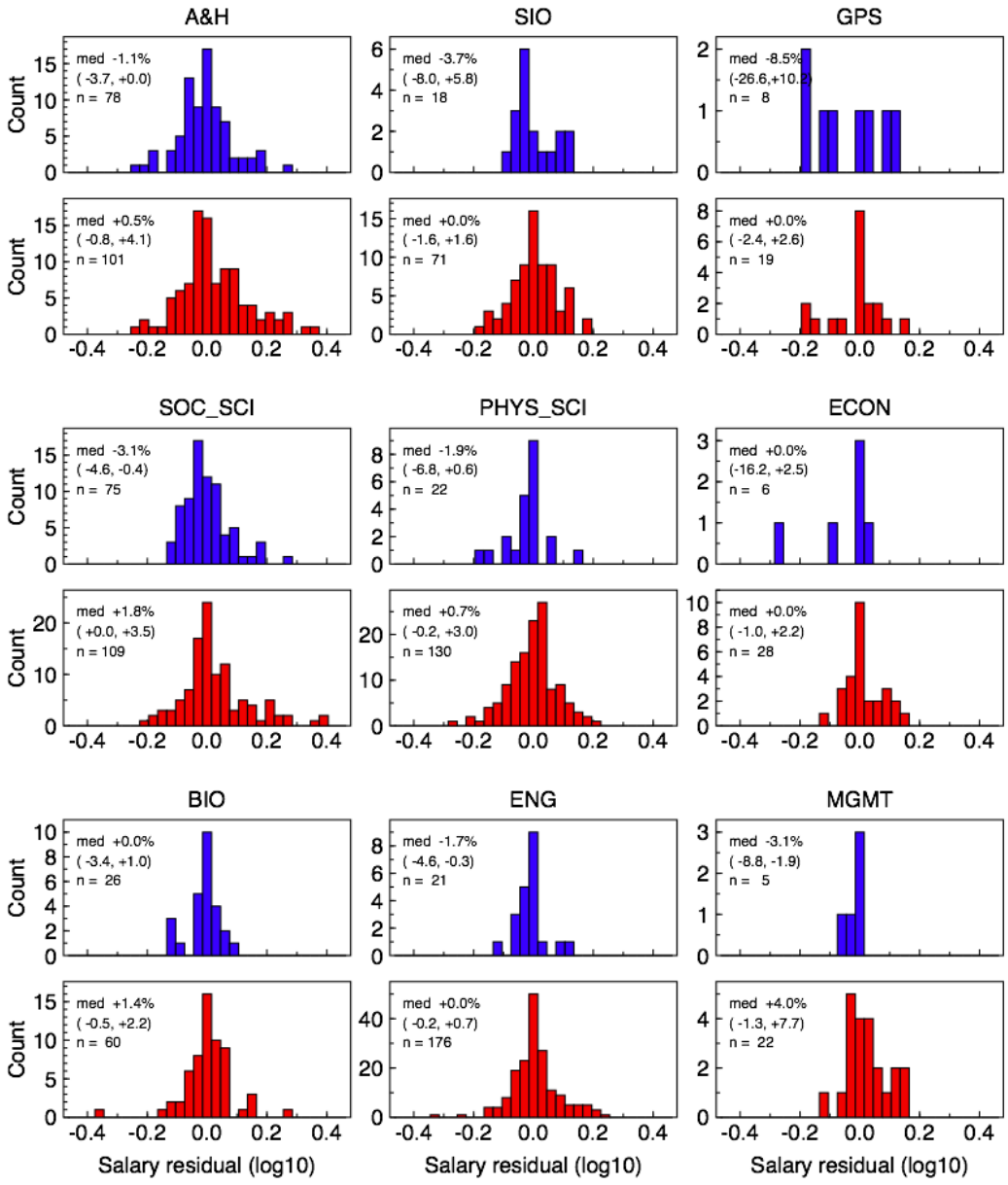

Figure 6. Histograms of log salary residual based on median salaries by division and gender (blue=women, red=men). Median residuals and their 90% uncertainty intervals based on bootstrap resampling are labeled in the upper left of each panel.

Analogous results for median salaries

The average value is a solution to a least-squares minimization problem and is thus subject to the same biases due to outliers as the existing UCSD regression approach. A more robust measure of a distribution is provided by the median, because it is much less sensitive to extreme values. Overall, UCSD women are paid 1.9% less than the median salary of their divisional contemporaries within 4 years of the same degree date and men are paid 0.2% more. This median gender gap of 2.1% is statistically significant, but is much less than the 5.6% gap in average salaries because of the insensitivity of the median to the small number of extremely high male salaries.

Figure 6 plots residual histograms by Division and gender for UCSD faculty compared to the median salary of their contemporaries within 4 years of the same degree date. There are statistically significant gender gaps for Social Science, Engineering, and Management (4.9%, 1.7%, and 7.1%, respectively), statistically insignificant gaps in Arts & Humanities, Biology, SIO, Physical Sciences, and GPS (1.6%, 1.4%, 3.7%, 2.6%, and 8.5%, respectively), and no gap for Economics. However, it should be noted that there is no Division in which men have a lower median salary than women of similar degree age.

