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Determinants of Faculty Gender Ratios Across Institutions and Departments

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Abstract

Faculty gender ratios vary considerably across institutions, and past research (Tolbert and Oberfield 1991; Bach and Perrucci 1984) has shown that certain characteristics of institutions have a significant effect on these gender ratios. Understanding the drivers of faculty gender ratio variation is important since the concentration of women in particular types of institutions contributes to gender differences in earnings, career patterns and employment outcomes.

This thesis tests the hypotheses, drawn from theories of organizational behavior, that gender ratios of assistant professors are influenced by employers' discriminatory preferences, the gender composition of the student body, and women's preferences for employment in teaching vs. research universities. In addition, it is hypothesized that public institutions and institutions located in highly-populated areas will have a greater proportion of female assistant professors.

The explanatory variables suggested by the hypotheses are examined using cross-sectional data from two separate years, and a fixed-effects analysis is used to obtain unbiased estimates. The results support all of the hypotheses except for the preference of women for employment in teaching universities.

This thesis also attempts to explain the variation in faculty gender ratios across economics departments. It is hypothesized that the departmental model will be more accurate than the institutional model since hiring decisions are made at the departmental level. The results, however, do not support this hypothesis. The implications of this thesis for future studies of inter-organizational variation in faculty gender ratios are discussed

Keywords

Faculty gender, gender ratios, career patterns, departmental hiring

Comments

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Determinants of Faculty Gender Ratios Across Institutions and Departments

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I. Abstract

Faculty gender ratios vary considerably across institutions, and past research (Tolbert and Oberfield 1991; Bach and Perrucci 1984) has shown that certain characteristics of institutions have a significant effect on these gender ratios. Understanding the drivers of faculty gender ratio variation is important since the concentration of women in particular types of institutions contributes to gender differences in earnings, career patterns and employment outcomes.

This thesis tests the hypotheses, drawn from theories of organizational behavior, that gender ratios of assistant professors are influenced by employers' discriminatory preferences, the gender composition of the student body, and women's preferences for employment in teaching vs. research universities. In addition, it is hypothesized that public institutions and institutions located in highly-populated areas will have a greater proportion of female assistant professors.

The explanatory variables suggested by the hypotheses are examined using cross-sectional data from two separate years, and a fixed-effects analysis is used to obtain unbiased estimates. The results support all of the hypotheses except for the preference of women for employment in teaching universities.

This thesis also attempts to explain the variation in faculty gender ratios across economics departments. It is hypothesized that the departmental model will be more accurate than the institutional model since hiring decisions are made at the departmental level. The results, however, do not support this hypothesis. The implications of this thesis for future studies of inter-organizational variation in faculty gender ratios are discussed.

II. Introduction

During the past few decades, women have increased their representation in a number of professions. Between 1973 and 1988, the percentage of new doctorates awarded to women at U.S. universities grew from 18 to 35 percent (Ehrenberg 215). Women, however, continue to be underrepresented in male-dominated fields such as engineering and the physical sciences. Gender disparities within academia are also apparent when looking at the entrance of women into faculty positions. Although the proportion of female faculty has grown, women are increasingly found in non-tenure track positions. Between 1975 and 1998, the percentage of female faculty who are tenured has declined from 24 to 20 percent (Benjamin 61). Female representation in academia is an important aspect of gender equity since universities and colleges are the training ground for the next generation of professional women. In male-dominated fields of study, the presence of female faculty members can provide encouragement to female students, who often prefer working with female professors (Ferber and Kordick 955). Female undergraduates also rate female professors more highly than male undergraduates do (Basow and Silberg 312).

The U.S. Equal Opportunity Commission extended affirmative action to women faculty in the 1970's, yet there remains significant variation across universities with respect to the recruitment, rank, tenure and salary of female faculty. Many gender equity studies focus on the individual as the unit of analysis, using personal characteristics as explanatory variables. This thesis, however, uses characteristics of academic institutions to explain variations in equity. According to Szafran, 1983, certain traits of universities significantly affected the schools' personnel patterns in the 1960's. More recently, Tolbert and Oberfield, 1991, have conducted comparative organizational research on equity in academia. Their study uses three theories of organizational behavior to examine variations in the proportion of female faculty members across institutions.

The first theory is that employers have a preference for hiring members of the dominant social group, males. Reasons that employers would prefer to hire males include beliefs that, on average, men are more productive or contribute more to a university's prestige than women. Higher demand for the preferred group drives up their wages, thus making wealthy organizations more likely to indulge in discriminatory preferences since these institutions are able to bear the higher compensation costs. Total student enrollment, degree of selectivity and per capita revenues are explanatory variables in Tolbert and Oberfield's model that are measures of the amount of wealth and resources that an institution has.

The second theory of organizational behavior focuses on the preferences of constituents. Tolbert and Oberfield assume that female students prefer female teachers and therefore the gender composition of faculty members is likely to mirror the gender composition of the student body. The preferences of employees are the focus of the third theory. In order to explain the observed underrepresentation of women in large research universities, Johnson and Stafford, 1974, suggest that women prefer not to work in these institutions because the greater work demands on the faculty conflict with women's family responsibilities. Johnson and Stafford also assume that women, in anticipation of spending less time in the labor force than men, invest less time in acquiring specialized research skills, and consequently, are less likely to be hired by universities with a strong emphasis on research. Tolbert and Oberfield test these assumptions by including research expenditures as an explanatory variable in their model. The results of their study lend support to the first two theories, employer and constituent preferences, but not to the third theory of employee preferences.

Bach and Perrucci, 1984, suggested additional characteristics of institutions as explanations for the variation in faculty gender ratios. Bach and Perrucci include in their model the percentage of high-level academic administrators who are women, hypothesizing that the greater this percentage, the more equal opportunity and affirmative action policies will be promoted at the university, resulting in more women faculty. Bach and Perrucci also include the population of a university's surrounding area, based on the assumption that women are more likely to be employed in large urban areas because these areas provide greater employment opportunities for spouses and more female professors than male professors are part of dual-career couples. For large research universities, Bach and Perrucci found both the percentage of women administrators and the area population variable significant.

As in the studies by Tolbert and Oberfield and Bach and Perrucci, the first part of my thesis also uses the university as the unit of analysis. This part of the thesis attempts to explain the variation in faculty gender ratios across a sample of 233 research and doctorate universities. I hypothesize that the percentage of female students and the size of the population in the area surrounding an institution are positively correlated with the percentage of female faculty, while the wealth of an institution and an institution's freedom from federal scrutiny are negatively correlated with the percentage of female faculty. By using two separate data sets from 1996 and 1991, the thesis is also able to examine the determinants of changes in faculty gender ratios over time.

