
Final Report Ad Hoc Committee on Faculty Salary Equity

Executive Summary¹

Campus Senate Resolution 31-10, approved October 18, 2002, created the Ad Hoc Committee on Faculty Salary Equity. The committee is a joint faculty-administrative effort to examine possible systemic salary bias related to gender or race and also to develop a model for administration of salary equity adjustments. The committee began meeting in January 2003 deliberating in a spirit of collective, open-minded inquiry about the approach the campus should take to defining and analyzing faculty salary equity. Our deliberations were greatly aided by the 2002 AAUP publication *Paychecks: A Guide to Conducting Salary-Equity Studies for Higher Education Faculty* by Lois Haignere.

In the Fall of 2003, the committee arrived at a point in its deliberations where we believed it was important to share our thinking about salary equity analysis at UIS. We prepared an interim report in October 2003 covering general principles, specifications of faculty to be included in the analysis and variables to be used to search for patterns of equity and inequity. This interim report was distributed to the deans and college executive committees. In November and December of that year, members of the Committee met with the deans and college executive committees to solicit feedback. The response to the interim report was positive. The committee finalized the model in spring 2006 and produced this final report.

Focus of the Analysis: The committee recognizes that equity can be approached in many ways. Formation of the committee had been motivated by growing concerns about gender and race equity among our faculty as well as salary compression. While it is legitimate to ask questions about the relationship between salaries at UIS and salaries at other institutions, the committee chose to begin the examination of faculty salary equity on this campus by examining the relationship between the internal distribution of faculty salaries and variables reflecting bona fide occupational qualifications.

Analytic Approach Chosen: As recommended by Haignere, the committee chose to explore the issue of the relationship between bona fide occupational qualifications and individual salaries using a multiple regression model². The strength of multiple regression is that it enables the researcher to examine the effects of several variables simultaneously. We were able to examine the impact of gender, race, rank, years in rank and discipline on the variable of salary. The relatively small number of faculty included in our analysis

¹ Note: This report was submitted to the administration and reviewed with the Campus Senate leadership in June 2007. The recommended approach was used in the FY 2007 salary equity program implemented during July 2007. The implementation of the report's recommendations is reflected in the Executive Summary.

² See Appendix D for an introduction to the concept of regression analysis

(n=147) meant that we had to limit the number of variables to be included in the model. The multiple regression model developed and tested by the committee is viewed as a tool to assist in a larger multi-method analysis of internal salary equity among full-time tenure-track faculty at UIS. The quantitative analysis is heuristic, not dispositive. Nothing in the approach recommended by the committee precludes deans from making salary equity adjustments based on the considerations of individual circumstance that cannot be captured in an aggregate quantitative analysis.

Elements of the Analytic Model. Every statistical technique has limitations and every application of statistics involves judgments. The committee sought to operate in a way that documented both the points at which judgments were made and the rationale for our decisions. The committee had to make judgments about who was to be included in the population of faculty members whose salaries would be analyzed and about which factors would be included in an analysis of patterns of equity and inequity among those salaries.

Three adjustments were made to the salary figures used in the model to try to remove the influence of factors that might mask inequities. Amounts for faculty receiving administrative stipends were removed from the salary figures for those faculty members because the issue of equity among administrative salaries was beyond the scope of our analysis. Salary increases associate with retirement agreements were removed from the salary figures used in the analysis because these increases do not reflect the salary that would have been paid absent the retirement agreement. Nine-month salary figures were adjusted to remove the effects of merit adjustments. Failing to adjust for merit increases could lead to faculty who received less-than-standard merit being identified as deserving equity increases and faculty who received greater-than-standard merit increases not being identified as deserving equity increases.

The committee deliberated on which faculty should be included in the analysis. The model is directed toward the analysis of salary equity and inequity among full-time tenured and tenure track faculty. The committee agreed to exclude from the analysis non-tenure track faculty, part-time faculty, endowed professors/chairs, and professors in unique programs, full-time academic administrators and former academic administrators. These groups were excluded from the analysis because the factors influencing the way their salaries are set differ significantly from the factors influencing the way the salaries of full-time tenure track faculty are set.

As stated above, the relatively small number of full-time tenure track faculty at UIS limited the number of factors that could be included in our analysis. (The statistical technique does not remain robust if you divide your population into so many categories that some categories contain fewer than five individuals.) The variables used in the analysis included those representing *bona fide* occupational qualifications that the committee hoped to identify as having a strong relationship to salary levels. The *bona fide* occupational qualifications used in the analysis are rank, years in rank, and discipline. If salaries are equitable, one's *bona fide* occupational qualifications are strongly related to one's salary. Quantitative analysis of salary equity also can be used to identify any inappropriate relationships between race or gender and salary levels. These

variables are included in the analysis because the committee hoped to find that there was no relationship between either race or gender and salary levels.

The regression model uses the adjusted salary as the dependent variable and rank, years in rank and discipline as the independent variables. The adjusted R^2 is 0.836 which means that approximately 84% of the variation in faculty salaries is explained by rank, years in rank, and discipline. (An R^2 of 1.0 would mean that the three independent variables explain all the variation in salary.) The model uses these three independent variables to calculate a predicted salary for each faculty member. To determine predicted salary for any individual faculty member, the model would make a numerical estimate based on that individual faculty member's rank, years in rank and discipline group. For example, an associate professor in a particular discipline group would have a higher predicted salary than would an assistant professor in that same discipline group. Among assistant professors in a particular discipline group, a faculty member with more years in the rank of assistant professor would be predicted to make more than a faculty member in that same discipline group with fewer years in the rank of an assistant professor. The model has a relatively high degree of predictive power and is consistent using three years of salary data.

The model described above can also be used to identify any patterns of racial or gender disparity in salaries. When race and gender were included in the regression model, the model explained an additional one percent of variation in salaries. Gender and race do not appear to be making a substantial impact on salary equity when the entire UIS faculty is examined. However, the model does identify gender equity concerns within the College of Business and Management. The status of gender equity in the College of Business and Management will be examined again this fall to determine if the gender-related disparity in salaries has been eliminated through the FY 2007 equity adjustments.

Differences between the predicted and actual salary using the model presented in this report were used as one input in a salary equity program for FY 2007. The equity analysis compared the predicted salary for each faculty member to her/his actual salary. A predicted salary higher than an actual salary was used to provide information to the deans on potential salary equity adjustments. The amount of funds available for our salary equity package controls the extent to which salary equity adjustments can be addressed in a given year. For FY 2007, sufficient funds were available to bring all faculty to within 92.5% of the predicted value.

During July 2006, the deans made recommendations to the provost on equity adjustments for faculty members based on the statistical information provided by the committee and other considerations deemed appropriate, such as the discipline of the degree and seniority. In all, salary equity adjustments were made for 31 faculty.

It is the intention of the UIS administration to continue a salary equity program building on lessons learned from this year's salary equity program and additional years of data.

Final Report Ad Hoc Committee on Faculty Salary Equity

Campus Senate Resolution 32-10, approved October 18, 2002, created the Ad Hoc Committee on Faculty Salary Equity.

The committee is a joint faculty-administrative effort to examine possible systemic salary bias related to gender or race and also to develop a model for administration of salary equity adjustments.

The original committee consisted of four faculty members: Patricia Byrnes, Denise Green, Karen Kirkendall, and Pinky Wassenburg and four administrators: Harry Berman, Bill Bloemer, Marya Leatherwood, and Larry Stonecipher. This committee worked together from Spring 2003 through Summer 2005. Patti Sims serves as staff to the committee. Harry Berman facilitated the discussions. Patricia Byrnes serves as the Faculty Salary Equity Committee's liaison to the Campus Planning and Budgeting Committee (CPBC).

The committee changed in Spring 2006. There were three faculty: Patricia Byrnes, Denise Green, Karen Kirkendall and three administrators: Bill Bloemer, Larry Stonecipher, and Pinky Wassenberg. Patti Sims continued to serve as staff to the committee. Bill Bloemer facilitated the discussions. Patricia Byrnes remained as the Faculty Salary Equity Committee's liaison to the Campus Planning and Budgeting Committee (CPBC).

