University of Michigan Gender Salary Study:

Summary of Initial Findings

Mary E. Corcoran, Professor of Political Science, Women's Studies, Social Work and Public Policy

Paul N. Courant, Professor of Economics and Public Policy, Associate Provost, Academic and Budgetary Affairs

Pamela A. Raymond, Professor of Cell and Developmental Biology, Associate Provost, Academic and Faculty Affairs

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Executive Summary

Consistent with widespread national attention to the issue of gender equity in faculty salaries, Nancy Cantor, former Provost and Executive Vice President for Academic Affairs, commissioned a group of faculty and academic administrators to do an econometric analysis of salaries for tenured and tenure-track faculty at the University of Michigan, Ann Arbor. This statistical analysis used multiple regression models to predict salaries based on several factors known to affect pay, and including gender as a variable. The analysis found no statistically significant gender effect when all controls were used, and a small but significant effect (on average, women are paid about 3% less than men) when rank and years and rank were omitted as control variables. The report suggests that the actual residual difference due to gender lies between 1 and 3%. This initial analysis did not account for variations in individual performance, and the next phase, which is ongoing, is to provide these data to the deans of the several schools and colleges who will determine whether individual salary adjustments should be made in the course of considering salary increases.

Introduction

This report is a summary of the findings of a statistical analysis of faculty salaries for tenured and tenure track faculty at the Ann Arbor campus of the University of Michigan.[1] In the past several years, a number of academic institutions have undertaken and published studies of faculty salaries that were based on a statistical analysis using multiple regression, in which several factors that affect pay were used to predict salaries, with gender included as one of the variables. Before undertaking a similar study at the University of Michigan, we consulted with a number of institutions that had done similar analyses, most notably the University of Wisconsin.

The analysis of faculty salaries at the University of Michigan was sponsored by the Office of the Provost and Executive Vice President for Academic Affairs, and was conducted by Professor Mary Corcoran, with the assistance of Laura Klem, Senior Research Associate at the Institute for Social Research, and Patricia Wolff, Senior Research Associate at the Office of Budget and Planning. An advisory group of faculty and administrative staff served as consultants for the Provost and senior staff in the Office of Academic Affairs.

Procedure

This study examined the salaries of tenure-track and tenured faculty at the University of Michigan, based on academic year 1999 appointment data. The statistical analysis of salary data

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[1] This initial analysis omitted faculty with primary appointments in the Medical School, because of the complexity of the salary structure and the incompleteness of the salary records that are held in central databases. A separate analysis for Medical School faculty is in progress.

used the technique of multiple regression, in which the following factors were used to predict

nine-month salary equivalents: gender, race and ethnicity, highest degree, year received highest

degree, years at Michigan, school or college, departmental unit affiliation, whether an

administrative appointment was held, whether a medical school appointment was held, number

of appointments, "market ratio" (the purpose of which was to capture outside market forces by

measuring the average relative pay by field in a set of peer institutions), current rank, years in

rank and the interaction of rank by years in rank.[2] Detailed information on the variables is

provided in Appendix Tables 1A, 2A and 3A.

At the outset, it is important to point out that this type of analysis considers only some of

the variables that should predict salary. It omits the most important factors that account for

individual salary differentiatials, notably measures of performance, scholarly reputation and

impact, quality and quantity of an individual's contributions to the institution and to their

academic profession. We would expect a good deal of individual variation around the salary

predicted by the regression model used here, because individuals who are identical in terms of

field, rank, and the other variables used here are likely to be different in terms of their specific

academic contributions. In a large population, however, the individual differences in variables

that are not considered in this analysis should average out, so this model is well suited to look for

systematic differences on average for the UM faculty. It can also be used as the first stage in an

examination of individual salaries, but can only be useful in that context if it is combined with

data relating to measures of academic performance and contribution to the institution.

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[2] Two parallel regressions were run, one including the rank and years in rank measures, and one excluding the two
sets of rank measures. This procedure was chosen to allow for the possibilities that women are hired in at lower
ranks than men with similar credentials or that women are promoted more slowly than are men with similar
credentials.