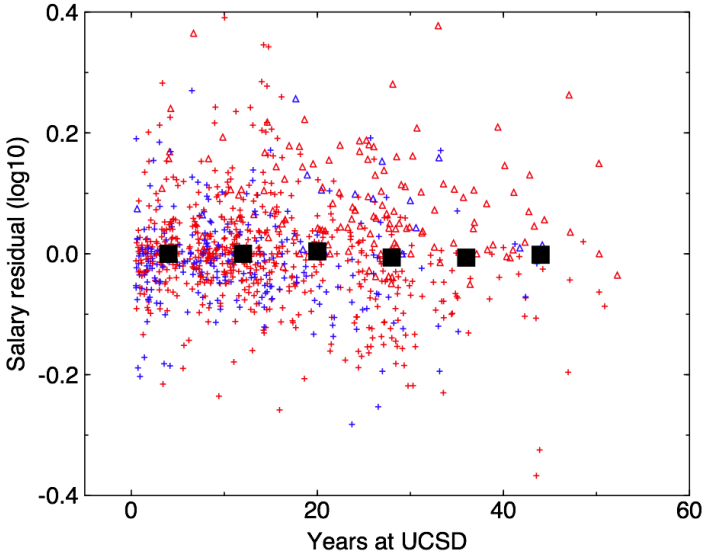

Figure 7. UCSD salary residuals (after accounting for years from degree and divisional differences) versus years at UCSD. Women are shown in blue and men in red. Average values in 8-year intervals are shown as black squares. Results based on median residuals are similar, i.e., show no trend with UCSD years.

Discussion

The gender difference in salaries is seen for early through mid-career faculty, but nearly vanishes for senior faculty (more than 30 years post-degree):

Years from degree	Mean salary difference	Median salary difference
0 – 15	6.0%	3.0%
15 – 30	6.7%	3.7%
30 – 45	0.7%	0.0%

There is sometimes talk of a "loyalty tax" in which long-time UCSD faculty suffer lower salaries compared to high-level recruitments from outside. If this was a significant factor in faculty salaries, then one might expect to see some negative correlation between salary and years at UCSD and indeed the 2012 UCSD pay equity study found such a negative correlation. However, the regression coefficient obtained was an order of magnitude smaller than the corresponding coefficient for years from degree, suggesting this is not a strong factor. Indeed, years at UCSD has no predictive value for salaries in the results presented here, once the years from degree trends are removed (see Figure 7).

Factors contributing to salary differences

Differences in current UCSD salaries may arise from three different factors: (1) initial rank and step at time of appointment, (2) rank and step advancement rate, and (3) current market off-scale salary (MOS) component. One could further divide (3) to consider the time that the MOS was awarded, but I do not attempt that here.

Figure 8 plots histograms of starting salary residuals (excluding MOS) for current UCSD faculty, after accounting for division and years from degree. Because base salary is entirely a function of rank and step within each division, this is a proxy for rank and step differences at the time of initial appointment. There is an *average* starting salary deficit of 2.8% for females compared to males, but this gap disappears entirely for *median* starting salaries. This suggests a skewed distribution, in which a small number of males are hired at a much higher rank/step than is typical for their years of experience

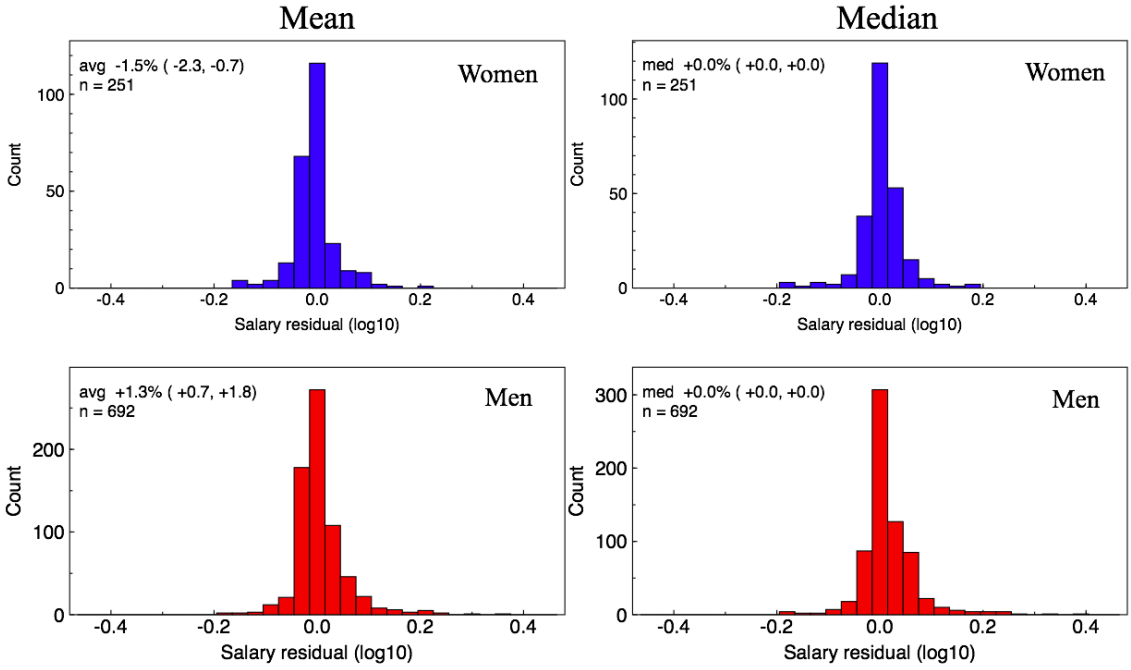

Figure 8. UCSD starting base salary residuals (excluding MOS), with respect to mean salaries (left) and median salaries (right). Women are shown in blue and men in red. Mean/median residuals and their 90% uncertainty intervals based on bootstrap resampling are labeled in the upper left of each panel.

