

Women in Economics: Moving Up or Falling Off the Academic Career Ladder?

Donna K. Ginther and Shulamit Kahn

The percentage of economics doctorates awarded to women increased from 8.7 percent in 1974 to 26.9 percent in 2000, according to data from the National Science Foundation (NSF) Survey of Earned Doctorates. This article considers whether the corresponding increases of women economists that one might expect as women move up the academic career ladder have occurred. A number of studies based on data through the 1980s find that women economists are less likely to be promoted to tenure than men (Kahn, 1993; Broder, 1993; McDowell, Singell and Ziliak, 1999, 2001) and that these differences are not fully explained by observable characteristics. Other recent studies on Sweden and the United Kingdom find that women are underrepresented in tenured academic ranks in economics there (Persson, 2002; Booth, Frank and Blackaby, 2002). However, relatively little is known about women economists' academic employment outcomes in the United States during the most recent decade. Our study draws upon several empirical approaches and multiple data sets for the 1990s. We find that when compared with other academic disciplines, women in economics are less likely to get tenure and take longer to achieve it. Although gender differences in productivity and the effect of children on promotion partly explain women's lesser chances of receiving tenure in economics, a significant portion of the gender promotion gap remains unexplained by observable characteristics.

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The Academic Career Ladder: Economics and Other Disciplines

Education: Stepping Onto the Career Ladder

Both economics and the sciences require mathematical skills and analytical abilities that attract people with a comparative advantage in these skills. Thus, the natural disciplines with which to compare economics are statistics, the physical sciences, the life sciences and engineering—along with political science, which is the social science we consider the closest to economics. Figure 1 shows the share of doctorates granted to women in these fields since 1974. Data on Ph.D.'s granted and on the sector of first job for economics and other fields are from the National Science Foundation (NSF) 1974–2000 Survey of Earned Doctorates (SED), a census of doctorates granted in the United States.

A significantly larger percentage of women obtain doctorates in the life sciences, political science and statistics than in economics, whereas the percentage of women obtaining doctorates in the physical sciences is similar to economics. Engineering awards a lower percentage of doctorates to women than any other discipline. In general, the rankings of these fields in terms of the share of doctorates received by women has not changed since 1974, although statistics and the life sciences have experienced the largest percentage point changes.

The percentage of doctorates granted to women in the humanities and the noneconomics social sciences is not shown here, but it was around 30 percent in 1974 and roughly 50 percent by 2000.

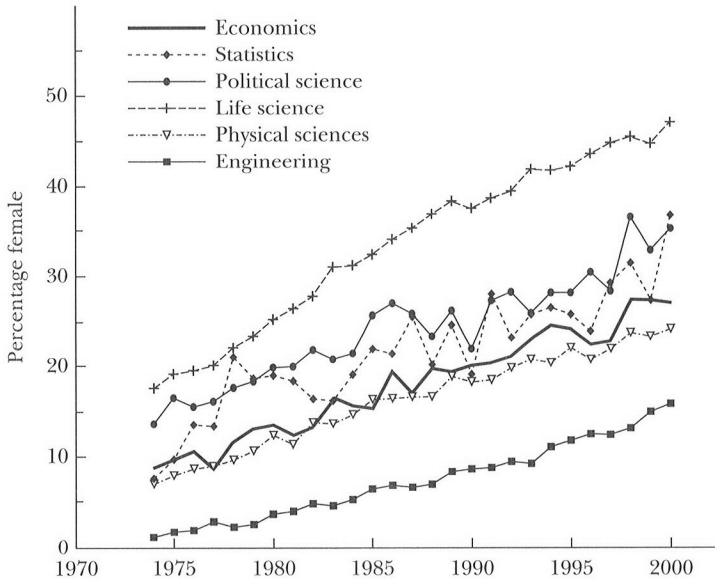
The last few years, however, growth in economics doctorates granted to females has slowed or stopped. In Figure 1, the economics line flattens out in 1999 and 2000. This flattening out is confirmed by data from an annual survey done by the Committee on the Status of Women in the Economics Profession (CSWEP) of the American Economic Association. CSWEP finds that the percentage of economics doctorates received by females has stabilized between 27 and 30 percent for the past six years (except for 1999, whose 34.2 percent female seems an anomaly). Data on first-year graduate students in economics predicts further drops among graduates in the coming years, particularly at top schools.

Women's Representation in Academia

How are these trends in doctorates received by women reflected by the academic rank achieved?

Figure 2 shows the percentage of female faculty by academic rank in economics, based on data from the AEA/CSWEP surveys that gather data from Ph.D.-granting economics departments. For some years the AEA conducted a Universal Academic Questionnaire (UAQ), but these data are not consistent because different departments respond each year. Therefore, CSWEP began its own survey in 1993, which has a higher response rate and more consistency, and it is used when

Figure 1
Percentage of Doctorates Granted to Females, 1974–2000 Survey of Earned Doctorates



Source: 1974–2000 Survey of Earned Doctorates.

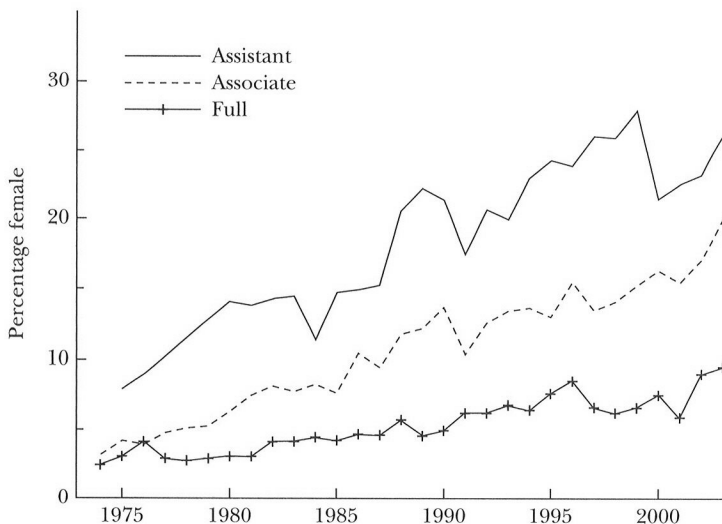
available. The two series are adjusted to be continuous.¹ In both panels, we use the data on the percentage female in various ranks because given the year-to-year variations in the surveys, the percentages are likely to be more consistent than absolute numbers.