The second part of my thesis explains the variation in the faculty gender ratios across approximately 80 economics departments. Although hiring decisions are decentralized to the departmental level, past research on inter-organizational variation in faculty ratios has focused solely on institutional-level characteristics. I will compare the results of the institutional and departmental regressions in order to determine which is more precise. I hypothesize that the departmental regressions will be more accurate since, for example, it is more likely that female professors deciding where to work would consider the faculty gender ratio within their discipline rather than in the university as a whole. Whether the departmental results are in fact more accurate has important implications on the validity of using the institution rather than the department as the unit of analysis.

III. Measures for the Institutional and Departmental Models

The data used to test the gender equity hypotheses was obtained from National Science Foundation and National Center for Education Statistics surveys, with the exception of population numbers, which were obtained from the U.S. Census Bureau, and data on faculty and student gender ratios in economics departments, which was obtained from the Committee on the Status of Women in the Economics Profession (CSWEP). The sample for the institutional model was drawn from the set of all U.S. doctorate and research universities as classified by the Carnegie Commission on Higher Education. This data set of 236 institutions was reduced to a final sample of 233 institutions because of missing data on faculty ratios. The set of all U.S. doctorate and research universities was chosen for the institutional regressions because it most closely matches the data set for the departmental regressions, which was provided by CSWEP. In order to compare the accuracy of the institutional and departmental regressions, it is necessary to have the same type of institutions in both data sets. For the departmental regressions, data from 1998 and 1993 was available for 121 and 81 economics departments, respectively. Missing data reduced the sample size to 87 economics departments for 1998 and 76 departments for 1993.

Measures for the institutional model

Two sets of institutional regressions were estimated, one using data from 1996 and the other using 1991 data. The percentage of female assistant professors is used as the dependent variable in the regressions. Assistant professors are the most junior faculty and were hired the most recently, while other faculty members may have been hired 10 or more years prior; current data on explanatory variables cannot accurately be used to explain gender ratios of faculty who were hired more than 10 years ago.

To test the theory that wealthy institutions are more likely to follow through on discriminatory preferences for hiring males, as mentioned in the study by Tolbert and Oberfield, this thesis uses per capita endowment, per capita revenues and total student enrollment as indicators of wealth. While Tolbert and Oberfield combine per capita revenues, total enrollment and selectivity to create a single indicator of wealth, I believe that it would be of greater interest to see the effect of each variable separately. The model uses both per capita endowment and per capita revenues in order to determine which measure is a better indicator of discretionary power (wealth). Total student enrollment is also included as an indicator of wealth since high levels of enrollment indicate a strong level of demand for an institution, meaning that a larger institution is more secure about the funds it receives from the student body (Tolbert and Oberfield 309). For public universities, student enrollment also is an important determinant of the size of the budget (Perrucci 236).

The theory of constituent preferences is tested in the model by including the gender ratio of the student body (undergraduate and graduate students) as an explanatory variable. The disciplinary mix of an institution is also controlled for in the model since it has an influence on faculty gender ratios. Since the percentage of female PhDs, which is the pool from which faculty are hired, varies considerably across disciplines, institutions which emphasize different disciplines would be expected to have different faculty gender ratios. The disciplinary mix of an institution is also correlated with the gender ratio of the student body since certain subject areas attract a greater percentage of female students than others, e.g. psychology vs. electrical engineering.[1] To calculate the disciplinary mix measure used in my model, the number of degrees awarded in each discipline by Harvard, for example, was divided by the total number of degrees awarded by Harvard. The resulting percentages could be used to compare, for example, what percentage of the total degrees awarded by Harvard were in psychology vs. engineering. In order to combine these percentages into a single number that would predict the effect of disciplinary mix on Harvard's faculty ratios, I obtained national data on the percentage of PhD's awarded to females in each discipline (Appendix A). The number of PhDs awarded nationally in psychology, for example, was then multiplied by the percentage of Harvard's degrees that were awarded in psychology. This was done for each discipline and the results were added up to create a predictor of the percentage of female assistant professors at Harvard. For the 1996 data set, the disciplinary mix variable was calculated using 1995 numbers for the national percentage of female PhDs in each discipline. These lagged values for the national percentages of female PhDs were used since the assistant professors in 1996 data set earned their PhDs in 1995 or earlier. Similarly, 1990 numbers for the national percentages of female PhDs were used for the 1991 data set.

To further clarify the method used to calculate disciplinary mix, assume that Harvard has only two majors, engineering and psychology. Assume 50 percent of the PhDs awarded nationally in psychology went to women and 30 percent of the PhDs awarded nationally in engineering went to women. Assume also that 40 percent of the degrees earned at Harvard were in psychology and 60 percent were in engineering. The

[1] For an explanation of how the multicollinearity problem between student gender ratios and disciplinary mix was corrected for, see the methodology section.

disciplinary mix variable is (0.5)(0.4) + (0.3)(0.6) = 0.38. Thus, if Harvard hired randomly from a pool of PhDs, 38 percent of assistant professors at Harvard should be women.

This method of controlling for the disciplinary mix of an institution is based on two assumptions. The first is that the number of faculty in each discipline is proportional to the number of degrees awarded in each discipline. My disciplinary mix variable would be more accurate if it was calculated using the percentage of faculty members in each discipline rather than the percentage of degrees awarded in each discipline, but data on the number of faculty members in each discipline was unavailable. It is, however, reasonable to assume that disciplines which award the greatest number of degrees will usually have the greatest number of faculty members. The second assumption is that the number of assistant professors hired in a given discipline is proportional to the number of degrees awarded in that discipline. Data on the actual number of assistant professors hired in each discipline was unavailable, but it is also a reasonable assumption that larger departments will hire more faculty members each year. There are, however, variations in the retirement rates of faculty across disciplines, which could mean that for two disciplines of the same size, one discipline hires fewer new faculty because fewer faculty have retired. When looking at the significance of the disciplinary mix variable in the model, one should keep in mind the two assumptions that were made in its calculation.

To test the theory that women would prefer to work in institutions with a greater emphasis on teaching vs. research because of family commitments, research expenditures per student are included in the model.

