

## SPECIAL COMMITTEE ON MERIT EQUITY REVIEW

### Introduction

This report supplements the Report of the Special Senate Committee on Merit Equity presented to the February 24, 1999 Senate Meeting. It addresses issues raised at the meeting concerning the analysis of salary differentials related to gender and ethnicity. For a complete discussion of the investigation of the Special Committee, this supplement should be read in combination with the original report.

Differences in pay and promotion by gender or ethnicity that cannot be explained by differences in productivity constitute labor market discrimination. The salary data for members of the Academic Senate at UCSC available to the committee do not allow a direct test of the question of whether discrimination by gender or race has taken place. This is because actual measures of research productivity, teaching service, teaching ratings, and so forth for individual faculty cannot be reviewed by Senate Committees other than the Committee on Academic Personnel. However, the results reported here do indicate some significant statistical differences in salaries and salary advancement between men and women controlling for available (and conventional) measures of experience and service. Some indication of systematic differences in salary and advancement are also found between minority and non-minority faculty.

Several approaches have been taken in the study of discrimination in academic pay and promotion at research universities. The most directly relevant research for this study<sup>1</sup> is the recent analysis of faculty salaries at the University of Arizona by economists Iris Giesler and Ronald Oaxaca using individual faculty publications, teaching loads, teaching ratings and other data used in merit reviews at that institution. They find similar effects for gender and minority status as in the analysis reported here, but contrary to conventional wisdom, they find that when they control for measures of research and teaching performance used in the actual personnel process, the salary discrepancies between female and male faculty increase rather than decrease.<sup>2</sup>

While the data made available to the committee cannot be used to prove that there has been discrimination in the personnel review process at UCSC, they also cannot be used to rule it out. Other UC campuses have undertaken merit equity reviews without undertaking the level of analysis done by this committee. The combination of the February 1999 report of this committee and this supplementary report provide a deeper and more thorough analysis of salary differentials by gender and minority status than undertaken by the other Academic Senates in the UC system.

This supplement addresses three issues:

1. The objection on the senate floor that individuals who did not self-report ethnicity to the University were included in the sample and identified as non-minority. These faculty now have been taken out of the data set when minority status is considered. The results are unchanged from the original report.
2. The Committee on Merit Equity Review's decision that salary regressions should not include rank and step within rank as independent variables to explain variations in salaries as done in its 1999 regression analyses. This use of rank and step is inappropriate

on statistical grounds. The reason is that rank and step within rank are determined in the same process at the same time as salary. These variables are not exogenous to the merit review process and cannot be included as independent controls. This supplement provides new analyses of rank and step within rank. It also provides additional analyses of salary advancement and of the potential role of some control variables.

3. This report concludes with a resolution and some recommendations unanimously agreed upon by the Special Committee on Merit Equity Review. Such action is being taken because the Committee, in its initial mandate by the senate, was commissioned to recommend procedures to redress cases of possible inequity, should it find evidence for the existence of potential inequities in its analysis.

The committee unanimously agrees that the results indicate a need for a process available to individual faculty that allows redress of possible inequities in salary, rank and step within rank. We believe that all parties – including individual senators, senate committees and administration - involved in the merit review process need to take these findings into consideration in augmenting current practices and procedures. While our recommendations are made to the Senate, the Administration has a responsibility to ensure non-discrimination in pay and promotion of faculty at UCSC.

## Summary statistics

### *Gender and salary*

Table 1A summarizes data by gender and other characteristics on salaries for the 421 senate faculty at UCSC in the 1997-98 academic year. This is the same table 1A that was presented in the February 1999 report. Averages are shown for age, years at UCSC, step in rank and annual salary by gender. All salaries are converted to a 9-month basis (i.e., any salary of an 11-month appointment was converted to a 9-month salary by multiplying by 9/11.) The lower part of the table reports averages and standard errors for female-male differences.

The tables shows that the average male faculty member receives an average salary that is \$10,054 higher than does the average female faculty member. This difference is statistically significant at the 1% level ( $p < 0.01$ , meaning that there is less than a one in one hundred chance of drawing this difference at random from a normal distribution with a true average salary difference of zero). The female-male salary differences are not significant for assistant and associate professor, but the average female-male salary difference for full professors is \$6,466 and significant at the 1% level.

Table 1B, also as in the earlier report, shows the same data for the 295 senate faculty hired after 1980 who were on campus in the 1997-98 academic year. These faculty comprise 70% of the UCSC faculty in 1997-98 and include 83% of the female and minority faculty on campus. The average salary for men exceeds that for women by \$4,903, a difference that is significant (Asignificant@ alone denotes at the 5% level throughout the report,  $p < 0.05$ ). With an important exception, the average differences between men and women in age and years at UCSC for this group are small and insignificant. The exception is that female associate professors are on average 2.3 years older than male associate professors. This may be the result of slower average

promotion to full professor. Gender salary differentials are studied more thoroughly in the regression analysis reported below.