Process

The committee began meeting in January 2003. Over the course of its meetings, the committee deliberated in a spirit of collective, open-minded inquiry about the approach the campus should take to defining and analyzing faculty salary equity. Our deliberations were greatly aided by the 2002 AAUP publication *Paychecks: A Guide to Conducting Salary-Equity Studies for Higher Education Faculty* by Lois Haignere.

In Fall 2003 the committee arrived at a point in its deliberations where we believed it was important to share our thinking about what we propose to be the key features of a salary equity analysis at UIS. Accordingly, the committee prepared an interim report (October 2, 2003) covering general principles, as well as definitions of faculty and variables. This report was distributed to the deans and college executive committees. In November and

December, members of the Ad Hoc Committee met with the deans and college executive committees to review the interim report and solicit feedback. The response to the interim report was positive. The college executive committees encouraged the Ad Hoc Committee on Faculty Salary Equity to follow through on the line of thinking developed in the interim report and use that approach to frame recommendations for salary equity adjustments.

The committee continued to meet through academic year 2004-2005, focusing attention on the issue of discipline groupings.

The committee finalized the model in spring 2006 resulting in model development using three years of faculty salary data. The committee now wishes to present its salary equity model to the Campus Senate, and the faculty as a whole.

General Principles

- There are many definitions of equity. This committee is looking at equity in terms of the relationship between the internal distribution of faculty salaries and variables reflecting *bona fide* occupational qualifications.

It is legitimate to ask questions about the relationship between salaries at UIS and salaries at peer institutions or to compare salaries at UIC and UIUC with those at UIS. However, those questions are outside the scope of this committee's work. This committee was established to examine questions of internal equity. Formation of the committee was prompted by concerns about gender equity and salary compression; these internal equity questions remain the focus of the committee's work.

- Every statistical technique has its limitations and every application of statistics involves judgments.

Several of the committee members have extensive experience with statistical analysis of natural science or social science data. The committee members recognize that every statistical technique has its limitations and that judgments are an inevitable feature of all statistical approaches. The committee seeks to operate in a way that clarifies points at which it made judgments and the reasons for those judgments. Quantitative analysis may be best viewed as the first step in an equity study.

- If it is possible to use the multiple regression techniques without violating the assumptions of those methods, it will be desirable to do so. If on the other hand, it is not possible to use the multiple regression techniques, the committee will suggest alternative approaches.

The strength of multiple regression is that it enables the researcher to examine the effects of several variables simultaneously. An example is looking at the effects of gender, rank, years in rank, and discipline on salary. A simple scattergram can be used to plot the relationship between any two of these variables. However, multiple regression techniques enable us to control statistically for variations in rank, years in rank, and discipline when examining the effects of gender on salary.

The committee ultimately determined that it was possible to use multiple regression without violating the assumptions of that method (see next bullet).

- If the UIS salary equity model is to be statistically sound, it will be important to limit the number of independent (predictor) variables.

Haignere (2002) notes that institutions having one hundred or more full-time faculty members can probably validly conduct a salary analysis using multiple regression techniques. The UIS analysis will be based on an N (number of cases for analysis) of 147 faculty – well above Haignere’s recommended threshold. However, with an N of the size available at UIS, minimizing the number of variables used in the multiple regression models will enhance the power of the statistical analysis. The committee’s goal is to create a model that accounts for as much variation as possible without diminishing the model’s power and stability from year to year.

The committee has been conscious of the assumptions that have to be met for valid use of multiple regression techniques: the problem of multicollinearity; error term requirements; outliers; possible gender bias in predictor variables. Appropriate tests have been made to ensure that the assumptions underlying multiple-regression analysis are met.

- The salary equity analysis being proposed by the committee will be a probabilistic aggregate analysis. It will conform to the best professional practices and will be conducted in good faith. Such an analysis will not, however, identify every case of inequity. Nothing in the approach recommended by the committee will preclude deans from making salary equity adjustments based on the type of consideration of individuals that cannot be captured in an aggregate analysis.

In the remaining sections of this report the committee presents its thinking on *who* was included in the UIS salary equity analysis and *how* the variables were defined.

Faculty

The committee deliberated on which faculty should be included in the model developed to address salary inequities. In general, the model was directed toward the analysis of salary equity and inequity among ***full-time tenured and tenure track faculty***. The committee used the following reasoning in defining those who will be included in the analysis:

Full-time nontenure-track faculty

The committee agreed that for the purposes of determining faculty salary equity/inequity, nontenure track faculty should not be included in the same analysis as tenure-track faculty. In the committee's judgment the factors influencing the way that initial salaries are set for nontenure track faculty differ significantly from those for tenure-track faculty. The issue of salary equity among full-time nontenure track faculty needs to be addressed through another process³.

Part-time/adjunct faculty

This committee will not address the issue of salary equity among part-time faculty. Appropriate compensation for part-time/adjunct faculty continues to be a significant concern (see *Report of Ad Hoc Committee on Nontenure Track Faculty*). However, the process envisioned for addressing salary equity among full-time faculty will not be suitable for addressing salary issues relating to part-time faculty.

Library faculty

At UIS, librarians hold faculty rank and are eligible for tenure. However, they are employed on a 12-month, rather than 9-month, basis. The committee believes that library faculty can be included in the campus-wide analysis by adjusting their annual salaries to put them on a 9-month basis.

Endowed professors, endowed chairs, professors in unique programs

The committee agreed that the focus of our work is on faculty hired through 'regular' processes, whose initial salaries are set by typical market factors, and who go through the normal tenure/promotion process. The employment of endowed professors and chairs does not follow these regular processes. Similarly, UIS had a program staffed by one faculty member, which makes salary comparisons difficult. Therefore, UIS' endowed professors/chairs and professors in unique programs are not included in the salary equity analysis.

³ In Fall 2005, UIS employed 23 full-time nontenure-track faculty: 19 were Visiting assistant professors/ visiting instructors and 4 were Instructors/Clinical faculty with continuing nontenure-track appointments

Academic administrators

Full-time administrators who hold faculty rank will not be included in the analysis. The faculty salary equity program is not intended to address salary equity issues of administrators, even those holding academic rank.

Former academic administrators

In the committee's judgment the factors influencing the salary levels of administrators who returned to the faculty since the time of the merger with the University of Illinois differ significantly from those for tenure-track faculty. This committee noted that the salaries of these former administrators are notably higher than the salaries of other faculty of comparable rank and discipline and could distort the equity analysis. Two such faculty will be excluded from the equity analysis.

Based on these decision rules, the population of faculty for purposes of this analysis has the characteristics shown in Table 1. The total number (N) of faculty for the analysis will be 147. Of those, 18 (132%) are full professors, 62 (42%) are associate professors, and 67 (46%) are assistant professors. Of the faculty for this analysis, 64 (43.5%) are women and 84 (56.5%) are men.

Table 1: AY2005-2006 Tenured / Tenure-Track Faculty: By Rank and Gender*			
RANK	GENDER		Total Sample
	F	M	
Assistant Professor	30	37	67 (45.6%)
Associate Professor	27	35	62 (42.2%)
Professor	7	11	18 (12.2%)
TOTAL	64 (43.5%)	83 (56.5%)	147 (100.0%)
*Excludes the following categories of faculty; full-time non-tenure track faculty; part-time/adjunct faculty; faculty currently or formerly holding endowed professorships/ chairs; academic administrators; former academic administrators			

Table 2 give provides a description of the sample by race.

Table 2: Sample Description by Race		
Race Category	Number	Percent
Asian	12	8.2
Black	8	5.4
Hispanic	2	1.4
White	125	85.0
Total	147	100.0

Table 3 provides a description of the sample by college.