The series for assistant professors is very irregular. The percentage female grows during the late 1970s and the late 1980s. The 1990s data shows a steady rise for most of the decade, but then a sharp decline in 2000 and a bounce back through 2003. The data series among associate professors show overall growth, particularly from 1985 through 1990. Yet in the early 1990s, when we might have expected even more growth due to increasing associates in the previous decades, the growth virtually stopped. There has been some growth in the percentage of female associate professors since the mid-1990s and an acceleration in growth since 2000. Finally, the percentage of full professors who are female has risen very slowly from decade to decade, often stagnating for years at a time. The 1990s showed very little if any growth in full professors, although there may have been some growth in the last two years.

Figure 3 shows the percentage of tenured faculty who are female in economics

¹ We multiplied all of the earlier UAQ percentages female by the ratio of CSWEP/UAQ percentage female in the overlapping years.

Figure 2

Percentage of Female Economists in Academic Rank

Source: 1973–2003 AEA/CSWEP Surveys.

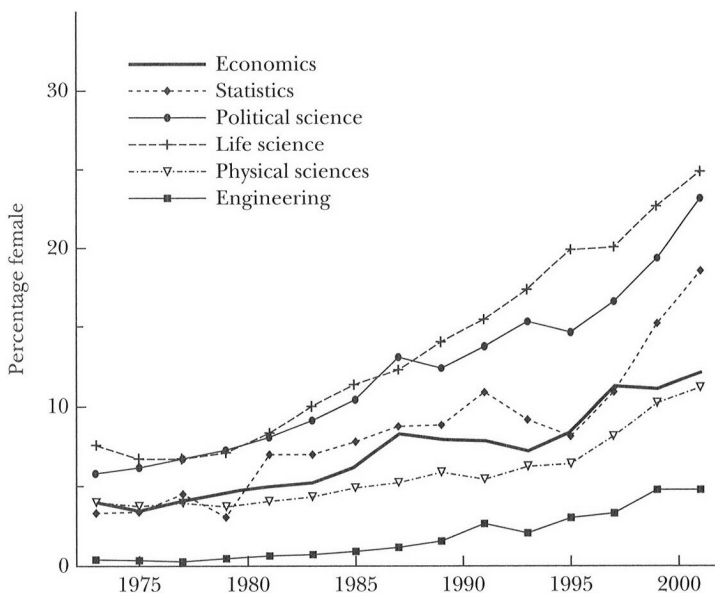
compared to other science and social science disciplines, using data from the Survey of Doctoral Recipients, a biennial longitudinal survey of doctorate recipients from all U.S. institutions of higher education conducted by the NSF.² Economics has a lower percentage of tenured female faculty than the life sciences, political science or statistics and a higher percentage than engineering, with comparable levels for physical science. Between 1987 and 2001, the percentage of tenured faculty who were female grew more slowly in economics than in the sciences, engineering, political science and statistics. More recent data from CSWEP indicate that in 2003, the percentage female among tenured professors of economics remained about 12 percent at Ph.D.-granting departments. These data suggest that the growth in the representation of women in tenured academia in economics has slowed relative to other fields.

We carried out a rough calculation of what the percentage of tenured female faculty *would* have been by 2003 as predicted based on Ph.D.'s granted, assuming

² The SDR data can also be used to discuss differences in assistant, associate and full professors as in Figure 2. Many of the patterns in the SDR data are similar to the CSWEP data, which has considerably broader coverage, but some differences exist. For assistant professors, the SDR data show a flatter pattern in the 1990s, rather than a rise and fall. For associate professors, the timing of the increase percentage female in the 1990s starts a few years earlier in the SDR data. For full professors, the SDR percentages are very volatile in the 1990s. But the sample of SDR females is small, and the women who are full professors are less than 10 percent of this small sample, so this time series is likely to be very noisy. Given data problems with each series, the differences between the sources might be random. However, they might also represent real differences between Ph.D.-granting economics departments and other four-year academic institutions and departments hiring economists.

Figure 3

Percentage of Tenured Faculty who are Female, by Discipline



Source: 1973–2001 Survey of Doctorate Recipients.

that women and men progressed through academic careers at the same pace and with the same mobility and retirement patterns mirroring the “typical” careers of academics who get tenure. This calculation predicts well the actual rise in tenured female Ph.D. economists from the early 1970s up to about 1988. But after that point, the calculation predicts that the percentage of economics faculties that are tenured women should have increased to about 19 percent in 2003, while the actual percentage was only about 12 percent. In the next section, we examine the tenure process in detail to understand why the steady growth in economics Ph.D.’s granted to women has not translated into a corresponding increase in tenured women faculty.

Gender Differences in Career Attainments in Economics and Other Disciplines

Longitudinal data that track individuals across time is best for studying developments of individual careers and the granting of tenure. We have constructed two longitudinal data sets of economics professors, both of which include variables about professors and their employers, which can help in calculating whether observable factors might explain gender differences in attaining tenure.

Our first longitudinal data set is based on the 1973–2001 waves of the Survey

of Doctoral Recipients. We draw upon the SDR to create a data set of individuals who received their Ph.D. in economics between 1972 and 1991, are observed at some point to be working in a tenure-track academic job and are observed in the survey at least ten years after Ph.D. receipt. The longitudinal sample includes 320 economists, of whom 93 are female. In the SDR, time until tenure is measured as the duration from Ph.D. until promotion to tenure, conditional on having a tenure-track academic appointment after receiving the doctorate. Time-varying covariates such as employer characteristics, marital status and primary work activities are measured as the proportion of surveyed years an individual meets each condition; for example, the variable, the proportion of time employed at a private institution, is defined as the number of times we observe an individual working at a private college or university divided by the total years this person is observed in the survey within 10 years of receiving their doctorate.³ Measures of academic productivity are largely missing from the SDR data, but the SDR does ask questions about publications in the 1983, 1995 and 2001 surveys. The 1983 question refers to publications between 1980 and 1983, whereas the 1995 and 2001 questions refer to numbers of publications in the previous five years. We use these data to create rough measures of productivity in the 10 years following the doctorate. If productivity data are missing for a particular year (as they are prior to 1980), average observed productivity is used to impute total productivity—an admittedly rough correction that nevertheless seems preferable to omitting the information altogether.