Faculty advance at UCSD at different rates, depending upon how many accelerations and no-change actions they receive when their files are reviewed. To quantify these differences, let us define an advancement factor, *af*, as

$$af = T_{\text{normal}} / T_{\text{actual}}$$

where T_{normal} is how many years it would take a faculty member to reach their current rank/step from their starting rank/step, assuming normal merit advancement from each on-cycle reviews, and T_{actual} is how many years have actually elapsed from the appointment date. Note that $af = 1$ for standard merit advancement, $af = 2$ for faculty who are accelerated at every review, and $af < 1$ for faculty who have received some no-change actions (and no accelerations).

Advancement factors can be computed more reliably for faculty who have been at UCSD for many years. The following table shows average *af* values for faculty at least 8 years from their appointment:

	mean advan. factor		
Div	all	women	men
ENG	1.14	1.05	1.16
PHYSSCI	1.12	1.13	1.12
SIO	1.08	1.28	1.04
BIO	1.07	1.04	1.08
MGMT	1.01	*	*
ECON	0.98	*	*
GPS	0.94	*	*
SOCSCI	0.92	0.82	0.92
A&H	0.91	0.83	0.90

The starred (and suppressed) cells for women are unreliable because they are based on very small numbers. The corresponding cells for men in those divisions also have been suppressed. Note that the STEM fields generally enjoy higher advancement rates. Women advancement more slowly than men in most divisions (SIO is a notable exception) and are likely a contributing factor to the salary gap in Engineering, Social Science, and Arts & Humanities.

Market off-scale (MOS) salary components are another important contributing factor to salary differences among faculty. Figure 9 plots 2015 MOS salaries by division, rank, and step. The dashed lines show the mean MOS for women and men at each rank, excluding Above Scale salaries. There is large scatter in MOS particularly for Full Professors. Most MOS are less than $30K, but there are a small number of very high MOS, which tend to be disproportionately male. For example, Social Science has 7 Full Professors with MOS of more than $50K, all of which are men. Although MOS is undefined for Above Scale faculty, very high AS salaries also tend to be male dominated. Both of these factors contribute to the skewed salary distribution for men discussed earlier.

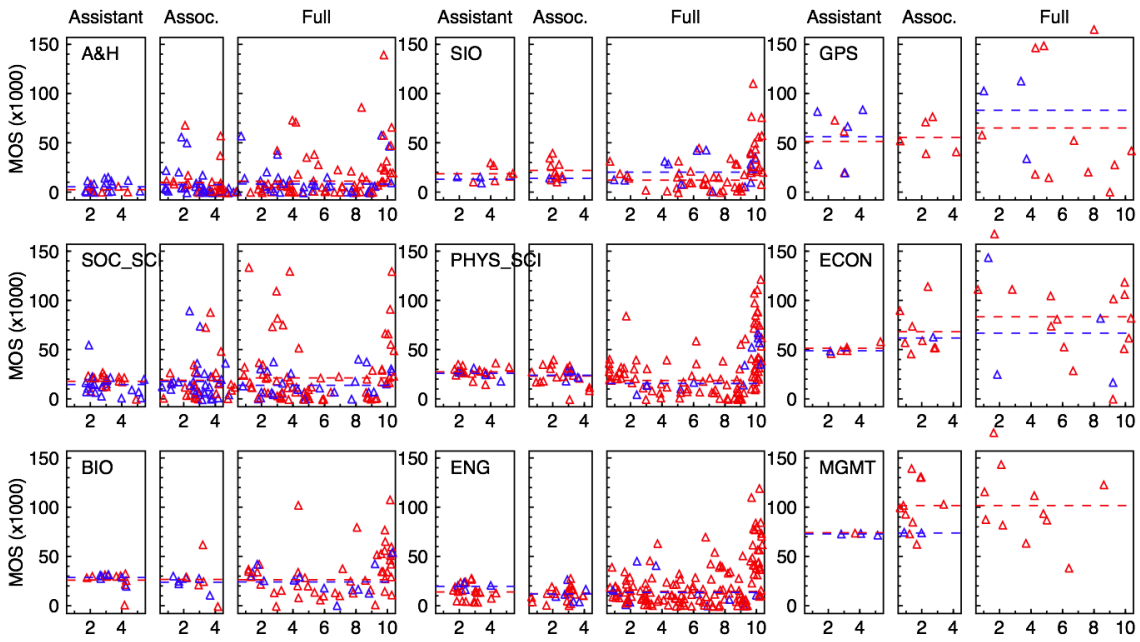

Figure 9. Market off-scale (MOS) salary components by division, rank, and step. Women are shown in blue and men in red. For comparison purposes, Above-Scale (AS) faculty are plotted at Step 10, with a pseudo MOS defined as the amount their current salary exceeds that of the "normal" initial AS salary for someone with no MOS. The dashed lines show the mean MOS at each rank (excluding the pseudo MOS for AS faculty).