### *Ethnicity and salary*

Tables 2A and 2B have been revised since the February 1999 report. These tables are corrected to exclude individuals who did not self-report ethnicity to the University. After excluding these individuals, the sample sizes used for analyzing ethnicity were 417 for all faculty and 293 for faculty hired after 1980. These tables make the same comparisons as found in Tables 1A and 1B, but show differences between minority and non-minority faculty.

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Table 1a: Characteristics of Current Faculty, By Gender

By Rank:

	All Ranks (1)	Assistant (2)	Associate (3)	Full (4)
<u>All Faculty:</u>				
Number of Faculty	421	80	111	224
Percent Female	33.3	45.0	43.2	23.7
<u>Females Only</u>				
Average Age	45.5	37.0	45.0	50.8
Years at UCSC	9.9	3.0	9.3	15.1
Average "Step"	--	3.1	2.4	3.7
Average Salary	60,501	46,072	54,974	75,351
<u>Males Only:</u>				
Average Age	48.6	36.8	43.9	53.3
Years at UCSC	14.2	2.7	9.4	19.9
Average "Step"	--	3.4	2.3	4.8
Average Salary	70,555	46,227	57,002	81,817
<u>Female-Male Difference:</u>				
Average Age	-3.2** (0.8)	0.2 (1.0)	1.6 (1.1)	-2.5* (0.9)
Years at UCSC	-4.3** (0.8)	0.2 (0.5)	-0.1 (0.9)	-3.8** (1.3)
Average "Step"	--	-0.3 (0.2)	0.1 (0.2)	-1.1 (0.3)

Average Salary	-10,054** (1,671)	-155 (765)	-2,027 (1,078)	-6,466 (2,118)
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Notes: Numbers in parentheses represent standard errors.  
 Column 1 includes 4 lecturers who are not included in columns 2-4.  
 Salaries are 9-month salaries for 1997-98 academic year.

Table 1b: Characteristics of Current Faculty Hired After January 1, 1980, By Gender

By Rank:

	All Ranks (1)	Assistant (2)	Associate (3)	Full (4)
<u>All Faculty (Hired 1980 or Later):</u>	295	80	103	108
Number of Faculty	39.3	45.0	43.7	30.6
Percent Female				
<u>Females Only</u>				
Average Age	43.7	37.0	45.0	48.9
Years at UCSC	7.1	3.0	8.4	9.9
Average "Step"	--	3.1	2.3	3.5
Average Salary	57,809	46,072	54,784	74,573
<u>Males Only</u>				
Average Age	44.3	36.8	42.8	49.5
Years at UCSC	7.5	2.7	8.2	9.6
Average "Step"	--	3.4	2.2	3.8
Average Salary:	62,712	46,227	57,098	76,428
<u>Female-Male Difference:</u>				
Average Age	-0.5 (1.0)	0.2 (1.0)	2.3* (1.0)	-0.6 (1.2)
Years at UCSC	-0.4 (0.5)	0.2 (0.5)	0.3 (0.5)	0.3 (0.9)
Average "Step"	--	-0.3 (0.2)	0.1 (0.2)	-0.3 (0.5)
Average Salary	-4,903*	-155	-2315	-1,855

(1,764)                      (765)                      (1,154)                      (2,931)

Notes: Numbers in parentheses represent standard errors.  
 Column 1 includes 4 lecturers who are not included in columns 2-4.  
 Salaries are 9-month salaries for 1997-98 academic year.  
 A single star indicates statistical significance at the 5 percent level; a double star indicates statistical significance at the 1 percent level (for a two tailed test of the hypothesis of a zero coefficient).

Table 2a: Characteristics of Current Faculty Hired, By Minority Status

By Rank:

	All Ranks (1)	Assistant (2)	Associate (3)	Full (4)
<u>All Faculty:</u>				
Number of Faculty	417	79	111	223
Percent Minority	21.9	37.9	28.8	12.5
<u>Minorities Only:</u>				
Average Age	43.9	36.2	45.4	50.1
Years at UCSC	9.3	2.9	10.0	15.1
Average "Step"	--	3.2	2.3	3.3
Average Salary	58,819	46,354	56,962	74,436
<u>Nonminorities Only:</u>				
Average Age	48.6	37.4	44.3	53.1
Years at UCSC	13.7	2.8	9.0	18.4
Average "Step"	--	3.3	2.4	4.7
Average Salary	69,612	46,124	55,786	81,129
<u>Minority-Nonminority Difference</u>				
Average Age:	-4.7** (0.9)	-1.3 (1.0)	1.1 (1.3)	-3.0* (1.2)
Years at UCSC	-4.5** (1.0)	0.1 (0.5)	1.0 (1.1)	-3.3* (1.6)
Average "Step"	--	-0.1 (0.2)	-0.1 (0.2)	-1.4** (0.4)
Average Salary	-10,793** (2,025)	229 (839)	1,176 (1,234)	-6,692 (2,473)

Notes: Numbers in parentheses represent standard errors.  
 Column 1 includes 4 lecturers who are not included in columns 2-4.  
 Faculty with unreported race are not included.  
 Salaries are 9-month salaries for 1997-98 academic year.  
 A single star indicates statistical significance at the 5 percent level; a double star indicates statistical significance at the 1 percent level (for a two tailed test of the hypothesis of a zero coefficient).