Our second longitudinal data sample Ph.D. economists who were assistant professors in Ph.D.-granting economics departments in the United States and Canada in 1988 and/or 1989 and had received Ph.D.'s during the 1980s. The names were randomly chosen from the 1989 AEA Directory and gender-stratified to ensure a roughly equal number of women and men. Specifically, by examining the 1989 AEA Directory we identified 95 female and 93 male assistant professors in Ph.D.-granting economics departments. Because of the scarcity of women in this category, this task required searching more than 90 percent of the AEA Directory pages. Career information on these 188 Ph.D. economists was obtained from the Internet and from subsequent AEA directories, including information on Ph.D. education, employers, rank and tenure status at a North American university or

³ The SDR has undergone substantial changes between the 1977 and 1993 waves (Mitchell et al., 1998). Technical reports provided by the National Science Foundation have allowed us to construct a longitudinal data set with consistent variable definitions and sampling frames over time. For example, individuals are excluded from the sample if they are not observed more than once or if they skip more than three surveys and do not report the year they received tenure. Individuals with missing or inconsistent data were dropped from both samples. The SDR sample does include individuals who no longer reside in the United States. Using the 1973 through 1991 surveys, we observe the exact tenure year. After 1991, we impute tenure year when people in the subsequent surveys report being tenured. Even though we have to impute tenure year for the later surveys, this is a better measure of promotion than changes in rank because we can only observe rank changes every other year. An appendix describing the data construction and variable definitions is available from the authors upon request.

college each year. Each person was matched with annual publication data from *EconLit*. Publications were categorized into four categories: top-10 journals (based on Laband and Piette, 1994, Table 2), other journals, book chapters and books (edited or authored). Working papers and other unpublished manuscripts were not included. Citations were calculated (excluding citations to oneself) and were collected from the *Social Science Citation Index*. The quality tier of the Ph.D.-granting department (a proxy for ability) and employing department are based the AEA's Committee on Graduate Education from this period (Hanson, 1991). The top tier contains the top six economics departments, the second tier, departments 7–16. Finally, to fill in missing information and to get a better sense of the reasons behind the specific career development of these economists, e-mail surveys were sent to those economists who were no longer at the same institution that they were in 1989 and had left that institution untenured.

It is useful to sum up the major differences between these two longitudinal samples. The SDR sample has a wider range of cohorts since it includes people who received doctorates between 1972 and 1991, while the sample of assistant professors in 1989 includes only people who received Ph.D.'s during the 1980s. The SDR sample includes all economics Ph.D.'s who held tenure-track jobs in any academic institution at any point 1973–2001, while the assistant professor sample includes only economics Ph.D.'s who held an assistant professorship in a Ph.D.-granting economics department during the late 1980s. In addition, the two data sets have different explanatory variables; for example, the SDR has more information on family status and demographic characteristics, while the sample of assistant professors has more detailed data on publications, citations and department rankings. The sample sizes of economists in each of these longitudinal sources are small, and so the results presented below must be interpreted with caution.

Descriptive Statistics by Gender

Table 1 gives descriptive statistics from the two data sets for male and female economists. Numbers in bold indicate statistically significant gender differences. In the SDR data, women are significantly less likely to get tenured and those who do take about a year longer to achieve tenure. Ten years after the Ph.D., 68 percent of the male economists but only 47 percent of female ones have tenure. Although men publish more than women in the SDR sample, the differences are not statistically significant. Key differences between men and women are that women are significantly less likely to be married and have children. In the assistant professor sample, tenured women also take a year longer to achieve tenure. The difference in the percentage tenured 10 years after the Ph.D. is smaller and less significant than in the SDR, presumably because of differences in sample construction and size, but the same general conclusion holds: fewer women received tenure than men. Notably, men publish more than women, particularly in non-top-10 journals. These patterns suggest two possible explanations for why the proportion of tenured women in economics is so low: family responsibilities and publication patterns. The next sections will examine these possible explanations in more depth.

Table 1
Average Characteristics by Gender

<i>1973–2001 Survey of doctorate recipients</i>			<i>1988/1989 Assistant professors in Ph.D.-granting departments (1980–2001)</i>		
<i>Control variables</i>	<i>Males</i>	<i>Females</i>	<i>Control variables</i>	<i>Males</i>	<i>Females</i>
Age 10 years post-Ph.D.	41.264	42.387	Ph.D. from top-6 economics department	0.247	0.316
African American = 1	0.075	0.075	Ph.D. from 7–15 economics department	0.301	0.347
Other race = 1	0.141	0.172	Year of Ph.D.	85.57	85.126
Foreign born = 1	0.260	0.280	Macroeconomics	0.333	0.379
			Labor economics	0.161	0.200
<u>Variables measured 10 years post-Ph.D.</u>			Econometrics	0.183	0.147
Proportion married	0.708	0.505	Theory	0.172	0.105
Children = 1	0.648	0.559	Agricultural economics	0.140	0.126
Young children	0.288	0.185	First job in private institution	0.434	0.400
Proportion research	0.292	0.335	First job in top-6 economics department	0.054	0.105
Proportion teaching	0.602	0.550	First job in 7–15 economics department	0.086	0.105
Proportion management	0.066	0.047	<u>Variables measured 10 years post-Ph.D.</u>		
Government support	0.178	0.226	Number of employers	1.817	1.916
Proportion private institution	0.385	0.363	Top-10 journal articles	1.323	0.989
Number of employers	1.846	1.828	Other journal articles	8.710	4.895
Year of Ph.D.	81.899	81.323	Nonjournal publications	1.968	1.484
Papers	6.238	6.770	Citations	40.892	38.000
Publications	5.799	5.136	Present job in top-6 economics department	0.032	0.053
			Present job in 7–15 economics department	0.064	0.084
<u>Tenure and related variables</u>			<u>Tenure and related variables</u>		
Average years to promotion	7.473	8.484	Average years to tenure	7.033	8.322
Tenured 10th year post-Ph.D.	0.683	0.473	Tenured 10 th year post-Ph.D.	0.570	0.463
Tenured as of 2001	0.819	0.688	Tenured as of 2001	0.645	0.568
Years experience since Ph.D. as of 2001	19.101	19.677	Years experience since Ph.D. as of 2001	15.376	15.8
In U.S. academia 10th year post-Ph.D.	0.894	0.860	In U.S./Canadian academia 10 th year post-Ph.D.	0.677	0.737
Sample size	227	93	Sample size	93	95

Notes: Numbers in bold indicate averages significantly different at five percent level of significance. See text on variable construction.

Sources: 1973–2001 Longitudinal Sample from the SDR; Sample of Assistant Professors in 1988/1989.

