

DOCUMENT RESUME

ED 219 043

HE 015 321

AUTHOR Hengstler, Dennis D.; And Others.  
 TITLE Salary Equity Studies: The State of the Art. ASHE Annual Meeting 1982 Paper.  
 PUB DATE Mar 82  
 NOTE 41p.; Paper presented at the Annual Meeting of the Association for the Study of Higher Education (Washington, DC, March 2-3, 1982).  
 EDRS PRICE MF01/PC02 Plus Postage.  
 DESCRIPTORS Case Studies; \*Comparative Analysis; Compliance (Legal); Court Litigation; Evaluation Methods; Federal Legislation; Federal Regulation; Females; Higher Education; Legal Problems; Males; \*Multiple Regression Analysis; Research Methodology; \*Salary Wage Differential\$; \*Sex Discrimination; \*Teacher Salaries; \*Women Faculty  
 IDENTIFIERS \*ASHE Annual Meeting

ABSTRACT

The strengths and weaknesses of various methodologies in conducting salary equity studies are examined. Particular attention is paid to the problems of identifying appropriate matches in the paired-comparison approach and to the sample, predictor and decision-rule problems associated with the regression analysis approach. In addition, highlights of university case studies and court cases are presented, along with current and future trends in salary equity studies. To illustrate the issues, the situation of female faculty members claiming sex discrimination in salaries is assessed with regard to law suits. Three main federal statutes or regulations barring sex discrimination in faculty salaries are the Equal Pay Act of 1963, Title VII of the Civil Rights Act of 1964, and Executive Order 11246 as amended by Executive Order 11375. The most common and costly type of law suit is the class action suit. Most salary discrimination cases have involved disparate treatment claims, since the requirement of proving a prima facie case is considerably more relaxed than the for a disparate impact claim. The plaintiffs bear the initial responsibility of proving a prima facie case of sex discrimination. In the early discrimination cases before the courts, plaintiffs relied almost exclusively upon the descriptive method for establishing a prima facie case of discrimination. The second method for determining possible sex discrimination in faculty salaries is the paired-comparison approach, also referred to as matching, counterparting, or the counter-factual approach. It is suggested that the multiple regression technique is the most effective method for analyzing sex discrimination in faculty salaries. (SW)

\*\*\*\*\*  
 \* Reproductions supplied by EDRS are the best that can be made \*  
 \* from the original document. \*  
 \*\*\*\*\*

ED219043

SALARY EQUITY STUDIES: THE STATE OF THE ART

by

Dennis D. Hengstler, Evaluation Specialist  
Office of Institutional Research  
University of North Carolina at Greensboro  
Greensboro, North Carolina 27412  
(919) 379-5930

John A. Muffo, Director  
Office of Institutional Research  
Cleveland State University  
Cleveland, Ohio 44115  
(216) 687-4700

Gary A. Hengstler, News Editor  
The Chronicle-Telegram  
Elyria, Ohio 44035  
Law Student  
Cleveland-Marshall College of Law  
Cleveland State University  
Cleveland, Ohio 44115  
(216) 329-7000

A Paper Presented at the Annual Meeting  
of the Association for the Study of Higher Education  
Washington, D.C.  
March 3, 1982

U.S. DEPARTMENT OF EDUCATION  
NATIONAL INSTITUTE OF EDUCATION  
EDUCATIONAL RESOURCES INFORMATION  
CENTER (ERIC)

This document has been reproduced as  
received from the person or organization  
originating it

Minor changes have been made to improve  
reproduction quality

Points of view or opinions stated in this docu-  
ment do not necessarily represent official NIE  
position or policy

"PERMISSION TO REPRODUCE THIS  
MATERIAL HAS BEEN GRANTED BY

*Dennis D. Hengstler*  
*John A. Muffo*  
*Gary A. Hengstler*

TO THE EDUCATIONAL RESOURCES  
INFORMATION CENTER (ERIC)."

HE 015, 321



# Association for the Study of Higher Education

The George Washington University / One Dupont Circle, Suite 630 / Washington, D.C. 20036  
(202) 296-2597

This paper was presented at the Annual Meeting of the Association for the Study of Higher Education held at the Washington Hilton in Washington, D.C. March 2-3, 1982. This paper was reviewed by ASHE and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC collection of ASHE conference papers.

Annual Meeting — March 2-3, 1982 — Washington Hilton  
Washington, D.C

## ABSTRACT

This study summarizes the strengths and weaknesses of various methodologies in conducting salary equity studies. Particular attention will be paid to the problems of identifying appropriate matches in the paired-comparison approach and to the sample, predictor and decision-rule problems associated with the regression analysis approach. Highlights of university case studies and court cases will be presented as well as current and future trends in salary equity studies.

Within the last decade there has been a dramatic increase in the number of court cases and studies dealing with sexual discrimination in faculty salaries. Impetus for such studies stems from federal statutes, executive orders, state legislation, and affirmative action programs, as well as the philosophical and moral considerations of equity. In view of recent court decisions both inside and outside of education which impact on this area, it is probable that the number of salary equity studies will increase.

Because of this increased interest in salary equity studies, it is imperative that scholars of higher education come to grips with the limitations of various salary equity approaches and their implications regarding legal and affirmative action considerations. Such understanding, combined with advanced preparation, can serve to help minimize the number of spurious law suits against a university, as well as facilitating adequate affirmative action procedures.

The purposes of the present study are to: (1) describe the federal statutes barring sex discrimination in faculty salaries; (2) describe the basic procedures utilized in law suits and litigations involving salary equity cases; (3) summarize the strengths and weaknesses of various methodologies employed in salary equity studies; and (4) discuss the methodologies in light of legal and affirmative action considerations.

### The Federal Statutory Framework

There are basically three federal statutes or regulations barring sex discrimination in faculty salaries. The first is the Equal Pay Act of 1963 (Note 1) mandating equal pay to men and women whose work activities are substantially equal in skill, effort, and responsibility, and when performed under similar working conditions. Prior to 1972, faculty in educational institutions were exempt from the Equal Pay Act; however, Title IX of the Educational Amendments of the 1972 Higher Education Act (Note 2) brought faculty under this law.

The second regulation is Title VII of the Civil Rights Act of 1964 (Note 3) which outlaws sex discrimination "against any individual with respect to his compensation, terms, conditions or privileges of employment." The Civil Rights Act is much broader in scope, since it bans discrimination in hiring, salary, promotion, or discharge based on race, color, religion, sex or national origin. As did the Equal Pay Act of 1963, Title VII of the Civil Rights Act of 1964 specifically exempted faculty in educational institutions. In 1972, Title VII was amended by the Equal Employment Opportunity Act (Note 4) to include employees of educational institutions. This amended law also established the Equal Employment Opportunity Commission (EEOC) to enforce the act.

The last major regulation affecting sex discrimination is Executive Order 11246 as amended by Executive Order 11375.