Table 3: Sample Description by College		
College	Number	Percent
BUS	30	20.4
EHS	22	15.0
LAS	66	44.9
LIB	6	4.1
PAA	23	15.6
Total	147	100.0

Variables

Salary

Time period. The Fall 2006 nine-month salary will be used as the dependent variable in the analysis.

The committee made three adjustments to the Fall 2006 salary figures prior to conducting the equity analysis:

Administrative stipends. Nine-month salaries of faculty receiving administrative stipends were adjusted to exclude administrative stipend. That is, the equity

analysis was based on what the faculty member’s salary would be without the administrative stipend.

Retirement agreements. In the committee’s judgment, salary increases associated with retirement agreements should be backed out of the salary to be used in the analysis, as these increases do not reflect the ‘true’ salary of the individual – the salary that would have been in effect in the absence of a retirement agreement.

Merit. Consistent with the recommendation in the interim report discussed in meetings with each of the colleges during AY2003-2004, nine-month salaries were adjusted to remove the effects of merit salary adjustments above or below the standard merit increase. Failing to adjust for merit increases could lead to faculty who received less-than-standard *merit* increases being identified as deserving *equity* increases and faculty who received greater-than-standard merit increases being identified as not deserving equity increases. The committee does not want merit increases to mask salary inequities. Instead of adding an independent (predictor) variable to reflect merit increases, the committee adjusted the dependent variable (salary). This approach has the additional advantage of avoiding adding variables to the regression equation.

Table 4 provides descriptive statistics for the adjusted salary variable used in the model. Statistics for the total sample and by rank are provided.

Table 4: Description Statistics for Adjusted-Salary: Total Sample and By Rank				
Rank (n)	Mean	St. Dev.	Minimum	Maximum
Assistant (67)	50,917.63	15,258.51	32,455.00	105,000.00
Associate (62)	61,556.64	14,557.00	34,302.00	111,240.00
Full (18)	76,648.78	15,006.61	56,909.00	103,394.00
Total (147)	58,555.59	17,057.61	32,455.00	111,240.00

Rank

Promotion from assistant to associate professor and from associate to full professor carries with it a salary increase. Therefore, rank needs to be considered in any analysis of

salary equity. However, research at other institutions has revealed gender bias in promotion. At those institutions including 'rank' as predictor of salary may introduce bias. The committee investigated possibility of gender bias in promotion at UIS in two ways: cohort analysis and discriminant analysis.

- Cohort Analysis: The committee examined data on promotion from assistant to associate professor in the ten most recent cohorts for whom complete data is available (See Table 5). As shown in Table 5, the proportion of female assistant professors who were promoted to associate professor (and tenured) across the ten cohorts (67.6%) was slightly higher but very close to the proportion of male assistant professors who were promoted to associate professor (65.8%). Therefore, the committee concluded that in terms of the cohorts for which we have complete data (cohorts hired between 1989 and 1997) there is little evidence that there is gender bias in promotion from assistant to associate professor.
- Discriminant Analysis: To summarize the results of the discriminant analysis (a detailed description is included in appendix A) we begin with a restatement of the problem. The problem with using rank in the salary equations is that there is a possibility that rank assignment is gender biased. This means that controlling for rank in a model would lead to an *understatement of the level of pay disparity* between men and women. Discriminant analysis allows one to test for gender bias in rank (controlling for other factors relevant to rank) and decide whether rank should be used in the analysis. The results indicate that there is little gender bias in the promotion and tenure.

Both methods of analysis do not support the idea of gender bias in promotion, including promotion from associate to full professor. Therefore, the committee believes it is reasonable to include rank as a variable in salary equity analysis at UIS.

Years in rank

It would be expected that the salaries of faculty with more years in rank should be higher than the salaries of faculty with fewer years in rank. Including a time/experience variable is central to an equity analysis and the committee plans to use years in rank as the experience variable.

Discipline

Data from the College and University Personnel Association (CUPA) strikingly reveal the substantial effect of market factors on salary across the country. The challenge faced by the committee was how to best reflect the effect of discipline on salary in the context of both national data and the actual distribution of salaries at UIS. The discipline groups found to add predictive power to the regression equation are shown in Table 6. Appendix B provides a detailed explanation of the creation of the discipline groups.

Table 5: Cohort Analysis

Gender Equity Study - Tenure Analysis

Cohort (year hired)		89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	All Cohorts										
All members of cohort on indefinite contract (tenured) terminal contract, or separated																					
		95-96		96-97		97-98		98-99		99-00		00-01		01-02		02-03		03-04		All Cohorts	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Total	F	5	50.0%	8	57.1%	1	16.7%	3	100.0%	10	47.6%	1	33.3%	1	25.0%	3	33.3%	2	100.0%	34	47.2%
	M	5	50.0%	6	42.9%	5	83.3%	0	0.0%	11	52.4%	2	66.7%	3	75.0%	6	66.7%	0	0.0%	38	52.8%
Tenured	F	3	60.0%	6	75.0%	0	0.0%	2	66.7%	7	70.0%	1	100.0%	1	100.0%	1	33.3%	2	100.0%	23	67.6%
	M	2	40.0%	4	66.7%	3	60.0%	0	0.0%	9	81.8%	2	100.0%	1	33.3%	4	66.7%	0	0.0%	25	65.8%
Denied Tenure	F	0	0.0%	1	12.5%	0	0.0%	0	0.0%	3	30.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	4	11.8%
	M	1	20.0%	2	33.3%	2	40.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	16.7%	0	0.0%	6	15.8%
Other [See Note A]	F	2	40.0%	1	12.5%	1	100.0%	1	33.3%	0	0.0%	0	0.0%	0	0.0%	2	66.7%	0	0.0%	7	20.6%
	M	2	40.0%	0	0.0%	0	0.0%	0	0.0%	2	18.2%	0	0.0%	2	66.7%	1	16.7%	0	0.0%	7	18.4%

Note A: Includes resignations and 1 Male on disability with death in 2002.

Table 6 Discipline Groups	
Group A (n=11)	Computer Science Management Information Systems
Group B (n=6)	Library
Group C (n=22)	Accountancy Business Management
Group D (n=10)	Economics Public Administration Public Health
Group E (n=18)	Biology Chemistry Clinical Laboratory Science Environmental Studies Mathematics
Group F (n=14)	Legal Studies Political Studies Criminal Justice
Group G (n=39)	Communication Educational Leadership Human Development Counseling Human Services Psychology Social Work Sociology/Anthropology Teacher Education
Group H (n=28)	African-American Studies English History Individual Option Philosophy Visual Art Women's Studies

Gender & Race/Ethnicity

The origins of this project were not only in the campus' concern about salary compression, but also in the concern about the possibility of a systemic salary bias related to gender and race/ethnicity.⁴ Therefore, both race and gender are included in the regression model to investigate race or gender bias in the faculty salaries. The committee

⁴ See Gardner (2000) and Livingstone (2000) for a discussion of these issues.

realizes that this analysis is limited in its ability to identify cases of gender and race bias but does allow for analysis of systematic bias.

Results

This regression model specified uses the adjusted salary as the dependent variable and years in rank, rank and discipline group as the independent variables. The model was estimated with AY 2005-2006 faculty salaries and the results of the regression analysis are summarized in Table 7. It should be noted that this regression model was applied to two other years of faculty salary data (AY 2003-2004 and AY2004-2005). Unless otherwise reported the model results were consistent over these three years of data.

The second to last row of table 7 presents a description of the model fit. The adjusted R^2 is reported as 0.836, which means that almost 84 percent of the variation in faculty salaries is explained by the variables in the equation. The F-statistics is large and statistically significant indicating further that the variables provide a “good-fit” to explaining the variation of faculty salaries. A high R^2 in a model that includes the *bona fide* occupational qualifications for determining salary provides a starting point for salary equity adjustments.

