Women in Academic Economics: Have We Made Progress?

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The paucity of women in tenured ranks of economics in the US has led to concern by many that there may be inequities in the tenure process. The AEA's Committee on the Status of Women in the Economics Profession (CSWEP) annually compares the percent female of synthetic cohorts as their careers progress. In 2019 they concluded, "The female share of associate professors is consistently about 5% lower than the share who were assistant professors seven years earlier." In other words, women are less likely than men to be awarded tenure. We ourselves have contributed to the literature on tenure in economics at several points in the last decades (Kahn 1993, Ginther and Kahn 2004, Ginther and Kahn 2014), primarily using the National Science Foundation's longitudinal Survey of Doctorate Recipients (SDR) that follows STEM PhDs post-PhD. Although the SDR sample of economists was small, we found significant gender differences in promotion to tenure, first among PhD recipients 1971-1980 and continuing through PhD recipients 1981-2003. This work was limited in its ability to control for productivity measures since the SDR had only self-reported numbers of publications and only in some survey waves (the last being 2008).

The current study turns to a different source of information about academic careers – Academic Analytics – to study recent gender differences in promotion in economics. We find that women in economics have almost achieved parity in promotion to associate professor in research-intensive institutions, but that significant gaps remain at institutions that are less research focused.

Other researchers have also examined gender differences in promotion in economics. Heather Sarsons (2017) collected data on economists who went up for tenure between 1985 and

2014 at the 30 top economics departments, including productivity variables. In her sample, women were 69% as likely as men to have received tenure (6-8 years post-PhD, p=.001) and those who did took half of a year longer to receive it (p=.012). A major reason for these differences were that women who coauthored with men received practically no credit for those papers, and less than half as much credit for papers coauthored jointly with men and women. Antecol *et al.* (2018) measured the gender gap in receiving tenure in a top 50 economics department (for hires 1980-2005) focusing the effect of a stop-the-tenure-clock policies. Their data show the tenure gender gap was approximately 7 percentage points at its narrowest in 1995, but grew substantially since then, partially due to gender-neutral stop-the-clock policies.

So why measure the gender difference in promotion in economics once again? First, because the articles on promotion are about earlier PhD cohorts, and there might have been substantial change since then. Second, the more recent studies described above are limited to economists at top schools, yet only 8½% of tenure-track assistant economists with PhDs 2014-2013 were at universities rated by Carnegie as "very high research" (calculated by us from the SDR). Third, recent research has shown that increased mentoring has increased women's productivity and likelihood of being promoted (Ginther *et al.* 2020).

I. Data and Methods

We use data collected by Academic Analytics, a company that provides data and analysis to higher education institutions including publications, grants, citations and awards to benchmark their faculty's productivity. Our sample includes data from 323 higher education institutions in the US, including 131 institutions listed by the Carnegie Classification of Higher Education Institutions as "Research Very High" and 114 Institutions classified as "Research High." We identified faculty who received PhDs from 2005-2011, were observed as tenure-track assistant

professors during that period and appeared in three or more separate years of Academic Analytics data. We follow individuals across universities that were part of the Academic Analytics Universe.

There were 798 assistant professor faculty members in economics departments (including agricultural economics but excluding economists in business schools not part of an economics department). We were able to follow faculty who entered the sample starting in 2009 and ending in 2018, or whenever they left the Academic Analytics sample. The data set included information on each faculty member's journal publications each year from 2004-2018 and total citations to each article accrued by 2018. We allocated each publication's citations to the years through 2018 based on the typical citation pattern over time since publication in the field (using this data set). We also observed federal research grants and the dollar amounts of those grants 2004-2018 (or whenever the person permanently exited the Academic Analytics sample.[1])

We estimated a Cox proportional hazard model of the time between PhD and either promotion to associate professor[2] or being right censored, as a function of gender, PhD degree year; whether the university was public/private; whether the university was categorized by Carnegie as "Very High Research", or as "High Research" or other Carnegie categories; dummy variables for department (general economics, or applied economics) and time-varying variables for the cumulative number of publications, of citations, of grants received, and the cumulative amount of grant dollars received from 2004 until that date. We use an inverse hyperbolic sine (IHS) transformation of productivity numbers (given the presence of many zero values).

