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Individual and institutional determinants of the male female wage gap among U.S. economics faculty

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Abstract

This paper provides new evidence on the male female wage gap in academia. Using unique data from the economics discipline, we estimate a human-capital based model to explore the nature of wage differentials among male and female economics professors. Results indicate the salary gap varies across systematically across individual and institutional characteristics.

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1. Introduction

The realm of academe is generally considered a progressive and enlightened environment but even in this bastion of progressiveness, charges of sex discrimination sometimes arise. For example, in 1999, Massachusetts Institute of Technology (MIT) faced a widely reported complaint of sex discrimination from female professors. An internal examination of the data supported the contention that an unequal playing field had resulted in women receiving relatively lower salaries, awards and resources. Robert J. Birgeneau, Dean of the School of Science, stated that "correcting this extreme imbalance is one of the major challenges that MIT faces as we enter the next millennium" (Birgeneau, 1999). Data provided by the American Association of University Professors (AAUP), suggest such male-female differentials are common throughout academe and do not appear to be narrowing.[1]

Academic researchers, of course, have weighed in on this issue. The literature provides considerable empirical evidence of a significant male-female salary gap in academia, but findings also reveal that there is substantial variation in the salary gap across disciplines (Ginther and Hayes, 2003. Economics is reported to have an especially large disparity in salaries and promotion rates between men and women professors across all ranks (Ginther and Kahn, 2004).[2]

While research generally indicates a salary gap exists, the literature does not provide a consensus on the underlying causes. Some studies contend that wage differentials between male and female professors arise from differences in salary negotiating behavior (Babcock and Laschever, 2003), competitive desire (Kanazawa, 2005) and social networks (McDowell et al., 2006). Others suggest the wage disparities arise from sex-specific lifecycle factors, such as child rearing and post doctoral training (Johnson and Stafford, 1974), and differences in the age of graduation and initial appointment (Ferber and Kordick, 1978). And much work has indicated that wage disparities may result largely from discrimination within the promotion and tenure processes (Ginther and Hayes, 2003). This paper employs a unique set of data to provide new set of insights to this issue while providing a benchmark for current and future work.

2. The Data

The data used for estimating and comparing academic salaries are unique and were compiled from a survey of academic economists (conducted between 1991 and 1993) who are listed in the 1989 American Economic Association membership volume. Though not recent, the uniqueness of the data provides opportunities for insights and benchmarks for the literature. All listed women were surveyed, and the sample of men included every tenth person that was male and working at an academic institution. If the tenth person was either not male or not in academia, the next encountered male academic was surveyed. Selecting men and women for the survey according to their names is obviously imperfect, but a relatively high level of accuracy was maintained by having respondents verify initial impressions by indicating their sex on returned surveys. Of the

[1] Blau and Kahn (2004) find the primary factor leading to the slowdown of convergence of male and female wages nationwide is the 'unexplained gap' which includes changes in labor market discrimination. Results from Blau and Kahn (2000) imply the slowdown of convergence in the academic salary gap is partially due to the general increases in salary inequality within academia.

[2] For example, Ginther and Kahn (2004) reports a 21.6 percent male female pay gap in economics (12.6 percent unexplained) and a 11.5 percent gap in political science (-2.4 percent unexplained), while Ginther and Hayes (2003) find no significant pay gap among professors in the humanities.

approximately 2600 forms mailed, 1251 usable ones (844 men and 407 women) were returned, a response rate of about 48 percent.

Table I provides a listing and brief description of the variables used for the regressions to follow. Annual academic salary, converted to log values, is the dependent variable. Table II reports the descriptive statistics for salaries by rank and institution type. A comparison of the aggregate numbers from our survey and those provided by the AEA's survey provides confidence in the reasonableness of our data.[3] Note that salaries from our survey have been adjusted to 2000 dollars, using the consumer price index. Independent variables used in regressions which might affect salary