Table 2b: Characteristics of Current Faculty Hired After January 1 1980, By Minority Status

By Rank:

	All Ranks (1)	Assistant (2)	Associate (3)	Full (4)
<u>All Faculty</u>				
<u>(Hired 1980</u>	293		79	103
<u>or Later):</u>	26.3		37.9	27.2
Number of				
Faculty				
Percent				
Minority				
<u>Minorities</u>				
<u>Only:</u>	41.7		36.2	43.8
Average Age	6.6		2.9	8.3
Years at	--		3.2	2.2
UCSC	55,856		46,354	57,096
Average				
"Step"				
Average				
Salary				
<u>Nonminorities</u>				
<u>Only:</u>	44.9		37.4	43.8
Average Age	7.6		2.8	8.3
Years at	--		3.3	2.3
UCSC	62,540		46,124	55,710
Average				
"Step"				
Average				
Salary				
<u>Minority-</u>				

<u>Nonminority</u>	-3.2**	-1.2	0.0	-2.3
<u>Difference:</u>	(0.9)	(1.0)	(1.1)	(1.4)
Average Age				
	-1.1*	0.2	0.0	0.4
	(-.5)	(0.5)	(0.6)	(1.0)
Years at UCSC	--	-0.1	-0.1	-1.6**
		(0.2)	(0.2)	(0.4)
Average "Step"	-6,684**	229	1,386	-7,268**
	(2,000)	(839)	(1,372)	(2,698)

### Average Salary

Notes: Numbers in parentheses represent standard errors.  
 Column 1 includes 4 lecturers who are not included in columns 2-4.  
 Faculty with unreported race are not included.  
 Salaries are 9-month salaries for 1997-98 academic year  
 A single star indicates statistical significance at the 5 percent level; a double star indicates statistical significance at the 1 percent level (for a two-tailed test of the hypothesis of a zero coefficient).

All salary differences are highly significant and minority faculty average 9-month salaries are \$10,793 less than non-minority faculty. The differences for assistant and associate professors are not significant, while minority full professors receive salaries that are \$6,692 less than for non-minority full professors. This difference is highly significant. Some of this difference may be due to significantly lower average age (by 3.0 years), fewer average years (by 3.3 years) at UCSC and lower average step within the rank of full professor (by 1.4 steps) for minority faculty. These factors are taken into account in the regression analysis below.

Ethnic group composition and salaries of UCSC faculty are shown in the revised Table 3 for faculty on campus in the 1997-98 academic year. Minority faculty includes Asians in this supplement as in the original report. The major ethnic groups are Asians (52% of minority faculty) and Hispanics (27%). Asian and American Indian faculty have the lowest average salaries and the highest proportions of assistant professors among all ethnic groups. African-American faculty receive the highest average salaries and account for the highest proportion of full professors among minorities. However, all the minority groups have lower average salaries than non-minority faculty, and non-minority faculty have the highest proportions in the more senior ranks (see Tables 2A and 2B). Because the numbers of some groups are relatively small, it is difficult to interpret differences across ethnic groups with confidence and such comparisons may reveal the characteristics and salaries of particular individuals. Therefore, in subsequent analyses, the various minority ethnicities are pooled and designated as minority faculty.

### Analysis of salary differences

The rank, step and salary of individual faculty members are determined in a multi-tiered personnel review process. The University salary scales associate a salary with each rank and step for faculty. On the Santa Cruz campus, two scales are in use, one for engineering faculty and one for all others. The 9-month salary scale for the academic year 1997-98 is provided in the Appendix. Off-scale increments allow differences between individual salaries and on-scale salaries. In personnel reviews, individual rank, step within rank and salary are determined at the same time in the same process. Rank and step within rank are jointly determined with salary. These must be treated as joint outcomes of the personnel review process.

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Table 3: Characteristics of UCSC Faculty by Ethnic Group



Note: This table excludes faculty that did not self-report ethnicity.

