

## Gender Differences in Salary and Promotion in the Humanities

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In their annual review of academic salaries, the American Association of University Professors (AAUP) observes large gender-related salary differentials: "At doctoral-level institutions, male professors at the rank of full professor earn 11.4 percent more than women full professors" (AAUP, 1998 p. 1) While this reported salary gap is large, the AAUP Salary Survey does not control for characteristics that contribute to pay differentials such as academic field or publication record. These variables potentially have a significant effect on salaries. For example, gender salary differences might be explained by differences in productivity. A recent article in *The Chronicle of Higher Education* notes that there is a gender gap in publications: men tend to publish more articles on average than women (Alison Schneider, 1998). In addition, these observed salary differentials might be closely tied to gender differences in promotion. Professors with academic tenure earn more than their untenured colleagues. In order to have a complete understanding of academic employment outcomes by gender, the researcher must consider both salaries and promotion.

This study uses data on academic labor markets from the Survey of Doctorate Recipients to evaluate gender differences in salaries and promotion probabilities. These data have individual-level observations on academic productivity, promotion, and salary; thus, they provide a unique opportunity to compare salary and promotion differentials by gender. In

addition, we can examine the relationship between the promotion to tenure in academia and the salary gap. If gender differences in faculty salaries or promotion exist after controlling for measures of productivity, these differences would provide evidence of discrepancies in employment outcomes by gender.

This study finds differences in employment outcomes by gender using two methods: the Oaxaca decomposition is used to examine salary differentials, and duration analysis is used to estimate promotion to tenure. While gender salary differences can largely be explained by academic rank, substantial gender differences in promotion to tenure exist after controlling for productivity, demographic characteristics, and primary work activity.

### I. Data and Empirical Methodology

This study uses data from the 1977–1993 waves of the Survey of Doctorate Recipients (SDR). The SDR is a biennial longitudinal survey of doctorate recipients from U.S. institutions conducted by the National Science Foundation. The SDR collects detailed information on doctorate recipients including demographic characteristics, educational background, primary work activity, employer characteristics, and salary. The SDR has undergone substantial changes between the 1977 and 1993 waves (Susan Mitchell et al., 1998). Technical reports provided by the National Science Foundation have allowed us to construct a longitudinal data set with consistent variable definitions and sampling frames over time.<sup>1</sup>

In order to examine salary and promotion differentials by gender, we have selected two samples of doctorates in the humanities. Sample 1 includes individuals with tenure or those on the tenure track in 1993. This sample is

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<sup>1</sup> An appendix describing the data cleaning is available from the authors upon request.

used to evaluate the gender salary gap. Sample 2 includes individuals who received their Ph.D.'s between the years of 1975 and 1991 and whose first observed job after the Ph.D. is a full-time position at an academic institution. This sample is used to evaluate promotion to tenure. These samples differ because individuals with tenure prior to entering the SDR are omitted from Sample 2. Individuals with missing or inconsistent data were dropped from both samples.

Our study focuses on the humanities because the SDR contains detailed measures of professional productivity such as publications for these fields. The SDR does not measure publications for doctorates in science and engineering disciplines. Academic fields in the humanities include: art history, American history, other history, music, speech, philosophy, English, French, modern languages, classical languages, and other humanities.

The changes in the SDR and the biennial sampling frame create challenges in estimating differences in salaries and promotion probabilities. Due to the sampling frame, we observe the year individuals received their doctorate and the year they were promoted to associate professor. Since we do not observe the exact year an individual enters the tenure track, we estimate the duration until promotion conditional on working full time in academia after receiving the doctorate. In addition, the SDR only began collecting productivity information for individuals in the humanities starting with the 1983 survey, allowing us to quantify productivity for individuals between 1981 and 1993.<sup>2</sup> In order to estimate the effect of productivity on salaries and promotion, we use these limited observations on publications to create average measures of productivity over an individual's career. Thus, we assume that an individual's productivity is roughly constant over the career. Because of data limitations, these average measures of productivity are measured with error and will potentially bias estimates of the effect of productivity on promotion and salaries.<sup>3</sup>

<sup>2</sup> The SDR did not ask productivity questions in the 1985 survey.

<sup>3</sup> For a full description of the data, see Ginther and Hayes (1999).