Table I. Definitions of Variables

Variable	Definition
*ln*Salary	the log of annual academic earnings for respondent
Productivity Measures	
Articles[1]	the number of articles published[1]
Articles Squared	the number of articles published squared
Top Articles[2]	the percentage of articles published in the top 24 journals[2]
Books	the number of books published
Courses	the number of courses taught each year
Experience	the number of years employed in academia
Experience Squared	the number of years employed in academia squared
Awards	dummy variable indicating if respondent has received an award for teaching, research or service; 1=yes, 0=otherwise
Institution Attributes	
AACSB[3]	dummy variable indicating if institution is AACSB accredited; 1=yes, 0=otherwise
Business	dummy variable indicating if department resided in a college or school of business; 1=yes, 0=otherwise
Public	dummy variable indicating if institution is public; 1=yes, 0=otherwise
Union	dummy variable indicating if respondent indicates institution to be unionized; 1=yes, 0=otherwise
Teaching	dummy variable indicating if respondent considers institution to be teaching oriented; 1=yes, 0=otherwise
Individual Attributes	
Sex	dummy variable indicating if respondent is male; 1=yes, 0=otherwise
Race	dummy variable indicating if respondent is nonwhite; 1=yes, 0=otherwise
Move	dummy variable indicating if respondent has changed jobs at least once; 1=yes, 0=otherwise

[1]published articles are discounted ½ for co-authored papers and ½ for notes
[2]as determined by Graves et al. (1982); see footnote 5 for the list of journals
[3]AACSB refers to the Association to Advance Collegiate Schools of Business, which is the leading business school accreditation agency.

[3] For comparison purposes, we assume that AEA Ph.D. Granting Schools are roughly comparable to the Carnegie Foundation's Research and Doctoral classification, Master's Degree Granting is similar to Carnegie's Comprehensive category, and Bachelor's Degree Granting corresponds to Carnegie's Liberal Arts classification

Table II. Range of Academic Salaries by Rank and Institution Type

	Professor	Associate	Assistant
Research			
Mean	74,937	52,888	43,988
Std Dev	14,521	6,856	7,108
AEA Mean	72,770	51,957	41,781
Comprehensive			
Mean	56,463	45,841	38,258
Std Dev	8,164	5,013	4,340
AEA Mean	57,966	47,767	41,094
Liberal Arts			
Mean	53,604	42,249	37,888
Std Dev	7,407	4,974	4,122
AEA Mean	54,504	42,788	34,499

levels are experience, research productivity, as measured by books and articles produced, teaching load, and certain attributes of the department and institution where respondents were employed. (see Ginther and Hayes (2003), among others, for more details of the well-documented variable set).[4]

3. The Model and Decomposition Procedures

In order to compare the earnings of men and women academic economists, we conditionally estimate salaries for each group. Any observed earnings differentials are then decomposed into three parts: that part which is due to differences in means; that part which is due to differences in response rates; and a residual which, since other influences have been accounted for, has generally been viewed as evidence of possible direct sex based discrimination.[5] Decomposition procedures were developed in sociology by Althauser and Wigler (1972) and in economics by Oaxaca (1973), and Blinder (1973), and extended by Neumark (1988).

The Oaxaca-Blinder procedure determines and analyzes earnings differentials by using the parameter estimates from either the male equation or the female equation as the benchmark, which is akin to a choice between placing women in a man's world or men in woman's world. Results will therefore indicate different residuals depending on which estimates are used as the benchmark. The Neumark procedure eliminates this issue by using estimates that are averages of the male and female regression coefficients, weighted according to the proportions of men and women in the relevant population. This method attempts to incorporate that, if male-favoring discrimination does exist and is eliminated, men's earnings will fall while those of women will rise. Marginal products and salaries will, ceteris paribus, tend to equalize. For this study, estimates using the Oaxaca-Blinder method are omitted and only the results obtained from the Neumark procedure are reported.[6]

[4] Regarding data specification, we use the 13 year mark to define relatively less and more experienced economists to yield a reasonable balance of observations in each category. Results were not sensitive to marginal changes to this definition. We did not include academic rank as an explanatory variable because it is highly correlated with years of experience and the productivity measures.

[5] As others have pointed out, uneven workplace conditions and labor market adjustments may disguise discriminatory practices and unexplained residuals may result from freely made but unidentified choices (e.g., Darity, 1980).

[6] Oaxaca-Blinder decompositions can be made available when requested.

