Research in Higher Education, Vol. 46, No. 6, September 2005 (© 2005)
DOI: 10.1007/s11162-004-4137-1

SALARY STRUCTURE EFFECTS AND THE GENDER PAY GAP IN ACADEMIA

Debra A. Barbezat,*,† and James W. Hughes**

This paper presents estimates of the gender salary gap and discrimination based on the most recent national faculty survey data. New estimates for 1999 indicate that male faculty members still earn 20.7% more than comparable female colleagues. Depending upon which decomposition technique is employed, the portion of this gap attributable to discrimination is 17% or, 19–23%. Both estimates of the unexplained salary gap are lower than previous estimates. Furthermore, application of the Juhn technique shows that differences in salary structure, especially between research and liberal arts institutions, constitutes an important determinant of the relative gender pay gap between institutional types.

KEY WORDS: salary; gender gap; discrimination; salary structure.

INTRODUCTION

Research on salary differentials in academic labor markets dates back to the early 1970s. These studies were, in part, motivated by changes in the legal environment of higher education. In 1968, Executive Order 11246 was amended to prohibit sex discrimination in government contracts and in 1972 Title VII was extended to higher education institutions. Over roughly 30 years, numerous campuses have performed pay equity studies and a multitude of studies focusing on particular academic disciplines have been published as well (Barbezat, 2002). The first national faculty survey was conducted by the Carnegie Commission in 1968–1969 and, in this study, we employ the most recent national faculty data, the 1999 National Study of Postsecondary Faculty (NSOPF:99). The methodology for measuring explained and unex-

*Economics Department, Colby College, Waterville, ME 04901, USA.
**Economics Department, Bates College, Lewiston, ME 04240, USA.
†Address correspondence to: Debra A. Barbezat, Economics Department, Colby College, Waterville, ME 04901. E-mail: dabarbez@colby.edu; James W. Hughes, Economics Department, Bates college, Lewiston, ME 04240, USA. E-mail: jhughes@bates.edu.

plained salary gaps has also evolved substantially over the past few decades and the benefits of competing techniques have been thoroughly examined (Toutkoushian and Hoffman, 2002). Despite this voluminous literature on salary gaps in academia, however, authors examining gender pay gaps in other settings have uncovered additional factors, relevant to the determination of gender pay gaps, that, up to now, have been overlooked in the higher education literature.

Specifically, authors including Blau and Kahn (1996, 1999), and Maurer-Fazio and Hughes (2002) have found that differences in salary or wage structure between countries or between different types of firms can account for a significant portion of the difference in gender pay gaps between such countries or firms. With this in mind, we present the first, to our knowledge, examination of how differences in salary structure between research institutions, doctoral institutions, comprehensive colleges and universities and liberal arts colleges influence the gender pay gap between types of academic institutions.

DATA AND METHODOLOGY

Our data base is the 1999 National Study of Postsecondary Faculty, which was sponsored by the National Center for Education Statistics. NSOPF:99 is based on a sample of 960 institutions and 28,576 full and part-time faculty members associated with these institutions. The sampled institutions include private and public campuses from 50 states and the District of Columbia. The majority of questions refer to faculty members' activities during the Fall semester of 1998. While some of the earlier surveys, the NSOPF-88, for example, were limited to faculty with instructional duties, the NSOPF:99 includes individuals designated as faculty, regardless of whether their responsibilities included instruction (e.g., faculty who do not teach), and other, non-faculty, individuals with instructional duties (e.g., library staff) (National Center for Education Statistics, 2002, Readme Text, p. 4). Therefore, for comparability with earlier studies, we selected our sample to include all individuals with instructional responsibility, but at least some of their courses must be for credit. Homogeneity of the sample, and comparability with earlier studies, is also assured by restricting the sample to full-time workers in the top three academic ranks at colleges and universities with four-year programs. The NSOPF:99 data were not weighted for use in this study.

Some of the salary gap estimates we present are derived from the single-equation method. Salary constitutes the dependent variable and the independent variables include various measures of faculty productivity,

including characteristics associated with both individual faculty members and institutional employers. In a sample of men and women any difference in pecuniary return between the two groups is picked up by a dummy variable representing gender (i.e., a shift in the intercept of the salary schedule). In order to release the restriction that all independent variables have an identical impact on salary for men and women, many researchers have estimated separate salary equations for each gender.

In addition to comparing estimated coefficients across the two groups, a two-equation approach permits the calculation of a predicted salary gap, including the decomposition of this total gap into both an explained and unexplained portion, the latter usually constituting the discrimination estimate. In this paper, we present salary gap and discrimination estimates based on both the one and two-equation approaches. We use both the Oaxaca (1973) and Neumark (1988) methods of decomposing the predicted male–female salary gaps since they are the most widely used techniques. In the Oaxaca approach, the salary structure in the absence of discrimination is estimated two ways: by comparing men's average predicted salary to the salary that women would earn if compensated according to the men's salary regression and, the second way, by comparing women's average predicted salary to the salary men would earn if they were paid according to the women's salary structure. Subsequent authors, including Neumark (1988) and Cotton (1988), preferred to define the non-discriminatory salary structure in other ways. For example, Neumark estimates the nondiscriminatory salary structure with a pooled sample of men and women while Cotton uses a weighted average of the men's and women's salary equations.