To test the hypothesis that institutions under less federal scrutiny will have a lower percentage of female faculty, a dummy variable for private vs. public institutions is included in the model. Since public institutions receive more funding from the government, and legislative committees and public interest groups have access to public universities' hiring and promotion information, it is hypothesized that these institutions will be under more pressure to conform to equity regulations.

Data on the population of a university's surrounding area is included in the model to test the hypothesis, mentioned in Bach and Perrucci's study, that universities in highly populated areas will have a greater percentage of female faculty. If a university is located in a Standard Metropolitan Statistical Area (SMSA), as defined by the Census Bureau, the population of the SMSA in 1998 is used. Otherwise, the 1998 population of the university's county is used. 1998 data was used for both the 1996 and 1991 regressions because it was the easiest to access and the change in population between those years is not great enough to affect the decision of a faculty member to locate in that area.

Data on the prestige of institutions and the percentage of women deans, which are variables in Bach and Perrucci's study, are not included in the model. Prestige is a measure of an institution's discretionary power (more prestigious universities are in demand and therefore more secure about funding from students), and therefore is not included since enrollment, per capita endowment and per capita revenues are already included in the model as measures of discretionary power. Instead of the percentage of women deans, the percentage of female tenured faculty is a variable in my institutional model. Since tenured faculty sit on hiring committees, the percentage of female tenured faculty should be positively correlated with the percentage of female assistant professors.

Measures for the departmental model

Two sets of departmental regressions were estimated, one using CSWEP data from 1998 and the other using 1993 data. The explanatory variables used in the institutional regressions are also used in the departmental regressions, with the exception of disciplinary mix (which is not necessary since the data is only for economics departments) and the percentage of tenured faculty who are female (which is replaced by the percentage of tenured *economics* faculty who are female). It is hypothesized that the percentage of tenured economics faculty who are female will be more significant than the female tenured faculty variable in the institutional regressions since hiring decisions are made at the departmental level and tenured faculty from the department sit on the hiring committees.

The data sets from CSWEP, which contain the dependent variable for the departmental regressions, were made available to me for 1998 and 1993, but National Science Foundation data on the explanatory variables is not available after 1996. Hence, I used 1996 data for the explanatory variables in the 1998 regressions, and, for the sake of consistency, 1991 data for the explanatory variables in the 1993 regressions. It seems unlikely that the change in the explanatory variables during two years would significantly affect the results of the regressions since faculty ratios are not very sensitive to small changes. Institutional explanatory variables such as per capita revenues, per capita endowment and enrollment are used in the departmental regressions because discretionary power is better measured at the institutional rather than departmental level since funding is generated at the institutional level.

The gender ratio of economics students is a variable that is added to the model. It will be compared to the gender ratio of the entire student body in order to determine which variable is more highly correlated with economics faculty ratios. For 1998, data on the gender ratio of economics students is available from CSWEP, but for 1993, CSWEP only has data on the gender ratio of economics graduate students. Since the gender ratio of graduate students is likely to differ significantly from the gender ratio of all economics students, National Science Foundation data on the gender ratio of economics students in 1993 is used instead.

IV. Methodology and Statistical Techniques

For the institutional data sets, one form of the linear regression model is:

(1) $$\mathbf{ASSTPROF_i = \beta_0 + \beta_1 TENURED_i + \beta_2 DISMIX_i + \beta_3 UNDER100_i + \beta_4 UNDER500_I + \beta_5 UNDER1M_i + \beta_6 PRIVATE_i + \beta_7 ENDOW_i + \beta_8 ENDOWDUM_i + \beta_9 ENROLL_i + \beta_{10} GENRAT1_i + \clubsuit_i}$$

ASSTPROF is the percentage of assistant professors who are female. TENURED is the percentage of tenured (associate and full professors) who are female. The model was estimated both with and without TENURED. TENURED is included in the model since tenured faculty members sit on hiring committees, and female faculty members are more likely than male faculty members to push for the hiring of female assistant professors. The model is also estimated without TENURED since it is likely that variables postulated to have an effect on the gender ratios of assistant professors will also have an effect on the gender ratios of tenured faculty.

DISMIX is the disciplinary mix variable, which was calculated using the method explained in Chapter III. For two disciplines, *Science and Engineering Technologies* and *Interdisciplinary and Other Sciences,* data on the national percentage of female PhDs in the discipline was unavailable. Because of the missing data for the two disciplines, the disciplinary mix variable was calculated using two different methods. The first method (DISMIX) substituted the national percentage of female PhDs in all disciplines for both of the two missing values. The second method (DISMIX2) dropped *Science and Engineering Technologies* and *Interdisciplinary and Other Sciences* from the disciplinary mix of each institution and reweighted the other disciplines. For example, if Cornell awarded 3000 degrees each year and 100 of these degrees were awarded in *Science and Engineering Technologies* and 50 were awarded in *Interdisciplinary and Other Sciences*, the reweighted method would use 2850 total degrees rather than 3000, so that if 1000 degrees were awarded in engineering, the proportion of engineering degrees at Cornell would be 1000/2850 rather than 1000/3000. The two calculation methods, DISMIX and DISMIX2, will be compared in order to determine which has a better fit. The use of these techniques to compensate for the missing data should not significantly alter results since *Science and Engineering Technologies* and *Interdisciplinary and Other Sciences* comprise less than 10 percent of the total degrees awarded at most institutions.

In the calculations for DISMIX and DISMIX2, the percentage of female PhDs in each discipline was based on PhDs earned at U.S. universities. A significant number of these PhDs, however, were awarded to temporary residents who do not have visas to teach in the U.S. Since these foreign PhD recipients are less likely to be in the hiring pool for the institutions in the data sample, and PhD gender ratios differ significantly for temporary residents vs. U.S. citizens or permanent residents (Appendix B), a new disciplinary mix variable, DISPERM, was calculated. In the computation of this variable, the percentage of female PhDs in each discipline was based on PhDs from U.S. universities earned only by U.S. citizens or permanent residents. Because of the missing data on PhDs in *Science and Engineering Technologies* and *Interdisciplinary and Other Sciences*, DISPERM was calculated using the substitution method that was used to calculate DISMIX, and another variable, DISPERM2, which is also based on PhDs earned only by U.S. citizens and permanent residents, was calculated using the reweighting method used to calculate DISMIX2. The two sets of disciplinary mix variables will be compared to each other in order to determine the effect of excluding PhDs earned by temporary residents from the calculations.