Results of the Analysis

      Table 1 presents mean salaries of faculty at the University of Michigan by gender and rank. A total of 1705 faculty (473 women and 1232 men) were analyzed in this study. The table shows that average salary for all women faculty is less than that of men, both overall, and at every rank. The average woman faculty member had a 9-month salary of $72,392; the average for male faculty was $88,155. Table 1 shows that part of this difference is clearly due to rank and time since degree: women are much less likely than men to be professors. Only 29 percent of women are professors, while 59 percent of men are professors. Similarly, the average female faculty member received her degree fourteen years ago; the average male faculty member received his degree twenty years ago. However, even within ranks men's average salaries are consistently higher than those of women.

      Part of the remaining differences in the average of men's and women's salaries is due to factors such as field of study. Table 2 reports results of regression models that predict the natural logarithm of a nine-month salary. Model (1) reports results of a regression equation that uses gender, race, ethnicity, highest degree, years since degree, years at the University of Michigan, departmental unit affiliation, administrative appointments, medical school affiliations, multiple appointments, and market ratios. Model (2) reports results when rank and years in rank are controlled and added as explanatory variables. The coefficients on the gender variable are roughly equal to the proportion less or more that women are paid relative to men, holding constant all the other variables in the regression.

      In reviewing Table 2, we see that the Model (1) shows an average 3.3% pay disadvantage

for women; this gender-based differential is statistically significant at conventional levels. However, when we add controls for rank and time in rank, the wage disadvantage of women faculty drops to 1.1% and is no longer statistically significant.

The literature on pay differentials by gender and race contains extended discussions of how to appropriately control for rank and years in rank. On the one hand, rank is clearly an important indicator of professional accomplishment, and it is plainly the case that rank is and should be a powerful predictor of salary level. On the other hand, if the processes that determine salary levels treat women and men differently, it is highly plausible that there is differential treatment in the processes that determine rank. There is evidence that women are promoted more slowly than men, and thus, many economists working in this area have argued that if one controls for rank and years in rank, one is over-controlling, with the result that the measured effect of gender on salary is understated in the model reported in Model (2).[3] It is the view of former Provost Cantor, the authors of this report, and the advisory committee that the actual difference in salary that can be attributed to gender is between Model (1) and Model (2) – probably a little over 2%.

In addition to the differential in salary related to gender, the coefficients of the control variables in the regressions indicate that:

(1)   Individuals with multiple appointments have higher salaries: 3.2% higher if two appointments, 4.6% higher for three or more appointments.[4] This suggests that interdisciplinarity is valued and rewarded at Michigan.

(2)   Individuals with administrative appointments also earn more: 3.9%, on average.[4]

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[3] Stapleton, L. & Lissitz, R. Evaluating Faculty Salary Equity using Hierarchical Linear Modeling. Paper presented at the Annual Meeting of the American Educational Research Association (Montreal, Quebec, CA, April, 1999).
[4] Calculations based on Model (2).

Next Steps

The next step in the analysis of gender differentials in salary rates for tenured and tenure-track faculty at the University of Michigan is to combine the information generated by this multiple regression analysis with an assessment of individual faculty performance based on the indicators outlined above as well as other measures. This second-stage of the analysis is now in progress at the level of the schools and colleges, where responsibility for faculty salary determinations resides. Once those additional analyses are accomplished, this will allow individual salary adjustments to be made, taking into account the regression analysis as well as informed evaluations of individual performance and contribution. The University of Michigan is committed to replicating this regression analysis on a periodic and continuing basis.