The techniques described above have become commonplace in the labor economics literature (Toutkoushian and Hoffman, 2002). We supplement this standard analysis with an examination of how salary structures at specific types of institutions influence the relative economic standing of female academics. The Oaxaca and Neumark procedures focus on gender differences in skill levels and returns to those skills as the source of gender salary gaps. Examining salary structure allows us to discern how the returns to skill levels and salary premia for employment in certain types of institutions affect the salary gap.

In our setting, salary structure could be an important determinant of the relative earnings of female academics to the extent that women on average have less experience than their male counterparts or are found in lower paid sectors of academia, such as liberal arts colleges. Other things equal, if women are relatively rare at research institutions, for example, any pay premium for that sector will contribute to the gender

salary gap. Examining salary structure also allows us to evaluate how overall salary inequality in a particular institutional type contributes to the gender salary gap. We employ the technique pioneered by Juhn, Murphy and Pierce (1991) and Katz and Murphy (1992), now known in the literature as the Juhn technique, to examine the effect of salary structure on gender pay gaps in the academic setting.

SALARY PREDICTORS FOR THE 1999 SAMPLE

Table 1 presents the results of three salary regressions: the full sample of 6,905 faculty members from NSPOF:99, and subsamples of 4,394 men, and 2,511 women. The independent variables included have proven to be important salary determinants in earlier studies. The estimated Male dummy coefficient, 0.0418, indicates that in 1999 there was still a statistically significant return to men relative to comparable female faculty. To facilitate comparison with other studies, in a basic salary model (without controls for academic field, publications, or type of institution), the estimated coefficient on Male would be larger, .0685 (standard error equals .0094). There has been substantial discussion about whether academic rank should be controlled when comparing male and female salaries and a few researchers, Ashraf (1996), for example, have done so. Including dummy variables for associate and assistant professor rank (full professor is the standard), the Male dummy coefficient drops to .0502 in the basic equation and .0317 in the most inclusive equation, significant at the 1% level in both specifications. Finally, recent articles have debated the link between seniority and faculty salaries. Consequently, Ransom and Megdal (1993) and Toutkoushian (1998) estimated faculty salary equations with linear and quadratic forms of seniority. This addition would change our estimates only slightly. Including seniority and seniority-squared produces an estimated Male coefficient of .0693 in the basic model and .0413 in the most inclusive regression (both significant at the 1% level). Experience, defined as number of years since receipt of highest degree, has a strong positive association with faculty salaries, while the quadratic form of experience also achieves statistical significance.

With the exception of Native Americans and Pacific Islanders (only .07% of the sample), minority representation appears to have grown relative to earlier surveys. Hispanics represent 5% of the sample, blacks constitute 7%, and 8% of faculty members are Asian. But, according to the results in Table 1, race and ethnicity generally prove to be insignificant salary predictors.

TABLE 1. Salary Determinants for Full Sample, Men and Women, 1999 (Dependent Variable is Natural Logarithm of Annual Academic Salary)

Variable Name	Full Sample	Men	Women
Male	.0418***	–	–
	(.0089)		
Age	.0010	−5.78E−05	.0020**
	(.0007)	(.0010)	(.0010)
Hispanic	−.0098	−.0012	−.0157
	(.0182)	(.0229)	(.0304)
Black	.0032	−.0047	.0187
	(.0156)	(.0204)	(.0243)
Asian	.0254*	.0228	.0347
	(.0148)	(.0171)	(.0308)
Native American/Pacific Islander	−.0528	−.0656	−.0335
	(.0454)	(.0575)	(.0749)
Experience	.0196***	.0195***	.0201***
	(.0015)	(.0020)	(.0025)
Experience-squared	−.0002***	−.0002***	−.0003***
	(.00004)	(.00004)	(.00007)
Advanced degree	.1890***	.2046***	.1640***
	(.01383)	(.0192)	(.0206)
Primarily administration	.1711***	.1727***	.1641***
	(.0132)	(.0165)	(.0221)
Primarily research	.0894***	.0964***	.0663***
	(.0136)	(.0162)	(.0257)
Primarily other	.0869***	.1049***	.0673**
	(.0178)	(.0226)	(.0294)
Mid East	.0405**	.0530**	.0177
	(.0179)	(.0227)	(.0295)
Great lakes	−.0506***	−.0494**	−.0508**
	(.0181)	(.0229)	(.0296)
Plains	−.0854***	−.0626**	−.1229***
	(.0204)	(.0259)	(.0335)
Southeast	−.0560***	−.0431**	−.0740s***
	(.0176)	(.0224)	(.0289)
Southwest	−.0874***	−.0689***	−.1233***
	(.0217)	(.0270)	(.0373)
Rocky mountain	−.0870***	−.0625**	−.1323***
	(.0251)	(.0309)	(.0433)
Far west	.0167	.0334	−.0138
	(.0196)	(.0245)	(.0327)
Refereed articles	.0021***	.0020***	.0027***
	(.0001)	(.0002)	(.0004)