UNDER100, UNDER500 and UNDER1M are dichotomous variables included in Model 1 that measure the population of a university's surrounding area. UNDER100 equals one if the population is less than 100,000 people and equals zero otherwise. UNDER500 equals one if the population is greater than or equal to 100,000 and less than 500,000 people and equals zero otherwise. UNDER1M equals one if the population is greater than or equal to 500,000 and less than one million and equals zero otherwise. The coefficients of these variables show effects relative to the category that was left out of the model, population equal to one million or greater. For example, a negative significant coefficient for UNDER100 means that in areas where the population is less than 100,000, the percentage of female assistant professors is less than it is in areas where the population is at least one million, ceteris paribus. Instead of actual population numbers, dichotomous variables are used so that measurement error is minimized.

PRIVATE is a dummy variable that equals one if an institution is private and zero if an institution is public.

ENDOW is the market value of the endowment divided by total enrollment. For the approximately 30 institutions that are missing endowment data, a zero is entered for ENDOW. ENDOWDUM is a dummy variable that equals zero if ENDOW is not zero and one if ENDOW is zero. The purpose of creating the dummy variable rather than dropping the institutions with missing endowment data is to avoid significantly reducing the number of observations in the sample.

Because of missing data on research expenditures per student (RESEARCH) and revenue per student (REVENUE), corresponding dummy variables RESDUM and REVDUM were created. Because of multicollinearity between ENDOW, RESEARCH and REVENUE (Table 1), the three variables could not all be included together in the model. Instead, they will be estimated one at a time. The correlation between RESEARCH and ENDOW and REVENUE is problematic because of the different theories that prompted the inclusion of these variables in the model. RESEARCH is included in order to test the theory of employee preferences while ENDOW and REVENUE are included in order to test the theory of employer preferences. If both RESEARCH and ENDOW are significant when estimated one at a time, the correlation between the two variables will make it unclear whether the significance is caused by employer or employee preferences.

The variable ENROLL in Model 1 is total student enrollment.

GENRAT1 is the percentage of the student body that is female minus DISMIX. The gender ratio of the student body is highly correlated with my measures of the disciplinary mix (Table 1). To reduce collinearity, DISMIX is subtracted from the gender ratio to create the variable GENRAT1, which is not correlated with DISMIX. Because of this transformation, the coefficient of DISMIX is affected. To see this, assume a model with only two explanatory variables, DISMIX and GENDER (student body gender ratio):

(2) $$\boldsymbol{\alpha_0 + \alpha_1 DISMIX_i + \alpha_2 GENDER_i + \clubsuit_i}$$

When GENDER is replaced by GENRAT1, which equals GENDER – DISMIX, the model becomes:

(3) $$\boldsymbol{\beta_0 + \beta_1 DISMIX_i + \beta_2 (GENDER \quad DISMIX)_i + \clubsuit_i}$$

By multiplying the β_2 through, the model becomes:

(4) $\beta_0 + (\beta_1 - \beta_2)DISMIX_i + \beta_2 GENDER_i + ♣_i$

The coefficient for GENRAT1 is the same as the coefficient for GENDER, but the coefficient for DISMIX is $(\beta_1 - \beta_2)$. Therefore, to calculate the t-statistic for DISMIX, the coefficient has to be divided by the standard error of $(\beta_1 - \beta_2)$, which is the square root of $(\beta_1 - \beta_2)^2$ var DISMIX + β_2^2 var GENRAT1 - $2(\beta_1 - \beta_2)\beta_2$ cov (DISMIX GENRAT1). Because there are four variations of the disciplinary mix variable, DISMIX, DISMIX2, DISPERM and DISPERM2, there are four corresponding gender ratio variables, GENRAT1, GENRAT2, which equals GENDER minus DISMIX2, GENRAT3, which equals GENDER minus DISPERM, and GENRAT4, which equals GENDER minus DISPERM2.

Methodology for Departmental Regressions

For the departmental data sets, one form of the linear regression model is:

(5) $ASSTPROF_i = \beta_0 + \beta_1 TENURED_i + \beta_2 GENECON_i + \beta_3 UNDER100_i + \beta_4 UNDER500_I + \beta_5 UNDER1M_i + \beta_6 PRIVATE_i + \beta_7 ENDOW_i + \beta_8 ENDOWDUM_i + \beta_9 ENROLL_i + ♣_I$

where ASSTPROF is the proportion of assistant professors of economics who are female and TENURED is the proportion of tenured economics professors who are female. GENECON is the proportion of female economics majors.

Assumptions

The institutional and departmental regressions test the significance of employer, constituent, and employee preferences, but the models do not control for quality differences between assistant professors. If female assistant professor candidates were of a lower quality than male candidates, it is hypothesized that top universities would have a lower percentage of assistant professors who are female. The institutional and departmental models, however, assume that the average quality of female assistant professors is equal to the average quality of male assistant professors. A main factor affecting the quality of assistant professors is the quality of the universities at which they earned their PhDs. It therefore seems reasonable to assume that if the gender ratio of PhD candidates at top universities is equal to the gender ratio of PhD candidates at all other doctorate institutions, there is no overall quality difference between male and female assistant professors. To test this assumption, the gender ratio of PhDs in the top 20 economics departments from 1993 to 1996 was compared to the gender ratio of PhDs in all economics departments from 1993 to 1996. There were no significant differences between the gender ratios, which supports the conjecture that the quality of male and female PhDs is roughly equivalent. Economics was the only discipline used to test the assumption.[1]

Statistical Techniques

Since many of the variables in equations 1 and 5, including the dependent variables, are percentages and can therefore only vary between 0 and 1, a log odds transformation was done for each of these variables to allow their distributions to be normal. The variable ASSTPROF, for example, was transformed into log (ASSTPROF/(1 - ASSTPROF)). The log-odds analysis and the OLS model produced substantively

[1] Data on the proportion of females in top-rated departments in other disciplines could be collected from the WebCASPAR system.

identical results, so the results will be reported using the coefficients and standard errors from the OLS regressions.

Another problem caused by the fact that the dependent variables in models 1 and 5 are percentages is that the variance is different for each observation. In a university with only five assistant professors, the dependent variable has less information than the dependent variable in a university with 15 assistant professors; The variance of the residual is greater in the observation that is based on fewer assistant professors. Because of this problem, the observations are weighted with a probability weight for each observation that is equal to the square root of the number of assistant professors at the institution.