Faculty advancement is related to productivity in research, teaching and other university service. Data on individual publications, teaching ratings, teaching loads and other measures of faculty performance were not available to the committee. However, factors that are widely correlated with salaries and wages and that measure, imperfectly, experience or seniority are available. These include age and years on the UCSC faculty. Given that there are systematic differences between female and male faculty and between minority and non-minority faculty with respect to age and years at UCSC, these must be used as control variables to uncover salary differences by gender or ethnicity because they are correlated with rank, step and salary. Differences in average salaries within rank and step arise across divisions. In the case of engineering, a different salary scale is in effect. In other cases, the academic market salaries for different disciplines varies leading to differences in the use of off-scale salaries (and salaries above full professor step 5) across divisions. Therefore, the analysis also controls for and investigates differences across divisions. Such differences also arise across departments within divisions, but distinguishing faculty by gender and ethnicity within individual departments again could reveal data on individuals. The distribution of characteristics of ladder-rank faculty self-reporting ethnicity by division are given in the table below:

*Characteristics of Faculty by Division*

Division	#Faculty	#Full Prof	%Female	%Min	%Min Female	%Min Male
Arts	41	21	12.0	24.0	0.0	24.0
Humanities	95	50	45.3	26.3	17.9	8.4
Soc. Sci	117	60	41.9	24.8	13.7	11.1
Nat. Sci.	137	84	16.8	16.8	2.2	14.6
Engineering	25	9	12.0	24.0	0.0	24.0

The regression analyses reported in new Tables 4A, 4B, 5A and 5B separate faculty into four mutually exclusive groups: non-minority men, minority men, non-minority women and minority women. This separation allows the effects of gender and minority status on salary or on rank and step to be addressed directly and simultaneously. These regressions also include age, age squared, years (at UCSC) and years squared as control variables. The squared terms allow for non-linear effects of age or service on advancement. These regressions also include ladder-rank faculty but not lecturers and exclude the faculty who did not self-report ethnicity to the University. These exclusions were not applied in the earlier report. The exclusion of lecturers with security of employment was done because the scale and review process and criteria for lecturers are not the same as for assistant, associate and full professors.

Table 4a: Alternative Salary Determination Models for all Ladder-rank Faculty

Model:

	(1)	(2)	(3)
Nonminority Female	-14.1** (3.0)	-7.3** (2.1)	-4.4* (2.0)
Minority Female	-26.4** (4.2)	-11.0** (3.0)	-6.4** (2.9)
Minority Male	-15.2** (3.8)	-5.0 (2.6)	-5.1* (2.5)
Engineering	--	--	16.5** (3.6)
Natural Sciences	--	--	4.9* (2.1)
Humanities	--	--	-2.8 (2.2)
Arts	--	--	-9.3** (2.9)
<u>Other Controls:</u>			
Age, Age <sup>2</sup>	no	yes	yes
Years, Years <sup>2</sup>	no	yes	yes
R-squared	0.120	0.605	0.649

Notes: Coefficients are percentage differences in salary for gender/minority groups (relative to male non-minority faculty). Standard errors in parentheses.

A single star indicates statistical significance at the 5 percent level; a double star indicates statistical significance at the 1 percent level (for a two tailed test of the hypothesis of a zero coefficient). Dependent variable in all models is the logarithm of annual (9-month) salary for 1997-98 academic year for 421 observations. The model in column 3 includes controls for Division relative to Social Sciences. Other models exclude controls for Division. The other control variables are defined as follows: age is age in 1997; years represents the number of years on the UCSC faculty.

Table 4b: Alternative Salary Determination Models for Ladder-rank Faculty Hired After January 1, 1980

Model:

	(1)	(2)	(3)
Nonminority Female	-7.2* (3.3)	-5.8* (2.4)	-3.3 (2.3)
Minority Female	-15.0** (4.2)	-8.6** (3.1)	-5.4 (3.1)
Minority Male	-9.6* (4.1)	-2.3 (3.1)	-2.5 (2.9)
Engineering	--	--	14.9** (3.9)
Natural Sciences	--	--	1.6 (2.5)
Humanities	--	--	-2.5 (2.6)
Arts	--	--	-12.1** (3.3)

Other Controls:

Age, Age <sup>2</sup>	no	yes	yes
Years, Years <sup>2</sup>	no	yes	yes
R-squared	0.052	0.503	0.562

Notes: Coefficients are percentage differences in salary for gender/minority groups (relative to male non-minority faculty). Standard errors in parentheses.

A single star indicates statistical significance at the 5 percent level; a double star indicates statistical significance at the 1 percent level (for a two tailed test of the hypothesis of a zero coefficient). Dependent variable in all models is the logarithm of annual (9-month) salary for 1997-98 academic year for 295 observations on faculty hired after 1980. The model in column 3 includes controls for Division relative to Social Sciences. Other models exclude controls for

Division. The other control variables are defined as follows: age is age in 1997; years represents the number of years on the UCSC faculty.

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Table 5a: Alternative Rank and Step Determination Models for all Ladder-rank Faculty

Model:

	(1)	(2)	(3)
Nonminority Female	-2.11* (0.51)	-0.97** (0.31)	-0.68* (0.31)
Minority Female	-4.80** (0.72)	-1.92** (0.44)	-1.49** (0.44)
Minority Male	-2.88** (0.65)	-1.05** (0.39)	-0.98** (0.38)
Engineering		--	-0.36 (0.55)
Natural Sciences		--	1.05** (0.31)
Humanities		--	-0.22 (0.33)
Arts		--	-1.13 (0.44)
<u>Other Controls:</u>			
Age, Age <sup>2</sup>	no	Yes	Yes
Years, Years <sup>2</sup>	no	Yes	Yes
R-squared	0.128	0.699	0.721

Notes: Coefficients are percentage differences in salary for gender/minority groups (relative to male nonminority faculty). Standard errors in parentheses.