Gender Differences in Publications in the Assistant Professor Sample

Can differences in publications explain different tenure rates for women economists? The assistant professor survey is better suited for comparing publications because it has data for publications in every year. As the averages in Table 1 illustrated, women have fewer publications than men at com-

parable years from Ph.D. receipt, although only the “other journal” publications are significantly different. Table 2 presents regression results where the dependent variable is whether the person has received tenure after ten years.⁴ The first three columns use the entire sample, the other columns only those in academia in the United States and Canada, where academic tenure systems are similar. The first column again shows the overall size of the gender differences. Column B shows that the gender difference does not change with controls for cohort and for differences observable in the beginning of an academic career—the tier of Ph.D. institution, the tier of the first job and field, with agricultural economics being the only field that affects tenure rates. However, adding controls for publications (column C) erases this gender difference.

The other columns limit analysis to those remaining in academia in the United States or Canada 10 years from Ph.D. In this case, gender differences in tenure rates are twice as large as with the full sample. Publications account for between 23 to 30 percent of this gender difference, depending on the specification. Even with all controls, unexplained gender differences in tenure rates are more than 13 percent.

When looking at the impact of publications, the academic sample is more relevant since it is reasonable to believe that publications decline drastically for those who leave academia. Consequently, for people leaving academia, publications are more a result of not receiving tenure than a cause. An alternative methodology is hazard analysis in which leavers are not dropped, but instead censored at the point they leave academia. Using this alternative, we have graphed the likelihood of remaining without tenure as years pass, controlling for all variables including publications in Figure 4.⁵ At 10 years past Ph.D., 37 percent of women and only 12 percent of men remain without tenure.

Citations may measure a person’s reputation, and tenure decisions often rest on an assessment of reputation by senior colleagues in the field. Column G in Table 2 shows that cumulative citations are not correlated with tenure receipt, once publications and the other covariates are controlled for. Also, although women’s slower progress is often attributed to reputational factors, analysis of the citation data shows that women have more citations per publication, whether measured in terms of top-10 publications, journal publications or total publications.

Employer variables in the assistant professor survey data set are the prestige of the department converted into variables describing current and first department, whether the institution is private or public, whether it is a Ph.D. department and

⁴ We also replicated results using probit analysis, and the qualitative results were similar to those reported here. For simplicity of exposition, we focus in this paper on the linear probability regressions.

⁵ We estimated a proportional hazards model where duration until tenure was a function of year of Ph.D., Ph.D. from a top-6 department, Ph.D. from a top-7–15 department, an indicator for agricultural economist, currently employed at a top-6 department, publications in top journals and other publications. As would be expected, the significance of the gender tenure differential was between the two analyses reported in the text, as was the impact of publications on this differential. The comparable graph from the SDR data, shown in the first panel of Figure 5, is very similar.

Table 2

**Linear Probability Estimates of Promotion to Tenure 10 Years Post-Ph.D.,
Survey of 1989 Assistant Professors**

Variables	Full sample				In North American academia				H:	
	A	B	C	D	E	F	G	Female coef.	H: Male coef.	
Female	-0.107 (0.073)	-0.109 (0.071)	-0.051 (0.068)	-0.213 (0.075)	-0.187 (0.074)	<u>-0.130</u> (0.075)	<u>-0.135</u> (0.073)			
Year of Ph.D.		-0.019 (0.014)	-0.022 (0.013)		0.019 (0.014)	0.008 (0.014)	0.010 (0.015)	0.010 (0.020)	-0.001 (0.022)	
Ph.D. from top-6 economics department		-0.118 (0.090)	-0.202 (0.088)		-0.093 (0.095)	-0.155 (0.095)	<u>-0.169</u> (0.094)	<u>-0.295</u> 0.154	-0.052 (0.118)	
Ph.D. from 7-15 economics department		-0.175 (0.085)	-0.250 (0.083)		<u>-0.148</u> (0.089)	-0.191 (0.088)	-0.197 (0.087)	-0.173 (0.126)	<u>-0.231</u> (0.122)	
Agricultural economist		0.271 (0.133)	0.310 (0.102)		0.289 (0.105)	0.304 (0.103)	0.302 (0.101)	0.394 (0.156)	0.152 (0.133)	
First job in top-6 economics department		0.271 (0.133)	0.287 (0.127)		0.104 (0.124)	0.157 (0.123)	<u>0.229</u> (0.136)	0.495^b (0.184)	-0.235 ^b (0.204)	
Cumulative top-ten journal articles ^a			0.052 (0.017)			0.036 (0.016)	0.037 (0.018)	0.045 (0.035)	0.024 (0.020)	
Cumulative other journal articles ^a (log)			0.037 (0.011)			0.034 (0.016)	0.026 (0.016)	0.027 (0.018)	0.086 (0.063)	
Cumulative citations (log)							0.035 (0.028)	0.057 (0.043)	0.011 (0.036)	
Presently working in a top-6 department ^a							-0.359 (0.171)	-0.481 (0.236)	-0.139 (0.259)	
Intercept	0.570 (0.052)	0.698 (0.106)	0.640 (0.099)	0.841 (0.055)	0.754 (0.106)	0.711 (0.100)	0.637 (0.107)	0.415 (0.138)	0.674 (0.174)	
R-squared	0.011	0.106	0.210	0.057	0.156	0.223	0.263	0.337	0.214	
Adjusted R-squared	0.006	0.076	0.174	0.050	0.116	0.172	0.203	0.238	0.080	
Sample size	188	188	188	133	133	133	133	70	63	

Notes: Standard errors in parentheses. **Bold** indicates significant at 1 percent level. *Italics* indicates significant at 5 percent level. Underline indicates significance at 10 percent level.

^a Variables measured 10 years post-Ph.D.

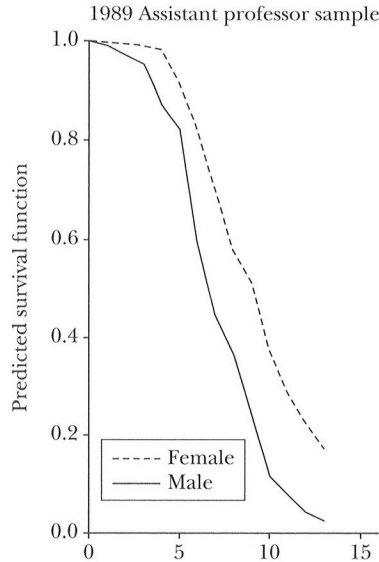
^b Gender difference significantly different at the 5 percent level.