For the institutional data, a fixed effects model is used as well as the individual year cross-sections. The fixed effects model is used to obtain unbiased estimates. Suppose there is an unmeasured variable, such as the attitudes of hiring committees towards female professors, that affects faculty gender ratios and is also correlated with one of the explanatory variables. This causes a correlation between that explanatory variable and the error term in the model, which creates biased estimates in a cross-section. If the omitted variables and the coefficients of the model do not change over time, however, the fixed effects model, which takes first differences, will cause the omitted variables to drop out, leaving unbiased estimates. The fixed effects model is created by subtracting each variable in the 1991 data set from the corresponding variable in the 1996 data set. The resulting change observations were estimated using OLS.

To better understand how the fixed effects model creates unbiased estimates, assume that in the equations below, V_{it} represents the omitted variables and X_{it} represents all explanatory variables in the model:

$$\textbf{(6)} \qquad Y_{it} = \alpha_0^{t} + \alpha_1 X_{it} + ♣_{it} + V_{it}$$

$$- \quad Y_{i\,t-1} = \alpha_0^{t-1} + \alpha_1 X_{i\,t-1} + ♣_{i\,t-1} + V_{it}$$

$$Y_{it} - Y_{i\,t-1} = \alpha_0 + \alpha_1(X_{it} - X_{i\,t-1}) + (♣_{it} - ♣_{i\,t-1})$$

In the fixed effects equation directly above, α_0 is not equal to $\alpha_0^{t} - \alpha_0^{t-1}$, but is simply an intercept term. The V_{it} terms cancel out, leaving unbiased estimates.

In addition to omitted variables, sample size is another factor that can affect the statistical significance of explanatory variables. The departmental data sets contain approximately 150 fewer observations than the institutional data sets do. In order to test the effect of the smaller sample size on the significance of the explanatory variables, a 1996 institutional regression will be run using only the 87 universities that are in the 1998 departmental data set, and a 1991 institutional regression will be run using only the 77 universities that are in the 1993 departmental data set. The results of these regressions will then be compared to the results of the institutional regressions that use all 230 observations.

V. Results of the Institutional and Departmental Regressions

Institutional Regressions

Tables 3 and 4: In 1996, the dependent variable, which ranges from 0 to 1, has a mean of 0.43 and a standard deviation of 0.095 (Table 2). Table 3 shows the effect of the explanatory variables on the proportion of female assistant professors in 1996. Because they fit the data better, ENDOW and DISPERM2 are listed in Table 3 instead of REVENUE and DISMIX2, respectively. When calculating the national percentages of female PhDs in each discipline, DISPERM2 excludes PhDs who are temporary residents. The fact that DISPERM2 provides a better fit than DISMIX2 indicates that the candidate pool for faculty hiring at U.S. institutions should be calculated using only U.S. citizen and permanent resident PhDs, a greater percentage of whom are female compared to temporary residents. The mean of DISPERM2 in 1996 is 0.44 compared to a mean of 0.39 for DISMIX2. DISPERM2 is also a better fit than DISPERM, indicating that the reweighting method of solving the missing data problem is preferable to the substitution method, both of which are explained in Chapter IV.

The fact that ENDOW is a better fit than REVENUE indicates that the former is a better measure of an institution's discretionary power. In fact, REVENUE is not even significant in the model while ENDOW is significant at the one percent level. A possible explanation for this is that the greater variation in endowment values allows for greater explanatory power (Table 2). As predicted, TENURED and DISPERM2 are significant in the positive direction and ENDOW, ENROLL, PRIVATE and UNDER100 are significant in the negative direction in Table 3. The student gender ratio variable, GENRAT4, is not significant at the 10 percent level, which is surprising. ENDOWDUM is significant in the negative direction, indicating that the set of institutions with endowment data missing have a lower percentage of female assistant professors than the other institutions do.

In 1991, the dependent variable has a mean of 0.37 and a standard deviation of 0.106. In Table 4 (1991 data), TENURED, ENDOW, ENDOWDUM, DISPERM2 and GENRAT4 are significant. PRIVATE, UNDER100, and ENROLL are significant in Table 3 (1996 data) and not significant in Table 4. One possible explanation for the fact that PRIVATE is significant in 1996 but not in 1991 is that governmental agencies could have increased their scrutiny of public institutions after 1991, causing public institutions to become more responsive to gender equity considerations, thereby creating a divergence between public and private universities. This explanation would gain credibility if there is concrete evidence of increased governmental scrutiny after 1991, such as the formation of new task forces or new standards of accountability. Another explanation for the lack of significance in 1991 of PRIVATE, as well as ENROLL and UNDER100, is related to the higher R-squared value[1] of 0.64 in 1991 (Table 4) vs. 0.53 in 1996 (Table 3). Perhaps the fact that certain explanatory variables, such as GENRAT4, explain more of the variance in 1991 than in 1996 means that there is less variance left for PRIVATE, ENROLL and UNDER100 to explain.

Tables 5a and 6: TENURED is included as an explanatory variable in Tables 3 and 4 since tenured faculty members play a role in the hiring of assistant professors and,

[1] Adjusted R-squared values are not listed in any of the data tables, except Tables 7 and 8, because the models use probability-weighted data.

therefore, institutions with a greater proportion of female tenured faculty are predicted to have a greater proportion of female assistant professors. The problem with using TENURED as an explanatory variable, however, is that factors affecting assistant professor gender ratios are also likely to affect the gender ratios of tenured professors, making it impossible to separate the effect of TENURED from the effect of other explanatory variables. TENURED is highly correlated with disciplinary mix and student gender ratios (Table 1), which proves to be the reason that GENRAT4 is not significant in Table 3.

In Table 5a (1996 data set), TENURED is not included in the model, which eliminates the multicolinearity problem, and GENRAT4 becomes significant, as hypothesized, at the one percent level. UNDER100 and ENROLL also become more significant when TENURED is removed from the model. The increased significance of GENRAT4 when TENURED is removed from the model causes DISPERM2 to lose its significance in 1991 (Table 6). One possible explanation for the significance of DISPERM2 in 1996 but not in 1991 is that GENRAT4 explains more of the variance in the dependent variable in 1991, meaning that there is less variance left for DISPERM2 to explain. It is also interesting to note that the intercept term is not significant in Table 6. With both the 1996 and 1991 data sets, the R-squared value decreases when TENURED is dropped from the model, suggesting that TENURED is correlated with unmeasurable explanatory variables that affect the assistant professor gender ratios.