(Seabury, 1972). Executive Order 11375 prohibits discrimination in employment (including salaries) on the basis of sex and certain other factors and requires that: "(federal) contractors will take affirmative action to ensure that employees are treated during employment without regard to their race, color, religion, sex, or national origin." Department of Labor guidelines expanded the executive orders by requiring federal contractors to submit affirmative action plans, including "an analysis of areas within which the contractor is deficient in the utilization of minority groups and women." These executive orders and guidelines were the first national directives issued to universities concerning sexual discrimination on campus.

#### Sexual Discrimination Suits

For hypothetical purposes, the authors will use throughout the study the situation of female faculty members claiming sex discrimination in salaries; that is, the female faculty members claim that the university is paying them less when compared with similarly qualified men. The female faculty members may take their claim before the Affirmative Action Office, the Equal Employment Opportunity Commission, or they may initiate a law suit against the university. We will restrict the scope of this paper to law suits. The most common and costly type of law suit is the class action suit, one "filed by individuals who claim that they have suffered an injustice or injury which has been systematically

inflicted upon an entire class of individuals, of which they are but token representatives" (Note 5).

Most often the suits are brought under Title VII of the Civil Rights Act of 1964 rather than the Equal Pay Act of 1963 as amended, since Title VII does not explicitly require that the plaintiffs (i.e., the female faculty members) prove that their work is substantially equal in skill, effort, and responsibility to those of men (Greenfield, 1977). As the Supreme Court recently held: "a sex discrimination compensation claim can be brought under Title VII without regard to whether the equal work standard of the Equal Pay Act, 29 U.S.C. § 206 (d), is met" (County of Washington v. Gunther, 26 EPD ¶731,877, 101 S.Ct. 2242, 68 L.Ed.2d 751, 1981). Thus, it may be easier for plaintiffs to substantiate their claims of sex discrimination under Title VII than the Equal Pay Act.

As dictated by the Supreme Court ruling in McDonnell-Douglas Corp. v. Green (411 U.S. 974, 1973), the plaintiffs have the initial responsibility of establishing a prima facie case of discrimination; that is, the plaintiffs (female faculty) must prove that they are receiving lower salaries compared to male faculty members with similar qualifications and work activities. If enough evidence is presented to establish a prima facie case, "the burden then must shift to the employer to articulate some legitimate, nondiscriminatory reason for [the apparent discrimination]" (Note 6). If the defendant (the university) is successful in rebutting



the plaintiff's prima facie case, the plaintiff may then attempt to show that the reasons given by the defendant amounted to a pretext.

In establishing the prima facie case, plaintiffs may make one of two claims, disparate treatment or disparate impact. The distinction between disparate treatment and disparate impact cases was explained by the Supreme Court in International Brotherhood of Teamsters v. United States:

'Disparate treatment' such as alleged in the present case is the most easily understood type of discrimination. The employer simply treats some people less favorably than others because of their race, color, religion, sex, or national origin. Proof of discriminatory motive is critical, although it can in some situations be inferred from the mere fact of differences in treatment. . . . Undoubtedly disparate treatment was the most obvious evil Congress had in mind when it enacted Title VII. . . .

Claims of disparate treatment may be distinguished from claims that stress 'disparate impact.' The latter involves employment practices that are facially neutral in their treatment of different groups, but that in fact fall more harshly on one group than another and cannot be justified by business necessity. (431 U.S. 324, 339, 97 S.Ct. 1843, 1856, 52 L.Ed.2d 396, 1977)

Most salary discrimination cases have involved disparate treatment claims, since the requirement of proving a prima facie case is considerably more relaxed than the requirements for a disparate impact claim. Under present law, once the plaintiff has demonstrated that the salary process contains a discretionary element and has produced a substantial disproportionate impact on the class (female faculty), an inference of disparate treatment will generally arise without further proof being required (Baldus & Cole, 1980). In establishing the disparate treatment claim, the Supreme

Court has never said that the plaintiff must present direct evidence of discriminatory intent (Washington v. Davis, 426 U.S. 229, 96 S.Ct. 2040, 48 L.Ed.2d 597, 1976). In fact, one court has stated: "Particularly in a college or university setting, where the level of sophistication is likely to be much higher than in other employment situations, direct evidence of sex discrimination will rarely be available" (Sweeney v. Board of Trustees of Keene State College, 569 F.2d 169, 1978). Thus, a disparate treatment claim requires proof that a discrimination motive exists; however, such proof can be inferred by demonstrating substantial differences in salary by sex.

To summarize the litigation process, the plaintiffs bear the initial responsibility of proving a prima facie case of sex discrimination. In our example, the female faculty members (plaintiffs) must show that there is an observable difference in their salaries compared with those of male faculty members with similar qualifications and work activities; that the differences in salaries are significant in magnitude; and that the existing situation could hardly occur by chance. To refute the plaintiff's prima facie claim, the defendant (university) must show that the discrepancy in salaries can be explained by a legitimate criterion or bona fide requirement for the job (e.g., requirement of a Ph.D); that the discrepancies could have occurred by chance; or that the differences are caused by some other factor involved in the salary process (Note 5). If the

defendants fail to rebut the plaintiff's prima facie claim, the court will, in essence, assume the allegations to be true. If, however, the defendant is successful in rebutting the plaintiff's claim, then the plaintiff must show that the reasons given by the defendant amount to a pretext.

Before examining the various methodologies that can be employed in salary equity studies, it is important to describe the courts' previous approach toward university discrimination cases. For many years the courts have been reluctant to get involved in hiring, promotion, and salary decisions of colleges and universities. As one federal appeals court stated: "Of all fields, which the federal courts should hesitate to invade and take over, education and faculty appointments at a University level are probably the least suited for federal court supervision." (Faro v. New York University, 502 F.2d 1229, 1974).

Recently, the courts have taken an opposite position regarding such cases. In Sweeney v. Board of Trustees of Keene State College (supra), the court inferred that they should not keep a "hands off" policy regarding salary, promotion and hiring decisions of a college "thereby abdicating responsibility entrusted them by Congress, but should provide [a] forum for litigation of complaints of sex discrimination in institutions of higher learning as readily as for other Title VII suits." We can, therefore, expect courts to be more receptive to salary discrimination suits and for them to develop a critical eye in evaluating

the promotion and salary decision-making processes of academia.

A second judicial concern is the court's receptiveness to the use of statistics in sex discrimination cases. The Supreme Court has recognized in McDonnell Douglas Corp. v. Green (supra) that the quantum of proof sufficient to constitute a prima facie case cannot be expressed in any general rule and that the factors and statistics used necessarily will vary in Title VII cases. A major concern of the judges, however, is their difficulty in comprehending complicated statistics. As one federal district court judge indicated: "Judges are quite handicapped in trying to understand this (statistical) testimony. . . . All a trial judge whose statistics course dates back 45 years can do is try to use his limited knowledge of this quasi-mathematical approach to a problem and then temper the argued for results with a pinch of common sense" (Otero v. Mesa County Valley School Dist., 470 F. Supp. 326, 331, D. Colo., 1979).