TABLE 1. *(Continued)*

Variable Name	Full Sample	Men	Women
Non-refereed articles	.0002	6.64E−05	.0004
	(.0002)	(.0002)	(.0004)
Chapters/reviews	.0016***	.0015***	.0019**
	(.0004)	(.0005)	(.0008)
Texts/monographs	−4.2E−05	−.0003	.0012
	(.0005)	(.0005)	(.0014)
Other publications	.0024	.0030	−.0010
	(.0022)	(.0025)	(.0046)
Doctoral	−.0850***	−.0848***	−.0829***
	(.0124)	(.0152)	(.0215)
Comprehensive college and university	−.1193***	−.1358***	−.0845***
	(.0106)	(.0135)	(.0176)
Liberal arts college	−.1742***	−.1901***	−.1428***
	(.0149)	(.0191)	(.0242)
Public	.0229**	.0069***	.0514***
	(.0095)	(.0119)	(.0158)
Constant	10.326***	10.395***	10.298***
	(.0373)	(.0494)	(.0581)
R-squared	.43	.42	.35
Number of observations	6,905	4,394	2,511

Notes: Regressions also control for 24 academic fields including: math/statistics, computer science, economics, other social science, psychology, law, philosophy/religion, history/geography, foreign language, English, medicine, other health field, bioscience, chemistry, other science, business, engineering, applied professional, agriculture, teacher education, general education, occupational, other field.

Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) levels. Standard errors are in parentheses.

Among the significant salary predictors, having an advanced degree raises men's salary by approximately 20% vs. 16% for women. Location in New England (the omitted regional category) is associated with higher salaries than any other part of the country except the Mid East United States. Most of the earlier national surveys included variables designating the individual's primary activity. In this survey, we distinguish between primary emphasis in teaching, research, administration, or ''other'' area (e.g., a clinical practice). While similar proportions of men and women emphasized administration (10%) and ''other'' activities (7%), more men than women were primarily engaged in research (15% of men vs. 9% of women). Findings from Table 1 confirm that the highest return is

associated with administration. Notably, the estimated premium for administration, research, and ''other'' activity'' is greater for men.

For each publication category, refereed articles, non-refereed articles, book chapters and reviews, texts and monographs, and an ''other'' category, men published more than women. Only two categories attain statistical significance in the salary regressions, however, number of refereed articles and the quantity of published books and reviews. The mean number of refereed articles is 10.92 for women vs. 25.74 for men, and the mean level of chapters and reviews is 4.15 for women, which is below the men's value of 6.12. The gender difference in means is statistically significant at the 1% level for both variables. The salary increase for each refereed article is two-tenths of 1% for men, and slightly higher for women (.0027). Similarly, women's reward for publishing a chapter or review is slightly higher (.0019 vs. .0015).

The omitted institutional category represents Research I and II universities, so it is expected that salaries at all other institutions are lower. For the full sample, the average salary is $74,212 at research universities vs. $59,857 at doctoral institutions, $53,238 at comprehensive colleges/universities, and $47,738 at liberal arts colleges.[1] When the full salary regression in Table 1 was estimated for each of four institutional types (Research, Doctoral, Comprehensive College/University, and Liberal Arts College), the Male dummy variable ranged substantially from .025 to .057. Later in the paper we return to the issue of how the salary structure at particular types of higher education institutions may influence the male–female salary gap. Our findings also suggest that faculty members at public institutions earn salaries that are approximately 2% higher. This effect seems to be larger for women who constitute the same proportion of faculty at public and private institutions (36% female at the former and 38% at the latter).

Changes in supply and demand create different market situations by academic discipline. In 1999, the highest paid fields were similar for male and female academics: business, computer science, economics, engineering, law and medicine. In fact, the pecuniary return to teaching in these fields was very similar for both groups with two notable exceptions. The salary premium was greater for male economists (estimated coefficient was .27 vs. .14) and higher for female law professors (.53 for women vs. .46 for men). These categories encompass relatively few individuals, however. There were only 42 women and 70 men teaching law and 15 women and 113 men teaching economics.

Finally, a review of single-equation estimates of the male salary advantage for earlier periods suggests that, despite a decline during the seventies, there was little to no progress during the eighties

(Barbezat, 2002). There are relatively few estimates of the male salary advantage for the nineties. Toutkoushian's (1998) estimate, based on NSOPF:93 data, indicates a 7.8% salary disadvantage for women after controlling for many of the same control variables used in this study. Consequently, our estimate of approximately 4.2% for 1999 indicates some progress toward eliminating discriminatory salary gaps in academia.

THE DECOMPOSED SALARY GAP FOR 1999

Estimates based on single-equation models are limited in that the models do not allow for differences in the return to productive characteristics by gender. In recent years, it has become customary to estimate separate salary regressions by gender and calculate a total predicted salary gap. A decomposition technique is used to estimate the portion of this total gap that is attributable to discrimination, the so-called "unexplained" gap, and the explained portion of the gap, which arises from gender differences in the levels of the independent variables.

Our estimate of the total salary gap by gender is 20.7% for the year 1999. This estimate is slightly higher than Toutkoushian's estimate of 19.9% using 1993 national faculty data. But the optimistic news is that when the total gap is partitioned using the Oaxaca technique, we find that relatively few percentage points (between 3.9 and 4.9) can be attributed to discrimination. In other words, only 19–24% of the total gap is unexplained. Using the alternative Neumark decomposition technique, we find that the unexplained gap is even smaller, only 3.6 percentage points of the 20.7% total gap.