The study begins with an evaluation of salary differentials using the Oaxaca decomposition. Let  $\ln(w_m)$  and  $\ln(w_f)$  be the means of log salaries for males and females respectively. After estimating salary regressions separately for males and females, the salary gap can be characterized as follows:

$$(1) \quad \ln(\bar{w}_m) - \ln(\bar{w}_f) = \Delta \bar{X}' \beta_m + \bar{X}_f' \Delta \beta.$$

The first right-hand-side term in equation (1) accounts for differences in average characteristics, and the second term accounts for the effect of discrimination as measured by differences in the coefficients. Differences in average characteristics (endowments) are being weighted by male coefficients (the assumed advantaged group), and differences in the coefficients are multiplied by the female average characteristics. Equation (1) implicitly assumes that the male coefficients are representative of the underlying salary structure.<sup>4</sup>

The study continues by evaluating differences in promotion probabilities by gender using duration analysis. Let  $t = 1, 2, 3 \dots$  represent elapsed time since receiving the doctorate. We model the duration until tenure using the proportional-hazards model. The hazard function gives the instantaneous risk that promotion to tenure will occur at time  $t$ , given that an individual has survived until time  $t$ . We can model the hazard of promotion  $h_i(t)$  as a function of the baseline hazard  $\lambda_0(t)$  and covariates,  $x$ :

$$(2) \quad h_i(t) = \lambda_0(t) \exp\{\beta_1 x_{i1} + \dots + \beta_k x_{ik}\}.$$

Relevant exogenous characteristics include demographic variables, productivity, employer characteristics, and primary work activity. These covariates are suggested by other studies of academic promotion (Scott Long et al., 1993). The baseline hazard function is left unspecified and can be interpreted as the hazard function for an individ-

<sup>4</sup> David Neumark (1988) and Ronald Oaxaca and Michael Ransom (1994) discuss the problem of determining appropriate weights for the underlying wage structure. The researcher can assume that the female coefficients represent the underlying wage structure as well.

ual for whom all covariates equal zero. The proportional-hazards model allows us to estimate the hazard of promotion stratified by field of doctorate. When stratifying the hazard of promotion by field of doctorate, a separate baseline hazard,  $\lambda_0(t)$ , exists for each field. Equation (2) is estimated using partial-likelihood estimation.

## II. Empirical Results

Table 1 presents the results for the Oaxaca decomposition, estimated using Sample 1. Log salaries are regressed on demographic characteristics, work experience, field of doctorate, and rank.<sup>5</sup> The estimated gender salary gap is 9.5 percent. However, the entire gender salary differential can be attributed to men's higher average characteristics. This model is subject to the criticism that academic rank is endogenous in the salary regression. The estimated salary gap might be overstated if salaries are largely determined as a function of rank. In order to examine this possibility, we run separate salary regressions by academic rank and recalculate the Oaxaca decomposition. The results appear at the bottom of Table 1. The gender salary gap virtually disappears at all levels of academic rank. Predicted female salaries are 0.6-percent higher than predicted male salaries for assistant professors. The gender salary differential for associate and full professors falls below 1.5 percent. These results indicate that separate salary structures for tenured and tenure-track faculty exist by rank. The gender salary differential observed in the full sample estimates is apparently an artifact of having more male faculty members at higher ranks in higher-paying fields.

These results lead us to the question of whether gender differences exist in the probability of promotion to tenure. To examine this question we use Sample 2 to estimate proportional-hazards models for the entire

<sup>5</sup> The actual specification regresses log wages on the following variables: age in 1993, full-time work experience since doctorate, work experience squared, number of years married, number of children, and dummy variables for race, handicapped status, field of doctorate, appointment at a private college or university, and academic rank.

TABLE 1—MALE AND FEMALE PREDICTED WAGE DIFFERENTIALS IN THE HUMANITIES, DECOMPOSED BY ENDOWMENTS AND COEFFICIENT DIFFERENTIALS, BASED ON THE SURVEY OF DOCTORATE RECIPIENTS 1977–1993

Sample	Predicted wage gap	Differences in endowments	Differences in coefficients
Full sample	0.0954	0.1105	-0.0151
By Rank:			
Assistant professor	-0.0061	-0.0157	0.0096
Associate professor	0.0108	0.0431	-0.0324
Full professor	0.0139	0.0342	-0.0203

Notes: The regressions were estimated using Sample 1. The actual specification regresses log wages in 1993 on the following variables: age in 1993, full-time work experience since doctorate, work experience squared, number of years married, number of children, and dummy variables for race, handicapped status, field of doctorate, appointment at a private college or university in 1993, and academic rank in 1993. The sample size is 1,266 for men and 583 for women.

sample and for men and women separately. Our analysis begins with an estimate of the empirical survival functions for men and women working full time in academia. The log-rank test on the Kaplan-Meier estimate rejects the null hypothesis that the survival functions are homogeneous across men and women with a  $p$  value of 0.0003; thus, without controlling for covariates, the likelihood of not being promoted differs by gender. As a second test of differences in promotion, we estimate a proportional-hazards model of promotion regressed on a dummy variable for gender. The coefficient on gender is negative and significant, indicating that women are 25-percent less likely than their male counterparts to be promoted to tenure.