Other variables excluded because they were insignificant in all specifications are the fields of labor, econometrics, micro theory and macroeconomics/international finance, whether an institution is private or public, other gradations of tier of Ph.D. and present department. The functional forms used for publications and citations were those that fit the regression best. For scaling, Ph.D. year subtracted 1980.

whether the current employer is an economics department rather than a business school or an agricultural economics department, for example. Only department prestige variables are significant determinants of tenure outcomes. It is more difficult for people to get tenure in a top six department, but people starting in these departments nevertheless are more likely to get tenure *somewhere* by the 10th year (column G). When coefficients for men and women are not constrained to be the same, starting in these prestigious departments increases ten-year tenure probabilities more for women than for men (column H).

Top Ph.D. programs try to admit students with the most potential, yet in the 1989 assistant professor sample, graduates of the top 15 Ph.D. programs did not have better tenure prospects and actually had worse ones, with or without control

Figure 4

Predicted Likelihood of Remaining Without Tenure, by Gender, Ph.D. Economists

Source: 1989 APS; Based on hazard model estimates.

variables. Two possibilities suggest themselves for this anomalous result, with very different implications. On the one hand, it could have been due to affirmative action in education or in the hiring process at the more highly ranked institutions. Alternatively, it could indicate more discriminatory promotion practices at more prestigious schools.

Fields make little difference to tenure rates and also make little difference to publication rates. The exception is agricultural economists, who are more likely to receive tenure and more likely to have non-top-10 journal articles. They, as well as macroeconomists, have lower citations controlling for the different kinds of publications. These relationships do not differ by gender, nor do women and men have significant differences in field or quality of Ph.D. department.

When we model men's and women's tenure rates in separate equations (column H), another striking finding appears. The covariates explain far more of the variation in tenure rates for women than for men in the assistant professor data set. Indeed, we cannot say with statistical confidence that the regression as a whole is useful for predicting men's tenure rates, although it is highly significant for women.⁶ It seems that once men have assistant professor status in economics, they get tenure irrespective of their publications, citations or background, while women who are assistant professors of economics only receive tenure based more on observable traits.

⁶ For the male equation, Prob > F = .14. For the female, Prob > F = .002.

Examination of the assistant professor survey indicates that the particular juncture where the women fall off the tenure ladder occurs at a woman's first academic job. The gender difference in being tenured at one's *original* academic institution is very large. By 10 years out, 60 percent of men are tenured at their original department while only 33 percent of women are, a highly significant difference. Women manage to close some of this large gap in tenure rates at the original institution by finding tenured jobs elsewhere. Consistent with this, women in the assistant professor survey moved jobs somewhat more than men. By 10 years after Ph.D., 72 percent had moved from their first employers, compared with 65 percent of men. Limiting the sample to those remaining in U.S./Canadian academia, gender differences in mobility were larger and significant, with 61 percent of women no longer at their first job compared with 47 percent of men. Of course, mobility could either result from nonreceipt of tenure or cause it. The evidence suggests that this mobility was *not* the cause of differential tenure rates at original institutions, since looking at those remaining at their first job, 32 of the 33 men had tenure, but only 19 of the 27 women did.

Another way to evaluate academic careers is to look at the likelihood that economists who began their careers in academia remained in academia but untenured. Women are significantly more likely to be *untenured* in academia in the assistant professor survey. The gender differences are very large and significant, although they do taper off over time: 19 percent after eight years, 16 percent after ten years and 12 percent after twelve years. Once we add controls for initial characteristics, subsequent productivity and reputation and department, the eight- and ten-year differences remain significant and large—14 percent and 12 percent respectively, but the twelve-year difference drops to 7 percent.

The Impact of Personal Characteristics in the SDR Survey

The SDR data include detailed background marriage, family and employer characteristics, and thus they are well-suited for examining these issues. Although male economists are more likely to be married and have children, the effects of marriage and children differ by gender.

In the entire SDR sample, Table 3 indicates in column A that men economists have a 20 percent greater probability of having tenure ten years after Ph.D. receipt than women, a result that is statistically significant at the 1 percent level. Including demographic variables reduces the negative impact of gender by two percentage points (column B). When controls are added for publications, the gender promotion gap is reduced to 17 percent (column C). Additional controls for primary work activity and employer characteristics reduce the promotion gap to 15 percent ten years after doctorate (column D).

We perform a separate analysis for those in U.S. academia—a sample that omits individuals who have left academic careers—in columns E and F. In the SDR, slightly more women have left academia than men. Thus, calculating tenure probabilities dropping those no longer in academia overestimates tenure rates in general and underestimates gender differences in promotion in the SDR sample.

Table 3

Linear Probability Estimates of Promotion to Tenure 10 Years Post-Ph.D., 1973–2001 Survey of Doctorate Recipients

Variables	Full SDR sample				In U.S. academia			
	A	B	C	D	E	F	G Female	H Male
Female	-0.199 (0.058)	-0.181 (0.058)	-0.174 (0.060)	-0.146 (0.058)	-0.201 (0.059)	-0.159 (0.060)		
Age 10 years post-Ph.D.		0.013 (0.005)	0.016 (0.006)	0.009 (0.006)		0.003 (0.006)	0.001 (0.010)	0.010 (0.008)
African American = 1		-0.202 (0.098)	-0.139 (0.102)	-0.079 (0.099)		<u>-0.062</u> (0.104)	0.017 (0.216)	-0.126 (0.118)
Other race = 1		0.024 (0.087)	0.058 (0.089)	-0.010 (0.087)		0.007 (0.088)	-0.018 (0.165)	-0.016 (0.104)
Foreign born = 1		-0.043 (0.071)	-0.048 (0.073)	-0.005 (0.071)		-0.017 (0.071)	0.008 (0.141)	-0.022 (0.085)
Proportion married ^a		0.133 (0.086)	0.117 (0.087)	0.090 (0.084)		0.088 (0.085)	-0.029 (0.148)	0.156 (0.108)
Children = 1 ^a		-0.056 (0.074)	-0.049 (0.074)	-0.035 (0.072)		-0.030 (0.074)	<u>-0.226</u> ^b (0.136)	0.030 ^b (0.088)
Young children ^a		<u>0.216</u> (0.111)	0.226 (0.111)	0.214 (0.107)		<u>0.194</u> (0.106)	0.159 (0.250)	<u>0.210</u> (0.122)
Year of Ph.D.		0.007 (0.005)	0.004 (0.006)	0.002 (0.006)		0.004 (0.006)	0.010 (0.011)	-0.005 (0.007)
Papers ^a			-0.002 (0.005)	0.000 (0.005)		-0.001 (0.005)	-0.003 (0.010)	0.002 (0.007)
Publications ^a			0.011 (0.006)	0.018 (0.006)		0.016 (0.006)	0.029 (0.012)	0.016 (0.007)
Proportion private institution ^a				0.095 (0.061)		0.072 (0.062)	0.072 (0.144)	<u>0.270</u> (0.071)
Proportion teaching ^a				0.297 (0.083)		0.264 (0.083)	0.186 (0.181)	0.276 (0.099)
Proportion management ^a				0.132 (0.179)		0.214 (0.181)	0.441 (0.416)	0.005 (0.202)
Number of employers ^a				-0.070 (0.030)		-0.067 (0.030)	<u>-0.115</u> (0.065)	<u>-0.060</u> (0.035)
Government support ^a				-0.074 (0.097)		-0.065 (0.099)	-0.144 (0.202)	-0.131 (0.121)
Intercept	0.664 (0.031)	-0.497 (0.418)	-0.462 (0.474)	-0.098 (0.469)	0.742 (0.031)	0.035 (0.490)	-0.423 (0.995)	0.329 (0.556)
R-squared	0.034	0.106	0.118	0.207	0.038	0.183	0.276	0.190
Sample size	337	330	320	320	298	283	93	227