Even with their limited knowledge of statistics, the courts have continued to uphold the use of statistics in discrimination cases. In both the Hazelwood School District v. United States (433 U.S. 399, 97 S.Ct. 2736, 53 L.Ed.2d 768, 1977) and International Brotherhood of Teamsters v. United States (supra) cases, the Supreme Court has ruled that statistics alone may be sufficient to establish a prima facie case of discrimination. The Court further stressed in the Teamster's case: "Statistics are equally competent

9

in proving employment discrimination. We caution only that statistics are not irrefutable; they come in infinite variety and, like any other kind of evidence, they may be rebutted. In short, their usefulness depends on all of the surrounding facts and circumstances."

### Salary Equity Methodologies

In conducting salary equity studies, various models or approaches can be used. Almost all are variations of the descriptive, paired-comparison, or regression analysis approach. Numerous books and articles have discussed the limitations and appropriateness of these statistical and evaluative models for analyzing salary equity between the sexes (Baldus & Cole, 1975, 1980; Cloud, 1980; Finkelstein, 1973, 1980; Fisher, 1980; Gray & Scott, 1980; Koch & Chizmar, 1980; Neville, 1975; Pezzullo & Brittingham, 1979; Reagan & Maynard, 1974; Scott, 1977; and Simpson & Rosenthal, Note 5). A brief summary of the major strengths and weaknesses of the different approaches will be presented here.

### Descriptive Method

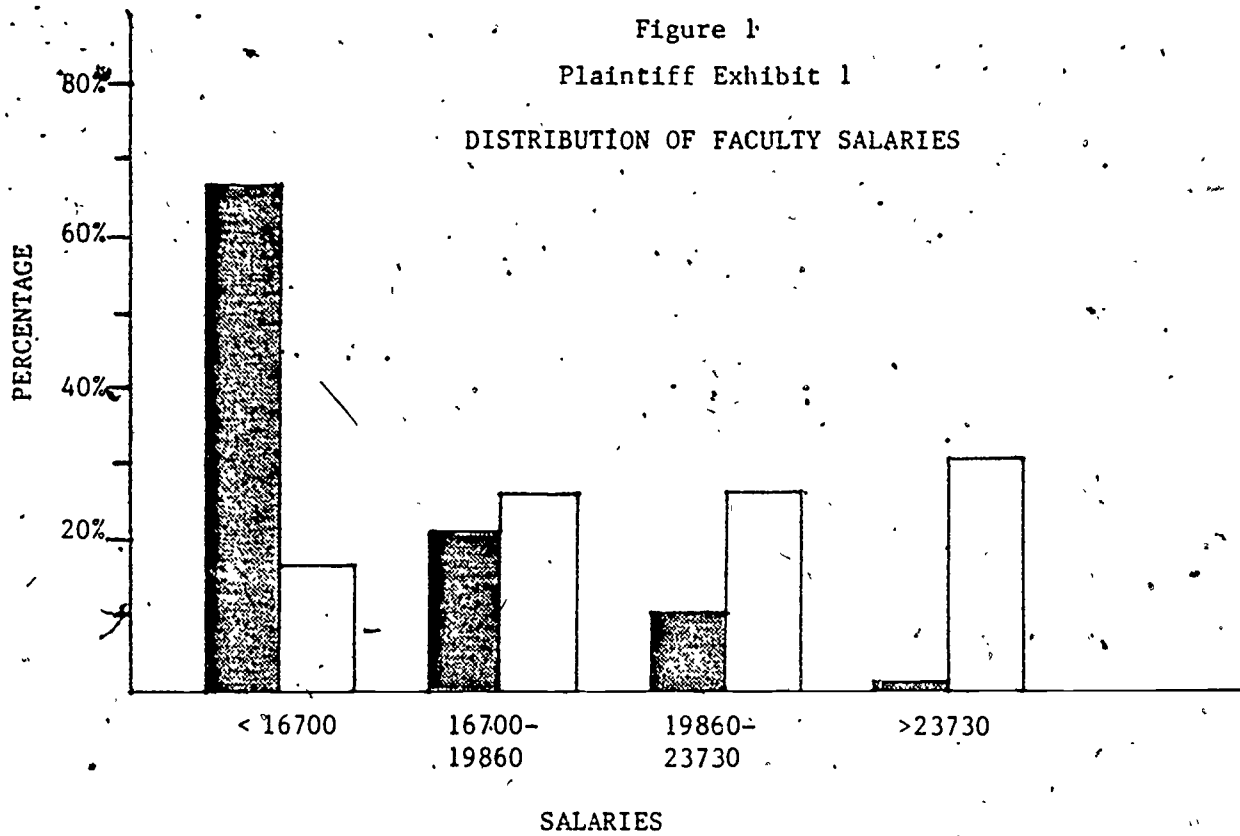
In the early discrimination cases before the courts, plaintiffs relied almost exclusively upon the descriptive method for establishing a prima facie case of discrimination. The success of those plaintiffs set the precedent for subsequent plaintiffs to use this particular approach (e.g., Albemarle Paper Co. v. Moody, 95 S.Ct. 2362, 2375, 1975; McDonnell Douglas Corp. v. Green, supra).

The effectiveness of this method in establishing a prima facie case is centered on its ability to present frequencies and percentage differences as evidence of discrimination. (See Figure 1.) As interpreted in Griggs v. Duke Power Co. (401 U.S. 424, 426, 432, 1971), the mere demonstration of a percentage difference, absent an explanation in terms of differing job related abilities, is sufficient to constitute a violation of Title VII. Consequently, the plaintiff's case can be made on percentages alone.

Although frequencies and percentages are effective in establishing a prima facie case of discrimination, they can often be refuted by simple demographic analyses. Within the context of an institution of higher education, such analyses could include a breakdown of the salaries by rank, highest degree, tenure, discipline, different samples or cohorts, etc. (Most institutional research offices are capable of conducting this type of analysis for the university.) In Keys v. Lenoir Rhyne College (552 F.2d 579, 1977) the court ruled that the plaintiff failed to establish a prima facie case, even though the evidence revealed that the average male faculty salary was higher than that of females. The court's rationale was that there was no salary differential when analyzed for teaching positions, and that the plaintiff made no comparison of salaries by discipline or department. Thus, specific analyses should be conducted if the descriptive methodology is employed.