To understand how the model can be used for salary adjustment an example of how the results are used to determine predicted salary is helpful. The equation for the predicted salary based on the model is:

$$\begin{aligned} \text{Predicted Salary} = & \$43,905 + \$396 x (\text{Years in Rank}) + \$4,281 x (\text{ASSOC}) + \\ & \$15,067 (\text{FULL}) + \$37,436 x (\text{GROUP A}) - \$10,471 x (\text{GROUP B}) \\ & + \$30,156 x (\text{GROUP C}) + \$12,792 x (\text{GROUP D}) + \$2,882 x \\ & (\text{GROUP E}) + \$688 x (\text{GROUP F}) + \$8,377 x (\text{GROUP G}) \end{aligned}$$

To determine predicted salary for any individual faculty you would include values of the variables in parentheses and compute the equation. All of the variables, except the Years in Service variable, are binary or dummy variables. This means that they have a value of 1 for an individual in the designated group and a value of zero otherwise. The variables describe all the different combinations of rank and discipline group except the baseline group, which is assistant professors in-group H (African American Studies, English, History, Individual Option, Philosophy, Visual Arts and Women’s Studies). For this group their predicted salary would be the intercept plus their value for their years in rank.

**Table 7:
AY05-06 Adjusted Salary Regression Results (N=147)**

	Estimated Coefficient	Standard Error	t-value
Constant ⁺	43,905.10	1,379.7	31.8*
Years In Rank	395.97	114.9	3.4*
Associate	4,280.64	1376.3	3.1*
Full	15,067.46	1,978.2	7.6*
Group A: CMS_MIS (Info Tech)	37,436.44	2,390.2	15.6*
Group B Library	-10,470.87	3,004.1	-3.5*
Group C: ACC_BUS_MGT (Business)	30,155.95	1,969.4	15.3*
Group D: ECO_MPH_PAD	12,792.40	2,490.8	5.1*
Group E: BIO_CHE_ENS_MAT_CLS	2,881.68	2,019.7	1.4
Group F: COM_EDL_HDC_HMS_PSY_SOA_SWK_TEP	688.35	1,645.6	0.4
Group G: CRJ_LES_POS	8,376.95	2,213.1	3.8*
Model Fit: Adjusted R ² =0.849 F-Statistic= 82.89			
Notes: +The baseline group is assistant professors in group H—African American Studies, English, History, Individual Option, Philosophy, Visual Arts and Women’s Studies.			
* Significant at 0.01 level or below.			

For example, the predicted salary of an assistant professor in History with 3 years in rank would be:

Predicted Salary for
History Assistant Prof = \$43,905 + \$396 x (3) = \$43,905 + \$1,188 = \$45,093
With 3 Years in Rank

The intercept, \$43,905, is the average base salary for everyone and increases by \$461 dollars for each year of service. As another example, the predicted salary of a Full professor in Management with 10 years of time in rank is computed as:

Predicted Salary for
Management Full Prof = \$43,905 + \$396 x (10) + \$15,067 + \$30,156 = \$93,088
With 10 Years in Rank

For this example faculty member, the predicted salary includes: the base intercept salary, \$396 dollars for each year in rank (or \$3,960), \$15,067 for the rank of full professor (the estimated coefficient of FULL), and \$30,156 for GROUP C in the Management.

For faculty with predicted salaries higher than their actual salaries, these predicted salaries could suggest the need for salary adjustments. Suppose the actual performance-adjusted salary for AY 2005-2006 of our example assistant professor from History with 3 years in rank was \$39,000. The salary adjustment recommended by the model could be computed as

$$\begin{array}{l} \text{Salary Adjustment of} \\ \text{History Assistant Prof} \\ \text{With 3 Years in Rank} \end{array} = \begin{array}{l} \text{Predicted} \\ \text{Salary} \end{array} - \begin{array}{l} \text{Actual} \\ \text{Salary} \end{array} = \$43,905 - \$39,000 = \$4,905$$

Thus, for this hypothetical professor, the model suggested salary adjustment \$4,905, which is 12.6 percent of the actual salary.

The predicted salaries can also be used to shed light on the magnitude of salary equity problem. How much funding would be needed to bring all faculty to 90% of predicted salary? Table 8 summarizes this calculation by providing the cost of this 90 percent faculty adjustment for the campus and by college. For the campus, 13 faculty have actual salaries below 90 percent of their predicted salary and would receive adjustments totaling over \$28 thousand. The size of this adjustment can be seen by comparing the total adjustment to total actual salaries. The adjustment for the campus would be less than half a percent, 0.3 percent of total AY05-06 salaries for the campus. The College of Business requires more adjustments as a percentage of total college salaries and would have more faculty receiving an adjustment based on the model results.

Table 8: Budget Impact of 90 Percent Salary Adjustment Program					
College	Number of Faculty with Adjustments	Faculty w/ adjustments as percent of Total	Total Adjustments	Total Actual AY05-06 Salaries	Adjustment as Percent of Total Salaries
BUS	7	23.3%	\$16,234	\$2,462,379	0.66%
EHS	0	0%	\$0	\$1,092,795	0.00%
LAS	3	4.5%	\$8,943	\$3,421,492	0.26%
LIB	1	16.7%	\$1,780	\$295,751	0.60%
PAA	2	8.7%	\$1,365	\$1,421,860	0.10%
Total	13	8.8%	\$28,322	\$8,694,277	0.33%

Table 9 and 10 report results for a 92.5 percent and 95 percent salary adjustment based on the model results. A salary equity adjustment based on the model and a policy that would bring all faculty to within 92.5 percent of their predicted salary would cost over \$62 thousand and 28 faculty (19.0%) would receive adjustments. A salary equity adjustment based on the model and that would bring all faculty to within 95 percent of their predicted salary would cost would be over \$115.5 thousand. Under this policy, the model suggests that 40 faculty (27.2%) would receive adjustments.

**Table 9:
Budget Impact of 92.5 Percent Salary Adjustment Program**

College	Number of Faculty with Adjustments	Faculty w/ adjustments as percent of Total	Total Adjustments	Total Actual AY05-06 Salaries	Adjustment as Percent of Total Salaries
BUS	9	30.0%	\$34,539	\$2,462,379	1.40%
EHS	0	0.0%	\$0	\$1,092,795	0.00%
LAS	12	18.2%	\$17,330	\$3,421,492	0.51%
LIB	1	16.7%	\$2,782	\$295,751	0.94%
PAA	6	26.1%	\$7,755	\$1,421,860	0.54%
Total	28	19.0%	\$62,406	\$8,694,277	0.72%

**Table 10:
Budget Impact of 95 Percent Salary Adjustment Program**

College	Number of Faculty with Adjustments	Faculty w/ adjustments as percent of Total	Total Adjustments	Total Actual AY05-06 Salaries	Adjustment as Percent of Total Salaries
BUS	10	33.3%	\$54,763	\$2,462,379	2.22%
EHS	1	4.5%	\$198	\$1,092,795	0.02%
LAS	21	31.8%	\$38,747	\$3,421,492	1.13%
LIB	2	33.3%	\$4,596	\$295,751	1.55%
PAA	6	26.1%	\$17,270	\$1,421,860	1.21%
Total	40	27.2%	\$115,575	\$8,694,277	1.33%

Descriptive statistics for the 90 percent adjusted salaries by rank are given in table 11. There is considerable variation in the adjustments for the 13 faculty that would receive the 90 percent adjustment; lowest adjustment is \$281 and the highest is \$7,060. By rank the largest variation is within the adjustments for associate professors.

Table 11: Descriptive Statistics for 90 Percent Salary Adjustments: All Adjustments and By Rank				
Rank (# adjusted)	Mean	St. Dev.	Minimum	Maximum
Assistant (3)	\$970	\$49	\$941	\$1,028
Associate (9)	\$2,786	\$2,129	\$281	\$7,060
Full (1)	\$337	na	\$337	\$337
Total (13)	\$2,179	\$1,986	\$281	\$7,060

Model Diagnostics

The model described in the previous section (see table 7) is based on regression analysis. The committee conducted diagnostics on the model to increase confidence in the model results. The complete set of diagnostics is described in appendix C. This section summarizes two important issues that the model results and diagnostics suggest: 1) race and gender analysis and 2) analysis by college.