A single star indicates statistical significance at the 5 percent level; a double star indicates statistical significance at the 1 percent level (for a two tailed test of the hypothesis of a zero coefficient). The dependent variable in each model is an index of the rank and step for each assistant, associate and full professor during the 1997-98 academic year (415 individuals) as described in the text. This varies from 1 to 17. The model of column 3 includes controls for

Division relative to Social Sciences. Columns 1 and 2 exclude controls for Division. The other control variables are defined as follows: age is age in 1997; years represents the number of years on the UCSC faculty.

Table 5b: Alternative Rank and Step Determination Models for Ladder-rank Faculty Hired After January 1, 1980

Model:

	(1)	(2)	(3)
Nonminority Female	-0.98 (0.57)	-0.76* (0.37)	-0.52 (0.37)
Minority Female	-2.83** (0.73)	-1.64** (0.48)	-1.37** (0.49)
Minority Male	-2.04** (0.71)	-0.67 (0.47)	-0.53 (0.46)
Engineering		—	-0.68 (0.62)
Natural Sciences		—	0.75 (0.40)
Humanities		—	-0.06 (0.42)
Arts		—	-1.52** (0.53)
<u>Other Controls:</u>			
Age, Age <sup>2</sup>	No	yes	Yes
Years, Years <sup>2</sup>	No	yes	Yes
R-squared	0.064	0.609	0.635

Notes: Coefficients are percentage differences in salary for gender/minority groups (relative to male nonminority faculty). Standard errors in parentheses.

A single star indicates statistical significance at the 5 percent level; a double star indicates statistical significance at the 1 percent level (for a two tailed test of the hypothesis of a zero coefficient). The dependent variable in each model is an index of the rank and step for each

assistant, associate and full professor during the 1997-98 academic year (415 individuals) as described in the text. This varies from 1 to 17. The model of column 3 includes controls for Division relative to Social Sciences. Columns 1 and 2 exclude controls for Division. The other control variables are defined as follows: age is age in 1997; years represents the number of years on the UCSC faculty.

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In Tables 4A and 4B, the dependent variable is the logarithm of the 9-month salary, which is regressed on the various factors that may influence salary. The dependent variable for the regressions reported in Tables 5A and 5B is a measure of rank and step within rank. The steps used are those that are held by ladder-rank faculty in the academic year 1997-98. There are 17 steps on this scale: 4 for assistant professors, 4 for associate professors and 9 for full professors. An issue is that Associate Professor Step 4 has a nearly identical salary to Professor Step 1. These steps are assigned the values of 8 and 9, respectively, in the rank-step variable because there is a meaningful difference between the rank of associate professor and full professor.

In the original report, rank and step were used as control variables in the salary regressions. This is improper for a compensation system that uses a salary schedule based on rank and step that are determined through an internal personnel process. Under a strict salary scale, salary is uniquely determined by the assignment of a step on the scale. The entire explanation for salary would be the determination of rank and step. Under such a system, if discrimination occurs, it arises in the assignment of salary steps.

Salary, rank and step within rank are outcomes of the same personnel process. Including a jointly dependent variable as a control variable in the regression for salary produces biased estimates of the effects of all the controls, including ethnicity and gender. The inclusion of rank and step in the original report increased the percentage of the variability of salaries across faculty members explained by the regressions (the  $R^2$  value reports the fraction of the variation of the dependent variable [salaries in this case] explained by the included controls). However, two jointly dependent outcomes can be highly correlated, as salary is with rank and step within rank. By including one as a control variable for the other, the estimated effects of causal variables can be eliminated. The  $R^2$  value is not a measure of causality.<sup>3</sup>

Table 4A reports 3 alternative regression models: (1) with no controls, (2) only age and years of service controls and (3) age, years of service and divisional controls using data for all senate faculty (except those specifically excluded, as explained above). The variables common to each regression are gender and minority status. The salaries for non-minority women, minority women and minority men are compared to those of non-minority men in these regressions. Each column reports the estimated average effect of gender and minority status, or of the division of appointment, on salary.

The first column of Table 4A reports that non-minority women receive salaries 14.1% lower than non-minority men when no controls for age or years at UCSC are included (by using logarithms of salaries, the estimates are given in terms of percentages). When age and years at UCSC are included, the second column reports that non-minority women receive salaries 7.3% below those

for non-minority men on average. The inclusion of age and years of service at UCSC reduce the female-male salary differential. This is a consequence of the younger average age and number of years at UCSC for non-minority female faculty relative to non-minority male faculty combined with the fact that on average salaries rise with career length.