Magnitude of Results (using Table 5a as an example): As mentioned above, the mean of the dependent variable in 1996 is 0.43 and the standard deviation is 0.095. In Table 5a, the coefficient on UNDER100 is -0.037, which is the difference in the dependent variable for universities located in counties with less than 100,000 people vs. universities in counties with greater than one million people. A 0.037 change in the dependent variable is approximately 40 percent of the standard deviation. The coefficient on PRIVATE, -0.034, indicates that private institutions have a 0.034 lower proportion of female assistant professors than public institutions, which is approximately 36 percent of the standard deviation. The coefficients on ENDOW, DISPERM2, GENRAT4, and ENROLL in Table 5a show the change in the dependent variable for an increase of one in the explanatory variable. The coefficients would be more meaningful, however, if a five percent increase in the explanatory variable, for example, is used instead of an increase of one unit. Using the mean of ENDOW, $39,572, as a base, a five percent increase in ENDOW is approximately $2,000. Five percent is a reasonable number to use for the percentage increase in ENDOW since universities' endowments have grown by an average of five percent per year over the past decade or so. For a $2,000 increase in endowment, the dependent variable decreases by 3.8×10^{-5}, which is 0.04 percent of the standard deviation. Table 5b shows the effects of five percent increases in the other explanatory variables on the dependent variable.

Tables 7 and 8:

Unlike the models in Tables 3 through 6 and 9 through 18, the models in Tables 7 and 8 do not use probability-weights. The reason for using probability-weights is discussed in Chapter IV in the methodology for institutional regressions. To reiterate, the variance of the dependent variable is not constant across observations since the gender ratio for an institution with only 10 assistant professors will have a greater variance than the gender ratio for an institution with 30 assistant professors. The probability-weight is therefore used to give greater emphasis to the observations that have lower variances. Table 7 (1996 data) uses the same model as Table 5 except for the fact that probability-weights are not used in Table 7. The higher R-squared of 0.48 in Table 5 vs. the adjusted R-squared of 0.46 in Table 7 indicates that probability-weights improve the fit of the model by mitigating the effect of the dependent variable's changing variance across observations. ENROLL becomes more significant in Table 7 while ENDOW loses its significance. ENROLL is highly correlated with the probability-weight (the square root of the number of assistant professors in an institution) since institutions with a large number of students will also have a large number of assistant professors. By giving more weight to the observations with large enrollments, the probability-weighted regressions restrict the range of the ENROLL variable, which reduces its explanatory power.

ENDOW is significant in Tables 5 and 6 but not in Tables 7 and 8 because probability-weights emphasize large universities, and the endowment data is a better fit for these large institutions, which tend to have low values for ENDOW. In 1996, the mean of ENDOW for institutions that have 150 or more assistant professors (primarily state universities) is $19,938 with a standard deviation of $54,735, while the mean of ENDOW for institutions that have less than 150 assistant professors (mainly private institutions) is $60,773 with a standard deviation of $441,666. The endowment data is a better fit for larger institutions because there are small institutions such as Wake Forest University that have fairly high endowments yet also have a high proportion of female assistant professors. One possible reason for cases like Wake Forest has to do with the level of demand that assistant professor candidates have for an institution. It makes sense that, all else equal, assistant professor candidates would prefer to work at more prestigious universities, which usually have enough discretionary power to hire more males (Tolbert and Oberfield's theory of employer preferences). Because of this discrimination at the more prestigious universities, more women than men will seek employment in the less desirable institutions, resulting in higher proportions of female assistant professors at these less prestigious universities. This explanation should be tested in future research by including a measure of prestige in the model.

Tables 9, 10 and 11:

The models used in Tables 9 and 10 go back to using probability-weights and also replace ENDOW with RESEARCH. ENDOW and RESEARCH cannot be included together in the same model because the two variables are highly correlated with each other. RESEARCH is not as good a fit as ENDOW, although RESEARCH is significant in 1996 at the 10 percent level. The replacement of ENDOW by RESEARCH does not affect the coefficients of the other explanatory variables. RESEARCH is included in the model used in Tables 9 and 10 in order to test the theory that women have a preference for universities that emphasize teaching over research, but because of the correlation between RESEARCH and ENDOW, it is unclear whether the significance of RESEARCH supports this theory of employee preferences. In 1991, the fact that ENDOW is significant while RESEARCH is not makes it more likely that the theory of *employer* preferences is correct while the theory of *employee* preferences is not. In Table 11 (1996 data), the variable RESDUM and the observations that are missing RESEARCH are dropped from the model, leaving 193 observations. In the other tables, the observations with missing data are not thrown out and dummy variables are used. As explained in Chapter IV, the dummy variables allow all 233 observations to be used in the model. ENROLL, UNDER100 and RESEARCH are significant in Table 9 but not in Table 11, which suggests it is beneficial to keep the larger sample size by using dummy variables when there is missing data. The exception to this is the use of ENDOWDUM in 1991. When ENDOWDUM and the observations that are missing endowment data are dropped from the model in 1991, UNDER100 and ENROLL become significant. This means that the observations that are missing endowment data are correlated with unmeasurable explanatory variables that cloud the impact of UNDER100 and ENROLL.

Table 12:

The fixed-effects model is used to obtain unbiased estimates of the variables that cause assistant professor gender ratios to change over time, as explained in Chapter IV. The model was created by subtracting the 1991 values for each variable from the corresponding 1996 values for the variables. PRIVATE and the population variables drop out of the fixed-effects model since they do not change over time. In the individual-year institutional models, the disciplinary mix variable is subtracted from the student gender ratio variable because of the correlation problem between the two variables (Chapter IV). This transformation does not need to be done in the fixed-effects model, however, since the *change* in student gender ratios is not correlated with the *change* in disciplinary mix. The probability-weight used in the regression is the square root of the average of the number of assistant professors at each institution in 1996 and 1991.

The R-squared for the fixed-effects model is 0.03, indicating that the changes in faculty gender ratios over the five year period cannot be predicted by the variables in the model. One reason could be that five years is too short of a time period; the explanatory variables do not change by a large enough magnitude during that time to have an effect on the dependent variable. Future research should use a time period of at least 10 years for the fixed-effects model in order to see whether the changes in the explanatory variables over the 10 year period can better explain the change in the dependent variable.