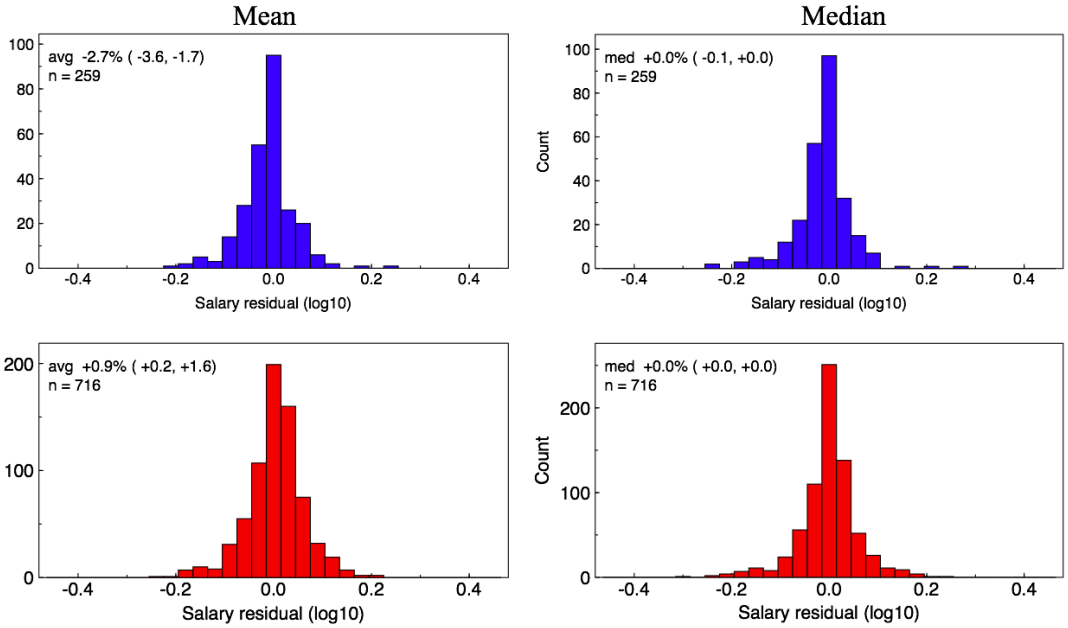

Figure 10. Base salary (i.e., from salary scales, no BOS or MOS) residuals with respect to mean salaries (left) and median salaries (right). Women are shown in blue and men in red. Above Scale faculty are excluded. Mean/median residuals and their 90% uncertainty intervals based on bootstrap resampling are labeled in the upper left of each panel.

Another way to consider the effect of MOS on salaries differences is to analyze base salaries alone. Figure 10 plots base salary residuals for women and men, computed using the same method used to produce Figures 4–6, i.e., by comparing faculty to the base salary of their contemporaries in the same division. Women are paid an average of 2.7% less than the UCSD average and men are paid an average of 0.9% more, for a gender salary gap of 3.6%. However, the gender gap vanishes entirely for median base salary residuals. By comparing to the previous results for total salary, it is apparent that excluding MOS salary components reduces the gender gap in mean salary from 5.6% to 3.6% and the gender gap in median salary from 2.1% to 0.0%.

Summary

- Divisions at UCSD with the highest salaries tend to have proportionally fewer women.
- However, even after taking Divisional differences into account, women are paid less than men at similar years from highest degree. The mean and median salary differences are 5.6% and 2.1%, respectively.
- The mean vs. median difference is caused by a skewed salary distribution, with a small number of men having anomalously high salaries.
- The mean salary difference arises from male/female differences in starting step, advancement rate, and MOS.
- The median salary difference is almost entirely due to differences in MOS.

Kate Antonovics' analysis

Building on insights from Peter Shearer's analysis above, my goal was to develop a regression-based model (similar to that in the 2012 Faculty Equity Report) for understanding salary differentials by race and gender. The goal of this model was not only to quantify race and gender salary differentials, but also to determine whether these differentials (if any) arise due to differences in starting salary or differences in rate of advancement. In addition, my hope was that this model could be used to identify individuals whose salaries are substantially less than would be predicted given their department, years since degree and years since ladder rank hire.

There are several key ways in which my regression-based model diverges from the analysis in the 2012 Faculty Equity Report.

1. I base my main analysis solely on salary data for the 2015-16 academic year, which is the most recent academic year for which data were available. The 2012 Faculty Equity report used data from July 1997 to October 2011. I focused only on the most recent year since salary data are highly correlated over time and since I wanted to estimate a model that best describes the current relationship between an individual's characteristics and his or her wages.
2. My model accounts for the fact the growth rate of salaries may differ by department. This is accomplished by including an interaction term between an individual's department and the number of years since he/she was hired in a ladder-rank position at UCSD. Including this interaction terms is important since salaries grow at different rates in different departments, and models that fail to account for this will not do a good job of predicting wages for individuals in departments where average wages grow either more or less quickly than average.
3. While my model controls for years since ladder rank faculty hire (*yrslrf*) and years since degree (*yrsdg*), unlike the 2012 study, my main specifications do not

include the square of these terms. In my analysis, the estimated coefficients on these squared terms were not statistically significant and including them in the analysis had little impact on any of the other coefficient estimates.