Race and Gender

The previous model only includes measurable variables that are factors that should determine faculty salary levels. The committee investigated whether two other variables, gender and race, explain the variation in faculty salaries at UIS. Table 12 summarizes these model results. When gender and race are included in the model the R² increases by about 0.01 (from 0.849 to 0.859), which means that a model with race and gender explains 1 percent more of the variation in salaries. By the size of the coefficients and the stability of the coefficients over different models, it was determined that race contributes to explaining salaries. In fact, the model suggests that on average, White and Asians had lower salaries by over \$6,800 controlling for rank, years in rank and discipline. Differences by gender are not as large, with on average increase for males over \$1,500. This gender estimate is less stable under different specifications of the model.

**Table 12:
AY05-06 Adjusted Salary Regression Results
With Gender and Race (N=147)**

	Estimated Coefficient	Standard Error	t-value
Constant ⁺	49,641.79	2,491.3	19.9*
Years In Rank	375.42	112.3	3.3*
Associate	4,154.35	1,333.3	3.1*
Full	14,838.48	1,920.7	7.7*
Group A: CMS_MIS (Info Tech)	37,148.48	2,395.0	15.5*
Group B Library	-9,279.26	2,951.3	-3.1*
Group C: ACC_BUS_MGT (Business)	30,189.50	1,908.0	15.8*
Group D: ECO_MPH_PAD	12,566.12	2,403.5	5.2*
Group E: BIO_CHE_ENS_MAT_CLS	2,767.53	1,954.1	1.4
Group F: COM_EDL_HDC_HMS_PSY_SOA_SWK_TEP	724.08	1,588.5	0.5
Group G: CRJ_LES_POS	7,794.7	2,142.2	3.6*
Gender (MALE =1)	1,513.37	1,167.7	1.3
RACE (WHITE and ASIAN =1)	-6,820.61	2,215.6	-3.2*
Model Fit: Adjusted R ² =0.859 F-Statistic= 75.301			
Notes: +The baseline group is White or Asian, male assistant professors in group H—African American Studies, English, History, Individual Option, Philosophy, Visual Arts and Women’s Studies.			
* Significant at 0.01 level or below.			

College-Level Analysis:

As the regression diagnostics were conducted it became clear that differences by college might also be relevant. This was especially true for the College of business, where plots of the residuals and outlier analysis revealed some difference between Business and the other Colleges. Table 13 summarizes the results of the regression model for the data split between all other colleges and the college of business. The results are quite different for the Business College-only model. Most disturbing is the fact that year-in-rank has a negative relationship with adjusted salary, although it is a small influence on salary.

Also, males on average are paid almost \$15,000 more than females in the College of Business after controlling for years-in-rank, rank, discipline and race.

Next Steps

The committee concludes with the following summary and recommendations:

- A regression model of faculty salary was been developed with the following special features: a definition of salary which includes a specification for merit and in-depth analysis of discipline groups that best fit the salary structure at UIS.
- The model has a relatively high degree of predictive power and is consistency and is robust using three cohorts of salary data.
- The model suggests that the College of Business has a different salary structure than the other three colleges. In the short-term this should be examined separately until the salary structure is more similar to that of the other Colleges.
- Using the model, gender or racial biases are not a problem, on average. However, gender bias needs to be further analyzed in the College of Business.
- Nothing in the approach recommended by the committee will preclude deans from making salary equity recommendations based on the type of consideration of individuals that cannot be captured in an aggregate analysis.
- Differences in the predicted and actual salary can be used as one input in a salary equity program. If funds become available for a salary equity program in AY 2006-2007, the deans will make recommendations to the Provost on equity adjustments based upon the statistical information provided by the committee and other considerations they deem appropriate.
- It is the intention of the UIS administration to continue a salary equity program building on this model, additional years of data, and lessons learned from the salary equity program of fiscal year 2007.

**Table 13:
AY05-06 Adjusted Salary Regression Results: College of Business and Others**

	Business Only⁺ (n=30)	Without Business⁺⁺ (n=117)
Constant ⁺	81,491.32 (6.4)*	47,329.59 (29.7)*
Years In Rank	-385.22 (-1.1)	603.00 (7.1)*
Associate	1,950.81 (0.4)	4,805.87 (5.2)*
Full	11,863.14 (1.7)	16,225.67 (12.3)*
Group A: CMS_MIS (Info Tech)	1,811.92 (0.3)*	32,740.76 (16.4)*
Group B Library		-9,679.12 (-5.4)*
Group D: ECO_MPH_PAD	-14,970.93 (-2.4)**	10,918.76 (6.5)*
Group E: BIO_CHE_ENS_MAT_CLS		2,647.63 (2.2)**
Group F: COM_EDL_HDC_HMS_PSY_SOA_SWK_TEP		839.51 (0.9)
Group G: CRJ_LES_POS		7,083.50 (5.4)*
GENDER (MALE=1)	14,793.14 (2.9)*	-140.3 (-0.2)
RACE1 (WHITE and Asian=1)	-9,405.29 (-0.9)	-4,927.42 (-3.6)
Adjusted R ²	0.442	0.897

+The baseline group is female, African American or Asian assistant professors in Group C—Accounting, Business or Management.

++The baseline group is female, African American or Asian e assistant professors in group H—African American Studies, English, History, Individual Option, Philosophy, Visual Arts and Women’s Studies.

* Significant at 0.01 level. ** Significant at 0.05 level.

Bibliography

- Carlin, P. and P. Rooney, (2000). "Am I Paid Fairly?" Change, v. 32, n.2 (March/April) 107-124
- Balzer, W, N. Boudreae, P. Hutchinson, A. Ryan, T. Thorsteinson, J. Sullivan, R. Yonker and D. Snavelly, (1996). "Critical Modeling Principles when Testing for Gender Equity in Faculty Salary," Research in Higher Education, v. 37, n.6 p. 633-658.
- Becker, W. and R. Toutkoushian. (2003). "Measuring Gender Bias in the Salaries of Tenured Faculty Members," New Directions for Institutional Research, n. 117 (Spring) p. 5-20.
- Gardner, C. (2000). "Progress Report on the Status of Women within the University of Illinois," mimeo (January 14, 200), Champaign, IL: University of Illinois at Urbana Champaign, Office of the Vice President for Academic Affairs.
- Haignere, L., (2002). Paychecks: A Guide to Conducting Salary-Equity Studies for Higher Education, Washington, DC: American Association of University Professors.
- Livingstone, C. (2000). "Faculty Equity Regression Study," mimeo (January 14, 200), Champaign, IL: University of Illinois at Urbana Champaign.
- Moore, N. (1993). "Faculty Salary Equity: Issues in Regression Model Selection," Research in Higher Education, v. 34, n.1 p. 107-124.
- McLaughlin G. and J. McLaughlin (2003). "Conducting a Salary-Equity Study: A Consultant's View," New Directions for Institutional Research, n. 117 (Spring) p. 97-114.
- Ferree, M. and J. McQuillan (1998). "Gender-Based Pay Gaps: Methodological and Policy Issues in University Salary Studies," Gender and Society, v. 12, n. 1 p. 7-20.
- Oaxaca, R. and Ransom, M. (2002). "Regression Methods for Correcting Salary Inequities Between Groups of Academic Employees," New Directions for Institutional Research, n. 115 (Fall) p. 7-20.
- Riggs, M., R. Downey, P. McIntyre and D. Hoyt. (1986). "Using Discriminant Analysis to Predict Faculty Rank," Research in Higher Education, v. 25, n.4 p. 365-376.