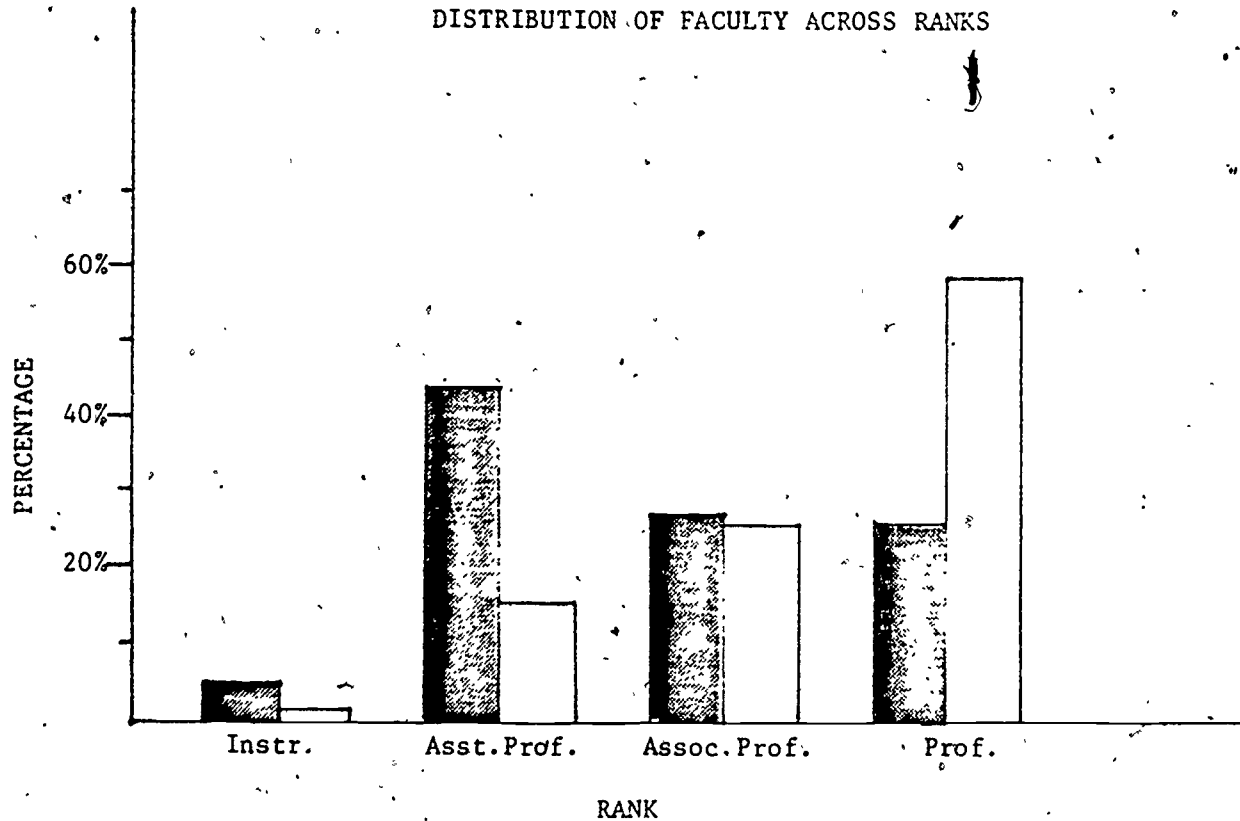
Plaintiff Exhibit 1

DISTRIBUTION OF FACULTY SALARIES



Plaintiff Exhibit 2

DISTRIBUTION OF FACULTY ACROSS RANKS



Legend:

Female [shaded box]

Male [unshaded box]

Reprinted from Simpson & Rosenthal (Note 5)

### Paired-Comparison Method

The second method for determining possible sex discrimination in faculty salaries is the paired-comparison approach, also referred to as matching, counterparting, or the counterfactual approach. In essence the paired-comparison method attempts to match a male counterpart to each female faculty member. If any discrepancies between the male and female salaries are identified, such discrepancies are assumed to be the result of sex discrimination, thereby establishing the plaintiff's prima facie case of discrimination. Counterparts for the paired-comparison approach are usually selected on the basis of the female's department, experience, degree, rank, or other academic qualification variables. The basis for selection may be determined: (1) solely by the department chairperson or dean (Smith, Note 7); (2) by the chairperson or dean and the female faculty member (Kimmel, Note 8; Nevill, 1975); or (3) by a committee (Clark, 1977).

One of the obvious major problems confronting the paired-comparison approach is the identification of appropriate pairs. In a study (Note 9) on the status of men and women at the University of Chicago, department chairpersons were asked to select for each female faculty member in their department the man most nearly matching her in qualifications and responsibilities. Only 68 percent of all faculty women could be matched.

The problem of matching is further complicated in departments such as nursing and home economics where there



may be an insufficient number of male faculty colleagues with whom meaningful salary comparisons can be made. In situations where no satisfactory pairs can be identified, the female faculty member's salary could be compared with the average salary of males within the department with comparable qualifications, the salary offered to a recruit with similar qualifications, or comparing the department's salary structure with other departments on campus or similar departments at other institutions.

Besides the problem of identifying appropriate pairs, there are other disadvantages to the matching approach, especially if the plaintiff is selecting her counterpart. First, the plaintiff often lacks the knowledge and objectivity that a chairperson or dean has in regard to the qualifications, experience, and responsibilities of his/her subordinates. A defendant might, with little effort, successfully challenge all of the plaintiff's matches, as in the case of Faro v. New York University (supra). On the other hand, if the plaintiff asked the defendant to select the matches, the results could reflect the defendant's bias (Greenfield, 1977). A second problem is the atmosphere that is created when counterparts must be identified. As Prather and Smith (Note 10) state: "The emotional upheaval resulting from the ramifications of having to identify and agree upon matching counterparts is an obvious drawback which could result in a negative climate for all parties. It also provides no operational basis for keeping salaries in balance after

parity has been reached." A final disadvantage to the paired-comparison approach is the fact that it can only demonstrate whether inequity exists; it cannot determine the extent of inequity (Pezzullo & Brittingham, 1979). The reason why the approach cannot determine the extent of inequity is that it does not allow for every possible comparison. A female may have several male counterparts who have similar qualifications, of which she or the department chairperson is asked to select but one.

The advantage of the paired-comparison method lies in its simplicity and straightforwardness. It can be easily understood by all, especially the courts. If the plaintiff is involved in the selection of appropriate pairs or in the salary review process, there may be fewer ill-feelings and less chance of recrimination. This latter point, however, is open to debate, (Neville, 1975).