The estimated equations are derived from the following behavioral model:

$$Y_i = \beta_0 + \Sigma_j \beta_j X_{ij} + \varepsilon_i \quad (1)$$

where Y_i is the mean salary of the academic economists in the relevant population, X_j is the corresponding vector of independent variables, and ε_i is the stochastic error term. Average salary estimates for men and women are obtained separately using the ordinary least-squares technique:

$$\ln\bar{Y}_m = \Sigma B_j \bar{X}_j^m \quad (2)$$
$$\ln\bar{Y}_f = \Sigma B_j \bar{X}_j^f \quad (3)$$

where B_j are parameter estimates and $\bar{X}_j^m$ and $\bar{X}_j^f$ are sample means of the independent variables from the survey data. Decomposition of the sex-specific total earnings differential is accomplished according to:

$$\ln\bar{Y}_m - \ln\bar{Y}_f = \Sigma B_j^* (\bar{X}_j^m - \bar{X}_j^f) + \Sigma \bar{X}_j^m (B^m{}_j - B_j^*) + \Sigma \bar{X}_j^f (B_j^* - B^f{}_j). \quad (4)$$

B^* is the vector of parameter estimates which is the weighted average (by sub-population sizes) of male and female regression coefficients from equations 2 and 3. The first term on the right side of equation (4) is the familiar adjustment for differences in productivity and other choice-related factors. The second and third terms constitute the unexplained residual earnings difference between men and women. The second term measures the amount by which current marginal productivity for men differs from that which would occur in a discrimination-free condition and the third term measures the amount by which marginal productivities of women differ from the discrimination free condition.

4. Regression Results

Tables III and IV present the estimated coefficients and p-values for five models: *pooled*, *less experience*, *more experience*, *research* and *comprehensive*. Each model performs well and explains much of the total variation (44 to 59 percent) in salaries. Parameter estimates indicate the independent measures, especially those related to experience and productivity, have substantial explanatory power with respect to salary levels—a result that is consistent with theory. Estimates across all models indicate the number of published *articles* and the proportion of articles in high level journals (*top articles*) generally have significant positive effects on salary levels for men and women.[7] The number of published *books* has a significant positive effect on men's salaries in all cases except the comprehensive and less experience models, and on women's salaries in all cases except the pooled, experience and comprehensive models. The negative estimated coefficients for *articles squared* indicate diminishing returns from publishing, while estimates show the number of *courses* taught is negatively related to salary levels for men and women in all models.

[7] Note that data stratification will thin the sample and consequently diminish the robustness of the estimates, particularly when estimating female models with limited female observations.

Table III. Wage Equation Estimates for Pooled and Experience Models

	Pooled		Less Experience		More Experience	
Variable	Male	Female	Male	Female	Male	Female
Articles	0.0129‡	0.0138‡	0.0179‡	0.0148‡	0.0118‡	0.0148‡
	(0.0000)	(0.0000)	(0.0000)	(0.0014)	(0.0000)	(0.0009)
Articles^2	-8-05‡	-1-04‡	-2-04‡	-2-04‡	-7-05‡	-1-04†
	(0.0000)	(0.0031)	(0.0000)	(0.0000)	(0.0000)	(0.0163)
Top Articles	0.0024‡	0.0014‡	0.0011†	0.0016‡	0.0043‡	-5-04
	(0.0000)	(0.0007)	(0.0115)	(0.0002)	(0.0000)	(0.5340)
Books	0.0117‡	0.0128†	0.0153	0.0089	0.0117‡	0.0114*
	(0.0008)	(0.0119)	(0.2133)	(0.4869)	(0.0015)	(0.0627)
Courses	-0.023‡	-0.022‡	-0.015‡	-0.018‡	-0.030‡	-0.039‡
	(0.0000))	(0.0001)	(0.0077)	(0.0044)	(0.0000)	(0.0009)
Experience	0.0244‡	0.0156‡	0.0172	0.0238‡	0.0326‡	0.0038
	(0.0000))	(0.0002)	(0.3417)	(0.0000)	(0.0000)	(0.7828)
Experience^2	-4-04‡	-2-04	-4-04	-0.001	-5-04‡	-2-05
	(0.0000)	(0.1500)	(0.7604)	(0.3714)	(0.0003)	(0.9447)
Awards	0.0872‡	0.1286‡	0.1428‡	0.1913‡	0.0301	0.0016
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.2093)	(0.9675)
AACSB	0.0336†	0.0365†	0.0378*	0.0262	0.0422†	0.0802†
	(0.0182)	(0.0464)	(0.0718)	(0.2430)	(0.0254)	(0.0136)
Business	0.0992‡	0.0441*	0.1277‡	0.0439	0.0688‡	0.0186
	(0.0000)	(0.0574)	(0.0000)	(0.1158)	(0.0021)	(0.1310)
Public	-0.054‡	-0.028	-0.026	-0.029‡	-0.081‡	-0.031
	(0.0002)	(0.1301)	(0.2069)	(0.0044)	(0.0001)	(0.3455)
Union	0.0087	0.0047	-0.029	0.0072‡	0.0314	0.0085
	(0.9389)	(0.8376)	(0.9637)	(0.8275)	(0.3138)	(0.8758)
Teaching	-0.098‡	-0.093‡	-0.090‡	-0.106‡	-0.091‡	-0.048
	(0.0000)	(0.0000)	(0.0003)	(0.0000)	(0.0001)	(0.2495)
Race	-0.004	0.0253	0.0021	0.0221†	-0.001	0.0501
	(0.8535)	(0.5085)	(0.8062)	(0.5597)	(0.7305)	(0.4955)
Move	-0.004	0.0341*	0.0096	0.0571†	-0.009	-0.007
	(0.8029)	(0.0781)	(0.9768)	(0.0126)	(0.6283)	(0.8470)
Constant	10.57‡	10.59‡	10.57‡	10.58‡	10.89‡	10.60‡
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
F	81.58	34.64	33.31	18.48	44.68	10.01
R^2	0.589	0.554	0.441	0.428	0.571	0.469
N	844	407	351	253	493	154