Appendix A: Discriminant Analysis

The treatment of rank in salary equity studies is problematic and hence controversial. On the one hand, controlling for rank in salary regression models is important since research has found that rank is an important predictor of faculty salaries. In addition, because academic promotions typically involve increases in pay, rank is considered a bona fide occupational qualification. The problem with using rank in the salary equations is that there is a possibility that rank assignment is gender biased. This means that controlling for rank in a model would lead to an *understatement of the level of pay disparity* between men and women.⁵ This is because if gender enters into the determination of rank, these two explanatory variables in a salary regression are correlated, resulting in multicollinearity and perhaps selection bias.

The possibility of bias from including rank in the salary model was evaluated by the committee using three different methods⁶

1. Cohort Analysis: Examination of tenure and promotion records and a comparison across gender for three cohorts of faculty.
2. Discriminant Analysis: A statistical method to evaluate whether gender is a predictor of rank, providing a test of a gender bias in rank.
3. Regression Model Sensitivity: Estimate two regression equations, one controlling for rank and the other with rank excluded as an independent variable. The sensitivity of the coefficients, especially the gender coefficient, can be evaluated by comparing the results of the two equations.

This appendix provides details on the second and third methods and the results.

Discriminant Analysis

Discriminant Analysis (DA) allows for a statistical test of whether men and women with similar characteristics have equal chance of attaining rank. DA predicts group membership (across the three rank groupings) from a set of predictors specified in the model. The fit between actual and predicted group membership and the statistical significance of the set of predictors provides the test of gender bias. In addition, the analysis can assess the relative importance of factors in classifying the dependent variable or put differently discard factors that are not related to the classification. The lack of gender bias in rank would be indicated by the lack of importance of gender as a predictor of rank classification.

DA requires specification of variables expected to predict rank attainment. The variables specified were based on those used in the literature and available data. They include:

⁵ See appendix H of [Paychecks](#) for a description.

⁶ See Becker and Toutkoushian (2003) and Riggs, Downey, McIntyre and Hoyt (1986).

years in rank, years since degree, degree type (group 1=Ph.D.; group 2=DBA, EDD, PSYD and JD; and group 3=Master's), gender, and race. Table A1 summarizes the DA results for this specification and the AY05-06 faculty cohort of 148. Separate DAs were conducted for assistant-associate groups and associate and full groups.⁷ DA maximizes the between rank differences in discriminant scores and minimizes the within-rank differences. The Eigenvalue is one statistic for evaluating the magnitude of the DA. For the assistant-associate rank discriminant function, the Eigenvalue is high (1.661), which indicates that the between-ranks differences are greater than the within-rank differences. On the other hand, for the associate-full function the results are a low Eigenvalue indicating low discriminating power of the model. The DAs also revealed that for both models the percentage of the cases that were correctly classified were 85.3 percent by the assistant-associate function and 71.3 percent for the associate-full function.

To further evaluate the model the Wilkes' lambda can be used. The interpretation of the Wilkes' lambda is similar, in concept, to an R-square statistic in regression analysis. The lower the value of Wilkes' the higher the percent of explained variance, which is calculated as $[(1-\text{Wilkes' Lambda}) \times 100]$. The explained variance in rank for the assistant-associate model is therefore 55.8 percent. In addition, the high value of the chi-square statistics implies that the function discriminates well between ranks. For the associate-full model, the discriminate power is much lower, the explained variation between groups is only 24.1 percent and the chi-square statistics is significant.

**Table A1
Summary of Rank Discriminant Analysis**

Variable	Assistant and Associates ¹ (n=123)		Associates and Fulls ² (n=80)	
	Standardized DA Coefficient	Wilks' Lambda	Standardized DA Coefficient	Wilks' Lambda
Years at UIS	0.657	0.513*	0.788	0.787*
Degree Type	0.160	0.997	0.297	0.981
Year Since Degree	0.546	0.567*	0.340	0.892*
Gender (Male=1)	-0.134	1.000	-0.188	0.998
Race (White=1)	0.011	0.994	0.004	0.998

¹The assistant-associate sample results for the canonical discriminant function were: Eigenvalue=1.263; Wilks' Lamda= 0.442; Chi-Square=101.69; p=0.0001.

²The associate-full sample results for the canonical discriminant function were: Eigenvalue=0.317; Wilks' Lamda= 0.759; Chi-Square=20.77; p=0.001.

⁷ The DA with all three groups provided only one significant discriminating function. The separate DAs are reported, as they are more informative.

Table A1 also shows the relative importance of the independent variables in the model. The larger the standardized coefficient and lower the Wilks' lambda, the more the variable contributes to the discriminant function. Two variables in both analyses have a significant effect: years at UIS and years since degree type. In both DA functions, race and gender do not contribute to the model, suggesting that rank is not determined by these variables for the sample. This suggests that there is no gender or race bias in rank for the cohort of UIS faculty.

Regression Model Sensitivity

The purpose of this approach is to compare the sensitivity of the estimated full model (as reported in table 10 of the text) with a similar model that is estimated but which excludes rank. The results of these two estimations are summarized and reported in table A2. It should be noted that the equation without rank is likely not specified correctly as most studies have found an association between rank and salary. This misspecification can result in biased estimators as well. While there is no specific test that compares the two models, Becker and Toutkoushian (2003) suggest that reporting both results gives reviewers of the model an opportunity to access the decision to include rank in the model.

The two models with and without rank yield fairly similar results with no unstable change in any of the estimated regression coefficients. The estimated coefficient of gender decreases by about half in the equation without rank, but is the same sign and is still not significant. The decrease in the coefficient is inconsistent with a gender bias in rank. That is, one would expect that if there were a gender bias, the inclusion of rank would underestimate the effect of gender on salaries.

**Table A2:
AY05-06 Adjusted Salary Regression Results:
With and Without Rank (n=147)**

	With Rank	Without Rank
Constant ⁺	49,641.79 (19.9)*	52,815.32 (18.2)*
Years In Rank	375.42 (3.3)*	701.16 (6.0)*
Associate	4,154.35 (3.1)*	
Full	14,838.48 (7.7)*	
Group A: CMS_MIS (Info Tech)	37,148.48 (15.5)*	39,907.80 (14.1)*
Group B Library	-9,279.26 (-3.1)*	-9,864.74 (-2.8)*
Group C: ACC_BUS_MGT	30,189.50 (15.8)*	30,961.98 (13.7)*
Group D: ECO_MPH_PAD	12,566.12 (5.2)*	12,689.80 (4.4)*
Group E: BIO_CHE_ENS_MAT_CLS	2,767.53 (1.4)	1,691.07 (0.7)
Group F: COM_EDL_HDC_HMS_PSY_SOA_SWK_TEP	724.08 (0.5)	338.48 (0.2)
Group G: CRJ_LES_POS	7,794.70 (3.6)*	9,640.42 (3.8)*
GENDER (MALE=1)	1,513.37 (1.3)	710.97 (0.5)
RACE1 (WHITE and Asian=1)	-6,820.61 (-3.2)*	-8,037.27 (-3.2)*
Adjusted R ²	0.859	0.799
⁺ The baseline group is female, African American or Asian E assistant professors in group H—African American Studies, English, History, Individual Option, Philosophy, Visual Arts and Women’s Studies. * Significant at 0.01 level. ** Significant at 0.05 level.		

Appendix B: Discipline Group Analysis

The committee examined 4 different models based on different discipline groups. The four groups were (see Table B1 for details on the groups)

Model I Stepwise Regression: The challenge is to combine disciplines based on salary to reduce the number of independent variables. The committee developed a “modified” stepwise regression approach to forming the groups. The procedure was to establish discipline groups based on examination of standardized residuals for individuals and mean standardized residuals for departments. Table B2 provides details on this process. Based on this analysis the discipline group was included in the adjusted salary regression. If the increase in R^2 was significantly increased then the discipline group was included. This was done until the residual analysis did not suggest further groupings. The resulting groups are reported in table B1.

Model II-CUPA Data: This model uses the discipline groups used in Spring 2001, which were based on CUPA data, but updates the groups to reflect program consolidations and the addition of the library.