A variation of the matching technique, which has the potential of providing very useful information, is what we shall refer to as the rank-order comparison approach. Here salaries of all faculty within a given unit, department, or discipline are rank-ordered within each academic rank. Additional information pertinent to the faculty salaries is listed for each person (e.g., highest degree, year and/or place of degree, experience, date of promotion, number of administrative positions currently held). Figure 2 provides an example of how such information can be presented for review. In this approach the relationship between the

Figure 2

RANK-ORDER COMPARISON APPROACH

Department X

<u>Rank</u>	<u>Salary</u>	<u>Former Salary</u>	<u>Degree</u>	<u>Year of Degree</u>	<u>Source of Degree</u>	<u>Year of Init. Hire</u>	<u>Date of Tenure</u>	<u>No. of Adm. Pos.</u>	<u>Sex</u>
Prof.	40,300	35,500	Ph.D.	1950	U of Ill.	1972	1972	0	Male
	39,600	34,800	Ph.D.	1962	U of NC	1971	1971	1	Male
	37,000	32,200	Ph.D.	1970	Clev.State	1977	1977	0	Male
Assoc.	28,650	25,450	Ph.D.	1963	UCLA	1961	1967	0	Female
Prof.	25,250	21,550	Ph.D.	1973	Indiana U	1971	1978	0	Male
	24,500	20,700	Ph.D.	1972	U of Wisc.	1972	1978	0	Male
	24,450	21,850	Ph.D.	1973	U of Minn.	1970	1977	0	Male
Asst.	22,300	19,300	Ph.D.	1972	Harvard	1973	1980	0	Male
Prof.	20,450	17,750	Ph.D.	1975	Stanford	1976	-	0	Male
	20,100	17,200	Master	1976	Princeton	1979	-	0	Male
	18,150	16,400	Ph.D.	1975	Yale	1976	-	0	Female

salaries of male and female faculty members can be compared both within and between academic ranks, as well as with other factors associated with salary. The method further allows for individual comparisons (matching), as well as comparisons within the entire faculty. The latter comparison will enable the reviewers to determine the relative standing of female faculty members within the department. The approach is very similar in concept to the regression analysis approach, except that comparisons are made by individual reviewers and not by computers using statistical formulas.

#### Regression Analysis Approach

Perhaps the most effective model in analyzing sex discrimination in faculty salaries is the multiple regression technique. This technique has been employed with varying degrees of success in several sex discrimination cases presented before the courts (Mecklenburg v. Montana Board of Regents of Higher Education, 93 Empl. Prac. Dec. ¶11, 438, D. Mont., 1976; Presseisen v. Swarthmore College, 442 F. Supp. 593, E.D. Pa., 1977, aff'd. 582 F.2d 1275, 3rd Cir. 1978; Board of Regents of University of Nebraska v. Dawes, 522 F.2d 380, 8th Cir. 1975, cert. denied, 424 U.S. 914, 1976; Trout v. Hidalgo, 517 F. Supp. 873, 1981; and Wilkins v. University of Houston, 26 EPD ¶32101, 5th Cir. 1981). One court has recognized the utility of multiple regression by stating: "if properly used multiple regression analysis is a relatively reliable and accurate method of gauging classwide discrimination" (Wilkins v. University of Houston, supra).

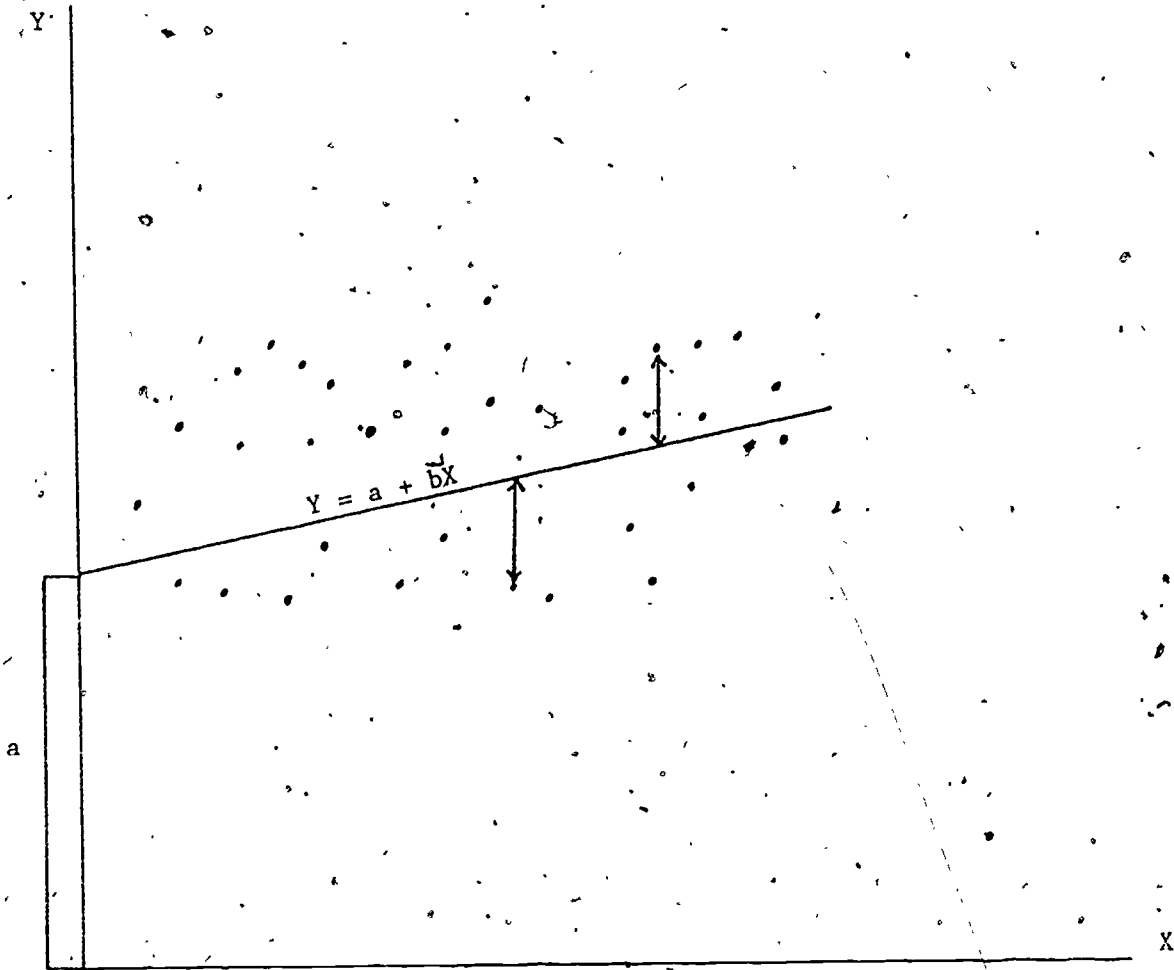
Multiple regression is a statistical technique that measures the relationship between a criterion, in this case salary, and a set of predictors (independent variables) presumed to have a direct relationship with the criterion. A major advantage of this approach is that it determines not only whether a particular predictor (e.g., sex) influences the criterion (e.g., salary), but also how much the predictor influenced the criterion; that is, it assigns a number (called a beta weight) approximating how much the value of a given predictor should be weighted in the formula estimating the actual salary of an individual.