TABLE 1

SUMMARY STATISTICS FOR FACULTY BY GENDER

	WOMEN	MEN	ALL
Number	473	1232	1705
Mean Years of Experience (years since highest degree)	14	20	18
Mean Years at UM	9	15	13
Mean Salary	$ 72,392	$ 88,155	$ 83,782
Rank			
Assistant Professor	35%	19%	24%
Associate Professor	36%	22%	26%
Professor	29%	59%	51%
Mean Salary by Rank			
Assistant Professor	$ 57,366	$ 61,464	$ 59,776
Associate Professor	$ 67,367	$ 73,626	$ 71,206
Professor	$ 96,620	$ 102,211	$ 101,319

TABLE 2

EFFECTS OF GENDER ON FACULTY SALARIES [a]

	MODEL	
	1 *coefficient* *(standard error)*	**2** *coefficient* *(standard error)*
INDEPENDENT VARIABLES		
Female	-0.033 * (0.013)	-0.011 (0.010)
Asian	-0.027 (0.018)	-.0004 (0.014)
Black, American Indian, Alaskan Native, Hispanic	-0.016 (0.017)	0.011 (0.013)
Gender, race and ethnicity are predictors	X	X
Controls for time since degree, years at UM, and highest degree	X	X
Controls for department/college unit, market ratio, number of appointments, medical or administrative appointments held	X	X
Controls for rank and years in rank		X
Adjusted R^2	0.634	0.785
(n)	1705	1705

[a] All salaries have been adjusted to a nine-month equivalent

* $p < .05$

DEFINITIONS OF VARIABLES USED IN THE REGRESSIONS [b]

Ln Salary The natural logarithm of salary averaged across appointments.
Salary was adjusted to nine months.
Salary was as of November 1, 1999.

Gender Female = 1

Race Asian, Pacific Islander = 1
Under-represented Minority = 1 Black, American Indian,
  Alaskan Native, Hispanic

[White is the excluded category.]

Degree Date Date of highest degree.
Eight cases have missing data.

Years at UM 1999 – Instructional entry date

Highest Degree Holds doctorate or other appropriate terminal degree = 1

Departmental Units Dummy variables were constructed for 29 Departmental
Unit Affiliation Categories. Appendix Table 2A shows affiliation
categories. Faculty members with more than one appointment were
assigned fractional dummies.
Member of that department = 1
[Psychology is the excluded category.]

Market Ratio The natural logarithm of the average market ratio across appointments.
The market ratio was calculated as the average salary at peer institutions
for a given field and a given rank divided by the average peer salary of all
fields for a given rank.

Number of Appointments
Two appointments = 1
Three or more appointments = 1
[One appointment is the excluded category.]

Medical Appointment = 1

Administrative Appointment = 1

Rank   *For a faculty member with more than one rank, the highest rank is used.*
Professor = 1
Associate Professor 1-6 years = 1
Associate Professor 7 or more years = 1
[Assistant Professor is the excluded category.]

Years in Rank   *For a faculty member with more than one rank, Years in Rank is based on highest rank.*

Rank by Years in Rank Interactions
Professor by Years in Rank
Associate Professor 1-6 years by Years in Rank
Associate Professor 7 or more years by Years in Rank
[Assistant Professor by Years in Ranks is the excluded category.]

School / College   *Faculty members with more than one appointment were assigned fractional dummies.*
A. Alfred Taubman College of Architecture and Urban Planning
School of Art and Design
School of Business Administration
School of Dentistry
School of Education
College of Engineering
School of Information
Division of Kinesiology
Law School
School of Music
School Natural Resources & Environment
School of Nursing
College of Pharmacy
School of Public Health
Gerald R. Ford School of Public Policy
School of Social Work
[College of Language, Science and the Arts is the excluded category.]

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[b] Dummy variables are used to capture the information in categorical variables. A categorical variable with j categories requires j-1 dummy variables in order to capture the information in the original variable. Each dummy variable corresponds to one category of the original variable; if a respondent was member of that category, he or she is a one on that dummy variable. Otherwise, he or she is a zero.

For example to code for three categories of Race, two dummy variables are needed: Asian and Underrepresented Minority. If the person is an Asian, the two dummy variable would be coded as 1,0. If the person is an Underrepresented Minority the two dummy variable would be coded as 0,1. If the person is White, the two dummy variables would be coded as 0,0. In the Salary Study dataset, because of multiple appointments, some dummy variables have fractional values less than 1.0.