4. Although not shown in any of the results below, I also experimented with including interaction terms between race and gender. The coefficients on these interaction terms were small (close to zero) and statistically insignificant, and including them had almost no impact on any of the model's estimated coefficients. For this reason, these interaction terms were dropped from the model.
5. Unlike the 2012 study, in some of specifications I control for an individual's starting salary as well as indicators for whether the individual is an assistant, associate, full or acting professor.
6. I estimate my wage model using both mean and median regression. The latter is important since coefficients from a mean regression may not provide an accurate description of central tendency when there are a small number of individuals with unusually high salaries (which we know to be the case from Peter Shearer's analysis above).

Using data from the 2015-16 academic year, I estimate the following basic model using both mean and median regression:

$$\log(w_i) = \beta_o + \beta_1 female_i + \beta_2 race_i + \beta_3 yrsdg_i + \beta_4 yrslrf_i + \beta_5 dept_i + \beta_6 dept \times yrslrf_i + u_i$$

where $\log(w_i)$ is the log of individual i's salary, $female_i$ indicates whether the individual is a women, $race_i$ is a set of indicator variables capturing the race of individual i, $yrsdg_i$ captures the number of years since individual i earned his or her degree, $yrslrf_i$ indicates the number of years since individual i was hired at UCSD, $dept_i$ is a set of indicator variables indicating the department to which individual i belongs, and $dept_i \times yrslrf_i$ is the interaction between individual i's department and years since he or she was hired at UCSD, and is meant to capture the fact that wages grow at different rates in different departments[1]. In several specifications, I additionally control for whether the individual is an assistant, associate, full or acting professor, and the individual's starting salary. The use of log wages is justified by the fact that log wages are typically approximately normally distributed. This basic specification is standard among labor economists.

Results from Mean Regression (Table 1)

Table 1 shows the results of estimating the above model using mean regression (or ordinary least squares). As the first column (Model 1) indicates, for the campus as a whole, there are substantial race and gender gaps in average salary. The average salary of women is 21.3 percent less than that of men, and the average salary of Asians and URMs, respectively, is 6.5 percent and 16.4 percent less than that of whites. Much of these disparities, however, are related to the fact that women, Asians and URMs are at relatively early stages of their careers. Indeed, as the second column (Model 2) indicates,

[1] Peter Shearer's analysis accounts for differences between divisions in log(salary) growth with years since highest degree, while mine accounts for differences between divisions in log(salary) growth with years at UCSD. Despite this difference, our results are very similar, likely because years since highest degree and years at UCSD are highly correlated.

the disparities shrink substantially once controls for years since ladder rank faculty hire and years since degree are included in the model. The third column (Model 3) shows that the race and gender disparities in pay shrink even further once controls for department and the interaction between department and years since ladder rank faculty hire are included in the model, suggesting that part of the reason for the observed race and gender pay gaps is that women, Asians and URMs tend to be clustered in lower-paying departments. With these added department-level controls, the gender pay gap shrinks to 5.1 percent and the racial wage gap (for both Asians and URMs) drops to approximately 2 percent. While this remaining gap remains statistically significant for women (at the 99 percent level), it is not statistically significant at conventional levels for either Asians or URMs.

The fourth column of Table 1 (Model 4) attempts to understand, by controlling for current title, whether the race and gender pay gaps found in column 3 arise because women, Asians and URMs have slower rates of advancement. As Model 4 reveals, once these controls are added to the model, the gender pay gap falls to 2.7 percent and is no longer statistically significant, suggesting that part of the reason that female faculty members have lower average wages than their male counterparts is that they are progressing more slowly through the ranks. This finding is consistent with Peter Shearer's analysis and is explored in greater detail below. Once current title is added to the model, we also see that the pay gap between whites and URMs shrinks (from 1.9 percent to 0.1 percent), though it is hard to draw definitive conclusions since these coefficient estimates are not statistically different from each other. The pay gap between whites and Asians changes very little once controls for current title are added to the model.

The fifth column of Table 1 (Model 5) investigates whether the gender gap in average salary is an outgrowth of gaps in starting salary. Once starting salary is added to the model, the gender gap in average salary shrinks (from 2.7 percent to 1.9 percent), but it is hard to draw definitive conclusions since these coefficient estimates are not statistically different from each other.

I also investigated whether the race and gender pay gaps in average salary vary by division. The data group faculty into 9 "divisions": Arts & Humanities, Biological Sciences, Economics, Engineering, GPS, Rady, Physical Sciences, SIO, and Social Sciences. I found that even after controlling for years since degree, years since ladder rank hire, department and department×years since ladder rank faculty hire (the same specification as in Model 3 of Table 1), women have a lower average salary than do men in all divisions except SIO[2]. The gaps are statistically significant (at the 90 percent level or higher) in Arts & Humanities, Biological Sciences and Rady, where women on average earn 7.1 percent, 9 percent and 18.5 percent, respectively, less than do their male counterparts. By division, the racial salary gaps varied and were sometimes negative and sometimes positive, but the only statistically significant gap (at the 93 percent level) was in Social Sciences, where URMs earn 8.8 percent less than whites.