Notes: Standard errors in parentheses. ^a Variables measured 10 years post-Ph.D. ^b Gender difference significantly different at the 10 percent level.

Bold indicates significant at 1 percent level. *Italics* indicates significant at 5 percent level. Underline indicates significance at 10 percent level.

As it turns out, the results in the SDR do not differ qualitatively by whether one includes the entire sample or only those who have remained in academia. In both sets of estimates, women are about 15 percent less likely to be promoted to tenure after controlling for all variables. Part of the reason for this similarity is that the SDR sample has already censored people once they leave the United States—which includes a substantial share of those who leave academia. (In contrast, in the assistant professor survey with its more detailed and accurate publication data, the

impact of publications differs when using the entire sample or the sample just in academia.)

Overall, the regressions in columns D and F suggest that along with women, African-Americans and the foreign-born are less likely to be promoted, although the effects are smaller than being female. Young children have a positive and significant effect on tenure as do publications and working primarily as a teacher. Having a large number of employers reduces the likelihood of promotion.

These regressions mask some important gender differences in the impact of these variables on tenure. The last two columns of Table 3 present estimates that allow coefficients on all explanatory variables to differ by sex. (Results in these columns include everyone in the sample, not just academics.) Family variables have a differential impact on men and women. Male economists are more likely to be married and have children. As shown in columns G and H, young children increase men's promotion chances, while both marriage and having children also have positive although insignificant effects. However women's tenure prospects are harmed by marriage and children. The differences in these coefficients increases the probability that men are promoted by nearly 40 percentage points while reducing the probability that a woman is promoted by 10 percentage points. Besides marriage and family, having more employers significantly reduces the probability of promotion for both men and women; however, the negative impact for women is nearly twice as large. Although it is statistically insignificant, the positive coefficient on age is 10 times the size for men than for women. Despite having fewer publications, the positive effect of publications on promotion is almost twice as large for women than for men. This may reflect the fact that women's publications are more likely to be cited.

The difference between estimated male and female salaries can be decomposed using a method developed by Oaxaca (1973) that separates the gender salary gap into two components, the "explained" portion of the gap attributable to differences in observable endowments (such as academic rank and differences in productivity) and the "unexplained" portion of the gap attributable to gender differences in the estimated regression coefficients. The sum of the explained and unexplained portions is the total gender salary gap. The unexplained gap resulting from gender differences in coefficients should equal zero provided that men and women are paid the same for a given level of observable characteristics. These results appear in the first row of Table 4.⁷ The overall gender promotion gap in economics is 21 percent 10 years post-Ph.D., as shown in the first column and is derived from the estimates in columns G and H of Table 3. Only 4–5 of these percentage points are due to differences in observable characteristics. Of the

⁷ We also carried out an Oaxaca decomposition for the assistant professor survey. The size of the gap and the proportion explained by endowments differ considerably depending on which way the decomposition is done (male coefficients or female coefficients). Based on female coefficients, only 6.8 percent of the 21.2 percent gender difference can be explained by different endowments; based on male coefficients, 18 percent of it can.

Table 4

Gender Promotion Gap by Discipline, 10 Years After Ph.D., 1973–2001 Survey of Doctorate Recipients

Discipline	Promotion gap	Male coefficients		Female coefficients	
		Percentage explained by endowments	Percentage unexplained	Percentage explained by endowments	Percentage unexplained
Economics	21.0%	5.3%	15.7%	4.0%	16.9%
Political science	-4.4%	-1.4%	-3.1%	6.6%	-11.0%
Statistics	0.3%	4.4%	-4.1%	15.6%	-15.3%
Physical science	2.8%	1.0%	1.9%	2.2%	0.6%
Life science	-2.2%	0.5%	-2.7%	-1.9%	-0.2%
Engineering	-3.9%	3.8%	-7.6%	2.5%	-6.3%
Social science	8.1%	2.3%	5.8%	1.9%	6.2%

Notes: Includes control variables discussed earlier.

Table 5

Productivity Comparisons, 10 Years After Ph.D., Male and Female Economists, 1973–2001 Survey of Doctorate Recipients

Productivity comparisons	Men	Women with children	Women without children
Papers 10 years post-Ph.D.	6.238	7.210	6.049
Publications 10 years post-Ph.D.	5.799	6.188	3.392

Notes: Numbers in bold indicate averages significantly different at 5 percent level of significance.

Source: 1973–2001 Longitudinal Sample from the SDR.

remaining 16–17 percent “unexplained” gap resulting from coefficient differences, the coefficient differences on age and young children contributed the most to the unexplained promotion gap compared with all other variables in the specification.

It is sometimes argued that the two explanations of publications and family are interrelated; that is, women with children in academia are less productive because of their child-rearing responsibilities. We investigate this possibility in the SDR by comparing the productivity of (all) men and women with and without children and find that this pattern does not hold for economists in Table 5. The average numbers of papers and of publications *are not* significantly different for women with children versus all men. However, men write significantly more papers than women *without* children. This outcome may be the result of self-selection. Women who are less productive in their careers may decide not to have children because of the anticipated impact on their productivity.