Again, for comparison, we note that Toutkoushian used three different methodologies to decompose the total salary gap in 1993: Oaxaca, Neumark, and Reimers (1983) (see Toutkoushian and Hoffman, 2002, for a fuller discussion of alternative techniques). After deriving a total salary gap of 19.9%, the lowest discrimination estimate he calculated was 7.4 percentage points. So, at a minimum, he found that 37% of the total gap was unexplained. While recognizing that these estimates are very sensitive to model specification, the 1993 and our 1999 findings seem to suggest continued improvement in achieving salary equity. When thinking about the source of any remaining salary inequality, however, conventional methodology has certain shortcomings. We address some of these limitations in the following sections.

EFFECTS OF INSTITUTIONAL TYPE ON 1999 GENDER SALARY GAPS

Table 1 above showed that the type of institution—research, doctoral, comprehensive college/university, or liberal arts college—is a key determinant of faculty salaries. According to Table 1, faculty at liberal arts colleges were paid over 17% less on average than their counterparts at research universities. Similarly, the gender salary gap varies with institutional type. The middle column of the top panel in Table 2 gives the average male–female salary gap, expressed in logs, for the four types of academic institutions. Research universities had a gender salary gap of just over 20% in 1999, while doctoral institutions had a gender salary gap of almost 18%. Referring again to Table 2, gender salary gaps at comprehensive colleges/universities and liberal arts colleges were substantially less, measuring 12% and 12.6%, respectively. Thus, overall gender salary gaps are some 60% wider at research and doctoral institutions.

We next performed Oaxaca decompositions, described in Section 2 above, to separate these institutional salary gaps into the part that is explained by differences in productive characteristics between men and women, and the part that is unexplained. For each institutional type, we calculated the decomposition using male and female salary regressions with identical specifications as those in Table 1, but omitting institutional type. Finally, we used male salaries within each institutional type as the base, or nondiscriminatory, salary.

Of the total salary gap within each institutional type, the unexplained portion of the gap was 22% at research institutions, 29% at doctoral institutions, 26% at comprehensive colleges and universities, but only 8.3% at liberal arts colleges. The much smaller unexplained gender salary gap at liberal arts colleges would generally be interpreted as an indication that gender salary discrimination is less at these institutions. The smaller unexplained gender salary gap from the Oaxaca decomposition suggests that there is relatively little gender difference in the return to observed productive characteristics at liberal arts colleges, such that almost the entire gender salary gap is explained by gender differences in the level of productive characteristics.

More recent research suggests that this standard conclusion is premature (Blau and Kahn, 1996, 1999; Juhn et al., 1991; Katz and Murphy, 1992; Maurer-Fazio and Hughes, 2002). Comparing Oaxaca, Cotton, or Neumark decompositions across different groups of employees implicitly assumes that the groups face the same salary structure at each type of employer. Given that different employers often have

TABLE 2. Juhn Decompositions of the Relative Wage Gap between Research Institutions and Other Institutional Types

Institutional Type	Mean Female Residual Percentile	Gender Difference in Mean Log Salary	Difference-in-Difference with Research I & II Inst.	
Research	45.6	0.2015	N/A	
Doctoral	45.7	0.1757	−0.0258	
Comprehensive Coll. & Univ.	44.3	0.1201	−0.0814	
Liberal arts	48.8	0.1255	−0.0760	
Institutional Type	**Observed Characteristics**	**Observed Prices**	**Gap Effect**	**Unobserved Prices**
Doctoral	−0.0136	−0.0190	0.0042	0.0026
(%)	−53%	−74%	16%	10%
Comprehensive Coll. & Univ.	−0.0336	−0.0334	−0.0139	−0.0005
(%)	−41%	−41%	−17%	−1%
Liberal arts	−0.0448	0.0051	−0.0355	−0.0008
(%)	−59%	7%	−47%	−1%
Institutional Type	**Sum of Gender-Specific Effects**	**Sum of Salary Structure Effects**		
Doctoral	−0.0094	−0.0164		
(%)	36%	64%		
Comprehensive Coll. & Univ.	−0.0475	−0.0338		
(%)	58%	42%		
Liberal arts	−0.0803	0.0043		
(%)	106%	−6%		

Note: The components of the decomposition are defined as follows: observed characteristics = $(\Delta X_i - \Delta X_R)B_R$, Gap Effect = $(\Delta\theta_I - \Delta\theta_R)\sigma_R$, Observed Prices = $\Delta X_i(B_i - B_R)$, Unobserved Prices = $\Delta\,\theta_I(\sigma_I - \sigma_R)$ where the subscript R refers to Research institutions and the subscript I = D, C, L refers to Doctoral Institutions, Comprehensive Colleges and Universities and Liberal Arts colleges respectively. X is a vector of explanatory variables, B is a vector of estimated coefficients from the male wage equation for the indicated institutional type, θ is a standardized residual, σ is the residual standard deviation of male wages, and a Δ prefix denotes the mean male/female difference in the variable immediately following the symbol (see Blau and Kahn, 1999, Table 2).

different goals in setting salaries (e.g., different weighting of pay equity vs. merit pay), the assumption of identical pay structures needs to be examined more closely.

The procedure developed by Juhn et al. (1991) allows researchers to explicitly account for differences in salary structure between different types of employers when comparing salary gaps. In the Juhn technique, gender differences in the levels of productive characteristics and gender discrimination determine women's ranking on the male residual wage distribution. The salary structure, measured as the level of male salary inequality, determines women's salary penalty associated with a given percentile ranking.

