Are Women and Blacks Closing the Gap? Salary Discrimination in American Science During the 1970s and 1980s
Author(s): Yitchak Haberfeld and Yehouda Shenhav
Source: *Industrial and Labor Relations Review*, Vol. 44, No. 1 (Oct., 1990), pp. 68-82
Published by: Cornell University, School of Industrial & Labor Relations
Stable URL: http://www.jstor.org/stable/2523430

ARE WOMEN AND BLACKS CLOSING THE GAP? SALARY DISCRIMINATION IN AMERICAN SCIENCE DURING THE 1970s AND 1980s

YITCHAK HABERFELD and YEHOUDA SHENHAV*

The authors use two longitudinal surveys of American scientists conducted by the Census Bureau, one for the years 1972–76 and one for the years 1982–86, to estimate salary discrimination against black scientists and female scientists. In counterpoint to the results of some other studies, which have suggested that race- and gender-based salary discrimination has been either declining or stable in many occupations, this analysis provides evidence that salary discrimination against black scientists and female scientists worsened between the 1970s and the 1980s. Female scientists earned about 12% less than similarly qualified male scientists in 1972, but 14% less in 1982; and black scientists earned about the same amount as white scientists in 1972, but 6% less in 1982.

EMPIRICAL evidence points to a persistent gap of approximately 40% between men's and women's average earnings in the United States, and to a gap of approximately 30% between the earnings of whites and blacks (Cain 1986). The "unexplained" portion—that is, the portion of the earnings gap that is not explained by human capital and job characteristics—is found to constitute between one-third and two-thirds of this gap depending on the study. (For the male-female gap, see, for example, Corcoran and Duncan 1979; Mincer and Polachek 1974; and Oaxaca 1973. For the black-white gap, see Long and Heltman 1975; Farley 1977; Gwartney and Long 1978; and Reimers 1983.)

Two recent studies have investigated the trends in these gaps and in labor market wage discrimination during the 1970s in the United States (Blau and Beller 1988; Carlson and Swartz 1988). Using different samples and somewhat different estimation models, the two studies both found that the salary gap between nonwhite and white workers narrowed during the 1970s. With respect to the gender gap, on the other hand, the two studies present conflicting evidence: Blau and Beller concluded that salary discrimination against women declined substantially during the 1970s, whereas Carlson and Swartz found no evidence of such a trend.

In order to shed some light on these puzzling findings, a longitudinal study is called for. Two longitudinal data sets constructed by the Bureau of the Census

* Yitchak Haberfeld is Assistant Professor of Industrial Relations and Yehouda Shenhav is Assistant Professor of Sociology, both at Tel-Aviv University, Israel. The authors share equal responsibility for this paper and for the conduct of the study. They thank Yasmin Alkalai, Sigal Alon, Liat Ron, and Tal Simons for their assistance. The study was supported by a research grant from the Ford Foundation through the Israel Foundation Trustees, 1988.

Additional results, and copies of the programs used to generate the results presented here, are available from Yitchak Haberfeld at the Department of Labor Studies, Tel-Aviv University, Tel-Aviv 69978, Israel.

Industrial and Labor Relations Review, Vol. 44, No. 1 (October 1990). © by Cornell University.
0019-7939/90/4401 $01.00

for the National Science Foundation enabled us to undertake such a study. The data include labor market information on two large samples of scientists and engineers, one set assembled during the 1970s and the other during the 1980s (U.S. Bureau of the Census 1979, 1987). Members of each sample were interviewed three times, with two-year intervals between interviews, thus enabling us to examine the same people at two (or even three) points in time. The availability of data for the 1980s enables us to keep track of trends into the present decade. Moreover, the sample is composed of scientists and engineers only. This "one occupation-longitudinal" design avoids problems associated with data aggregation across occupations and samples, although it does not address discrimination in occupational mobility to higher-paying occupations.

Evidence of Discrimination Against Women in Scientific Occupations

Women are under-represented in scientific occupations (Cole and Cole 1973; Zuckerman and Cole 1975; National Science Board 1985), constituting approximately 12% of the scientific population.[1] Several studies have sought to estimate the portion of the gap between the average salaries of male and female scientists that may be attributed to discrimination (see Bognanno 1987 for a review).[2] Most of these studies were conducted in academic settings, several of them at a single university (for example, Loeb and Ferber 1973; Hoffman 1976),[3] and others were based on aggregated data (for example, Barbezat 1987, 1989). Very few studies have been undertaken in non-academic settings. Ferber and Kordick (1978) used a national sample of Ph.D.'s, and Malkiel and Malkiel (1973) and Shenhav and Haberfeld (1988a) studied researchers in a single corporation. None of the studies mentioned above used longitudinal data.

The observed wage gap in studies of discrimination against female scientists ranges from 11% to 22%, and the unexplained gap varies between 7% and 16%, depending on the type of study. Studies employing firm-level analyses find lower unexplained gaps than do studies using aggregated data. Thus, studies conducted in a single university report unexplained gaps of only 7% to 9%.[4]

Evidence of Discrimination Against Black Scientists

Only two to four percent of American Ph.D.'s in the sciences are black (Pearson 1986, 1987). Although this figure is primarily attributable to pre-market barriers such as differential socialization processes and low-quality education, in this study we are concerned only with labor market discrimination.

Only a few studies have examined wage discrimination against black scientists (Freeman 1977; Gordon, Morton, and Braden 1974; Hoffman 1976; Barbezat 1989). Although Freeman (1977) reported an initial finding of a gap of 7% favoring whites, all studies cited above concluded that after controlling for human capital and job characteristic variables, there is no evidence of discrimination against black scientists. This finding can be explained by Mommsen's (1974) suggestion that affirmative action processes have resulted in increased demand for blacks in scien-

[1] This phenomenon has been attributed to a successive filtering process that tends to lower the probability of women's engagement in scientific research (Zuckerman and Cole 1975).

[2] Studies examining the gender effect on the allocation of non-remunerative rewards have produced inconsistent results. Whereas Cole and Cole (1973) concluded that discrimination against female scientists is insignificant, other studies have found differences in the allocation of rewards and awards to male and female scientists (for example, Reskin 1978; Cole 1979).

[3] Salary discrimination against female faculty has been examined also in the literature on higher education. The terminology and estimation methods used in that literature differ from those used in the present paper. (See, for example, Schau and Heyward 1987).