Each column in the table also reports the standard error of the coefficient estimate in parentheses under the estimate. In the case of column 2, the estimate of a 7.3% difference for non-minority women relative to non-minority men is highly significant ( $p=0.0005$ ). The salary difference for minority women is higher (10.5%) and equally significant. The average salary for minority men, controlling for age and years of service, is estimated to be 5.1% lower than for non-minority men. This estimate is significant at the confidence level just under 95%.

Column 3 of Table 4A shows the effects of including divisional differences. Here the effects of division are measured relative to the Division of Social Sciences. The differences in salaries for the Divisions of Natural Sciences, Engineering and Arts are sizable and significant, while that for the Division of Humanities is statistically insignificant. The effects of gender and minority status are reduced, but remain statistically significant at the 5% level. The average salaries are estimated to be 4.4% lower for non-minority women, 6.4% lower for minority women and 5.0% lower for minority men below those of non-minority men. The use of a different salary scale is reflected in the 16.5% higher average salary for engineering faculty.

An explanation for the reduction in the salary differentials between male and female faculty caused by including divisional controls is that the representation of women is lower in the divisions with higher average salaries. However, the female-male salary differential within each division could be different. Such differences could also result in the reduction in the estimated impact of gender on salary with the inclusion of divisional controls. These differences are discussed below.

Table 4B reports the same regressions as those presented in Table 4A but restricts the sample to faculty hired after 1980. The estimates are similar, although statistical significance is lost with the addition of controls for division. A smaller sample size can contribute to the larger standard errors because there are fewer degrees of freedom, sometimes resulting in loss of statistical significance. The results can be affected by the differences in the percentages of minority and female among faculty hired since 1980 and among all faculty. As Tables 2A and 2B reveal, minority and female faculty are represented at lower rates relative to non-minority male faculty at the rank of full professor. The difference in representation at the higher ranks of the salary scale, even though the controls for age and years at UCSC are included, may affect the estimated impacts of gender and ethnicity.

The new Tables 5A and 5B report similar regressions using the measure of rank and step within rank as the dependent variable in place of salary. The effects of gender and minority status on rank and step are all significant, in most cases highly so, in the results for all ladder-rank faculty reported in Table 5A. Controlling for age and years of service alone, non-minority women are on average about 1 step below non-minority men and minority women are at an average rank-step 1.9 below non-minority men (minority men are 1 step lower). When division is included, non-

minority women are 0.68 steps below non-minority men. Minority women are 1.5 steps lower and minority men remain 1 step lower than non-minority men.

The results of the new Tables 5A and 5B corroborate the results of the new Tables 4A and 4B. They also illustrate the importance of considering rank and step as simultaneous outcomes of the same process that determines salary.

### **Analysis of advancement and salary**

The February 1999 report considered the advancement of faculty by constructing a variable to measure normal progress through the rank, step and salary scale. Here, a more direct approach is reported to supplement that procedure. The effect of years of service at UCSC on salary is estimated separately by gender and minority status. The estimated effect of years at UCSC is a measure of salary advancement per year of service. A lower average rate of advancement will be reflected in a significant negative impact of gender or minority status on the rate of salary increase with years of service at UCSC, controlling for age.

The new Table 6 reports the results for including separate controls for years and years squared for women and for minority faculty. This is done by including interactive variables combining years on the UCSC faculty with gender and minority status. The effects for minority women are the sum of the effects for minority faculty and for women. The control variable, years, estimates the average effect of an additional year at UCSC on the salary (in percent) for non-minority men. The control variable, female-years, gives the amount less that an additional year of service will raise the average salary for a female faculty member. The variable, minority-years, gives the amount less that an additional year raises the salary of a minority faculty member on average.

The first column of Table 6 shows that average salaries rise at a 1.2% lower rate per year for women than for non-minority men. This difference is highly significant. Non-minority male salaries rise on average, controlling for age, at a rate of 2.5% per annum. The per annum increase for additional years for minority faculty overall, as compared with non-minority males, does not differ significantly. That is, salaries for non-minority and minority women rise on average 1.3% per year, while salaries for non-minority and minority men rise on average 2.5% per year. The second column of Table 6 includes divisional controls. The estimated effect of gender on salary advancement is nearly halved and is no longer statistically significant. There is a significant difference between the rate of salary growth across divisions. Again, the estimates for each of the divisions are relative to the Division of Social Sciences.

The effect of including division can be approached from a different direction. The data were separated by division to allow the estimation of separate regressions by division. The results provide estimates of the rate of salary growth with years of service for female and minority faculty in comparison with the rate for non-minority men in the same division. This helps to reveal what the inclusion of divisional controls explains.

Columns 3, 4 and 5 of Table 6 report separate results for three divisional groupings: social sciences, arts and humanities and natural sciences and engineering. Distinguishing faculty by gender and minority status within the two smaller divisions, arts and engineering, does not allow



for statistical significance, as there are very few female and minority faculty in these divisions. The divisions are combined on the basis of the history of inclusion of engineering in natural sciences and of arts in humanities.