The above estimates do not account for differences in academic field, demographic characteristics, primary work activity, and productivity. We include these variables to examine the differences between men and women in promotion to tenure in Table 2. The first model in Table 2 pools both genders and includes controls for demographic characteristics, marital status, number of children, employer characteristics, average number of publications, and primary work activities. Each model is stratified by field of doctorate. In the pooled model, besides cohort, demographic, and employer-related variables, the average number of books published and "primarily working as a teacher"

TABLE 2—DURATION OF PROMOTION TO TENURE IN THE HUMANITIES, BASED ON THE SURVEY OF DOCTORATE RECIPIENTS, 1977–1993

Variable	(i) Pooled	(ii) Men	(iii) Women
Race (African-American = 1)	0.298 (0.158)	0.150 (0.200)	0.531* (0.272)
Age in 1993	0.035** (0.007)	0.043** (0.009)	0.035** (0.011)
Years married	-0.019* (0.009)	-0.016 (0.012)	-0.014 (0.015)
Number of children under age 18	0.068* (0.034)	0.079* (0.040)	-0.005 (0.071)
Cohort 1975–1979	1.047** (0.278)	0.706* (0.347)	1.587** (0.494)
Cohort 1980–1984	1.153** (0.267)	0.853** (0.332)	1.630** (0.471)
Cohort 1985–1989	0.554* (0.260)	0.275 (0.324)	1.097* (0.454)
Proportion of career spent at two-year college	1.730** (0.390)	1.786** (0.480)	2.037** (0.738)
Proportion of career spent at four-year college	2.721** (0.350)	2.893** (0.441)	2.599** (0.640)
Proportion of career spent at university	2.270** (0.331)	2.431** (0.423)	2.067** (0.606)
Proportion of career spent at private institution	-0.323** (0.112)	-0.344* (0.145)	-0.341 (0.191)
Proportion of years receiving government support	-0.273 (0.259)	-0.339 (0.332)	-0.241 (0.441)
Average number of articles	0.022 (0.041)	0.002 (0.052)	0.080 (0.072)
Average number of books	0.205* (0.096)	0.219 (0.117)	0.297 (0.179)
Average reviews	-0.027 (0.034)	-0.007 (0.044)	-0.091 (0.065)
Average chapters	0.048 (0.067)	0.095 (0.087)	0.032 (0.122)
Average other publications	0.006 (0.041)	-0.042 (0.052)	0.118 (0.067)
No publications indicator	-0.414* (0.197)	-0.448* (0.230)	-0.295 (0.410)
Primary work activity:			
Research	-0.168 (0.414)	-0.314 (0.507)	-0.089 (0.816)
Teaching	1.013** (0.314)	0.562 (0.396)	1.644** (0.603)
Management	-0.065 (0.393)	-0.472 (0.512)	0.542 (0.694)
Gender (female = 1)	-0.256** (0.091)		

Notes: The regressions were estimated using Sample 2. Standard errors appear in parentheses. The sample size was 915 for men and 644 for women.

\* Statistically significant at the 5-percent level.

\*\* Statistically significant at the 1-percent level.

have positive and significant effects on being promoted. We anticipated that primarily working as a researcher would have a positive effect on the likelihood of promotion. However, only 7 percent of the sample indicated that their primary work activity was research, while 70 percent reported working primarily as a teacher. The coefficient on gender is negative and significant, indicating that women are 23-percent less likely to be promoted than men after controlling for the above characteristics. Controlling for productivity, demographic characteristics, and job characteristics only reduces the gender difference in promotion by 2 percent.

The second and third models in Table 2 estimate the hazard model separately for men and women. In all models, being a member of an older cohort means a person is more likely to be promoted. Private colleges and universities are less likely to promote individuals of either gender. Average productivity measures are not significant for either gender at the 5-percent level of significance. However, at the 10-percent level of significance, average number of books authored has a positive effect on promotion for both genders, and average other publications has a positive effect for women. Men with no publications are less likely to be promoted at a 5-percent level of significance. Primary work activities do not have significant effects on the promotion of men, while women whose primary work activity is teaching have a positive and significant chance of being promoted. In terms of demographic characteristics, presence of children has a positive and significant effect on male promotion while having a negative and insignificant effect on female promotion. The effect of years married is negative and insignificant for both genders. Finally, African-American women have a positive chance of promotion. The differences in estimated coefficients indicate that the hazard of female promotion is not proportional to the hazard of male promotion.