Results from Median Regression (Table 2)

Table 2 shows the results of estimating the above model using median regression. As column 1 (Model 1) indicates, for the campus as a whole, the median salary is substantially lower for women, Asians and URMs relative to that of white men. Similar to Table 1, these gaps shrink considerably once controls for years since degree and years since ladder rank faculty hire are added to the model (Model 2). In addition, once department-level controls are added to the model (Model 3), these gaps shrink even

[2] Peter Shearer's analysis found the same pattern.

further (to roughly 2 percent) and become statistically insignificant at conventional levels. The fact that the average salary gap between men and women is larger than the median salary gap suggests that gender wage in average salary is at least partly driven by a small number of very high earning men.

As in Table 1, the fourth column (Model 4) adds controls for current title. As in Table 1, we see that the gender pay gap falls from 2.1 to 0.2 percent, suggesting that part of the reason that female faculty members have lower median wages than their male counterparts is that they are progressing more slowly through the ranks. It is hard to draw definitive conclusions, however, since the estimated coefficients in columns 3 and 4 are not statistically different from each other.

The fifth column of Table 2 (Model 5) shows that once starting salary is added to the model, the race and gender gaps in median salary shrink, though the estimated coefficients in columns 4 and 5 are not statistically different from each other, making it difficult to draw definitive conclusions.

Rates of Promotion and Advancement

As discussed above, part of the reason for the pay gap between men and women appears to arise because women have slower rates of advancement than do men. To investigate this directly, I conducted two separate analyses. First, I isolated the 211 individuals who were hired as Assistant Professors between 1997-98 and 2007-08 *and* who had obtained tenure by 2015. I then regressed (using OLS) the number of years it took each of these individuals to receive tenure on an indicator for whether the individual was a female we well as a set of indicators for race, with white being the omitted category. The results of this analysis are summarized in Table 3.

Table 3

tttenure	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
female	.4828668	.273064	1.77	0.078	-.0554916	1.021225
rasian	.7069973	.3345442	2.11	0.036	.0474279	1.366567
rurm	.9131558	.4162298	2.19	0.029	.0925393	1.733772
rother	-1.162035	1.297998	-0.90	0.372	-3.721099	1.397029
_cons	5.662035	.1714427	33.03	0.000	5.324028	6.000042

As these results suggest, on average, it takes 5.66 years for white men to receive tenure. Women take half a year (0.48) longer, and Asians and URMs take closer to a year longer (0.71 and 0.91, respectively). For women, this gap was statistically significant at the 10 percent level, and for Asians and URMs, it was statistically significant at the 5 percent level. I also investigated whether these gaps in time to tenure varied by department and division, but no clear patterns emerged, and none of my findings were statistically significant due to small sample sizes.

One issue with the time-to-tenure analysis above is that it ignores the fact that men and women may differentially leave UCSD prior to receiving tenure. Thus, in my second analysis, I isolated the 283 individuals who were hired as Assistant Professors between 1997-98 and 2007-08, and I examined the likelihood that these individuals both stayed at UCSD *and* received tenure (that is, were promoted to Associate Professor at UCSD). These results are summarized below.

For the campus as a whole we see that roughly equal fractions of men and women who are hired as Assistant Professors stay and are eventually tenured at UCSD (74 to 75

percent). This parity holds in both Arts & Humanities and Social Sciences[3]. However, looking at traditionally male-dominated STEEM fields (which in my analysis includes Biological Sciences, Engineering, Physical Sciences, SIO, Economics, GPS, and Rady), we see that, relative to men, women who are hired as Assistant Professors are substantially less likely to stay at UCSD and receive tenure (58 percent compared to 72 percent), and while this difference is not statistically different from zero (the p-value is 0.128), the magnitude of the gap is a cause for concern, and adds to the evidence presented above that women may be less successful than men at advancing through the ranks, particularly in more male-dominated fields.

Table 4

Campus

female	mean	N
0	.7525773	194
1	.741573	89
Total	.7491166	283

A&H

female	mean	N
0	.8709677	31
1	.8888889	27
Total	.8793103	58

Social Sciences

female	mean	N
0	.7446809	47
1	.7741935	31
Total	.7564103	78

STEEM

female	mean	N
0	.7241379	116
1	.5806452	31
Total	.6938776	147

I also conducted a similar analysis by race. For the campus as a whole, there are no statistically significant differences in the likelihood that Asians, URMs and whites who are hired as Assistant Professors both stay and receive tenure at UCSD. In the Social Sciences, however, Asians and URMs are, respectively, 34 and 30 percentage points less likely than whites to stay and receive tenure at UCSD. For Asians this gap is statistically significant at the 93 percent level, and for URMs, this gap is statistically significant at the 97 percent level.