In the case of one predictor and one criterion, what the regression procedure does is plot the actual criterion (y) and predictor scores (x) and then fit a straight line among the scores. The line is determined by the least squares solution, which means that the sum of the squared deviations between the actual and the predicted scores is minimized. (See Figure 3.) In calculating the line one must determine the parameters of "a" and "b" (i.e., the intercept and the slope of the line). The intercept (a) is that point where the line intercepts the Y-axis. The slope of the line (b) determines the rate of increase or decrease in Y as the value of X increases by one unit. The slope of the line is thus the weight that is attached to X. The formula for the regression equation is expressed as follows:

$$Y' = a + bX$$

Figure 3

Regression Line for One Criterion and One Predictor



where:  $Y'$  = predicted score (salary)  
 $a$  = intercept or constant  
 $b$  = regression weight attached to  $x$  (slope of the line)  
 $X$  = predictor (e.g., salary)

The above principles also hold true when one is dealing with more than one predictor. When more than one predictor is employed, the procedure is termed multiple regression analysis and the formula is identical to the above equation except that more predictors are involved:

$$Y' = a + b_1X_1 + b_2X_2 + \dots + b_nX_n$$

As an example, let us assume that an institution has conducted a multiple regression study using the salaries of faculty members as the criterion. The predictors for this fictitious study were: (a) whether the person has a terminal degree in his/her area (0=No and 1=Yes); (b) Years since the degree was obtained; (c) Years of experience at the institution; (d) whether the person is in a given department or not (0=No and 1=Yes); and (e) sex (0=Male and 1=Female). Let us further assume that the institution obtained the following regression equation:

$$\begin{aligned} \text{Predicted 9-month salary} &= 8000 + (2000) (\text{terminal degree}) + \\ &\quad (500) (\text{years since degree was} \\ &\quad \text{obtained}) + (1000) (\text{years of exper-} \\ &\quad \text{ience}) + (2000) (\text{department}) + \\ &\quad (-900) (\text{sex}) \end{aligned}$$

An interpretation of the above equation would be that the predicted salary is equal to \$8000 plus \$2000, if the person has a terminal degree, plus \$500 for each year since

obtaining the degree, plus \$1000 for each year of experience at the institution, plus \$2000 if the person is a faculty member of a given department, minus \$900 if the person is female. In other words, controlling for all other variables in the equation, being female means \$900 less salary, on the average, than that of a male counterpart with identical qualifications.

This information alone is not sufficient to interpret the results from a multiple regression analysis. One also needs to know what the standard error of the regression weights (b values) are, the significance level of the regression weights, the standard error of estimate, and the multiple correlation and its square.

The standard error of the regression weight provides a measure of the weights reliability. The larger the standard error, the less accurate it is in estimating the true effect of a given variable. In a technical sense the standard error of the regression weight is the standard deviation of the weight, if one used the same estimating procedure over and over again. The significance level of the regression weight is used to determine whether the weight is significantly different from zero or not. The t-statistic is generally used to determine the significance of the weight. In the above example, the standard error of the regression weight could have been 400 and the t-statistic equal to .54. In this case, we would conclude that the regression weight for sex (-900) is not significantly different from zero.



The definition of the standard error of estimate is very similar to that of the standard error of the regression weight. The standard error of estimate is the standard deviation of the predicted scores; this provides an indication of the accuracy in predicting a person's salary. In large samples, the chances are ninety-nine out of one hundred that the predicted salary lies within two and one-half standard errors of estimate. The larger the standard error of estimate, the less accurate the prediction of the person's salary.

The final statistic that is necessary in interpreting the results of a multiple regression analysis is the multiple R and  $R^2$ . The multiple R denotes the correlation between the criterion and the optimally weighted combination of predictors. By squaring the multiple R, one obtains a measure of the amount of variance in the criterion that is accounted for by the set of predictors in the regression equation. In other words,  $R^2$  will indicate how much of the variability in salary can be explained by terminal degree, years since degree, years of experience, departmental affiliation and sex in the above example.

Another important feature of  $R^2$  is that it indicates the amount of additional variance accounted for in the criterion by a given predictor, when that predictor is first excluded and then included in the regression equation. The difference between the two obtained  $R^2$  will indicate the amount of additional variance in the criterion (salary)

that is accounted for by the predictor (sex). The regression weight for sex may be significantly different from zero, yet sex may account for only a very small percentage of the variance in salaries. This was one of the reasons given by the court in ruling against the plaintiff's charge of sex discrimination in Wilkins v. University of Houston (supra).

To fully understand the regression model, one must be aware of the assumptions, limitations, and specific characteristics of the model. The following discussion will deal with only two of these major characteristics, since a more detailed treatment is beyond the scope of this paper. For such a discussion, one should consult: Baldus & Cole, 1980; Fisher, 1980; Greenfield, 1977; Kerlinger & Pedhazur, 1973; Pezzullo & Brittingham, 1979; and Rosenthal, Simpson, and Sperber (Note 11).

The two characteristics which most affect the results of a multiple regression study are the type of predictors and the type of sample employed. In estimating salaries in the higher education setting, numerous predictors can be utilized: sex, academic rank, discipline/department affiliation, years in rank, highest degree, terminal degree, years employed at the institution, prior experience, total experience, age, tenure status, administrative responsibility, former administrative responsibility, graduate faculty, marital status, books/articles published, grants, honors, offices held, student ratings of instruction, and peer ratings.

There are several problems inherent in selecting a set of predictors. The first is the actual number of predictors that one should use. As the number of predictors approach the sample size, the power of the test decreases, possibly resulting in a spuriously high correlation. As Cohen and Cohen state (1975, p. 160): "Having more variables (predictors) when fewer as possible increases the risks of both finding things that are not and failing to find things that are." In other words, if there are an exceedingly large number of predictors, sex may be found not to be a significant predictor of salary when in actuality it should be.

A related problem is that of multicollinearity. Multicollinearity refers to the substantial correlation between some or all of the predictors allowing for misinterpretations of the results. Assume, for instance, that sex is correlated with salary as well as with years of experience, highest degree, and departmental affiliation. If sex were the last variable included in the regression equation, it may not be found to be related to salary. The true variance in salary accounted for by sex is being explained by the other three predictors due to their strong relationship (correlation) with sex. Consequently, multicollinearity serves to "mask" the true relationship between the predictors and the criterion.

The third problem associated with predictors is the inclusion of inappropriate variables in the equation. Such

predictors include those that are not directly related to salary or are found to be inappropriate. Marital status would be a good example of a predictor of this kind. In Stastny v. Southern Bell Telephone & Telegraph Co. (458 F. Supp. 314, W.D.N.C. 1978), the court observed that the defendant's regressions incorporated predictors (i.e., marital status) that were "tainted". As the court pointed out: "There is no evidence that an unmarried woman is less likely to be a productive worker than a married man."