Model III-A Priori Discipline: These groups are based on a priori discipline groupings as described in the table.

Model IV-Blended Model: Blended model based on combination of stepwise and a priori groupings. We discussed the difficulties in going forward with a model that groups higher paying fields in the natural sciences, such as chemistry, biology, and mathematics, with lower paying fields in the humanities. Thus, dividing Group 6 in Model 1 creates the blended model into three separate groups.

Model IV was the grouping selected. The final model chosen was based on the following criteria:

- The goodness of fit of with model specification under each discipline group.
- The stability of the sign of coefficients and significance level of independent variables across the three years of analysis

**Table B1:
Description of Discipline Groups For Models I-IV**

<i>Model</i>	<i>Description</i>	<i>Discipline Groups</i>	<i>Programs</i>
Model I	Straight stepwise regression, including only discipline groups found to make significant increments in R ²	Group 1	CSC, MIS
		Group 2	Lib
		Group 3	BUS, MGT, ACC
		Group 4	ECO, MPH, PAD
		Group 5	LES, POS, CLS, CRJ
		Group 6 <u>OTHER</u>	INO, HIS, CHE, WMS, EDL, HDC, HMS, SWK, TEP, AAS, BIO, COM, ENG, MAT, PHI, PSY, SOA, ART, ENS, AAS
Model II	CUPA Groupings. This model uses the discipline groups used in Spring 2001, which were based on CUPA data, but updates the groups to reflect program consolidations and the addition of the library	Group 1	CSC, MIS
		Group 3	ACC, BUS, MGT
		Group 4	PAD, ECO, LES, MPH
		Group 5	COM, ENG, HIS, PHI, SOA, ART, WMS, AAS
		Group 6-- <u>OTHER</u>	BIO, SWK, CHE, CLS, CRJ, EDL, ENS, HDC, INO, MAT, POS, PSY, TEP, HMS
		Group 2	LIB

Table B1 (continued)			
<i>Model</i>	<i>Description</i>	<i>Discipline Groups</i>	<i>Programs</i>
Model III	À priori discipline groupings	Group 1 Infor Tech	CSC, MIS
		Group 3 Business	BUS, ACC, MGT
		Group 4 Professional	PAD, MPH, LES, SWK, CRJ, EDL, ECO, TEP, HMS, HDC
		Group 5 Natural Science	CHE, BIO, CLS, ENS, MAT
		Group 6 Social Science	SOA, PSY, POS, COM
		Group 7 Humanities	ENG, HIS, ART, AAS, PHI, WMS, INO
		Group 2 Library	LIB
Model IV	Blended model based on combination of stepwise and à priori groupings and is created by dividing Group 6 in Model 1 into three separate groups.	Group A	CSC, MIS
		Group B	LIB
		Group C	ACC, BUS, MGT
		Group D	ECO, MPH, PAD
		Group G	LES, POS, CRJ
		Group E	CHE, MAT, BIO, ENS, CLS
		Group H	ART, ENG, INO, HIS, WMS, PHI, AAS
		Group F	EDL, HDC, HMS, SWK, TEP, PSY, COM, SOA

**Table B2:
Stepwise Regression Procedure for Discipline Groups**

Discipline Group	Programs	Comment
1	CSC, MIS	Added based on inspection of z-scores by rank and of standardized residuals
2	LIB	LIB faculty grouped at extreme of negative standardized residuals inclusion of discipline group 1 in the regression.
3	BUS,MGT, ACC	Faculty in these programs tend to have high-standardized residuals after inclusion of discipline groups 1 and 2 in the regression.
4	ECO, MPH, PAR, PAD	These four programs were the only ones with mean standardized residuals > 1.0 after inclusion of discipline groups 1, 2, and 3 in the regression.
5	INO, HIS, WMS, CHE	These four programs were the only ones with mean standardized residuals < .90 after inclusion of discipline groups 1, 2, 3, and 4 in the regression.
6	LES, POS, CLS, CRJ	These four programs were the only ones with mean standardized residuals < .90 after inclusion of discipline groups 1, 2, 3, and 4 in the regression.
7	EDL, HDC, HMS, SWK, TEP, AAS, BIO, COM, ENG, MAT, PHI, PSY, SOA, ART, ENS	Remaining programs

Appendix C: Regression Diagnostics

Functional Form

Some studies have considered a nonlinear relationship between salary and experience (years in rank or years in institution) this possibility was examined in two ways. First, plots of salary with different functional forms (linear, quadratic and cubic) were performed. This suggested that the cubic might be a better functional form. The second step was to run the regression with a quadratic and cubic terms included as explanatory variables. This was done for the adjusted model with no additional explanatory power.

Time-in-rank specification

The models were estimated with “years at UIS” as an independent variable, as an alternative to years in rank. The estimated coefficient for this variable was not statistically significant and did not improve the fit of the model.

Multicollinearity

The existence of multicollinearity was checked by examining correlation between the independent variables and by examining the VIF scores in the regression. None of the correlation coefficients were above 0.25 for the variables. All VIF scores, in the salary regression with the adjusted groupings, were below 2 (see table below), which indicate multicollinearity is not likely.

Table C1: Multicollinearity Analysis	
Variable	VIF
Years In Rank	1.5
Associate	1.5
Full	1.4
Group A: CMS_MIS (Info Tech)	1.3
Group B Library	1.2
Group C: ACC_BUS_MGT (Business)	1.6
Group D: ECO_MPH_PAD	1.3
Group F1: CRJ_LES_POS	1.5
Group E: BIO_CHE_ENS_MAT_CLS	1.8
Group F2: COM_EDL_HDC_HMS_PSY_SOA_SWK_TEP	1.4

Outlier Analysis

The impact of outliers on the estimation results were examined by defining outliers having a residual more than three standard deviations from the mean residual. Using this definition, 3 outliers were found and the model was re-estimated excluding these 3 observations. These results are reported in Table C2. As expected the R2 increased when the outliers were removed. The estimated coefficients remained relatively stable. The results of this estimation did not reveal changes in the model results; the committee agreed that not dropping the outliers does not change the results and was therefore included in the model.⁸

⁸ Haignere (2002) suggests that discarding outliers is not a good practice if they do not “distort the issues after careful analysis.” Her argument is that discarding outliers eliminates the highest and lowest paid faculty, which there is no reason for this.

**Table C2:
AY05-06 Adjusted Salary Regression Results:
Outlier Analysis**

	Full Sample (n=147)	Without Outliers (n=144)
Constant ⁺	49,641.53 (19.9)*	49,380.53 (27.7)*
Years In Rank	375.42 (3.3)*	469.06 (5.7)*
Associate	4,154.35 (3.1)*	4,115.30 (4.3)*
Full	14,838.48 (7.7)*	13,681.33 (9.8)*
Group A: CMS_MIS (Info Tech)	37,148.48 (15.5)*	38,646.81 (22.5)*
Group B Library	-9,279.26 (-3.1)*	-8,600.90 (-4.1)*
Group C: ACC_BUS_MGT	30,189.50 (15.8)*	27,457.64 (19.3)*
Group D: ECO_MPH_PAD	12,566.12 (5.2)*	13,084.53 (7.6)*
Group E: BIO_CHE_ENS_MAT_CLS	2,767.53 (1.4)	3,472.22 (2.51.4)
Group F: COM_EDL_HDC_HMS_PSY_SOA_SWK_TEP	724.08 (0.5)	1,541.64 (1.3)
Group G: CRJ_LES_POS	7,794.70 (3.6)*	8,548.19 (5.5)*
GENDER (MALE=1)	1,513.37 (1.3)	944.06 (1.1)
RACE1 (WHITE and Asian=1)	-6,820.61 (-3.2)*	-7,421.09 (-4.9)*
Adjusted R ²	0.859	0.919

+The baseline group is female, African American or Asian E assistant professors in group H—African American Studies, English, History, Individual Option, Philosophy, Visual Arts and Women's Studies.

* Significant at 0.01 level. ** Significant at 0.05 level.