[4] The one study that was conducted in a single firm in Israel (Shenhav and Haberfeld 1988a) reports no unexplained wage gap, but reveals substantial discrimination in promotion.

tific institutions. It should be noted, however, that all studies are based on samples of academic scientists only—two utilizing national samples (Freeman 1977; Barbezat 1989) and the other two utilizing samples drawn from a single university. Again, none of these studies examined longitudinal data.

The analysis that follows contributes to the existing literature on trends in male-female and white-black earnings gaps in the labor market in general and in the scientific labor market in particular. First, we utilize data collected during two decades—the 1970s and the 1980s. Moreover, these data were gathered from a relatively homogeneous group of workers employed in the same labor market. We are thus able to avoid problems associated with data aggregation. The use of two longitudinal data sets enables us to follow the same workers over time. This advantage, together with the homogeneity of the sample, permits a clear identification of salary trends by gender and race. Finally, the scientists in the samples are drawn not only from academia, as in most studies examining gender- and race-based salary gaps in science, but from the industrial and public sectors as well.

Methodology

Estimation Models

The analysis was conducted at the individual level and at two times: t_1 and t_2. (For the 1980s, t_1 refers to 1982 and t_2 to 1986. For the 1970s, t_1 refers to 1972 and t_2 to 1976.) A drop in the number of cases between two times is usually one of the most serious problems associated with longitudinal data. In the present study, the 1980s sample was reduced by 57.9% between 1982 and 1986, and the 1970s sample dropped by 22.8% between 1972 and 1976. The characteristics of "survivors" were found to differ from the characteristics of those who dropped out. The former were less likely to be women and blacks, earned higher salaries, tended to be younger, had higher academic degrees, and had more family responsibilities (as measured by marital status and age of children). The possibility of sample selection bias is therefore evident, and a method of correction is called for in our analysis. We used the inverse of the Mills' ratio (λ) (Heckman 1980) in the two longitudinal equations. The ratio was calculated on the basis of a probit equation estimating the probability of an individual's inclusion in the longitudinal earnings equation.[5]

First, earnings equations were estimated at t_1 (using Ordinary Least Squares regressions) as follows:

$$(1) \quad Y_{t1} = X'_{t1} B_{t1} + Z'C_{t1} + d_{t1}G$$

where Y denotes salary; X is a vector of individual characteristics and B is a vector of their coefficients; Z is a vector of dummy variables representing scientific disciplines and sectors (that is, industry and academia, where public sector serves as a reference category) and C denotes their coefficients; and G indicates group membership (gender or race) and d is its coefficient.

Equation (1) was estimated separately (excluding the G variable) for men, women, whites, and blacks. The observed wage gaps between groups were decomposed into explained and unexplained portions.[6]

Finally, a longitudinal model, designed to detect changes over time in the salaries of minority and majority workers who are

[5] The probit equations of the 1970s included the following predictors: age, years of professional experience and its square, Ph.D. degree, M.A. degree, marital status, age of children, scientific discipline, full-time status, sector of employment, geographical location of most recent school attended and of employer, citizenship, gender, and race. Weeks of employment and administrative activities were added to the probit equations of the 1980s. Definitions of these variables may be found in Table 1.

[6] The method of decomposing wage differentials is commonly used in order to derive estimates of salary discrimination (see Oaxaca 1973). It is clear that such estimates may overstate labor market discrimination if omitted productivity measures are correlated with group membership, and they may understate discrimination if the acquisition of the measured variables is itself affected by discrimination.

identically situated at the beginning of each decade, was estimated.

$$(2)\quad Y_{t2} - Y_{t1} = X'_{t1} B + \text{chg}(X)' B^* + Z'C + dG$$

where chg is the difference between t_2 and t_1. One of the variables included in the vector X is the inverse of the Mills' ratio.

Such a model compares the growth in earnings of minority and majority workers between t_1 and t_2 after controlling for differences between them in occupational characteristics (Z), individual characteristics at t_1 (X), and changes in those characteristics between t_1 and t_2 (chg(X)). The model thus compares the growth in earnings of minority and majority workers who occupied an identical starting point at t_1 in terms of their characteristics and who experienced similar changes in those characteristics between the two times. As a result, the discrimination estimates derived from this model are rather conservative, as they are unaffected by possible discriminatory processes occurring before and during determination of the t_1 salaries. In other words, the model estimates unequal treatment occurring between t_1 and t_2 only.

Data

The data for the analysis are based on two longitudinal surveys conducted by the U.S. Bureau of the Census for the National Science Foundation. The survey for the 1980s is entitled *United States Personnel and Funding Sources for Science, Engineering, and Technology: Survey of Natural and Social Scientists and Engineers, 1982–1986*. Details of the sample definitions and explanations may be found in U.S. Bureau of the Census (1987).

Initially (1982) the survey was conducted among a nationwide sample of 138,080 individuals who were defined as part of the experienced labor force in engineering, scientific, or related occupations. The samples for the present study consist of 38,995 respondents in 1982 and 16,408 respondents in 1986.[7] The "survivors" for the present analysis are those individuals who were salaried scientists with a minimum annual salary of $2,000, and who completed their questionnaires with no missing values for all the variables outlined below.

Comparison with the 1970s is based on a similar survey conducted by the U.S. Bureau of the Census for the National Science Foundation entitled *United States Personnel and Funding Sources for Science, Engineering, and Technology: Survey of Natural and Social Scientists and Engineers, 1972–1978*. Details of the sample definitions and explanations may be found in U.S. Bureau of the Census (1979).

The initial sample (1972) included 50,093 engineers and scientists. The 1972 and 1976 analyses were based on 13,083 and 10,094 of these respondents, respectively. The criteria used in determining whether a respondent should be included in the analyses were similar to those applied to the 1980s sample. The minimum annual salary, however, was set at $1,000 rather than $2,000.

Variables

The dependent variable in the analysis is the natural logarithm of the gross annual salary. Definitions of all the variables used in this study are provided in Table 1.

Note the following regarding the variables and their measurement. First, the data set does not include number of hours worked, and in lieu of that measure we use employment status (FULL TIME). The reader should realize, however, that this measure cannot capture differences in number of hours worked within the categories of full- and part-time work. Second, the squared term of the age variable was not included in the analysis since the age, experience, and experience-

[7] Only 55% of those interviewed in 1982 provided earnings information. There are also other variables with large proportions of missing data—to name two, sector of activity and highest academic degree. Approximately 9% of the original sample were excluded from the analysis because they belonged to racial groups not analyzed in the present study (for example, orientals).

Table 1. Variable Definitions.