Figure 1 illustrates how differences in salary structure can affect the gender pay gap between different types of employers. The top panel shows a hypothetical male residual salary distribution at research universities, derived from a salary regression such as shown in Table 1, column 2. The "residual salary" is the difference between each man's actual salary and his salary as predicted using the salary regression. In other words, the residual salary is that part of the man's salary that is not explained by the productive characteristics included in the regression equation. In the top panel of Fig. 1 the mean of the distribution equals zero because, on average, men's predicted salary equals their actual salary. Individuals with positive residuals (i.e., located to the right of the mean), earn salaries that are above what would be predicted based on their observed productive characteristics. Negative residuals indicate underpayment relative to their predicted salary.

The bottom panel of Fig. 1 shows a parallel hypothetical distribution for liberal arts colleges. In this hypothetical example, the variance of the male residual salary distribution is larger at research universities, reflecting higher residual wage inequality at these institutions.

The shaded areas in Fig. 1 indicate the average woman's placement on the male residual salary distribution at each type of institution. The average female salary is derived from a female salary regression, again, similar to Table 1. Figure 1 indicates that women place at the same percentile—35th percentile—on the male residual salary distributions of their respective institutions. Thus, women are facing the same proportional disadvantage relative to men due to either discrimination or a gender deficit in some unmeasured productive characteristic. However, the higher level of overall salary inequality at research universities results in a larger salary penalty— $\$x$ vs. $\$y$ in Fig. 1—for women at these institutions. In the terminology of the Juhn procedure, this contribution of $\$(y - x)$ to the gender salary gap is called the "Unobserved Prices" effect, as a given percentile

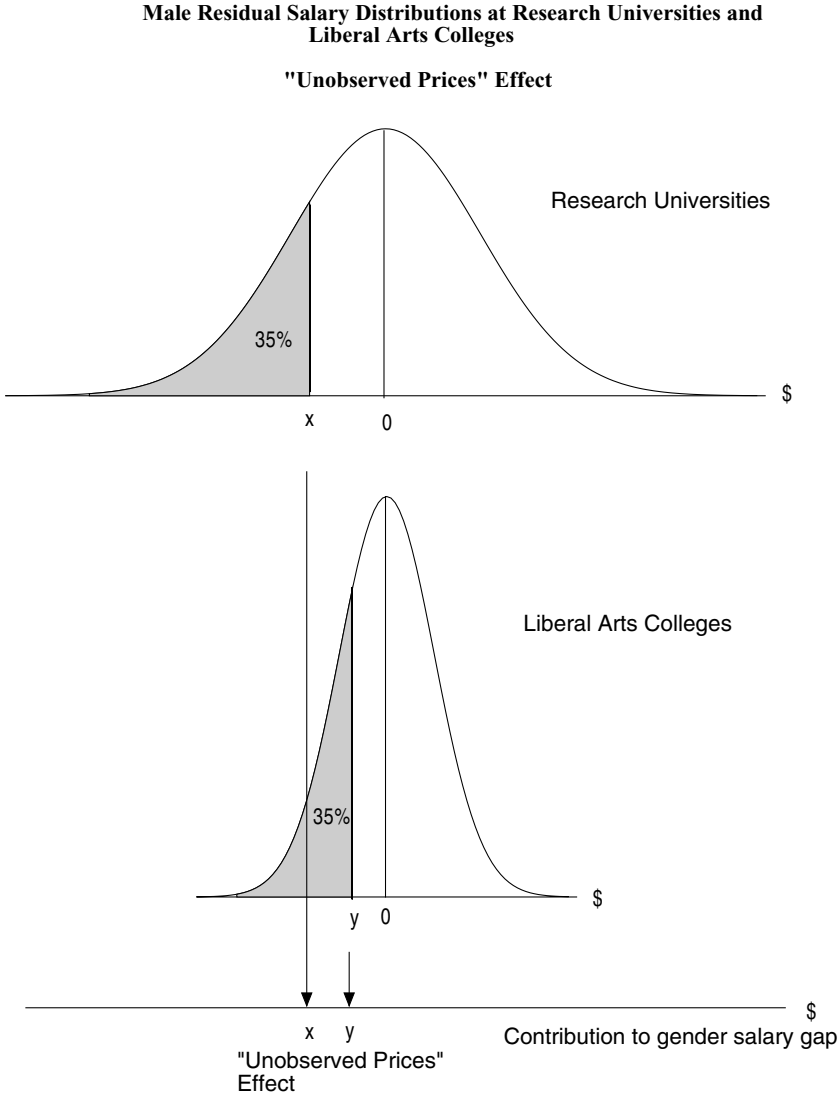

FIG. 1. Male residual salary distributions at research universities and liberal arts colleges ''unobserved prices'' effect.

ranking for women is valued differently at the two types of institutions.

The details of the calculation of the Juhn decomposition may be found in Blau and Kahn (1996). The Juhn method decomposes the gender pay gap between institutional types into four components:

(1) 'Observed Characteristics' represents the contribution of gender differences in productive characteristics between institutional types. For example, if women publish much less than men at liberal arts colleges compared to research universities, this relative deficit in observed productivity will be reflected in the 'Observed Characteristics' measurement.
(2) 'Observed Prices' captures the contribution of differences in men's returns to productive characteristics across institutional types. For example, for a given male-female gap in productive characteristics, a higher return to those characteristics for men at research institutions compared to men at other institutional types will increase the difference in the gender salary gap between research institutions and the other institutional types.
(3) 'Gap Effect,' is the portion of the gender salary gap caused by differences between institutional types in woman's percentile ranking on the male residual salary distribution.