Starting Salary

Although the results in Tables 1 and 2 provide only weak evidence that differences in starting salary explains current race and gender pay gaps, I directly investigated whether there exist race and gender gaps in starting salary. In particular, I estimated the following model using ordinary least squares:

$$\log(w_i) = \beta_o + \beta_1 female_i + \beta_2 race_i + \beta_3 yrsdg_i + \beta_4 yrslrf_i + \beta_5 title_i + \beta_6 dept_i + \beta_7 dept \times yrslrf_i + u_i,$$

where $\log(w_i)$ is the log of individual i's starting salary, $female_i$ indicates whether the individual is a women, $race_i$ is a set of indicator variables capturing the race of individual

[3] In my analysis Economics is counted as part of STEEM, not Social Sciences.

i, $yrsdg_i$ captures the number of years since individual i earned his or her degree, $yrslrf_i$ indicates the number of years since individual i was hired at UCSD, $title_i$ is a set of indicator variables indicating individual i's initial title, $dept_i$ is a set of indicator variables denoting the department to which individual i belongs, and $dept_i \times yrslrf_i$ is the interaction between individual i's department and years since the individual was hired at UCSD, and is meant to capture the fact that wages grow at different rates in different departments.

As column 1 (Model 1) of Table 5 shows, there are large and statistically significant race and gender gaps in average starting salary for the campus as a whole. In column 2 (Model 2), we see that these gaps shrink substantially once controls for years since degree, years since ladder rank faculty hire and initial title are added to the model. In column 3 (Model 3), we see that once department-level controls are added to the model, the racial gap in average starting salary becomes small and statistically insignificant, but the gender gap in starting salary remains. In particular, the average starting salary for women is 2.2 percent less than it is for men, and this gap is statistically significant at the 8 percent level. I also estimated the above model using median regression and obtained almost identical results (for example, using the same set of controls as in Model 3, the estimated gender gap in median starting salary was 2.1 percent and this gap was statistically significant at the 5 percent level). While this gender gap in starting salary is not large, it is troubling because it may translate into lower relative pay for the remainder of women's careers at UCSD.

Summary

- For both Asians and URMs relative to whites, controlling for years since degree, years since ladder rank faculty hire, department and department×years since ladder rank faculty hire, the racial gap in both average and median salary is roughly 2 percent and is not statistically significant at conventional levels.
- For women relative to men, controlling for years since degree, years since ladder rank faculty hire, department and department×years since ladder rank faculty hire, the gender gap in average salary is 5.1 percent and statistically significant at the 99 percent level, while the gap in median salary is only 2.1 percent and is not statistically significant at conventional levels. Notably, the magnitude of these pay gaps is almost identical to the gaps found in Peter Shearer's analysis above.
- The fact that the gender gap in average salary is larger than the gender gap in median salary suggests that part of the gap in average salary is driven by a small number of very high earning men, which is consistent with Peter Shearer's findings above.
- Part of gender pay gap appears to be explained by the fact that women are being promoted more slowly than men. There is also some evidence of this phenomenon for URMs, though for URMs this finding is not statistically significant. My findings suggest that it takes women, URMs and Asians longer to receive tenure than white men, and among women in traditionally male-dominated STEEM fields, there is evidence that women are substantially less likely than men to stay at UCSD and receive tenure, though this finding is not statistically significant at conventional levels.
- While there is some evidence that current race and gender pay gaps are explained by gaps in starting salary, it is difficult to draw definitive conclusions due to small sample sizes. Nonetheless, relative to men, women's average starting salary is 2.2 percent lower even after controlling for years since degree, years since ladder-rank faculty hire, initial appointment and department.

Summary and Conclusions

Assessing possible race or gender inequities in salaries at UCSD is complicated by the need to take into account the fact that salary tends to increase with career age and that substantial differences in salaries exist among different divisions at UCSD. We have analyzed 2015 UCSD general campus and SIO salary data using two different approaches and compared our results to the long-standing UCSD regression model that has been used for a number of previous salary studies. Our analysis methods are:

- Peter Shearer compares salaries to those of contemporaries in the same division. This is a largely non-parametric approach that adapts naturally to any division-specific patterns in the data.

- Kate Antonovics applies more traditional regression analysis, but improves on the existing UCSD model by including terms that account for differences in salary growth within divisions.

As in the UCSD study and in many labor economics studies, we consider log(salary), which is more normally distributed than salary. For robustness, we experimented with examining median salaries as well as the mean salaries considered in the standard UCSD model.

Our main conclusions may be summarized as follows:

- After controlling for division and career age, women faculty at UCSD are paid an average of about 5% less than men. This is similar to the gender gap seen in previous UCSD salary studies.

- The gender gap is about 2% in median salary. The significant mean vs. median difference is caused by a small number of men who earn anomalously high salaries, i.e., outliers that skew the distribution of male log salaries to a non-Gaussian shape.

- For perspective, base UCSD salaries grow at about 2.5% per year, so a 5% salary gap implies a 2-year lag in reaching the same salary.

- There are too few data to make statistically significant conclusions about possible salary differences among different races or ethnicities.

- There is some evidence that gender differences in starting step, advancement rate including time to tenure, and MOS all contribute to the gender gap in average salary, but the pattern is less clear for median salary, where MOS differences appear to be the dominant factor.

Please note that these results are for the general campus and SIO only; they do not include the Heath Sciences, which we plan to analyze separately. We also made no attempt to include any data on research productivity, teaching quality, or other measures that are typically considered when individual files are reviewed. It would be interesting to try to incorporate such data, but they are currently unavailable in the kind of quantitative form that could be used for modeling purposes.