In a related issue, the courts have not been hesitant to rule against the plaintiff or defendant when either has failed to take into account important predictors. In Wilkins v. University of Houston (supra), one of the major reasons why the court ruled against the plaintiff was because her regression procedure did not include a market factor as one of the predictors:

It appears uncontroverted that the most important factor is the college in which a professor teaches--all other factors being equal, professors in colleges such as law and engineering are, because of market forces outside of the university, paid significantly more than professors in colleges such as humanities and social sciences. Accordingly, plaintiffs' statistical evidence showing that men and women of the same age, rank, or length of service are paid differently does not demonstrate discrimination because the college factor has not been considered.

A final problem associated with the selection of predictors is whether to include academic rank in the regression equation. Since rank is generally highly correlated with salary, the inclusion of rank will increase the amount of

variability in salary being explained, but it may also conceal the influence of sex discrimination on salaries. As indicated by Braskamp, Muffo, and Langston (1978, p. 236): "If women tend to be discriminated against on rank and if rank is highly related to salary, the use of rank to predict salary diminishes the uncovering of sex discrimination in the regression analysis. Regression analyses, as an empirically based tool, provides information only on how the decision makers have acted, not on how they should have acted."

The court's reaction to the use of rank in regression analyses has varied. In Mecklenburg v. Montana Board of Regents of Higher Education (supra) the court objected to the defendant's regression analysis, since the regressions were conducted within rank and the court had previously found discrimination against women in the promotion and tenure process. In contrast, the court in Presseisen v. Swarthmore College (supra) found the plaintiff's regression unacceptable because rank was not included; the court had previously ruled that the plaintiff's claim of discrimination in promotions had not been sustained.

Should rank be included in the regression equations? It would appear that the courts are beginning to say yes under special circumstances. As Finkelstein (1980) pointed out in a recent edition of the Columbia Law Review: "In the normal case, rank should be included as an explanatory

variable only when there is clear evidence of neutral and objective standards that have consistently been followed in granting rank, so that there is no chance for discrimination. Most academic institutions have not yet developed such standards, although it may be possible to do so."

The second important characteristic of regression equations that requires attention is the selection of the sample. Different types of samples can be employed in a regression analysis. The AAUP Salary Kit (Scott, 1977) recommends running the regression equation on an homogeneous group (department/discipline) of male faculty members and then applying the obtained regression weights to the female faculty data to arrive at a predicted salary. The predicted salaries of male and female salaries would then be compared for potential sex discrimination. The econometric approach to studying salary equity (Ferber & Kordick, 1978; Hoffman, 1976; Johnson & Stafford, 1974; and Katz, 1973) often utilizes the entire university sample with sex as a predictor.

Presented in Figure 4 is a listing of studies and court cases by the type of sample and predictor (rank) employed. As indicated, most studies employed the university data base with both males and females included (Methods 1 and 2). In these particular methods, having an adequate number of female faculty members in the sample should generally not be a problem. However, if Methods 5 or 6 are employed, one may encounter only one or two females being included in the sample. If the number of males in the sample is fairly

Figure 4

Salary Equity Studies by Types of Sample and Use of Academic Rank as a Predictor in Regression Analyses

University Data Base

Discipline Data Base

Males and Females

Males Only

Males and Females

Males Only

W/Rank (1)	W/Out Rank (2)	W/Rank (3)	W/Out Rank (4)	W/Rank (5)	W/Out Rank (6)	W/Rank (7)	W/Out Rank (8)
Wilkins v. Univ. of Houston	Trout v. Hildago	Hunter Note 13	Ferber (1974)		Gould & Kim (1976)	Tanus (1978)	Scott (1977)
Gappa et al Note 11	Presseisen v. Swarthmore College	Ferber (1974)			Johnson & Stafford (1974)		Gray & Scott (1980)
Greenough Note 12	Finkelstein (1980)	Gordon et al (1974)					
Hunter, Note 13	Bergmann & Maxfield (1975)						
Prather & Smith, Note 9	Braskamp et al (1978)						
Bayer & Astin (1968, 1975)	Ferber & Kordick (1978)						
Gordon et al (1974)	Ferber et al (1978)						
Koch & Chizmar (1973, 1976)	Katz (1973)						

large, the true effect of sex on salary may be "masked" by the restricted number of females in the sample.

Dividing the university population into smaller homogeneous segments creates an additional problem. That is, as the population size decreases, a disparity must be increasingly large to be statistically significant. The defendants in Trout v. Hidalgo (supra) used this approach to try to prove that sex was not a significant predictor in the smaller segmented samples. The court rejected the defendant's methodology and expressed their support in aggregating the samples: "The Court does not agree with the view that an aggregation across job lines necessarily destroys the probative value of regressions. Indeed, . . . the technique is superior to methods which entail a fragmentation into populations so small that statistical analysis loses much of its power to find any discrimination."

In a final note, it should be mentioned that a unique relationship is developing between the court system and the use of multiple regression analyses. As indicated above, the courts were at first reluctant to get involved in university cases, perhaps because of having complicated statistical analyses presented as evidence. The courts were, and to some extent still are, wary of having the expert witnesses of both sides attack each other's methodology in terminology beyond their comprehension. One federal district court judge has even gone on record to complain about Title VII class action suits having become "contests between college



professor statisticians who revel in discoursing about advanced statistical theory" (Otero v. Mesa County Valley School Dist., supra). This is not to say that courts are not receptive to regression analyses.

One other court decision which affects this area is that of the Board of Regents of the University of Nebraska v. Dawes (supra). In this decision, the courts held that if a university established a formula for determining a minimum salary schedule for one sex, based on specific criteria, it is a violation of the Equal Pay Act to refuse to pay faculty of the opposite sex the minimum required under the formula. Thus, if a university uses the regression weights in a formula to increase the salaries of female faculty members whose actual salaries were lower than predicted, those same weights must be used for male faculty members whose actual salaries were lower than predicted.

In analyzing the recent court rulings, it would appear that the plaintiffs have the advantage in sex discrimination cases. This is only true, however, when the plaintiffs have employed appropriate predictors and samples and that statistically significant and meaningful differences between the sexes have been identified. The reason why the plaintiffs have the apparent advantage in salary equity studies utilizing the regression approach, is the difficulty the defendants face in trying to rebut the plaintiff's prima facie case. To rebut the plaintiff's prima facie case, the defendants

must first discredit the plaintiffs regression analyses by showing that inappropriate predictors and/or samples were employed. In addition, the defendants must show that when these deficiencies are corrected, the results disprove the claim of discrimination. This was the court's position in both Trout v. Hidalgo (supra) and Segar v. Civiletti (508 F. Supp. 690, 1981). As the court specifically stated in Segar v. Civiletti:

When a plaintiff submits accurate statistical data, and a defendant alleges that relevant variables are excluded, defendant may not rely on hypothesis to lessen the probative value of plaintiff's statistical proof. Rather, defendant, in his rebuttal presentation, must either rework plaintiff's statistics incorporating the omitted factors or present other proof undermining plaintiff's claims.