LN EARNINGS	The natural logarithm of the gross annual salary.
GENDER	Coded as one if male, zero if female.
RACE	Coded as one if white, zero if black.
FULL TIME	Employment status coded as one if full-time, zero otherwise.
EMPLOYMENT	Number of weeks worked during the year.
M.A.[a]	Coded as one if highest academic degree is M.A., zero otherwise.
Ph.D.[a]	Coded as one if highest academic degree is Ph.D., zero otherwise.
AGE	Age in years.
EXPERIENCE	Professional experience in the labor market in years.
EXPERIENCE SQ	Squared term of professional experience.
MARRIED	Marital status coded as one if married, zero otherwise.
CHILDREN	Age of children coded as one if children five years old or under living with the respondent, zero otherwise.
CITIZEN	U.S. citizenship coded as one if the person is a citizen of the U.S., zero otherwise.
EMPLOYER LOCATION	Geographical location of employer coded as one if in the North, zero if in the South.
SCHOOL LOCATION	Geographical location of most recent school attended, coded as one if in the North, zero if in the South.
ADMINISTRATION	Primary work activity coded as one if in administration, zero otherwise.
ACADEMIA[b]	Coded as one if sector of activity is academia, zero otherwise.
INDUSTRY[b]	Coded as one if sector of activity is industry, zero otherwise.
SOCIAL SCIENCE, PSYCHOLOGY, EDUCATION, BIOLOGICAL SCIENCE, MEDICAL SCIENCE, ENGINEERING, MATH, PHYSICAL SCIENCE	A series of eight dummy variables representing different scientific disciplines (with Humanities serving as the reference discipline).

[a] The reference group is a B.A. degree.
[b] The reference group is the public sector.

squared variables did not leave over any salary variance to be "explained" by the age-squared measure in most equations. Third, the weeks of employment (EMPLOYMENT) and primary work activity (ADMINISTRATION) variables were not included in the 1970s data.

Another important issue is the absence of direct productivity indicators in this study owing to the level of data aggregation. Instead, productivity proxies were used. Although such proxies are admittedly crude, they are often used in economic and sociological research. Based on previous studies, we believe that use of such proxies produces only a small bias in the estimated discrimination for the academic sector. Barbezat (1987), for example, showed that omission of publications measures from the basic wage equation for academicians lowered these estimates by no more than 3%. Furthermore, our study examines scientists employed not only in academia but in other sectors as well. No direct productivity measures are available for scientists outside academia, and comparisons of publication rates across sectors is meaningless.[8]

Results

The wage gaps found between minority

[8] For a detailed discussion of the validity of productivity measures in different scientific contexts, see Shenhav and Haberfeld (1988b).

and majority groups in the present study are smaller than those observed in national probability samples, since we examined a relatively homogeneous group of workers who are employed in specific, distinct labor markets. Table 2 provides descriptive statistics regarding salaries and sample composition by gender and racial groups.

It is clear from the table that women earn, on average, the lowest salaries in both decades and across all sectors of scientific activity. The ratio of female-to-male average annual earnings was 0.76 in 1972 and 0.70 in 1982, rising to 0.77 and 0.78 in 1976 and 1986, respectively. These apparent increases could be the result of a sample selection between t_1 and t_2.

Examination of female-to-male earnings ratios across sectors reveals that the largest gap is apparent in the academic sector. In 1972, female scientists in academia earned, on average, 72% as much as their male counterparts, as compared to 77% in the public sector and 75% in the industrial sector. We observe similar figures in 1982: the female-to-male ratio in academia was 0.66, as compared to 0.70 in the public sector and 0.72 in industry.

It should be emphasized that these ratios *fall* in all three sectors between 1972 and 1982. As already indicated, the average change in the whole sample amounts to 6%—from 0.76 in 1972 to 0.70 in 1982. This finding contradicts the result found in national samples by Blau and Beller

Table 2. Average Annual Earnings (in Dollars) and Representation of Men, Women, Blacks, and Whites in the Sciences, by Sector, 1972, 1976, 1982, and 1986.

Description	*1972*	*1976*	*1982*	*1986*
Whole Sample				
Men's Earnings	18,133	24,216	36,966	44,679
Women's Earnings	13,798	18,660	25,924	34,743
Percent Women	5.4	5.3	18.3	14.3
Whites' Earnings	17,917	23,932	35,176	43,488
Blacks' Earnings	16,043	22,346	30,638	37,320
Percent Blacks	1.0	0.9	5.1	3.7
Industry				
Men's Earnings	17,855	24,380	37,725	45,573
Women's Earnings	13,474	19,478	27,240	36,597
Percent Women	2.3	2.2	15.4	11.8
Whites' Earnings	17,762	24,282	36,362	44,735
Blacks' Earnings	15,953	21,693	30,807	37,818
Percent Blacks	0.5	0.4	4.6	3.2
Public Sector				
Men's Earnings	18,027	24,623	34,608	41,631
Women's Earnings	13,929	17,995	24,392	32,025
Percent Women	9.2	8.0	26.0	20.8
Whites' Earnings	17,681	23,930	32,056	39,787
Blacks' Earnings	16,004	21,930	30,668	37,162
Percent Blacks	1.8	1.6	7.8	5.9
Academia				
Men's Earnings	19,314	23,580	32,393	41,934
Women's Earnings	13,838	18,904	21,263	30,945
Percent Women	9.8	10.9	32.7	24.5
Whites' Earnings	18,818	23,204	28,811	39,474
Blacks' Earnings	16,215	23,243	27,021	30,705
Percent Blacks	1.5	1.5	3.4	2.7

Source: U.S. Bureau of the Census (1979, 1987).

(1988), who reported an increase in this ratio between 1971 and 1981, and the result reported by Carlson and Swartz (1988), who found that the ratio between 1969 and 1979 among whites remained stable.

The sample of black scientists fared far better than the sample of female scientists. In 1972 they earned, on average, 90% of their white counterparts' salaries. In 1982 this ratio was 87%. Black-white earnings ratios across sectors differ from female-male ratios. In 1972, the largest earnings differential between blacks and whites was in the industrial sector, not in academia. The black-to-white average annual earnings ratio in this sector was 0.86 in 1972, falling to 0.85 in 1982. In contrast, black-to-white earnings ratios in the public sector and academia in 1982 (0.96 and 0.94, respectively) are larger than the equivalent ratios in 1972 (0.91 and 0.86, respectively). These findings are in general accordance with those described by Carlson and Swartz for a national data set (1988), apart from the decrease in the ratio between 1972 and 1982 identified in the industrial sector.