Appendix D: Introduction to Regression

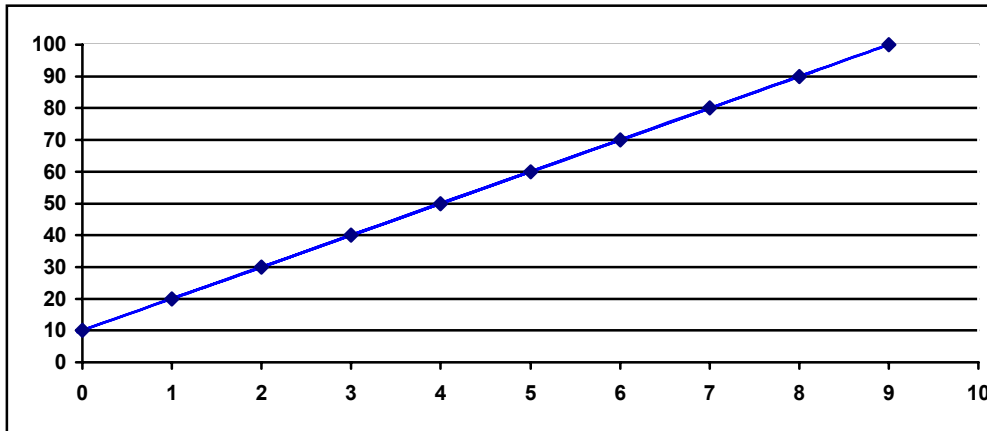
The following introduction to regression analysis, the statistical technique used in the UIS salary equity study was prepared by Dean Pinky Wassenberg

Multiple regression is one way social scientists explore the causes of variation. When a characteristic varies from person to person, we assume there are identifiable reasons for that variation. We also assume that the causes of that variation are identifiable. In a complex world, any interesting characteristic that varies from person to person is probably the result of multiple causal factors. Multiple regression gives us a way of quantifying the relative impact of these factors. The causal factors we explore are called independent variables; the characteristic whose variation we are trying to explain is the dependent variable. Turning this all into jargon, we would say that multiple regression is a way of quantifying the relative impact of multiple independent variables on a single dependent variable.

It is easiest to explain the elements of our analysis if we start with a simple example. This is what I use in class to introduce the general concepts of regression. This is a bivariate (2 variable) example. We start out with a table that shows us the ages and weights of 10 hypothetical children. Our goal in this hypothetical is to find out what factor influences weight (we start with one causal factor to keep it simple). In this table, we are exploring the impact age has on weight. Weight is our dependent variable (weight depends on age) because a child's weight increases as he/she gets older. Age is our independent variable (age doesn't depend on weight – you can't get younger by losing weight).

Person	Age	Weight
1	3	40
2	5	60
3	2	30
4	6	70
5	8	90
6	1	20
7	9	100
8	4	50
9	0	10
10	7	80

The graph below shows what we see if we plot these 10 hypothetical children on a graph. The dependent variable of weight is represented by the values of the “y” axis (vertical). The independent variable of age is represented by the values of the “x” axis (horizontal).



We can also use an expression to show the relationship between age and weight. Our children gained 10 pounds for every 1 year increase in age.

$$\text{WEIGHT} = 10 \times \text{AGE}$$

However, a person who weighs 20 pounds is not 2 years old because a person has to weigh something at birth. In this hypothetical group, children weigh 10 pounds at birth. So, our relationship really is:

$$\text{WEIGHT} = \text{WHAT YOU WEIGH AT BIRTH} + (10 \text{ pounds multiplied by every year of AGE})$$

$$\text{WEIGHT} = 10 + (10 \times \text{AGE})$$

This is a prediction formula. If we know someone's age, we now have a means of predicting his/her weight. If a child is 8.5 years old:

$$\text{Predicted Weight} = 10 + (10 \times \text{AGE})$$

$$\text{Predicted Weight} = 10 + (10 \times 8.5)$$

$$\text{Predicted Weight} = 10 + 85$$

$$\text{Predicted Weight} = 95 \text{ pounds}$$

or, in general terms:

the predicted value of our dependent variable equals

what the dependent variable is when the independent variable is zero (that constant everyone has)⁹

plus

⁹ This is called the intercept.

the impact of the influence of the independent variable on the dependent variable

In our salary equity analysis, salary is the single dependent variable we are trying to explain by examining multiple independent variables. Having multiple independent variables makes this multiple regression rather than bivariate regression (our age & weight example).

This salary equity exploration begins with the question: “Why doesn’t everyone have the same salary?” We assume that there are knowable reasons why salary varies from one person to the next. Some of those reasons are going to be rational, legal reasons that we understand as part of the way salary is supposed to be determined. These are called bona fide occupational qualifications (BFOQs). For example, we expect faculty salaries to be influenced by faculty rank. Assistant professors in a particular discipline are usually paid less than professors in the same. “Rank” is one of the rational independent variables we think will help explain why not everyone has the same salary. “Years in rank” is another reasonable independent variable we would expect to have an impact on salary. The more experience someone has, the more that employee should be paid. We know, even though we might not agree with it, that different disciplines have different salary structures. Accountants make more than political scientists. Therefore, discipline is another BFOQ, another independent variable we expect to have an impact on salary. We can create an expression that summarizes the relationship among these BFOQs and salary.

Predicted salary = a constant + the impact of rank + the impact of years in rank + the impact of discipline

In our hypothetical weight & age example, the constant was what the children weight at birth – what they weighed before the influence of our independent variable of age was added in. In our salary equity analysis, the constant is what the hypothetical average faculty member is paid before you add in the influence of the independent variables of rank, years in rank and discipline. Any individual faculty member’s predicted salary will be what the model shows as the predicted dependent variable once you take into account the influence of rank, years in rank and discipline. If an individual faculty member’s predicted salary is less than her/his actual salary, that faculty member might be a victim of salary inequity. Alternatively, the difference between their predicted salary and their actual salary might be the result of a factor we haven’t included in the analysis (remember, we haven’t explained 15% of the variation in salary).

There is a major difference between our salary equity analysis and the weight & age example. The hypothetical relationship between weight and age is a perfect relationship – that means if you know someone’s age you can make a perfectly accurate prediction of their weight. There is a perfect relationship between the independent variable of age and the dependent variable of weight. In statistical terms, the independent variable of age explains 100% (all) of the variation in weight. In our salary equity analysis, there is not a perfect relationship between salary (the dependent variable) and rank, years in rank and discipline (the independent variables). We can only explain about 85% of the variation in

salary with our three independent variables.¹⁰ That is the sort of result you would expect because what determines an individual's salary can be complex and is probably the result of more than 3 causal factors.

The best practices in salary equity analysis also suggest that institutions examine the relationship between salary and variables that shouldn't have an impact on salary. This is one way of identifying patterns of discrimination at an institution. The two variables most often considered are race and sex (female/male). These two characteristics do not represent BFOQs that should influence someone's salary. Therefore, we would hope that our analysis shows that there is not a statistically significant relationship between these two variables and salary. Our analysis showed that there is not a statistically significant relationship between race and salary. That is good – race should have no impact on salary. That same analysis did show a statistically significant relationship within the College of Business and Management between salary and whether a faculty member is male or female. Knowing that a faculty member in CBM is female helps you make a more accurate prediction of her salary than you would make not having information about that characteristic. This is a problem that the university has identified and plans to rectify.

Our salary equity report provides the results of our use of multiple regression to identify cases where a faculty member's salary is less than what we would predict based on knowledge of her/his rank, years in rank and discipline. This quantitative result allows us to begin the qualitative process of examining the reasons for the difference between individual faculty member's predicted salary and actual salary. Some times individual circumstances make that a rational difference. Sometimes that difference indicates a problem that needs to be addressed.

¹⁰ We don't have more than three independent variables because we have a relatively small number faculty. That limits the number of subcategories you can divide them into and still have the statistics work.