Note: p-values are reported in parentheses, and ‡, † and * indicate significance at the 1, 5 and 10 percent levels.

Table IV. Wage Equation Estimates for Pooled and Institution Models

	Pooled		Research		Comprehensive	
Variable	Male	Female	Male	Female	Male	Female
Articles	0.0129‡	0.0138‡	0.0135‡	0.0101†	0.0124‡	0.0238‡
	(0.0000)	(0.0000)	(0.0000)	(0.0299)	(0.0000)	(0.0000)
Articles^2	-8-05‡	-1-04‡	-8-05‡	-4-05	-1-04‡	-2-04‡
	(0.0000)	(0.0031)	(0.0000)	(0.7327)	(0.0000)	(0.0001)
Top Articles	0.0024‡	0.0014‡	0.0027‡	0.0013†	0.0013†	0.0008
	(0.0000)	(0.0007)	(0.0000)	(0.0154)	(0.0123)	(0.1878)
Books	0.0117‡	0.0128†	0.0017‡	0.0138†	0.0095	0.0024
	(0.0008)	(0.0119)	(0.0047)	(0.0227)	(0.2702)	(0.8743)
Courses	-0.023‡	-0.022‡	-0.023‡	-0.014*	-0.024‡	-0.035‡
	(0.0000))	(0.0001)	(0.0002)	(0.0934)	(0.0000)	(0.0000)
Experience	0.0244‡	0.0156‡	0.0297‡	0.0144†	0.0135‡	0.0222‡
	(0.0000))	(0.0002)	(0.0000)	(0.0154)	(0.0013)	(0.0008)
Experience^2	-4-04‡	-2-04	-5-04‡	-2-04	-7-05	-3-04
	(0.0000)	(0.1500)	(0.0000)	(0.3283)	(0.5188)	(0.1214)
Awards	0.0872‡	0.1286‡	0.0741‡	0.1454‡	0.0965‡	0.0956‡
	(0.0000)	(0.0000)	(0.0016)	(0.0000)	(0.0001)	(0.0020)
AACSB	0.0336†	0.0365†	0.0404†	0.0457*	0.0202	0.0383
	(0.0182)	(0.0464)	(0.0382)	(0.0880)	(0.2928)	(0.1016)
Business	0.0992‡	0.0441*	0.0997‡	0.1171‡	0.0797‡	-0.045
	(0.0000)	(0.0574)	(0.0000)	(0.0011)	(0.0004)	(0.1074)
Public	-0.054‡	-0.028	-0.091‡	-0.077‡	0.0282	0.0257
	(0.0002)	(0.1301)	(0.0000)	(0.0034)	(0.1645)	(0.3438)
Union	0.0087	0.0047	-0.006	-0.065	-0.0179	0.0671†
	(0.9389)	(0.8376)	(0.8563)	(0.1461)	(0.5145)	(0.0488)
Teaching	-0.098‡	-0.093‡	-0.080‡	-0.080†	-0.080‡	0.0028
	(0.0000)	(0.0000)	(0.0020)	(0.0153)	(0.0064)	(0.9356)
Race	-0.004	0.0253	-0.026	0.0557	0.0173	-0.009
	(0.8535)	(0.5085)	(0.4556)	(0.3182)	(0.4958)	(0.7942)
Move	-0.004	0.0341*	-0.015	0.0781‡	0.0317	-0.035
	(0.8029)	(0.0781)	(0.4541)	(0.0057)	(0.1306)	(0.1552)
Constant	10.57‡	10.59‡	10.60‡	10.64‡	10.58‡	10.59‡
	(0.0000))	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
F	81.58‡	34.64	45.69‡	16.22‡	21.16‡	18.53‡
R^2	0.589	0.554	0.578	0.528	0.462	0.567
N	844	407	490	205	354	202

Note: p-values are reported in parentheses, and ‡, † and * indicate significance at the 1, 5 and 10 percent levels.