Table 6: Alternative Model of Salary Advancement for Ladder-Rank Faculty

Model:

	(1)	(2)	(3)	(4)	(5)
			arts/hum	nat sci/eng	soc sci
Years	2.5** (0.44)	2.0** (0.44)	3.6** (0.83)	3.2** (0.64)	0.7 (0.82)
Years*Female	-1.2** (0.40)	-0.68 (0.39)	0.7 (0.65)	-1.9** (0.71)	-1.5 (0.77)
Years*Minority	-0.15 (0.47)	-0.12 (0.45)	0.3 (0.78)	-0.5 (0.69)	1.3 (0.69)
Engineering	--	15.5** (3.5)			
Natural Sciences	--	4.9* (2.0)			
Humanities	--	-3.0 (2.2)			
Arts	--	-9.5** (2.8)			
<u>Other Controls:</u>					
Age, Age <sup>2</sup>	yes	yes	yes	yes	yes
Years <sup>2</sup>	yes	yes	yes	yes	yes
(Years*Female) <sup>2</sup>	yes	yes	yes	yes	Yes
(Years*Minority) <sup>2</sup>	yes	yes	yes	yes	Yes
R-squared	0.613	0.655	0.670	0.742	0.517

Notes: Coefficients in the first row give percentage average annual rates of salary increase for non-minority male faculty. The second and third rows report differences in annual rates of salary

increase for female and for minority faculty, respectively, relative to non-minority male faculty. Standard errors in parentheses.

A single star indicates statistical significance at the 5 percent level; a double star indicates statistical significance at the 1 percent level (for a two tailed test of the hypothesis of a zero coefficient). Dependent variable in all models is the logarithm of annual (9-month) salary for 1997-98 academic year for 421 observations. The model of column 2 includes controls for Division relative to Social Sciences. Column 1 excludes controls for Division. The other control variables are defined as follows: age is age in 1997; years represents the number of years on the UCSC faculty; years\*female represents the number of years on the UCSC faculty for female faculty; and years\*minority represents the number of years on the UCSC faculty for minority faculty.

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Column 3 of Table 6 shows the average rate of annual salary growth for non-minority male faculty in the arts and humanities is about 3.6%, but that there is no statistically significant difference for men and women or for minorities and non-minorities within these divisions. Column 4 shows that in natural sciences and engineering, the average rate of salary growth is 3.2% for non-minority men and 1.9% lower for women. The difference within these divisions between male and female salary advancement rates is highly significant. The estimated difference for minorities is very small and insignificant. Column 5 shows that in social sciences, the average salary growth rate for female faculty is estimated to be 1.5% below that for male faculty and is significant at a level of 94% ( $p=0.059$ ).

Differences in the impact of gender on salaries across divisions can also be investigated returning to the analysis of Table 4A. Table 7 reports the results of separating women by division. The control variables labeled female-division provide estimates of the percentage difference in salary between male and female faculty within each division, controlling for age and years at UCSC. The divisional controls give the difference in salary for non-minority males across divisions, relative to social sciences. That is, the average salary for a non-minority male in the arts is estimated to be 8.4% less than in the social sciences, controlling for age and years at UCSC. The estimated average salary for women in the social sciences is 6.0% less than for men in the social sciences, controlling for age and years at UCSC. This difference is statistically significant. For each other division, the differences between male and female salaries within the division are not statistically significant. In the regression reported in Table 7, minority faculty were not separated by division because of the relatively small numbers of minority faculty in some divisions. Average salaries for minority faculty are estimated to be 4.1% less than for non-minority male faculty for all divisions.

The inclusion of controls for division reduced the impact of gender and minority status on salaries in the regressions reported in Tables 4A and 4B. A possible interpretation of these results is that part of the salary differences arises because female and minority faculty are smaller fractions of faculty in the divisions with higher average salaries. The regressions of Tables 6 and 7 show that female-male salary differences arise within the higher average salary divisions,

Social Sciences, Natural Sciences and Engineering, as well. Overall, the results suggest that there may be important divisional differences in the outcome of the personnel review process.

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Table 7: Salary Determination for all Ladder-rank Faculty within Division

Female-Arts	-7.2 (5.0)
Female-Engineering	-3.5 (9.7)
Female-Humanities	2.0 (3.3)
Female-Natural Sciences	-4.7 (3.6)
Female-Social Sciences	-6.0* (3.0)
Minority	-4.1** (1.9)
Engineering	15.4** (3.9)
Natural Sciences	3.9 (2.4)
Humanities	-6.3* (2.9)
Arts	-8.4* (3.9)
<u>Other Controls:</u>	
Age, Age <sup>2</sup>	yes
Years, Years <sup>2</sup>	Yes
R-squared	0.654

Notes: Coefficients are percentage differences in salary for gender and minority status relative to male nonminority faculty). Standard errors in parentheses.