A clearer and somewhat different trend is observed upon examination of the gender and racial composition of the scientific labor force. The ratio of women and blacks in the samples utilized for the analysis increased substantially between 1972 and 1982 in all sectors. Women's representation increased, on average, from 5.4% in 1972 to 18.3% in 1982. (It should be noted, however, that this rise is larger than the one described in a report by the National Science Board [1985].) Blacks' share in the scientific labor force increased from 1% in 1972 to 5.1% in 1982. The highest rate of increase for both groups was observed in the industrial sector (from 2.3% to 15.4% for women and from 0.5% to 4.6% for blacks).

Differences in Earnings: Cross-Sectional Analyses

Table 3 presents the earnings regression results for 1972 and 1982 by gender and race. The equations for the whole sample indicate that in 1972 female scientists earned, on average, about 12% less than equally qualified male scientists, whereas in 1982 this figure was approximately 14%. The race coefficient in 1972 was not found to be significantly different from zero.[9] The race coefficient in 1982, however, indicates that black scientists that year earned, on average, about 6% less than equally qualified white scientists.

Decomposition of the earnings gaps between male and female and between white and black scientists (see Table 5) shows that the unexplained portion of the male-female earnings gap is 0.098 (out of a total gap of 0.288) for 1972 and 0.141 (out of 0.385) for 1982. The black-white unexplained portion is 0.033 (out of 0.098) for 1972 and 0.110 (out of 0.117 total gap) for 1982. These results disagree with those obtained by Blau and Beller (1988), who found an upward trend in the adjusted female-to-male earnings ratio between 1971 to 1981, and with the results obtained by Carlson and Swartz (1988), who found a similar upward trend in the black-to-white ratio.

Some additional results deserve attention. First, the gender coefficient is statistically different from zero in 1972 and 1982 for both whites and blacks. In contrast, the only race coefficient that was found to be significantly different from zero is among men in 1982. Second, the academic sector is found to have paid the lowest salaries during 1972 and 1982 after individual and job characteristics are controlled for. This result is consistent across gender and racial groups. The industrial sector had lower earnings than the public sector for men and whites in 1972, but it was the highest-paying sector for all groups in 1982.[10]

[9] Our results regarding the situation of black scientists during the 1970s should be considered with caution, because there were relatively few black scientists in the sample (130 in 1972 and 99 in 1976). It should be emphasized, however, that these small numbers are not the result of a sampling deficiency, but rather a reflection of blacks' minor share in American science during the 1970s.

[10] The scientists studied here are employed in three sectors: academic, public, and industrial. The criteria for allocating salaries (and other rewards) differ from one sector to another. It is assumed that professional evaluations made by peers serve as the allocation criterion in academia. Public sector em-

Differences in Earnings: Longitudinal Results

The change models used in this study are designed to determine whether female and black scientists enjoyed a faster rate of salary growth than did men and whites. This examination is important because the gender and race effects identified in the cross-sectional equations could be the result of a better starting salary paid to men or whites. An egalitarian pay system introduced by employers during later stages of employment (adding equal *increments* to the salaries of equally qualified workers) cannot be detected by these equations, but since we use two longitudinal data sets—one from the 1970s and the other from the 1980s—we are able to overcome this limitation.

Table 4 presents the results of the longitudinal models of salary growth during the 1970s (from 1972 to 1976) and the 1980s (from 1982 to 1986). The dependent variable in these equations is the difference between the natural logarithm of earnings in t_2 and in t_1 (see equation 2 above).

All the gender coefficients in the equations for the 1970s are negative, although none is significantly different from zero. This means that female scientists' rate of salary growth during the 1970s was similar to that of equally qualified male scientists. The race coefficients were found to be negative (but insignificant) in the whole sample and female equations.

The inverse Mills' ratio has a negative (insignificant) coefficient in the female and white equations (as well as in the whole sample equation). This result suggests that women and whites who dropped from the sample between 1972 and 1976 might have enjoyed faster salary growth than female and white "survivors" with similar characteristics.[11] The coefficient of the selectivity correction in the male and black equations is found to be positive.

When the difference between male and female average earnings growth during the 1970s is decomposed, we find that the magnitude of the unexplained portion is −6.4%. This figure suggests that women had a 6.4% advantage in earnings growth over men with similar attributes. The decomposition of the white-black earnings growth differential yields an unexplained portion of −1.1%, indicating an advantage to blacks in salary growth during the 1970s.

This picture changes during the 1980s. Although the gender coefficients in all three equations (the whole sample, whites, and blacks) are similar to those of the 1970s—negative and insignificant—the race coefficient is found to be positive and significantly different from zero in the whole sample equation. This result suggests that black scientists not only had a lower starting salary than equally qualified white scientists but also had slower salary growth. The decomposition yields a positive 54.4% figure for gender and a positive 244% coefficient for race (indicating a much faster rate of earnings growth for men and whites).

A note of caution is called for at this point. The faster earnings growth rate for women and blacks than for similarly qualified and similarly situated men and whites observed during the 1970s by no means indicates the absence of salary discrimination against women and blacks. Table 3, in fact, indicates a large magnitude of estimated discrimination against women in the years examined. The longitudinal model examines whether people

ployees are compensated on the basis of rules and regulations made or controlled by elected officials. Finally, it is hypothesized that the basis of rewards allocation in the private industrial sector is that of economic efficiency, which is paramount under conditions of market competition. Our results indicate that the criteria utilized in the industrial sector result in smaller inequalities than those utilized in the other sectors. In contrast, the criteria used by academic institutions create the largest inequalities.

[11] Despite higher earnings in t_1 of the sample "survivors," we observe a negative coefficient on the inverse Mills' ratio. This inconsistency could be the result of the different nature of the two comparisons. The higher earnings of the "survivors" was observed in a simple comparison of salary means, whereas the negative coefficient of the inverse Mills' ratio is the result of a comparison between those who dropped out and equally qualified "survivors."