In order to understand how these different estimates affect the hazard function of being promoted, we estimate a smoothed version of the baseline hazard function for men and women separately at the sample means in Fig-

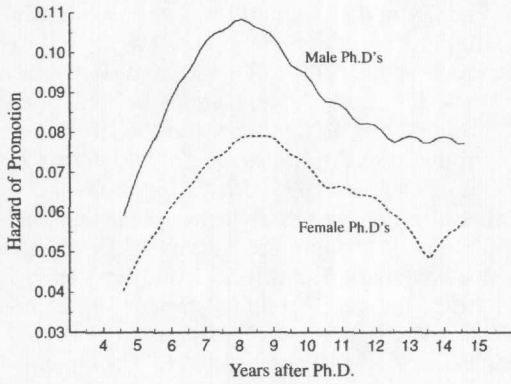


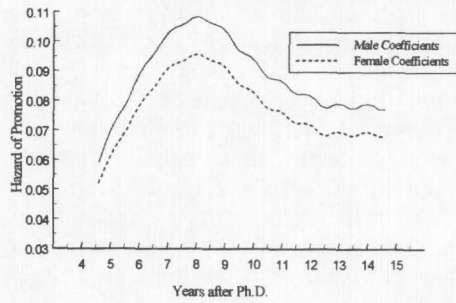
FIGURE 1. HAZARD RATE OF PROMOTION FOR HUMANITIES PH.D.'S, BY GENDER

ure 1.<sup>6</sup> At the peak of the hazard functions, men have a 0.11 hazard of being promoted while women have only a 0.08 hazard of being promoted. The peak of the hazard function happens eight years after completion of the doctorate.

We decompose gender differences in promotion as a function of differences in average characteristics and coefficient estimates between men and women in Figure 2. Figure 2A shows the baseline hazard estimated using the average male characteristics and the male and female hazard function coefficients. The solid line is the same estimate presented for men in Figure 1. Holding male characteristics constant and using the female coefficients lowers the hazard of male promotion by 0.015 at the peak of the function.

We perform the same thought experiment in Figure 2B, where baseline hazard is estimated as a function of average female characteristics. The dashed line now corresponds to the estimate presented for women in Figure 1. Using the male coefficients to estimate the hazard of female promotion increases the hazard 0.01 at the peak of the function. Thus, using the esti-

A. Predicted Hazard Based on Average Male Characteristics



B. Predicted Hazard Based on Average Female Characteristics

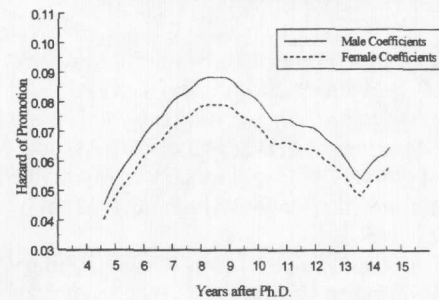


FIGURE 2. PREDICTED HAZARD RATE OF PROMOTION FOR HUMANITIES PH.D.'S (A) BASED ON AVERAGE MALE CHARACTERISTICS AND (B) BASED ON AVERAGE FEMALE CHARACTERISTICS

mated female coefficients lowers the average male hazard of being promoted, while using the male coefficients increases the average female hazard of being promoted. Even though women in the humanities tend to have fewer publications than men, there appear to be systematic differences in promotion as a function of gender. These gender differences in promotion might be smaller provided more complete measures of productivity such as citations and quality of publications were available. However, assuming the model is correctly specified, these results provide evidence of a glass ceiling—an invisible barrier to promotion—for women in the humanities.

III. Conclusions

While the observed differences in salaries by gender can largely be explained by academic rank, differences in promotion to tenure by gender persist after we control for

<sup>6</sup> The estimated hazard function is smoothed using a nonparametric kernel density estimator. The hazard of promotion is regressed on the covariates in Table 2 with the addition of covariates for field of doctorate. Each baseline hazard is a function of the average characteristics of men and women in the sample.

productivity, demographic characteristics, and discipline. These preliminary results have important implications for faculty and administrators in academia. While many institutions conduct periodic reviews of gender pay differentials, perhaps these energies are misplaced. If salary differences are largely explained by rank, as the results from this sample of humanities doctorates demonstrates, then a thorough investigation of a possible academic glass ceiling is in order.

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