Additional years of *experience* significantly increase salaries for men and to a lesser extent women, and estimates of *experience squared* suggest that only men appear to face a diminishing return from experience.

Estimates related to institutional attributes indicate that economists generally receive significantly greater compensation when affiliated with an *AACSB* accredited college of *business*. Whether an institution is *public* or private does not matter for salaries at comprehensive universities, but salaries at research institutions are significantly higher at private universities than *public*. Results also suggest salaries at unionized institutions (*union*) are not significantly different than those at non-unionized institutions, though the single significant effect (positive) for women at comprehensive institutions is an important exception.

We now turn to the decomposition of the estimated earnings to examine male-female wage differentials for academic economists. Table V summarizes salary information on men and women and provides details on the differences. For the pooled equations, men appear to earn about 15 percent ($7671) more than women. When the data are stratified, the gap narrows to 8 percent ($3774) for those with less than 13 years of experience but widens to 22 percent ($12123) for those in research-doctoral schools. The results suggest that differences in human capital and other identified factors explain 80 percent of the differential for the pooled data, leaving an unexplained gap of about 20 percent. Stratified results reveal that 17 percent ($740) of the wage differential is unexplained at comprehensive institutions while 39 percent ($4715) is unexplained at research institutions. Among less and more experienced academic economists 21 percent ($805) and 54 percent ($3822) of the wage gap is left unexplained.[8] The decompositions suggest that, for less experienced academics and for those working at comprehensive or liberal arts institutions, sex discrimination may not substantially affect salaries—the unexplained differential is about 1 percent of salaries. For those working in research-doctoral schools, and particularly those with more experience, the unexplained differentials are four to six times larger and sex discrimination may be of greater concern.

Table V. Analysis of Male-Female Salary Differentials by Category

	Male	Female	Difference	Skill	Residual
Pooled	10.9203 ($55,389)	10.7250 ($48,169)	0.1478 ($7,671)	0.1179 (80%) ($6,118)	0.0299 (20%) ($1,553)
Less Experience	10.7789 ($48,000)	10.6971 ($44,226)	0.0819 ($3,774)	0.0644 (79%) ($2,968)	0.0175 (21%) ($805)
More Experience	11.0378 ($62,182)	10.9178 ($55,149)	0.1200 ($7,033)	0.0548 (46%) ($3,210)	0.0652 (54%) ($3,822)
Research	11.0102 ($60,485)	10.7865 ($48,362)	0.2236 ($12,123)	0.1369 (61%) ($7,408)	0.0867 (39%) ($4,715)
Comprehensive	10.7835 ($48,218)	10.6872 ($43,790)	0.0963 ($4,428)	0.0805 (83%) ($3,688)	0.0157 (17%) ($740)

[8] Of course, the wage differentials will be understated to the degree that discrimination influences the explained portion of the differential, and overstated to the degree that self-selection influences the unexplained portion of the differential (e.g., Darity, 1980).

5. Summary and Conclusions

Using a unique set of data, we find that that a human-capital based model performs well in explaining salary differentials between men and women academic economists: salaries of both women and men tend to increase with levels of experience, the number of books and articles produced, and publication in top journals, while teaching more courses per year and working at a teaching oriented institution negatively affect salaries. We find evidence of a salary hierarchy, with salaries increasing from liberal arts to comprehensive to research-doctoral schools.

Results provide additional support for the contention that male economists earn more than women economists, with an unexplained residual arising in all cases. Though the data is limited, it uncovers a new perspective on how this gap differs across individual and institutional characteristics. The gap is largest among more experienced individuals at research-oriented institutions and smallest among less experienced individuals at liberal arts and comprehensive institutions. In addition to identifying systematic variations in the wage gap, the historical perspective will provide a useful benchmark for the literature and future research.

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