A single star indicates statistical significance at the 5 percent level; a double star indicates statistical significance at the 1 percent level (for a two tailed test of the hypothesis of a zero coefficient). Dependent variable in all models is the logarithm of annual (9-month) salary for 1997-98 academic year for 421 observations. Controls for Division provide differences for non-minority male faculty relative to Social Sciences. The control variables, female-division, represent women in that division. The coefficient estimate reports female to non-minority male differences within the division. The other control variables are defined as follows: age is age in 1997; years represents the number of years on the UCSC faculty.

Rank	Step	Normal Period at Salary	Regular Scale		Engineering Scale	
			Annual	Monthly	Annual	Monthly
ASSISTANT PROFESSOR (1300)	I	2 yrs.	41,200	3,433.33	54,700	4,558.33
	II	2 yrs.	43,600	3,633.33	57,600	4,800.00
	III	2 yrs.	45,900	3,825.00	60,500	5,041.67
	IV	2 yrs.	48,500	4,041.67	63,600	5,300.00
	V	2 yrs.	51,200	4,266.67	66,700	5,558.33
	VI	2 yrs.	54,000	4,500.00	69,500	5,791.67
ASSOCIATE PROFESSOR (1200)	I	2 yrs.	51,300	4,275.00	66,800	5,566.67
	II	2 yrs.	54,100	4,508.33	69,600	5,800.00
	III	2 yrs.	57,200	4,766.67	72,400	6,033.33
	IV	3 yrs.	61,000	5,083.33	74,500	6,208.33
	V	3 yrs.	65,200	5,433.33	76,900	6,408.33
PROFESSOR (1100)	I	3 yrs.	61,100	5,091.67	74,600	6,216.67
	II	3 yrs.	65,300	5,441.67	77,000	6,416.67
	III	3 yrs.	70,800	5,900.00	81,700	6,808.33
	IV	3 yrs.	76,800	6,400.00	87,700	7,308.33
	V	--	83,300	6,941.67	94,400	7,866.67
	VI	--	90,400	7,533.33	101,600	8,466.67
	VII	--	98,200	8,183.33	108,900	9,075.00
	VIII	--	106,300	8,858.33	117,200	9,766.67

\*The Adjunct Professor Series, Professor In Residence Series, and Astronomer Series are also paid on the Academic Year or Fiscal Year ladder rank salary scale.

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## Conclusion

The analyses presented here and in the February 1999 report reveal several statistically significant differences in salaries between female and male faculty and between minority and non-minority faculty. As stated in the introduction, while these data cannot be used to prove discrimination, they also cannot be used to rule it out. The members of the Special Committee on Merit Equity believe they indicate a need for investigation of individual cases if the Senate and the Administration are to ensure that discrimination by gender or minority status is not an outcome of the personnel review process. Averages across individuals do not provide a complete story. Investigating individual cases is important for understanding variation in career and salary advancement and identifying potential cases of unjustified slow advancement or salary growth. The Committee is also concerned that the data may indicate that current Senate and Administration oversight of the personnel review process does not have sufficient safeguards to assure non-discrimination on the basis of gender or minority status.

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## Footnotes:

1 The larger academic empirical literature on employment discrimination in professional and managerial occupations is directly relevant to the subject to this study.

2 Geisler and Oaxaca, A Faculty Salary Determination at a Research I University, @ University of Arizona, manuscript, 2000. Our search and survey of researchers in the field yielded this to be the only study of a complete faculty that uses such data.

3 An example illustrates. Suppose that left-handed faculty are never promoted to tenure as a sole consequence of being left-handed. All associate and full professors are right-handed. Also, suppose that the salaries for left and right handed assistant professors are distributed identically. The handedness of individual faculty should be a significant determinant of salary for a sufficiently large data sample. If rank is added, this significance should disappear (the expectation of the coefficient estimate will be zero). This is because rank is perfectly correlated with the difference between left and right handed faculty salaries and is also correlated with differences in salaries across right-handed faculty (associate versus full professor). It explains more of the variance in salaries and conceals discrimination against left-handed faculty. Rank is highly correlated with salary but not causal of salary.

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**Resolution:**

*Whereas* the analyses presented by the Committee on Merit Equity Review in its two statistical reports, February 1999 and May 2000, indicate some significant salary differences between women and men faculty and between minority and non-minority faculty;

*Whereas* these data cannot rule out the possibility of discrimination;

*Whereas* the results indicate a need for the investigation of individual cases, if the Senate and administration are to ensure that discrimination is not a possible outcome of the personnel review process;

**It is Resolved:**

1. *That* a "Merit Equity Review Process," which is a full-career review, be available to any individual faculty member who perceives her/his salary to be lower than appropriate for a scholar of her/his merit, based on parity at UCSC; and
2. *That* the Special Committee on Merit Equity Review work with appropriate Senate committees and the administration to develop the format of the Merit Equity Review Process.

Respectfully submitted,

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Ken Kletzer  
Gary Miles  
Lincoln Taiz  
Maria Schonbek, Co-Chair  
Mary Silver, Co-Chair

May 10, 2000