In conclusion, it would appear that the multiple regression technique is the most effective method for analyzing sex discrimination in faculty salaries. The courts are beginning to recognize the utility of this approach, although they harbor some concern over the difficulty in understanding such statistics. One can expect to find an increase in the number of regression studies being employed in sex discrimination cases. We must, however, emphasize the need for caution in the use of multiple regression, due to the many assumptions, limitations, and idiosyncrasies associated with this approach.

## REFERENCE NOTES

1. 29 U.S.C. 213 (d) 1970.
2. 29 U.S.C. 213 (a) Supp. II 1972, amending, 29 U.S.C. 213 (a) 1970.
3. 42 U.S.C. 2000e-1 (1970).
4. 42 U.S.C. 2000e-1 (Supp. II 1972), amending 29 U.S.C. 2000e-1 (1970).
5. Simpson, W. A., & Rosenthal, W. H. The role of the institutional researcher in a sex discrimination suit. Paper presented at the 21st Annual Forum of the Association for Institutional Research, Minneapolis, Minnesota, May, 1981.
6. McDonnell Douglas Corp. v. Green, 411 U.S. 974 (1973).
7. Smith, I. Problems in and approaches to monitoring the status of women faculty: A case study. Paper presented at the Association for Institutional Research Annual Forum, San Diego, California, May 13-17, 1979.
8. Kimmel, E. B. The status of faculty women. Unpublished manuscript, University of South Florida, 1972.
9. Women in the University of Chicago, Report of the Committee on University Women, 9-11 (1970).
10. Prather, J. E., & Smith, G. Salary prediction technique-- a tool for affirmative action. Paper presented at the Association for Institutional Research Annual Forum, Washington, D.C., 1974.

11. Rosenthal, W. H., Simpson, W. A., & Sperber, W. E.  
Using regression analysis to capture policy in a sex discrimination suit. Paper presented at the Association for Institutional Research Annual Forum, Minneapolis, Minnesota, May, 1981.
12. Gappa, J. M., Hurst, R. L., & Swenson, R. M. Equalizing faculty women's salaries: A case study in cooperation. Paper presented at the Association for Institutional Research Annual Forum, San Diego, California, May 13-17, 1979.
13. Greenough, H. P. Statistical analyses of faculty salaries. Paper presented at the Association for Institutional Research Annual Forum, Los Angeles, California, May 3-6, 1976.
14. Hunter, L. O. A method for monitoring university faculty salary policies for sex bias. Paper presented at the Association for Institutional Research Annual Forum, Houston, Texas, May 21-25, 1978.

## REFERENCES

- Baldus, D. C., & Cole, J. W. L. Beyond the prima facie case in employment discrimination law: Statistical proof and rebuttal. Harvard Law Review, 1975, 89, 2:
- Baldus, D. C., & Cole, J. W. L. Statistical proof of discrimination. New York: McGraw-Hill, 1980.
- Bayer, A. E., & Astin, H. S. Sex differences in academic rank and salary among science doctorates in teaching. Journal of Human Resources, 1968, 3, 191-200.
- Bayer, A. E., & Astin, H. S. Sex differentials in the academic reward system. Science, 1975, 188, 796-802.
- Bergmann, B. R., & Maxfield, M., Jr. How to analyze the fairness of faculty women's salaries on your campus. AAUP Bulletin, 1975, 61, 262-265.
- Braskamp, L. A., Muffo, J. A., & Langston, I. W. III. Determining salary equity: Politics, procedures, and problems. Journal of Higher Education, 1978, 49, 231-246.
- Clark, D. L. Discrimination suits: A unique settlement. Educational Record, 1977, 58, 233-249.
- Ferber, M. A. Professors, performance, and rewards. Industrial Relations, 1974, 13, 69-77.
- Ferber, M. A., & Kordick, B. Sex differentials in the earnings of Ph.D.s. Industrial and Labor Relations Review, 1978, 31, 227-238.
- Ferber, M. A., Loeb, J. W., & Lowry, H. M. The economic status of women faculty: A reappraisal. Journal of Human Resources, 1978, 13, 385-401.

- Finkelstein, M. O. The judicial reception of multiple regression studies in race and sex discrimination cases. Columbia Law Review, 1980, 80, 737-754.
- Fisher, F. Multiple regression in legal proceedings. Columbia Law Review, 1980, 80, 702-736.
- Gordon, N. M., Morton, T. E., & Braden, I. C. Faculty salaries: Is there discrimination by sex, race, discipline? American Economic Review, 1974, 64, 419-427.
- Gould, K. H., & Kim, B. C. Salary inequities between men and women in schools of social work: 'Myth or reality?' Journal of Education for Social Work, 1976, 12, 50-55.
- Gray, M. W., & Scott, E. L. A "Statistical" remedy for statistically identified discrimination. Academe, 1980, 66, 174-181.
- Greenfield, E. From equal to equivalent pay: Salary discrimination in academia. Journal of Law and Education, 1977, 6, 41-62.
- Hoffman, E. P. Faculty salaries: Is there discrimination by sex, race, and discipline? Additional evidence. American Economic Review, 1976, 66, 196-198.
- Johnson, G. E., & Stafford, F. P. The earnings and promotion of women faculty.. American Economic Review, 1974, 64, 888-903.
- Katz, D. A. Faculty salaries, promotions, and productivity at a large university. American Economic Review, 1973, 63, 460-477.

- Kerlinger, F. N., & Pedhazur, E. J. Multiple regression in behavioral research. New York: Holt, Rinehart and Winston, 1973.
- Koch, J. V., & Chizmar, J. F., Jr. Sex discrimination and affirmative action in faculty salaries. Economic Inquiry, 1976, 14, 16-24.
- Koch, J. V., & Chizmar, J. F., Jr. The economics of affirmative action. New York: D. C. Heath-Lexington Books, 1976.
- Koch, J. V., & Chizmar, J. F. The influence of teaching and other factors upon salaries and salary increments at Illinois State University. Journal of Economic Education, 1973, 27-34.
- Nevill, D. D. Achieving salary equity. Educational Record, 1975, 56, 266-270.
- Pezzullo, T. R., & Brittingham, B. E. (Eds.). Salary equity: Detecting sex bias in salaries among college and university professors. Lexington, Mass.: Lexington Books, 1979.
- Reagan, B. B., & Maynard, B. J. Sex discrimination in universities: An approach through internal labor market analysis. AAUP Bulletin, 1974, 60, 13-21.
- Scott, E. L. Higher education salary evaluation kit. Washington, D.C.: American Association of University Professors, 1977.
- Seabury, P. HEW and the universities. Commentary, 1972, 53, 28-44.

Tanus, J. M., & Coser, R. L. Pockets of poverty in the salaries of academic women. AAUP Bulletin, 1978, 64, 26-31.