As shown in Fig. 2, the 'Gap Effect' is the component of the gender salary gap that would result if research universities and liberal arts colleges had the same male residual salary distributions, but women at the two types of institutions differed in their percentile rankings thereon. In our hypothetical example, the average women's salary at research institutions falls at the 30th percentile on the male residual salary distribution. At liberal arts colleges, the average women rank at the 45th percentile on the men's residual salary distribution. The different percentile rankings may be the result of gender discrimination, or a relative gender deficit in some unobserved productive characteristic among women at research institutions. Thus, the Gap Effect, the difference between women's rankings at research universities and liberal arts colleges, is represented by the distance $\$(k - j)$ on Fig. 2.

(4) 'Unobserved Prices,' measures the contribution to the inter-group salary gap of differences in residual salary inequality between institutional types. The 'Unobserved Prices' effect measures the inter-group salary difference that would result from women having the same percentile ranking on the male residual salary distribu-

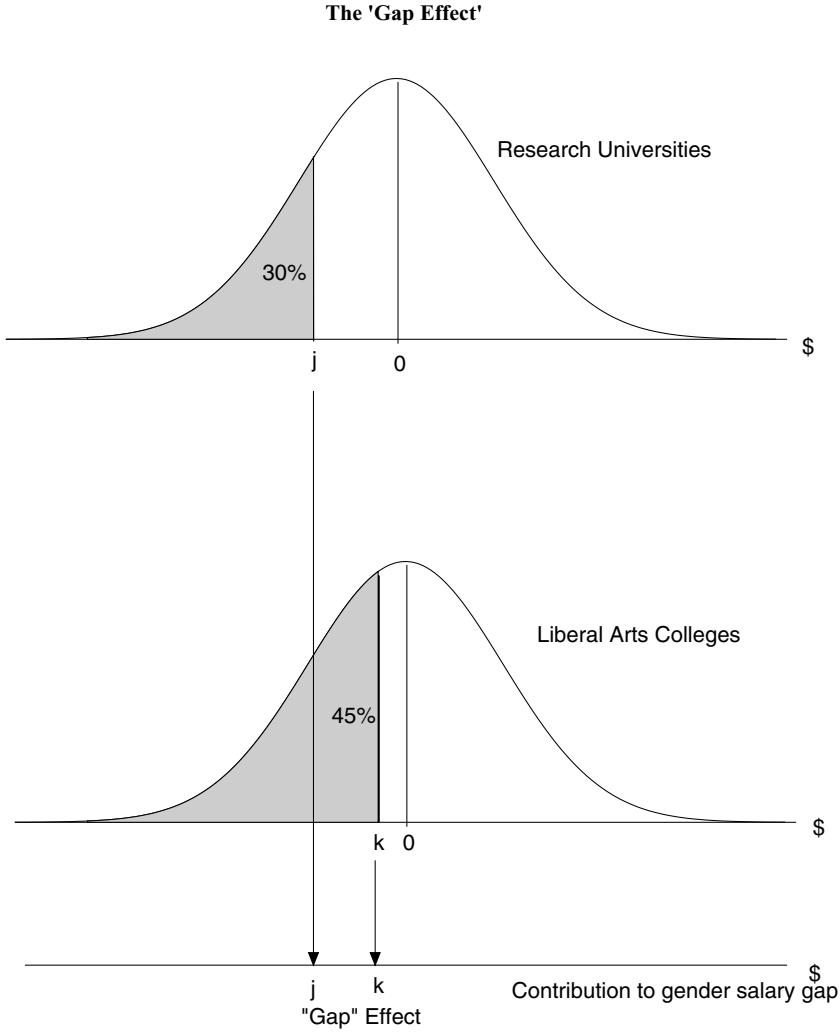

FIG. 2. The 'Gap Effect'.

tion, but with different levels of male residual salary inequality, as measured by the variance in the male residual salary distribution. The 'Unobserved Prices' effect was illustrated in Fig. 1 and explained in the accompanying text.

JUHN DECOMPOSITION RESULTS

This section presents Juhn decomposition results based on the NSOPF:99 data. According to the first column of Table 2, top panel, the mean women's position on the men's residual salary distribution does not differ greatly across institutional types. Women's position on the men's residual salary distribution varies from a low of 44.3% at comprehensive colleges and universities to a high of 48.8 at liberal arts colleges. These results indicate only a small difference between the average men's and average women's salary within institutional types after controlling for observable characteristics and prices.

The remainder of the table contains the Juhn decomposition results. The second column in the top panel is the mean log gender salary gap within institutional type, and the third column, Difference-in-Difference, reports the difference between the research universities' salary gap (the base category) and the salary gap for each of the other institutional types. For example, the entry for doctoral institutions, −.0258, equals the difference between the gender salary gap at doctoral institutions, 0.1757, and the gender salary gap at research universities, 0.2015. These difference-in-difference measures are all negative, as the mean gender salary gap is smaller at all other institutional types than it is at research institutions. The goal of the Juhn procedure is to decompose the entries in the Difference-in-Difference column into their component parts. For each institutional type, the four components listed in the middle panel sum to the corresponding entry in the Difference-in-Difference column.