Some Comparisons of Results from the Two Data Sets

The results from the assistant professor survey and the SDR in the previous two sections illustrate some difficulties of work in this area. The two data sets have different strengths and weaknesses. The assistant professor survey includes later cohorts on average and also includes more committed and successful academic economists (since they were once in a Ph.D.-granting economics department). The sample sizes are small enough that differences may also occur at random. As we worked with the data using various methodologies, including linear regressions, probit and hazard analysis, variables would sometimes be significant using one method, but not significant using another.

Yet the bottom line is clear. In the assistant professor survey, among those remaining in academia, women are less likely to get tenure and take longer to do so even after controlling for publications, prestige of Ph.D. department, citations and employer. In the SDR data, women are less likely to get tenure and take longer to do so even after controlling for publications, demographic characteristics and employer characteristics in the SDR. Taken together, these results indicate that productivity and background differences alone do not explain the gender gap in promotion. Instead, women and men in economics are systematically treated differently to the disadvantage of women.

Gender Differences in Tenure: Economics Compared to Other Disciplines

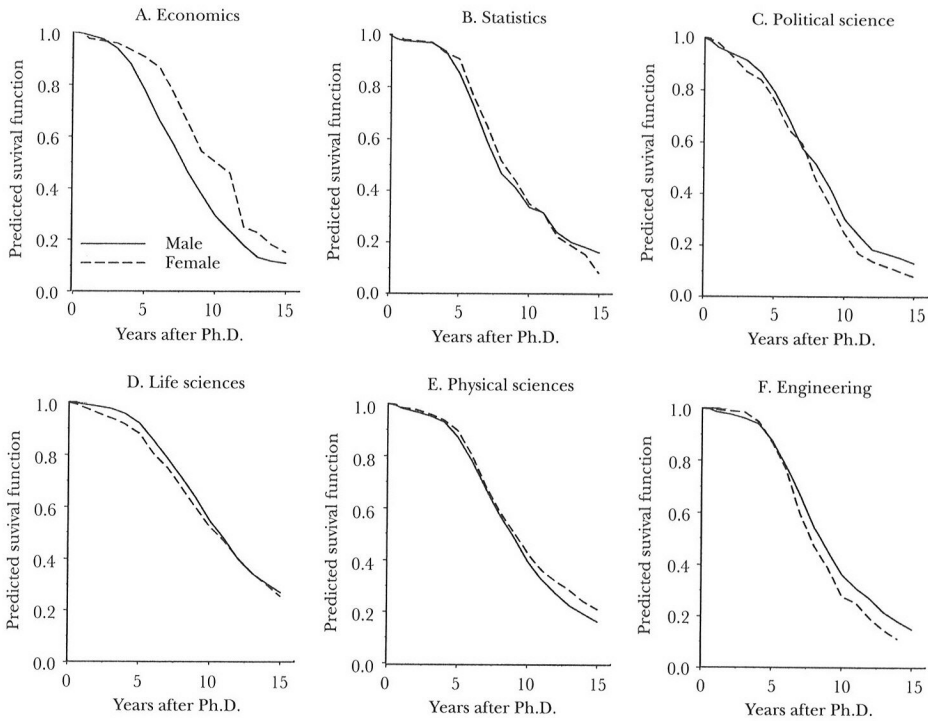
Women economists are 21 percentage points less likely to have a tenured academic job 10 years after Ph.D. receipt. To put this gender difference in perspective, we have decomposed the gender promotion gap in other disciplines in the SDR into the portion due to observable characteristics versus that due to unexplained coefficient differences just as we did for economics, with the results shown in Table 4. The differences between economics and the other disciplines are striking. Economics has by far the largest gender promotion gap of any discipline analyzed. For instance, for engineering there is a -3.9 percent gap that *favours* women, and in the other social sciences fields there is only an 8.1 percent gap.

We also compared economics to other disciplines by using a hazard model that estimates the predicted probability within each discipline of remaining without tenure ten years after receipt of the doctorate *ceteris paribus*. We have graphed these probabilities in Figure 5. There is little difference between men and women in the disciplines of statistics and physical science. In fact, in political science, engineering and the life sciences, a larger proportion of women have received tenure (fewer remain untenured) after ten years than men. These differences are not statistically significant with the exception of engineering. However when we apply this method to economists in the SDR data, the results are very different, as evident in these graphs.⁸ At 10 years past Ph.D., half of women and only 30 percent of men remain without tenure in economics. Among all science and social science disciplines

⁸ Similar to the Assistant Professor Sample, the significance of the gender tenure differential was between the two analyses reported in the text.

Figure 5

Predicted Survival without Tenure Functions, by Gender and Discipline



Source: 1973–2001 Survey of Doctorate Recipients.

analyzed, gender differences in the probability of promotion and the duration to tenure are the largest in economics.

Qualitative Accounts of Gender Differences in Promotion

Surveys were sent to those people in the assistant professor sample with identifiable e-mail addresses who left their 1989 department without tenure. The letter introduced the study briefly, asked people to rank the reasons they left from ten choices plus an “other” category, asked a few questions regarding dates and tenure and then left an optional open-ended question encouraging explanations. More surveys were sent to women than men primarily because more women left their 1989 department without tenure, and their response rates were higher as well. The total number of surveys—45 from women and 23 from men—are too small for systematic analysis, but the patterns and tone of the responses do provide some perspective.

Even though all of the people surveyed left their 1989 institution without tenure, some ranked the primary reason (or reasons) for leaving as being unrelated

to tenure. This proportion was practically identical for men and women. Roughly one-third of both men and women who left academia did not mention being denied tenure or not expecting to receive tenure as their number one reason for leaving, and roughly another quarter did not mention tenure as one of their reasons at all. Of the respondents who left primarily for a non-tenure-related reason, the same proportion of men and women (13–14 percent) listed a family-related reason as the primary motive for change. However, a considerably greater percentage of women listed as their primary reason for leaving that they did not like their job. One-third of female respondents ranked dislike of their job either their primary reason or one of their reasons for leaving, while no men ranked dislike of their job as a primary reason for leaving, and only 13 percent listed it as a reason at all. Moreover, the gender difference here is probably underestimated because of the higher male nonresponse rate, if we believe that nonresponders had fewer complaints about their department than responders.

Gender issues often seem to play a role in this bad feeling about jobs left behind. Of the 80 percent of women who were assistant professors in 1989 and who left that job without tenure, one-third of the women explicitly mentioned gender as having an unfair impact on their likelihood of achieving tenure in some way. Quotes from the survey responses give a sense of these comments:

“There were issues of sexual and general harassment.”

“The department had a history of being inhospitable to women The chair (made) fervent cases against (university-paid) maternity leaves.”