Table 1: Mean (OLS) Regression of the Log of an Individual's Salary on Various Characteristics for the 2015-16 Academic Year

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
FEMALE	-0.213***	-0.132***	-0.051**	-0.027	-0.019
	(0.000)	(0.000)	(0.002)	(0.078)	(0.176)
ASIAN	-0.065*	0.008	-0.020	-0.024	-0.022
	(0.025)	(0.731)	(0.301)	(0.174)	(0.174)
URM	-0.164***	-0.096***	-0.019	-0.001	-0.004
	(0.000)	(0.001)	(0.414)	(0.958)	(0.827)
OTHER/UNKNOWN	-0.284***	-0.038	-0.017	0.096	0.074
	(0.000)	(0.562)	(0.766)	(0.083)	(0.147)
YRS SINCE DEGREE		0.019***	0.021***	0.015***	0.004***
		(0.000)	(0.000)	(0.000)	(0.001)
YRS SINCE LRF HIRE		-0.003*	-0.001	-0.003	0.010*
		(0.014)	(0.864)	(0.437)	(0.017)
Controls for department and department x years since lrf hire	no	no	yes	yes	yes
Controls for current title	no	no	no	yes	yes
Controls for starting salary	no	no	no	no	yes
R-squared	0.109	0.432	0.672	0.730	0.774
N	975	975	975	975	975

Notes: Dependent variable is the log of an individual's salary for the 2015-2016 academic year. P-values in parenthesis.
* p<0.05, ** p<0.01, *** p<0.001.

Table 2: Median Regression of the Log of an Individual's Salary on Various Characteristics for the 2015-16 Academic Year

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
FEMALE	-0.228***	-0.114***	-0.021	-0.002	-0.008
	(0.000)	(0.000)	(0.199)	(0.887)	(0.556)
ASIAN	-0.107*	0.017	-0.027	-0.025	-0.016
	(0.016)	(0.504)	(0.167)	(0.217)	(0.317)
URM	-0.194***	-0.063*	-0.019	-0.013	-0.002
	(0.000)	(0.041)	(0.411)	(0.593)	(0.937)
OTHER/UNKNOWN	-0.396**	-0.023	0.000	0.078	0.036
	(0.002)	(0.746)	(0.995)	(0.221)	(0.482)
YRS SINCE DEGREE		0.022***	0.024***	0.018***	0.001
		(0.000)	(0.000)	(0.000)	(0.602)
YRS SINCE LRF HIRE		-0.003*	-0.005	-0.004	0.013***
		(0.034)	(0.243)	(0.337)	(0.000)
Controls for department and department x years since lrf hire	no	no	yes	yes	yes
Controls for current title	no	no	no	yes	yes
Controls for starting salary	no	no	no	no	yes
N	975	975	975	975	975

Notes: Dependent variable is the log of an individual's salary for the 2015-2016 academic year. P-values in parenthesis. * p<0.05, ** p<0.01, *** p<0.001.

Table 5: Mean (OLS) Regression of the Log of an Individual's Starting Salary on Various Characteristics for Individuals Employed in the 2015-16 Academic Year

	Model 1	Model 2	Model 3
	-	-	
FEMALE	0.104***	0.060***	-0.022
	(0.000)	(0.000)	(0.071)
ASIAN	0.071*	-0.031	-0.010
	(0.017)	(0.090)	(0.491)
URM	-0.053	-0.042	0.014
	(0.146)	(0.053)	(0.440)
OTHER/UNKNOWN	0.092	0.065	0.034
	(0.269)	(0.197)	(0.419)
YRS SINCE DEGREE		0.007***	0.011***
		(0.000)	(0.000)
		-	-
YRS SINCE LRF HIRE		0.015***	0.014***
		(0.000)	(0.000)
Controls for initial title	no	yes	yes
Controls for department and department x years since lrf hire	no	no	yes

Notes: Dependent variable is the log of an individual's starting salary for those employed at UCSD in the 2015-2016 academic year. P-values in parenthesis. * p<0.05, ** p<0.01, *** p<0.001.

3. Committee summary

The committee agrees with the overall conclusions of the data analyses described in Section 2 and recommends that future salary equity surveys incorporate some of the methods that were used. With regard to the issue of making scatter plots to show how individual faculty salaries compare to others in their division or department, the committee felt that such plots should not be included as part of the academic review process, as they might receive undue weight and could discourage Professors with below-average salaries. However, scatter plots should be made available to Deans to help them assess issues such as possible inequities among groups, salary compression, and large market off-scale differences.

4. Appendix – Membership

Co-Chairs

Tamara Wall, Associate Vice Chancellor – Academic Personnel
Sonia Jain, Professor, Family Medicine and Public Health

Administration

William Hodgkiss, Senior Associate Vice Chancellor Academic Personnel and Resources
Vivian Reznik, Associate Vice Chancellor Faculty Affairs, Health Sciences
Peter Shearer, Associate Dean, Marine Sciences

Senate Members

Kate Antonovics, Associate Teaching Professor, Economics
Julian Betts, Professor, Economics
Alison Coil, Professor, Physics
Judy Kim, Professor, Chemistry & Biochemistry
Valerie Ramey, Professor Economics
David Schkade, Professor, Rady School of Management
Judith Varner, Professor, Medicine

Staff Consultants

Lilibeth Dockery, SIO
Kelly Maheu, Academic Personnel
Ray Rodriguez, Academic Senate