Turning to the individual components, a positive (negative) entry indicates that that component will reduce (increase) the difference between the salary gap at the corresponding institution relative to research institutions. The column labeled 'Gap Effect' in the middle panel shows the contribution of women's standing on the men's residual salary distribution to the total difference to be explained. Women's higher percentile ranking at liberal arts colleges greatly increases the difference between the salary gaps at these institutions and research institutions, accounting for 47% of the total difference to be explained. The contribution of the Gap Effect is smaller for doctoral institutions and comprehensive colleges/universities, reflecting the similarity of women's percentile rankings at these institutions and research universities.

The contribution of the Unobserved Prices effect is negligible for all three institutional types, constituting only 1% of the total difference to be explained at liberal arts colleges and comprehensive colleges/universities. At most, the Unobserved Prices effect accounts for only 10% of the

difference to be explained between research universities and doctoral institutions. The positive entry in the Unobserved Prices column for doctoral institutions indicates that somewhat higher residual salary inequality at doctoral institutions slightly reduces the difference in the salary gaps between these institutions and doctoral institutions. One can conclude that a given level of discrimination or a female shortfall in an unobserved characteristic is penalized slightly more at research universities than at doctoral institutions.

The Observed Characteristics effect accounts for gender differences in the level of observed productive characteristics. Our results indicate that the male–female gap in the level of observed productive characteristics is larger at research institutions compared to the other three institutional types. The larger difference in men's and women's productive characteristics at research universities increases the gender salary gap at these institutions compared to doctoral institutions, comprehensive colleges/universities and liberal arts colleges. The Observed Characteristics effect accounts for over half of the total gender salary gap between both doctoral institutions and liberal arts colleges relative to research institutions. The Observed Characteristics effect accounts for 41% of the gap between comprehensive colleges/universities and research institutions.

The Observed Prices effect focuses on differences in the men's return to observed productive characteristics across institutional types. This effect is negative and large for doctoral institutions and comprehensive colleges/universities. For these institutional types, higher returns to men at research institutions increases the gender gap at research universities relative to other institutional types. The Observed Prices effect is positive but small for liberal arts colleges, indicating that this effect actually narrows the difference in the gender salary gaps between the two institutional types. Given the calculation of this term in the decomposition technique, this somewhat unexpected result could occur two ways. First, male returns to productive characteristics could be higher, on balance, at liberal arts colleges, an unlikely possibility given the substantially lower average salaries at liberal arts colleges. Second, the difference in the male returns at the two institutional types is weighted by the male–female difference in mean productive characteristics at liberal arts colleges. If men's and women's mean productive characteristics at liberal arts colleges are similar, this would result in a very small Observed Prices effect, such as we see here. This mechanism seems a more likely explanation for this result, given the relatively small gender salary gap at liberal arts colleges (12.55%) and the relatively large 'explained' portion of the salary gap (over 90%) we calculated earlier by the Oaxaca method.

The bottom panel of Table 2 presents two summary statistics. Gender-Specific Effects, which is the sum of Observed Characteristic plus Gap Effects, capture gender differences in productive characteristics and in salary percentile rankings, respectively. Also contained in the bottom panel of Table 2 is Salary Structure Effects, defined as the sum of Observed Prices and Unobserved Prices. This sum captures gender differences in returns to observed and unobserved characteristics across institutional types, reflecting differences in salary structure between the research institutions and the other institutional types.

Turning to the specific results (column 1 of panel 3), the majority of the difference-in-difference measure is attributable to gender-specific effects at comprehensive colleges/universities (58%) and liberal arts colleges (106%). At doctoral institutions, only a bit more than one-third of the difference-in-difference measure is attributable to gender specific effects. The negative sign on gender-specific effects for all three institutional types reflects the fact that women at these institutions have both favorable levels of productive characteristics relative to men, and higher percentile rankings, compared to women at research universities. Especially for liberal arts colleges, our results suggest that women more closely match men's productive characteristics, and receive better labor market treatment, in the form of a higher percentile salary rank, compared to women at research universities.

Differences in salary structure are most important at doctoral institutions, accounting for over 60% of the total difference-in-difference to be explained. For doctoral institutions and comprehensive colleges/universities, this result reflects large deficits in the returns to observable productive characteristics for men compared to research universities.

Like other researchers who have employed the Juhn technique to examine gender wage gaps (see Blau and Kahn, 1996, 1999; Maurer-Fazio and Hughes, 2002), we find that differences in salary structure are responsible for a significant portion of the gender salary gap at least for doctoral institutions and comprehensive colleges/universities. In particular, differences in the returns to observed productive characteristics compared to research institutions accounts for the vast majority of the disparity in gender salary gaps. Clearly, more attention to salary structure effects is indicated when comparing different groups of academics.

DISCUSSION

Using a single-equation salary model, our estimate of the male dummy variable for 1999 is .0418. Decomposition analysis, using the Oaxaca and Neumark methodologies, indicates that for 1999 the portion of the

total salary gap attributable to discrimination is lower than any previous estimate. Based on the Oaxaca methodology, between 3.9 and 4.9 percentage points of the 20.7% gender salary gap can be attributed to discrimination. In other words, 19–24% of the male–female salary gap is unexplained. The Neumark decomposition technique produces an even smaller unexplained gap, with 17% of the gender gap in salary unexplained (equal to 3.6 percentage points).