It is also the case that the dependent variable is not sensitive to changes in variables such as ENDOW, judging by the size of the coefficient for ENDOW in the Magnitude of Results section. Faculty gender ratios are somewhat self-perpetuating, meaning that it would require a drastic change in ENDOW to significantly affect the dependent variable. It is interesting to note that, although they do not explain much of the variance, the changes in the disciplinary mix and student gender ratios are significant in Table 12. The change in TENURED is not significant, however, which lends support to the idea that TENURED does not have a direct effect on the dependent variable but is significant in Tables 3 and 4 only because it is correlated with unmeasured explanatory variables that do not change over time. When these unmeasured variables drop out of the fixed-effects regression, TENURED loses its explanatory power. The proportion of tenured faculty who are female was used as a proxy for the proportion of females who sit on hiring committees because that data was unavailable. Although it is unlikely that TENURED has a direct effect on the dependent variable, is it still possible that the theory behind the inclusion of TENURED is correct and TENURED is simply not an accurate proxy for the proportion of females on hiring committees.

Summary of Institutional Results

In 1996, ENDOW, RESEARCH, ENROLL, PRIVATE and UNDER100 are significant in the negative direction while DISPERM2 and GENRAT4 are significant in the positive direction. The fact that ENDOW is significant while REVENUE is not indicates that ENDOW is a better measure of an institution's discretionary power. The significance of ENDOW and ENROLL supports the theory that institutions with more resources and wealth will be able to hire more professors who are part of the preferred group (males). The significance of GENRAT4 supports the theory that the demands of constituents (students) have an effect on the composition of the faculty. Although RESEARCH is significant in 1996, it is unclear whether the argument that females prefer teaching institutions is true. Because RESEARCH is highly correlated with ENDOW, the significance of RESEARCH could actually support the discretionary power theory mentioned above. The fact that DISPERM2 is significant in 1996 indicates that the disciplinary mix calculations adequately control for the differing subject mixes across institutions. The significance of PRIVATE in 1996 indicates that public institutions are more responsive to gender equity considerations that private institutions. As found in Bach and Perrucci, 1984, the population variable UNDER100 is significant in 1996, supporting the theory that female professors are more concerned that male professors about residing in areas with job opportunities for their spouses. In 1991, PRIVATE, ENROLL, UNDER100, RESEARCH and DISPERM2 are not significant. Explanations for this lack of significance have been discussed earlier in this chapter. For the most part, the coefficients of these five variables in 1991, are in the same direction as the coefficients in 1996. Judging by the results from both 1996 and 1991, the strongest explanatory variables appear to be GENRAT4 and ENDOW.

Results for Departmental Regressions

The mean of the proportion of assistant economics professors who are female is 0.28 in 1998, with a standard deviation of 0.25 (Table 13). In 1993, the mean of the dependent variable is 0.27 and the standard deviation is 0.24 (Table 13). The gender ratio of the entire student body, GENDER, is used in the models for Tables 14 through 17, because it provided a better fit than rather than the gender ratio of economics students, GENECON. It was hypothesized that the departmental model would be a better fit than the institutional model since hiring decisions are made at the departmental level, and many of the considerations that assistant professor candidates take into account when deciding where to work are also on a departmental level. This hypothesis is incorrect, however, as can be seen from the very low R-squared values in Tables 14 through 17. Only four percent of the variance in the dependent variable is explained by the models used in Tables 14 and 16 (1998 economics data). None of the explanatory variables in the four departmental tables are significant, except for TENURED in Table 15 (1993 economics data). The statistical significance of an explanatory variable is conditional on the assumption that the model is correct, however, and since the R-squared value in Table 15 is only 0.15, the statistical significance of TENURED should be "taken with a grain of salt".

Explanations for the poor fit of the departmental models : One possible explanation for the poor fit of the departmental models is the small sample size. The 1998 and 1993 data sets have 87 and 76 observations, respectively, while the institutional data sets have 233 observations. The departmental sample sizes could cause a restricted range problem if universities that have similar characteristics make up the majority of the observations. By looking at Table 13, one can see that explanatory variables such as ENDOW and RESEARCH have much less variance than they do in the institutional data sets, which could cause these variables to lose their explanatory power, thereby worsening the fit of the model.

To test whether the poor departmental results could be explained by the small sample sizes, a 1996 institutional regression was run using only the 87 universities that are in the 1998 departmental data set (Table 18), and a 1991 institutional regression was run using only the 77 universities that are in the 1993 departmental data set (Table 19). In the 87-observation institutional regression (1996 data), ENROLL, PRIVATE and UNDER100 were no longer significant, so it is clear that the smaller sample size does affect the significance of certain explanatory variables. The R-squared value in Table 18, however, is not much lower than the R-squared for the same model with 233 observations (Table 5). The R-squared in Table 18 is 0.42, and the R-squared value in Table 19 is 0.39 (1991 data), which means that small sample size is not a likely explanation for the poor fit of the departmental models.

Another possible explanation for the poor fit of the departmental models is that there is too much noise in the dependent variable. The standard deviation of 0.25 for the 1998 dependent variable is much larger than the standard deviation of 0.06 for the dependent variable in the 1996 *institutional* regression. The reason for the greater variance in the departmental dependent variable is that the proportion of assistant economics professors who are female is based on a smaller number of professors than the institutional dependent variable is based on. The average number of assistant professors at an institution in 1996 is 214 (Table 2), and the average number of assistant *economics* professors at an institution in 1998 is five (Table 13). If both the institutional and departmental dependent variables are equal to 0.4 for a particular university that has 214 total assistant professors and five assistant economics professors, the hiring of one female assistant economics professor will cause the departmental dependent variable to increase by 0.1 while the institutional dependent variable will stay roughly the same. From this example, one can see that small changes in the number of female economics professors have a large effect on the departmental dependent variable. Much of the variance in the departmental dependent variable can therefore be attributed to randomness since the explanatory variables are not likely to differ significantly for an institution with two females out of five assistant professors vs. a university with three females out of six assistant professors.

A third possible explanation for the poor fit of the departmental models is that the explanatory variables actually do not have an effect on the hiring of economics professors, meaning that the gender composition of economics faculty is random. Perhaps the departmental model would better explain the hiring of assistant professors in other disciplines. For example, the preference for male professors could be absent in economics but could be a factor affecting faculty hiring in the hard sciences. If the departmental model does not fit any disciplines, however, it would contradict the results of the institutional regressions since it is not possible to have an effect at the institutional level that is not replicated in at least some departments. Future research should apply the departmental model to disciplines other than economics in order to determine whether the model is a better fit in these disciplines. If the model does not fit other disciplines, it would strengthen the second argument discussed above, which suggests that the dependent variable has too much noise because it is based on the fairly small number of assistant professors in a given department.