Table 3. Factors Affecting the Earnings of Scientists in 1972 and 1982, by Gender and Race: Ln Earnings Regressions. (Standard Errors in Parentheses)

	1972					1982				
Variable	*Whole Sample*	*Men*	*Women*	*Whites*	*Blacks*	*Whole Sample*	*Men*	*Women*	*Whites*	*Blacks*
Human Capital										
M.A.	0.086**	0.088**	0.075**	0.087**	0.007	0.122**	0.116**	0.140**	0.123**	0.115**
	(0.006)	(0.006)	(0.032)	(0.005)	(0.051)	(0.004)	(0.004)	(0.009)	(0.004)	(0.016)
Ph.D.	0.319**	0.316**	0.316**	0.319**	0.340**	0.258**	0.241**	0.318**	0.258**	0.285**
	(0.008)	(0.007)	(0.040)	(0.007)	(0.077)	(0.006)	(0.006)	(0.017)	(0.006)	(0.034)
Experience	0.035**	0.035**	0.028**	0.036**	0.012	28.875**[a]	27.260**[a]	0.037**	28.895**[a]	0.031**
	(0.001)	(0.001)	(0.005)	(0.001)	(0.008)	(0.667)	(0.711)	(0.001)	(0.683)	(0.003)
Experience SQ	−0.646**[a]	−0.646**[a]	−0.574**[a]	−0.651**[a]	−0.057[a]	−0.509**[a]	−0.530**[a]	−0.627**[a]	−0.506**[a]	−0.730**[a]
	(0.022)	(0.022)	(0.131)	(0.022)	(0.238)	(0.016)	(0.016)	(0.050)	(0.016)	(0.091)
Age	3.273**[a]	3.061**[a]	0.005*	3.264**[a]	0.993[a]	2.346**[a]	5.073**[a]	−4.902**[a]	2.274**[a]	0.003**
	(0.561)	(0.579)	(0.002)	(0.565)	(4.299)	(0.345)	(0.386)	(0.785)	(0.355)	(0.001)
School Location	0.031**	0.029**	0.067	0.032**	−0.006	0.035**	0.029**	0.067**	0.041**	−0.026
	(0.006)	(0.006)	(0.038)	(0.006)	(0.051)	(0.004)	(0.005)	(0.013)	(0.005)	(0.020)
Occupation										
Social Science	0.054**	0.047**	0.077	0.055**	−0.049	0.043**	0.041**	0.053**	0.046**	−0.018
	(0.014)	(0.014)	(0.066)	(0.014)	(0.116)	(0.007)	(0.008)	(0.018)	(0.008)	(0.034)
Psychology	−0.012	−0.014	−0.017	−0.011	−0.005	−0.071**	−0.081**	−0.038	−0.075**	−0.040
	(0.015)	(0.016)	(0.065)	(0.015)	(0.128)	(0.011)	(0.014)	(0.022)	(0.012)	(0.047)
Education	−0.097**	−0.111**	−0.027	−0.096**	−0.030	−0.168**	−0.157**	−0.144**	−0.170**	−0.151**
	(0.021)	(0.022)	(0.078)	(0.021)	(0.120)	(0.009)	(0.011)	(0.017)	(0.009)	(0.036)
Biological Science	−0.114**	−0.111**	−0.138*	−0.113**	−0.146	−0.076**	−0.095**	−0.030	−0.075**	−0.075
	(0.012)	(0.012)	(0.065)	(0.012)	(0.116)	(0.007)	(0.008)	(0.016)	(0.007)	(0.033)
Medical Science	0.158**	0.201**	0.260[a]	0.160**	0.087	0.095**	0.183**	0.024	0.101**	−0.052
	(0.022)	(0.024)	(80.934)	(0.023)	(0.141)	(0.013)	(0.017)	(0.022)	(0.013)	(0.072)
Engineering	0.062**	0.064**	0.010	0.061**	0.135	0.109**	0.091**	0.244**	0.108**	0.130**
	(0.010)	(0.011)	(0.096)	(0.010)	(0.099)	(0.004)	(0.004)	(0.015)	(0.005)	(0.021)
Math	0.066**	0.066**	0.051	0.064**	0.125	0.127**	0.102**	0.205**	0.126**	0.141**
	(0.013)	(0.014)	(0.065)	(0.013)	(0.105)	(0.006)	(0.007)	(0.015)	(0.007)	(0.026)
Physical Science	−0.007	−0.005	−0.020	−0.006	−0.068	0.102**	0.088**	0.157**	0.104**	0.072**
	(0.011)	(0.011)	(0.067)	(0.011)	(0.102)	(0.007)	(0.007)	(0.018)	(0.007)	(0.030)
Administration	b	b	b	b	b	0.143**	0.152**	0.091**	0.146**	0.083**
						(0.004)	(0.004)	(0.010)	(0.003)	(0.017)
Employer Location	−0.009	−0.009	−0.565[a]	−0.010	0.085	−0.036**	−0.033**	−0.050**	−0.039**	0.008
	(0.006)	(0.006)	(38.097)	(0.006)	(0.049)	(0.004)	(0.005)	(0.013)	(0.005)	(0.020)
Full Time	0.644**	0.762**	0.431**	0.647**	0.168	0.759**	0.777**	0.726**	0.758**	0.718**
	(0.021)	(0.026)	(0.045)	(0.021)	(0.235)	(0.011)	(0.018)	(0.017)	(0.011)	(0.078)
Employment	b	b	b	b	b	9.601**[a]	9.850**[a]	8.989**[a]	9.601**[a]	0.009**
						(0.391)	(0.487)	(0.696)	(0.398)	(0.001)

(Continued)

Table 3. (Continued)

	1972					1982				
Variable	*Whole Sample*	*Men*	*Women*	*Whites*	*Blacks*	*Whole Sample*	*Men*	*Women*	*Whites*	*Blacks*
Academia	−0.097** (0.008)	−0.088** (0.008)	−0.126** (0.031)	−0.096** (0.008)	−0.098 (0.056)	−0.126** (0.009)	−0.104** (0.010)	−0.175** (0.018)	−0.126** (0.009)	−0.077 (0.045)
Industry	−0.012* (0.006)	−0.015** (0.006)	0.043 (0.034)	−0.011* (0.006)	−0.072 (0.051)	0.111** (0.004)	0.111** (0.005)	0.097** (0.011)	0.115** (0.005)	0.053** (0.019)
Demographic										
Married	0.066** (0.008)	0.073** (0.008)	−0.019 (0.026)	0.068** (0.008)	−0.055 (0.058)	0.049** (0.004)	0.064** (0.005)	−0.011 (0.009)	0.051** (0.005)	0.024 (0.019)
Children	0.027** (0.005)	0.025** (0.005)	0.055 (0.041)	0.027** (0.005)	0.048 (0.045)	0.719** (4.501)	−0.006 (0.004)	0.055** (0.013)	0.001 (0.004)	−0.017 (0.018)
Citizen	0.043** (0.015)	0.041** (0.015)	0.077 (0.091)	0.043 (0.015)	−0.181 (0.127)	0.001 (0.013)	−0.015 (0.013)	0.088** (0.036)	−0.013 (0.013)	0.096* (0.042)
Gender	0.121** (0.011)	—	—	0.120** (0.011)	0.166** (0.054)	0.137** (0.005)	—	—	0.139** (0.005)	0.093** (0.020)
Race	0.036 (0.023)	0.038 (0.025)	−0.010 (0.066)	—	—	0.059** (0.007)	0.072 (0.008)	0.008 (0.018)	—	—
Constant	8.274	8.276	8.514	8.305	9.094	8.328	8.365	8.526	8.396	8.381
N	13,083	12,374	709	12,953	130	38,995	31,853	7,142	37,000	1,995
R^2	0.418	0.407	0.327	0.417	0.599	0.432	0.350	0.424	0.438	0.281

[a] Multiplied by 1,000.
[b] Not in the equation.
* Significant at the .05 level; ** at the .01 level.