Our results using the Juhn decomposition technique indicate that the effect of differences in salary structure varies by institutional type. For doctoral institutions and comprehensive colleges/universities, salary structure effects account for roughly 40–60% of the total difference in salary gap between these institutions and research universities. Interestingly, most of the salary structure effects are due to the higher returns to observed productivity characteristics for men at research universities compared to the other two institutional types. While competition is generally thought to erode differences in observable prices, this difference in returns likely indicates that the three types of institutions actually compete for faculty in different markets. Unobserved prices, which captures differences in residual salary inequality between institutions, plays very little role in explaining the inter-institutional differences on gender salary gap. All three types of institutions have similar levels of residual salary inequality.

For liberal arts colleges, gender-specific effects account for all of the difference in gender salary gaps compared with research universities. Relative to liberal arts colleges, our results suggest that women at research universities receive less favorable labor market treatment as indicated by the large Gap Effect for liberal arts colleges. Women at research universities place lower on the male residual salary distribution than women at liberal arts institutions, reflecting either a relatively greater level of labor market discrimination against women at research institutions, or gender differences in some unobserved characteristics. The large, negative, Observed Characteristics entries for all three institutional types indicates that women at research institutions have larger deficits in observable productive characteristics relative to men when compared to the other three types of institutions. This result does not indicate that women (or men) at liberal arts colleges, comprehensive colleges/universities or doctoral institutions have higher levels of productive characteristics than their research university counterparts, but only that the gender gap in such qualifications is wider at research universities.

The results of the Juhn decomposition for liberal arts colleges are consistent with the results of our Oaxaca decompositions by institu-

tional type. The unexplained portion of the gender salary gap at liberal arts colleges is smaller relative to research institutions, suggesting that returns to productive characteristics are more equal for men and women at liberal arts colleges than at research universities. This more equal treatment may be the result of greater value placed on overall salary equity at liberal arts institutions, and less emphasis on performance-based pay structures. But, it should be noted that this more equal treatment comes at a cost, as women at liberal arts colleges are paid on average 30% less than their research university counterparts. Thus, while women at research universities experience less favorable treatment relative to their male colleagues, they do enjoy a substantial salary premium over women at liberal arts colleges. Our findings suggest that the issue of salary structure is worthy of further research, as standard measures of explained and unexplained salary differentials may not adequately control for important differences in salary structure between institutional types.

ENDNOTES

1. The gender salary gap is equal to $15,021 at research universities, $10,020 at doctoral institutions, $6,121 at comprehensive colleges and universities, and $5,368 at liberal arts colleges.

REFERENCES

Ashraf Javed (1996). The influence of gender on faculty salaries in the United States, 1969–1989. *Applied Economics* 28: 857–864.

Barbezat Debra (2002). History of pay equity studies. In: Toutkoushian, R. (ed.), *Conducting Salary-Equity Studies: Alternative Approaches to Research*, Jossey-Bass, San Francisco, CA, pp. 9–40.

Blau Francine, and Kahn Lawrence (1996). Wage structure and gender earnings differentials: an international comparison. *Economica, Suppl.* 63: S29–S62.

Blau Francine, and Kahn Lawrence (1999). Analyzing the gender pay gap. *The Quarterly Review of Economics and Finance* 39: 625–646.

Cotton Jeremiah (1988). On the decomposition of wage differentials. *Review of Economics and Statistics* 70(2): 236–243.

Juhn Chinhui, Murphy Kevin, and Pierce Brooks (1991). Accounting for the slowdown in black–white wage convergence. In: Kosters, M. (ed.), *Workers and their Wages: Changing Patterns in the United States*, The AEI Press, Washington, DC, pp. 197–143.

Katz Lawrence, and Murphy Kevin (1992). Changes in relative wages, 1963–87: Supply and demand factors. *Quarterly Journal of Economics* 107: 35–78.

Maurer-Fazio Margaret, and Hughes James (2002). The effects of market liberalization on the relative earnings of Chinese women. *Journal of Comparative Economics* 30: 709–731.

Oaxaca Ronald (1973). Male–female wage differentials in urban labor markets. *International Economic Review* 14(3): 693–709.

National Center for Education Statistics (2002). *Readme Text for 1999 National Study of Postsecondary Faculty*, U.S. Department of Education, Washington, DC.

Neumark David (1988). Employers' discriminatory behavior and the estimation of wage discrimination. *Journal of Human Resources* 23(3): 279–295.

Ransom Michael, and Megdal Sharon (1993). Sex differences in the academic labor market in the affirmative action era. *Economics of Education Review* 12(1): 21–43.

Reimers Cordelia (1983). Labor market discrimination against Hispanic and black men. *Review of Economics and Statistics* 65: 570–579.

Toutkoushian Robert, and Hoffman Emily (2002). Alternatives for measuring the unexplained wage gap. In: Toutkoushian, R. (ed.), *Conducting Salary-Equity Studies: Alternative Approaches to Research*, Jossey-Bass, San Francisco, CA, pp. 71–89.

Toutkoushian Robert (1998). Sex matters less for younger faculty. *Economics of Education Review* 17(1): 55–71.

Received November 14, 2004.