VI. Conclusions

The empirical findings demonstrate that the variation in the gender composition of assistant professors across institutions is not the result of chance but is influenced by certain institutional characteristics. The fact that particular types of institutions are predisposed to hire males has important implications for increasing the equity of women in academia. The significance of ENDOW in the institutional regressions supports the hypothesis of discriminatory preferences, which states that institutions with greater discretionary power can afford to offer higher compensation in order to attract more of the preferred gender (males). The significance of GENRAT4 supports Tolbert and Oberfield's second hypothesis, which states that the composition of the faculty is responsive to the composition of the student body. Because of the high correlation between RESEARCH and ENDOW, it is unclear whether the results of the institutional regressions support the hypothesis that women have a preference for universities that emphasize teaching vs. research. In the study by Tolbert and Oberfield, this hypothesis was not validated. In Bach and Perrucci's study, universities located in areas with a small population had a lower proportion of female faculty than universities in highly-populated areas. The significance of UNDER100 in the 1996 institutional regression supports this result. Other institutional characteristics that were found to affect the gender composition of assistant professors are disciplinary mix, which is included in the model as a control variable, and PRIVATE, which supports the theory that governmental scrutiny of public institutions causes these institutions to be more responsive to gender equity considerations than private universities.

The purpose of this thesis is to explain the variation in gender ratios across institutions, without taking into account the underrepresentation of women in certain PhD disciplines, which is another topic entirely. This analysis looks for reasons that universities deviate from the mean proportion of female assistant professors; The fact that the mean itself might be too low is an issue that was not studied. Understanding the reasons for the variation in gender ratios across institutions is important since the concentration of female assistant professors in certain types of universities impacts upon other gender equity issues in academia.

The results of the institutional regressions show that female assistant professors are disproportionately found in poorer, public institutions, which contributes to gender differences in earnings, career patterns and other occupational outcomes. Attempts to reduce the variation in gender ratios across institutions should focus on improving the representation of women in wealthy private institutions. Private institutions may not be as responsive to gender equity regulations as public institutions because private universities receive a smaller share of their funding from the government. One way of increasing the representation of women in wealthy private institutions would be to make these institutions more accountable to the government.

If universities themselves wish to increase female representation in their faculty, one way of doing so would be to make sure that there are high-level academic administrators who believe in the goal of increasing female representation. Although faculty hiring is largely decided by current members of the faculty, administrators have legal authority over the process, and the promotion of equal opportunity policies by these administrators should result in more female faculty being hired. In fact, Bach and

Perrucci, 1984, found that the percentage of women deans at a university was positively correlated with the percentage of women faculty.

Future Research

Although it was hypothesized that the departmental model would be a better predictor of faculty gender ratios than the institutional model because many decisions are made at the departmental level, this hypothesis proved to be incorrect. It is likely that the low R-squared of the departmental model stems from the fact that the small number of assistant economics professors at universities creates noise in the dependent variable, as explained in Chapter V. Future research should test the departmental model on other disciplines to see whether it is a better fit. If the departmental model does not fit any of the other disciplines, perhaps related disciplines could be grouped together and then tested. For example, all humanities departments could be tested together, which would increase the number of assistant professors in the sample and hopefully get rid of much of the noise in the dependent variable.

In the institutional results, ENROLL, RESEARCH, UNDER100, PRIVATE and DISPERM2 were significant in 1996 but not in 1991. Because the model was only run on two years of data, it is hard to determine which set of results is more accurate. The institutional model should therefore be tested on additional years in order to see which explanatory variables are significant in most years. A measure of prestige should be added to the model, as discussed in Chapter V, because the effect of prestige needs to be controlled for in order to make the endowment variable more accurate. Finally, the fixed-effects model should be run using a time period of at least ten years so that the changes in the explanatory variables are of a large enough magnitude to affect the results. If the R-squared value is still low when the longer time period is used, that could indicate that faculty gender ratios are self-perpetuating, meaning that gender ratios will stay roughly the same from year to year. This could occur because, for example, it will be hard to attract female assistant professor candidates to an excessively male department, even if the department is committed to increasing the representation of women; Not many women would be willing to be one of the first token females, so the underrepresentation of women in the department is perpetuated from year to year.

The variation in faculty gender ratios across institutions affects many other aspects of gender equity in academia, and consequently, further research is needed in order to better understand the drivers of such variation.

VII. References

Bach, Rebecca and Carolyn Perrucci. "Organizational Influences on the Sex Composition of College and University Faculty: A Research Note." Sociology of Education 57 (1984): 193-98.

Basow, Susan and Nancy Silberg. "Student Evaluations of College Professors: Are Female and Male Professors Rated Differently?" Journal of Educational Psychology 79 (1987): 308-14.

Benjamin, Ernest. "Disparities in the Salaries and Appointments of Academic Women and Men." Academe Jan-Feb (1999): 60-62.

"County Population Estimates for July 1, 1998." U.S. Census Bureau Accessed April 2000. <http://www.census.gov/population/estimates/county/co-99-1/99C1_00.txt>.

Ehrenberg, Ronald. "Academic Labor Supply." *Economic Challenges in Higher Education.* Ed. Charles Clotfelter et al. U of Chicago Press, 1991: 215-232.

Ferber, Marianne and Betty Kordick. "Sex of Study and Instructor: A Study of Student Bias." American Journal of Sociology 80 (1975): 940-63.

Johnson, George and Frank Stafford. "The Earnings and Promotion of Women Faculty." American Economic Review 64 (1974): 888-903.

"Metropolitan Area Population Estimates for July 1, 1998." U.S. Census Bureau Accessed April 2000. <http://www.census.gov/population/estimates/metro-city/ma98-01.txt>.

"National Science Foundation Surveys." WebCASPAR Database Accessed March 2000. <http://caspar.nsf.gov/>.

"National Center for Education Statistics Surveys." WebCASPAR Database Accessed March 2000. <http://caspar.nsf.gov/>.

Perrucci, Carolyn. "Gender Equity in Sociology Faculty Employment Patterns: A Cross-University Comparison." Sociology and Social Research 70. (1986): 235-41.

Szafran, R.F. "A Note on the Recruitment and Reward Equity of Organizations: U.S. Universities Before Affirmative Action." Social Forces 61. (1983): 1109-1118.

Tolbert, Pamela and Alice Oberfield. "Sources of Organizational Demography: Faculty Sex Ratios in Colleges and Universities." Sociology of Education 64 (1991): 305-15.