Table 4. Factors Affecting the Earnings of Scientists in the 1970s and 1980s, by Gender and Race: Change Models. (Standard Errors in Parentheses)

	1970s					*1980s*				
Variable	*Whole Sample*	*Men*	*Women*	*Whites*	*Blacks*	*Whole Sample*	*Men*	*Women*	*Whites*	*Blacks*
Human Capital										
M.A.	−0.014*	−0.014*	−0.001	−0.013*	−0.028	0.047**	0.062**	−0.036	0.046**	0.320
	(0.006)	(0.006)	(0.047)	(0.006)	(0.074)	(0.011)	(0.012)	(0.030)	(0.011)	(0.223)
Ph.D.	−0.055**	−0.054**	0.015**	−0.058**	0.415**	0.060**	0.071**	0.027	0.060**	0.556
	(0.008)	(0.008)	(0.085)	(0.009)	(0.177)	(0.018)	(0.020)	(0.046)	(0.018)	(0.310)
Experience	−12.56**[a]	−12.59**[a]	b	−12.735**[a]	0.027	b	b	b	b	b
	(0.950)	(0.956)		(0.955)	(0.017)					
Age	b	b	−0.124[a]	b	−0.017	−0.005**	−0.005**	−0.006*	−0.006*	0.004
			(3.300)		(0.011)	(0.001)	(0.001)	(0.003)	(0.001)	(0.008)
Chged[c]	0.076**	0.070**	0.124*	0.075**	0.067	0.117**	0.137**	0.097	0.121**	0.133
	(0.013)	(0.013)	(0.055)	(0.013)	(0.125)	(0.031)	(0.036)	(0.058)	(0.031)	(0.165)
Chgexp[c]	−0.001	−0.870[a]	0.006	−0.001	0.004	−0.009**	−0.008**	−0.014**	−0.008**	−0.013
	(0.001)	(1.020)	(0.008)	(0.001)	(0.009)	(0.001)	(0.002)	(0.005)	(0.001)	(0.008)
Chgemp[c]	b	b	b	b	b	0.014**	0.011**	0.019**	0.013**	0.024
						(0.001)	(0.002)	(0.003)	(0.001)	(0.010)
Chgkid[c]	b	b	b	b	b	−0.021	−0.017	−0.036	−0.019	−0.113
						(0.021)	(0.023)	(0.045)	(0.021)	(0.127)
Chgtosng[c]	b	b	b	b	b	−0.109**	−0.119**	−0.075	−0.096**	−0.411**
						(0.029)	(0.033)	(0.066)	(0.029)	(0.168)
Chgtomar[c]	b	b	b	b	b	0.041	0.038	0.031	0.031	0.260
						(0.026)	(0.031)	(0.051)	(0.026)	(0.145)
Chgtomgr[c]	b	b	b	b	b	−0.052**	−0.0063**	0.016	−0.049**	−0.137
						(0.015)	(0.016)	(0.039)	(0.015)	(0.099)
Chgfrmgr[c]	b	b	b	b	b	0.018	0.021	0.002	0.013	0.247
						(0.018)	(0.019)	(0.060)	(0.019)	(0.133)
Chgtoful[c]	0.741**	0.902**	0.247*	0.740**	1.160	0.361**	0.588**	0.369**	0.346**	1.352
	(0.051)	(0.063)	(0.122)	(0.051)	(0.762)	(0.087)	(0.185)	(0.104)	(0.087)	(1.063)
Chgtoprt[c]	−0.772**	−0.826**	−0.626**	−0.772**	−0.725**	−0.649**	−0.789**	−0.482**	−0.654**	−0.367
	(0.024)	(0.028)	(0.062)	(0.024)	(0.184)	(0.049)	(0.068)	(0.073)	(0.048)	(0.483)
Academia	−0.022*	−0.025**	−0.046	−0.021*	−0.442	0.011	−0.003	0.087	−0.010	0.147
	(0.010)	(0.010)	(0.071)	(0.010)	(0.286)	(0.026)	(0.030)	(0.054)	(0.026)	(0.236)
Industry	0.040**	0.039**	0.085*	0.039**	0.207	−0.054**	−0.051**	−0.066	−0.053**	−0.041
	(0.006)	(0.006)	(0.042)	(0.006)	(0.133)	(0.016)	(0.017)	(0.040)	(0.016)	(0.104)
λ	−0.270**	−0.271**	0.022	−0.276**	−0.981	0.582**	0.573**	0.664**	0.569**	1.706
	(0.039)	(0.039)	(0.332)	(0.040)	(0.870)	(0.078)	(0.086)	(0.217)	(0.078)	(1.108)
Gender	−0.084**	—	—	−0.084**	−0.237	−0.006	—	—	−0.001	−0.148
	(0.016)			(0.016)	(0.125)	(0.016)			(0.017)	(0.096)
Race	−0.019	−0.021	−0.066	—	—	0.243**	0.264**	0.161*	—	—
	(0.024)	(0.026)	(0.085)			(0.031)	(0.035)	(0.068)		

(Continued)

Table 4. (Continued)

	1970s					1980s				
Variable	*Whole Sample*	*Men*	*Women*	*Whites*	*Blacks*	*Whole Sample*	*Men*	*Women*	*Whites*	*Blacks*
Constant	0.604	0.492	0.080	0.590	1.640	−1.367	−1.638	−1.439	−1.098	−4.047
N	10,121	9,666	455	10,022	99	15,963	13,685	2,278	15,375	588
R^2	0.188	0.194	0.234	0.188	0.496	0.047	0.040	0.104	0.048	0.080

Note: Explanatory variables that were used in the analysis, but not presented here, are Experience SQ; School Location; Employment; Social Science; Psychology; Education; Biological Science; Medical Science; Engineering; Math; Physical Science; Administration; Employer location; Full-time; Married; Children; Citizen.