APPENDIX TABLE 2A

Departmental Unit Affiliation Categories

Category	N	% of Sample	Programs/Units Included
1	33	1.9	Anthropology
2	36.5	2.1	Chemistry
3	47	2.8	Economics Gerald R. Ford School of Public Policy
4	70.8	4.2	English Language & Literature Comparative Literature Program American Culture Program Women Studies Program
5	25	1.5	Geological Sciences
6	86	5	Classical Studies History Philosophy
7	78	4.6	Mathematics Statistics Biostatistics
8	73.5	4.3	Astronomy Physics Atmospheric, Oceanic and Space Science
9	31.5	1.8	Political Science
10	70.5	4.1	Psychology
11	105.2	6.2	Asian Languages and Culture Germanic Languages & Literature Program in Linguistics Near Eastern Studies Residential College Romance Languages & Literature Slavic Languages & Literature Center for Afro-American & African Studies

Category	N	% of Sample	Programs/Units Included
12	28	1.6	Sociology
13	52	3	Biology
14	127.7	7.5	Biomedical Engineering Aerospace Engineering Chemical Engineering Civil & Environmental Engineering Industrial/Operations Engineering Materials Science and Engineering Naval Arch & Marine Engineering Nuclear Eng & Radiological Science Industrial/Operations Engineering Macromolecular Science & Engineering
15	75	4.4	Electrical Engineering & Computer Science
16	47	2.8	Mechanical Engineering & Applied Mechanics
17	28.3	1.7	A. Alfred Taubman College of Architecture and Urban Planning
18	35	2.1	History of Art School of Art and Design
19	112	6.6	School of Business Administration
20	62.3	3.7	Biologic and Materials Sciences Oral/Maxillofacial Surgery Prosthodontics Cariology, Restorative Sciences and Endodontics Community Dentistry Periodontics/Prevent & Geriatrics Oral Diagnosis Oral Pathology Oral Surgery Orthodontics Pediatric Dentistry Periodontics

Category	N	% of Sample	Programs/Units Included
21	67.5	4	School of Education Division of Kinesiology
22	47.5	2.8	Law School
23	26.7	1.6	School of Information Communication Studies Technical Communication Program in Film and Video
24	108	6.3	School of Music Department of Dance Theatre and Drama
25	31.5	1.8	School of Natural Resources & Environment
26	71.5	4.2	Dental Hygiene - Dentistry School of Nursing Health Behavior & Health Education
27	26	1.5	College of Pharmacy
28	60.5	3.5	Health Management and Policy Environmental-Industrial Health Epidemiology
29	41.5	2.4	School of Social Work
Total	**1705**	**100%**	

APPENDIX TABLE 3A

MEAN VALUES FOR EACH INDEPENDENT VARIABLE

INDEPENDENT VARIABLE	MEAN
Sex	0.28
Asian	0.09
Black, American Indian, Alaskan Native, Hispanic	0.10
Years at UM	13.18
Any Doctoral Degree	0.92
Date of Highest Degree	1980.64
Professor	0.51
Associate Professor 1-6 yrs	0.09
Associate Professor 7 or more yrs	0.17
Years in Rank	8.42
Professor * years in rank	6.04
Assoc Professor 1-6 yrs * years in rank	0.44
Assoc Professor 7 or more yrs * years in rank	1.26
Administrative Appointment	0.10
Medical School Appointment	0.02
2 Appointments	0.24
3 or more Appointments	0.08
Market Ratio	0.01

MEAN VALUES FOR EACH INDEPENDENT VARIABLE (continued)

Departmental Unit Affiliation Categories:	
1	0.02
2	0.02
3	0.03
4	0.04
5	0.01
6	0.05
7	0.05
8	0.04
9	0.02
10	0.04
11	0.06
12	0.02
13	0.03
14	0.07
15	0.04
16	0.03
17	0.02
18	0.02
19	0.07
20	0.04
21	0.04
22	0.03
23	0.02
24	0.06
25	0.02
26	0.04
27	0.02
28	0.04
29	0.02