“I filed a lawsuit based on . . . sex discrimination and the university settled out of court with me.”

“I have been wishing for years that CSWEP would truly deal with the problem that female assistant professors face . . . relating to child bearing.”

My present job outside of academia has “much less of the old boy network.”

“An internal tenure and ethics committee found that I had been denied tenure unfairly.”

“The promotion committee promoted three guys to untenured associate and decided to delay the decision on mine because (given my husband’s lucrative job), they did not believe that I would mind having my decision delayed.”

Several women mentioned maternity leave and childbearing as affecting their tenure, whether or not they believed the process was unfair. Other researchers have found evidence that colleges and universities are inhospitable to family concerns. Thornton (2003) evaluated the parental leave policies of a random sample of 81 colleges and universities. She found that 35 percent of the institutions surveyed do not comply with federal parental leave mandates. Rosser and Lane (2002) surveyed women who received NSF grants for Professional Opportunities for Women in Research and Education between 1997 and 2000. Grant recipients in the Division of Social, Behavioral, and Economics Sciences, the majority of whom are economists, ranked balancing work and family responsibilities and the low numbers of women in their fields as the most significant challenges facing women in their careers.

Discussion

Women are less likely to get tenure at their first academic job compared to men. Our evidence allows us to evaluate some possible reasons, although as in all studies of gender differences, the ultimate conclusions involve how to interpret differences that are otherwise unexplained. The analysis here has controlled for the impact of supply-side factors such as publications and fertility choices on women's probability of promotion. However, these supply-side factors fail to explain the gender promotion gap fully. Here, we will summarize and review both arguments that our evidence addresses directly and also arguments that have been made elsewhere in the literature.

First, women economists do publish fewer papers than men—particularly in nontop journals—which explains about 30 percent of the promotion gap (based on the assistant professor data). Indeed, on average and across disciplines, women have traditionally published fewer articles than men (Schneider, 1998). Numerous potential explanations have been offered. For example, perhaps women academics publish less because they are more likely to be in non-tenure-track jobs or to spend more time on teaching, advising and administrative work. Whatever the merits of these arguments for women academics in general, they do not apply to our sample of economists, which is focused on tenure-track economists who do not spend a significantly different amount of time in teaching versus research (SDR) or in their likelihood to leave academia (SDR and the assistant professor sample). However, it is also possible that part of the publication difference traces to a lack of mentors for women or perhaps women have fewer resources, including research assistants and course reductions. Our data do not address these issues.

In science, Xie and Shauman (1998) find that the raw gender publications gap in scientific fields has narrowed over time and that after controlling for age, rank and field, gender differences in publications in the sciences disappeared. The same does not hold true in economics. McDowell, Singell and Stater (2004) used data from the AEA membership surveys between the years 1964 and 1997. After controlling for life-cycle, job placement and cohort effects, they find that women are significantly less likely to publish through the 1980s, but that the gender difference per year was much smaller and insignificant during the 1990s. However, in our assistant professor sample, when we also control for job placement and cohort, we do find significant gender differences in publications during the 1990s.

A second possible explanation involves responsibilities of family and children, young children in particular. This factor appears to have an impact separate from the quantity of papers and publications. One possibility is that women interrupt their careers to follow their husbands. However, this factor does not explain the large tenure differences at first academic jobs. Presence of children may also reduce productivity since women are more likely to be the primary care-givers. Evidence from the SDR suggests that women with children are equally productive as men. Nevertheless, despite the similarity in productivity, these women are less likely to receive tenure.

A third set of arguments suggests that if affirmative action for women is applied in the admissions process to Ph.D. programs and/or at the hiring stage, but *not* at the tenure stage, then this factor might help to explain why fewer women pass the tenure hurdle. Although the differences were not statistically significant at standard levels, the females in assistant professor jobs in Ph.D.-granting economics departments were more likely to come from top-15 Ph.D. programs and initially to be hired at top-15 institutions. In addition, women from the top-15 Ph.D. programs (like the women from other programs) did have significantly lower publication rates in nontop journals than their male counterparts. These facts are all consistent with—although not proving—affirmative action at the best departments.

The impact of affirmative action at earlier stages of academic careers is debatable, but there is no evidence of affirmative action at the stage of tenure. Substantial gender tenure differences remain, particularly in initial departments, even controlling for publications and reputation. In both data sets, if women economists were awarded tenure similarly to men based only on accomplishments and personal choice variables rather than prestige of Ph.D. or employing department, they would have a higher tenure rate than they do. Furthermore, one would expect to observe similar effects of affirmative action in other disciplines because affirmative action is typically a university-wide initiative. However, we do not observe the large gender differences in tenure in other science and social science disciplines that are apparent in economics.

Moreover, tenure outcomes refute the assertion of affirmative action at the best departments in education or first hiring. Affirmative action in education would suggest that women from top-15 departments would do more poorly than other women in terms of tenure progress and publications, and affirmative action in hiring new assistant professors would suggest the same for women starting in top-15 schools. However, the opposite is true: graduates from top departments have much smaller gender differences in tenure rates than graduates from lesser ranked departments, although women from high- or low-prestige departments have similarly low likelihoods of being tenured at their first department. Similarly, women starting in top-15 departments are more likely to receive tenure than women starting in other Ph.D.-granting economics departments, although less likely to receive it at their first departments.

A final reason for tenure differences may relate to women lacking the same professional networks as men, networks that at tenure time mean more adulatory outside reference letters. McDowell, Singell and Stater (2004) find that controlling for publications, women economists in top economics departments were *not* significantly less likely to coauthor during the 1990s, suggesting that they have developed access to social networks and mentors. This finding dovetails with our evidence that women have more citations per publication, also suggesting access to professional networks.

All studies of gender differences come down to the interpretation that one places on an unexplained coefficient on a gender variable or differences in coefficients when estimates are allowed to vary by gender. Such studies always leave

a reader grasping for possible alternative variables, whether potentially observable or not, which might fill the gap and offer an explanation not based in discrimination. Any satisfactory explanation for the gender gap in economics based on women's behavior or choices must account for why it does not apply equally in many other scientific disciplines. We cannot rule out the possibility of such an explanation in the future. But a fair reading of the evidence as it stands is that economists have experienced persistently large and unexplained gender differences in advancement to tenured ranks during the past decade, especially when compared with related academic disciplines. Given that the supply-side characteristics do not adequately explain the gender promotion gap in economics, we are left to wonder whether institutional and departmental behaviors contribute to the gender gap.

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