[a] Multiplied by 1,000.

[b] Not in the equation.

[c] The change variables are defined as follows. Chged: a dummy coded as 1 if degree attained in t_2 higher than the degree held in t_1; Chgexp: Experience t_2—Experience t_1; Chgemp: Employment t_2—Employment t_1; Chgkid: a dummy coded as 1 if children 5 years old and under are present in t_2 and not in t_1; Chgtosng: a dummy coded as 1 if married in t_1 and not married in t_2; Chgtomar: a dummy coded as 1 if not married in t_1 and married in t_2; Chgtomgr: a dummy coded as 1 if a managerial position is held in t_2 and not in t_1; Chgfrmgr: a dummy coded as 1 if a managerial position is held in t_1 and not in t_2; Chgtoful: a dummy coded as 1 if works part-time in t_1 and full-time in t_2; Chgtoprt: a dummy coded as 1 if works full-time in t_1 and part-time in t_2.

* Significant at the .05 level; ** at the .01 level.

with similar qualifications enjoy a similar salary growth over time—only one aspect of the far wider issue of salary discrimination.

Table 5 provides a summary of the results discussed above. There is a distinct change in the estimated discrimination between the 1970s and the 1980s. The unexplained earnings gap (both as a percentage of total earnings and as a percentage of the earnings gap) increases over time. These results are in direct contradiction to trends identified in previous studies.

The same pattern was found with regard to the wage growth of minority workers when compared to that of equally qualified majority workers. The advantage in salary growth held by female and black workers during the 1970s disappears. The more dramatic change is observed in the situation of black scientists. Whereas they benefited from a faster salary growth rate during the 1970s than that of whites (although the difference was not statistically significant in the whole sample equation), this trend was not maintained during the 1980s. Instead, we obtained an estimated discrimination figure of 11% in 1982. Moreover, the unexplained portion of the gap in salary growth during the 1980s is positive (and the race coefficient in the whole sample equation is significant), meaning that blacks lost their advantage over whites. When decomposing the male-female salary growth gaps we observe that female scientists, like black scientists, fared worse in the 1980s than in the previous decade. Women's salary growth rate, which exceeded men's in the 1970s, fell behind men's in the 1980s.[12]

Table 5. Annual Earnings of Scientists in the 1970s and 1980s: Comparisons Between Men and Women and Between Whites and Blacks.

Groups and Year	*Minority-to-Majority Earnings Ratio*[a]	*Earnings Gap (ln Y_{ma} − ln Y_{mi})*	*Unexplained Portion*[b]	*Percent of Gap*
1972:				
Female-Male	0.75	0.288	0.098	34.0
Black-White	0.91	0.098	0.033	33.7
1982:				
Female-Male	0.68	0.385	0.141	36.6
Black-White	0.89	0.117	0.110	93.7
1972–1976:[c]				
Female-Male	0.94	0.019	−0.061	−321.1
Black-White	0.98	0.006	−0.011	−183.3
1982–1986:[c]				
Female-Male	1.75	−0.056	0.544	48.8
Black-White	−0.20	0.104	2.437	2,343.3

[a] These ratios are based on geometric means, and hence might differ slightly from ratios calculated from Table 2 based on means of actual earnings (in dollars).

[b] The term $b_{\overline{\lambda}}$ was set to be equal to zero.

[c] The entries for the change models are based on the differences between geometric means at t_2 and t_1.

Discussion

At the outset of this paper we suggested that longitudinal data may help to shed some light on the conflicting results presented recently regarding the trend of gender-based earnings gaps and earnings discrimination during the 1970s. Our results, however, lend support neither to the finding of a trend of decreasing gaps (Blau and Beller 1988) nor to the finding of stability in those gaps (Carlson and Swartz 1988). Instead, we find that the situation of women and blacks employed in the scientific labor market worsened over recent years. Black scientists are in a particularly bad situation. After achieving relative equality during the

[12] The results of the decompositions presented in Table 5 were derived by the method suggested by Oaxaca (1973). These results can be sensitive to the inverse Mills' ratios included in the change models—as indicated by some of the large figures presented in that table The decompositions of the change models were redone for comparison purposes, and this time the coefficients of the Mills' ratio were not set to be equal to zero. The unexplained portions of the female-male earnings gap thus obtained were −0.0004 for 1972–76 and −0.082 for 1982–86, and the corresponding figures for the black-white gap were −0.249 and 0.093.

These results differ from those presented in Table 5 in two respects. First, the advantage in salary growth held by women during the 1970s becomes even more apparent during the 1980s. Second, the unexplained portion of the gap in salary growth between whites and blacks is approximately 9%, as compared to an estimate of 244% presented in Table 5. Hence, readers are advised to view the estimates of the unexplained portions derived from the change models with circumspection.

1970s, they found themselves at a severe disadvantage during the 1980s.[13]

Our findings may be attributed to the fact that we followed trends from the beginning of the 1970s to the mid-1980s, whereas other studies dealt only with the 1970s. It is possible that minority and female workers were worst hit by periods of recession that took place in the American economy between the mid-1970s and the mid-1980s. Since they constitute the weaker groups in the labor market, they are the first to suffer from salary cuts, demotions, and job loss (see, for example, Shulman 1987). Such effects are more pronounced during the later phases of a recession than during the early phases.

Second, it is possible that anti-discrimination policies were not at the top of the agenda of the political system in the United States in the 1980s. As a result, some of the achievements of policies concerned with social equality that were implemented during the 1960s and 1970s were eroded.

Finally, our results may well be peculiar to the scientific labor market, in which case they cannot be generalized to other segments of the market. If so, there is a need for a careful examination of trends in earnings and inequality within occupational labor markets rather than throughout the labor market as a whole.

[13] The comparisons of our results with results obtained in other studies must be made cautiously, since each study utilizes different samples and comparisons. We use two different longitudinal samples (one for 1972–76, the other for 1982–86), whereas Blau and Beller looked at the same cohort at two different times (1971 and 1981) based on two different samples, and Carlson and Swartz looked at three different sets of Census data (1959, 1969, and 1979).

REFERENCES

Barbezat, Debra A. 1989. "Affirmative Action in Higher Education: Have Two Decades Altered Salary Differentials by Sex and Race?" In Ronald G. Ehrenberg, ed., *Research in Labor Economics*, Vol. 10. Greenwich, Conn.: JAI Press, pp. 107–56.

———. 1987. "Salary Differentials by Sex in the Academic Labor Market." *Journal of Human Resources*, Vol. 22, No. 3, pp. 423–28.

Blau, Francine D., and Andrea H. Beller. 1988. "Trends in Earnings Differentials by Gender, 1971–1981." *Industrial and Labor Relations Review*, Vol. 41, No. 4, pp. 513–29.

Bognanno, Mario F. 1987. "Women in Professions: Academic Women." In Karen S. Koziara, Michael H. Moscow, and Lucretia D. Tanner, eds., *Working Women: Past, Present, Future*. Washington, D.C.: Bureau of National Affairs, pp. 245–64.

Cain, Glen G. 1986. "The Economic Analysis of Labor Market Discrimination: A Survey." In Orley Ashenfelter and Richard Layard, eds., *Handbook of Labor Economics*, Vol. 1. New York: Elsevier Science Publishers, pp. 693–785.

Carlson, Leonard A., and Caroline Swartz. 1988. "The Earnings of Women and Ethnic Minorities, 1959–1979." *Industrial and Labor Relations Review*, Vol. 41, No. 4, pp. 530–46.

Cole, Jonathan R. 1979. *Fair Science: Women in the Scientific Community*. New York: Free Press.

Cole, Jonathan R., and Stephen Cole. 1973. *Social Stratification in Science*. Chicago, Ill.: University of Chicago Press.

Corcoran, Mary, and Greg J. Duncan. 1979. "Work History, Labor Force Attachment, and Earnings Differences Between the Races and Sexes." *Journal of Human Resources*, Vol. 14, No. 1, pp. 3–20.

Farley, Reynolds. 1977. "Trends in Racial Inequalities: Have the Gains of the 1960's Disappeared in the 1970's?" *American Sociological Review*, Vol. 42, No. 2, pp. 189–208.

Ferber, Marianne A., and Betty Kordick. 1978. "Sex Differentials in the Earnings of Ph.D.s." *Industrial and Labor Relations Review*, Vol. 31, No. 2, pp. 227–38.

Freeman, Richard B. 1977. "The New Job Market for Black Academicians." *Industrial and Labor Relations Review*, Vol. 30, No. 2, pp. 161–74.

Gordon, Nancy M., Thomas E. Morton, and Ina C. Braden. 1974. "Faculty Salaries: Is There Discrimination by Sex, Race and Discipline?" *American Economic Review*, Vol. 64, No. 3, pp. 419–27.

Gwartney, James D., and James E. Long. 1978. "The Relative Earnings of Blacks and Other Minorities." *Industrial and Labor Relations Review*, Vol. 31, No. 3, pp. 336–46.

Heckman, James J. 1980. "Sample Selection Bias as a Specification Error." In James P. Smith, ed., *Female Labor Supply: Theory and Estimation*. Princeton, N.J.: Princeton University Press, pp. 206–48.

Hoffman, Emily P. 1976. "Faculty Salaries: Is there Discrimination by Sex, Race and Discipline? Additional Evidence." *American Economic Review*, Vol. 66, No. 1, pp. 196–98.

Loeb, Jane W., and Marianne A. Ferber. 1973. "Representation, Performance and Status of

Women on the Faculty at the Urbana-Champaign Campus of the University of Illinois." In Alice S. Rossi and A. Calderwood, eds., *Academic Women on the Move*. New York: Russell Sage.

Long, Larry H., and Lynne R. Heltman. 1975. "Migration and Income Differences Between Black and White Men in the North." *American Journal of Sociology*, Vol. 80, No. 6, pp. 1391–1409.

Malkiel, Burton G., and Judith A. Malkiel. 1973. "Male-Female Pay Differentials in Professional Employment." *American Economic Review*, Vol. 63, No. 4, pp. 693–705.

Mincer, Jacob, and Solomon Polachek. 1974. "Family Investments in Human Capital: Earnings of Women." *Journal of Political Economy*, Vol. 82, No. 2, Part 2, pp. S76–S108.

Mommsen, Kent G. 1974. "Black Ph.D.'s in the Academic Marketplace—Supply, Demand and Price." *Journal of Higher Education*, Vol. 45, No. 4, pp. 253–67.

National Science Board. 1985. *Science Indicators: The 1985 Report*. Washington, D.C.

Oaxaca, Ronald L. 1973. "Male-Female Wage Differential in Urban Labor Markets." *International Economic Review*, Vol. 14, No. 3, pp. 693–709.

Pearson, Willie, Jr. 1986. "Black American Participation in American Science: Winning Some Battles but Losing the War." *Journal of Educational Equity and Leadership*, Vol. 6, No. 1, pp. 45–59.

______. 1987. "The Graduate Education and Careers of Underrepresented Minorities in Science and Engineering." In L. S. Dix, ed., *Minorities: Their Underrepresentation and Career Differentials in Science and Engineering*. Washington, D.C.: National Academy Press.

Reimers, Cordelia W. 1983. "Labor Market Discrimination Against Hispanic and Black Men." *Review of Economics and Statistics*, Vol. 65, No. 4, pp. 570–79.

Reskin, Barbara F. 1978. "Sex Differences and the Social Organization of Science." In Jerry Gaston, ed., *The Sociology of Science*. San Francisco, Calif.: Jossey-Bass, pp. 6–37.

Schau, Candace G., and Vivian H. Heyward. 1987. "Salary Equity: Similarities and Differences in Outcomes from Two Common Prediction Models." *American Education Research Journal*, Vol. 24, No. 2, pp. 271–86.

Shenhav, Yehouda, and Yitchak Haberfeld. 1988a. "Scientists in Organizations: Discrimination Processes in an Internal Labor Market." *Sociological Quarterly*, Vol. 29, No. 3, pp. 451–62.

______. 1988b. "The Various Faces of Scientific Productivity: A Contingency Analysis." *Quality and Quantity*, Vol. 22, No. 4, pp. 365–80.

Shulman, Steven. 1987. "Discrimination, Human Capital, and Black-White Unemployment." *Journal of Human Resources*, Vol. 22, No. 3, pp. 361–76.

U.S. Bureau of the Census. 1979. *1972, 1974 and 1976 National Survey of Natural and Social Scientists and Engineers (SEE)*. Washington, D.C.

______. 1987. *1982, 1984 and 1986 National Survey of Natural and Social Scientists and Engineers (SEE)*. Washington, D.C.

Zuckerman, Harriet, and Jonathan Cole. 1975. "Women in American Science." *Minerva*, Vol. 13, pp. 83–102.