[1] Exiting the Academic Analytics sample does not mean that an individual leaves academic employment since Academic Analytics focuses on a subset of research-intensive higher education institutions.
[2] Ideally, we would observe when a person receives tenure. However, Academic Analytics only has verified tenure status for a subsample of individuals. As a result, we use promotion to associate professor as a proxy for promotion to tenure.

II. Results

Hazard ratios are shown in Table 1. Column 1 includes a female dummy only and shows women were 18.5% ($p<.03$) less likely to be promoted to associate professor. Controlling for institution type (public/private, Carnegie) in column 2 does not narrow the gender difference.

To compare, we estimated a similar regression for approximately the same period (survey years 2006-2017, PhD years 2004-2013) using the NSF's SDR, including anyone observed as a tenure-track assistant professor and calculating the time from PhD to when last observed. The sample included only 399 economists, some seen only once (and was collapsed into a single-record-per-person survival data). This is a smaller, less longitudinal sample than we had used in previous studies because of a 2015 major restructuring of the SDR. Results controlling for the same institutional variables as column 2 are in column 3, with a larger although somewhat less significant gender difference in promotion to tenure (hazard ratio .617, $p=.071$). This is an even larger gender difference than we had found in our earlier SDR-based studies, although not significantly so. For instance, Ginther and Kahn (2014) for 1981-2003 PhD cohorts with basic covariates found a hazard ratio on female of .788.

The Academic Analytics data allow us to control for productivity. Adding productivity measures to the model (column 4) somewhat narrows the female's disadvantage in tenure receipt to 15% and lowers its significance (p-value= .08.) The productivity measures that were important in this equation were numbers of publications and number of grants. Very high and high-research universities were much more likely than lesser ones to award tenure.

Some of the previous studies were limited to the best research universities. We therefore separately estimated the hazard analysis for two samples, those who entered academia into "Research Very High" institutions and those that did not. The results are in the last two columns

of Table 1. The majority of the observations were in the very-high-research universities (which is primarily informative about the clients interested in Academic Analytics services). We were frankly stunned by the results. The gender tenure gap was small and insignificant in very high research institutions. However, in less research-intensive universities it was huge, with women's rate of receiving tenure (with all controls) 45% lower than men's (p=.055).

Previously, several of the studies of gender differences in tenure and promotion compared economics to other science and social science fields (Ginther and Kahn 2004, 2014; Ceci et al. 2014; Sarsons 2017; Lundberg and Stearns 2019). In these, economics fared quite poorly. Table 2 compares the economics results including productivity and institutional variables (column 4 in Table 1) to other fields, including fields used in our 2004 study. In the top panel of Table 2, economics has the largest gender promotion gap after controlling for institution and productivity characteristics and is the only field whose difference was even marginally significant (p=.08). In results without controls not shown, both political science and biomedical science had statistically significant gender promotion gaps, but these differences are fully explained by controls for publications, citations, and grants that each significantly increase the likelihood of promotion to associate professor.

Figure 2 illustrates the predicted survival function for men and women by field.[3] The gap between genders is clearly largest in economics, although the predicted survival curve for women in biomedical science and political science is also above men's. In the other fields, one can discern no female disadvantage. Note that far more people remain in the assistant professor rank at the end of the period in biomedicine, reflecting the lengthy postdoctoral appointments that delay the start of tenure track employment (Kahn and Ginther 2017).

[3] Figure includes all covariates as in Table 1 column 4, but was estimated as a log-logistic model to achieve smoothed survival curves, and graphed at each field's covariates' means.

The next two panels of Table 2 divide the sample into Research Very High and Research Less-Intensive. The middle panel of Table 2 indicates no significant gender differences in any field in promotion at Research Very High institutions. The bottom panel shows that economics is the *only* field with a significant promotion gap at Research Less-Intensive Institutions.

III. Conclusions

We can only guess at why less research-intensive colleges and universities are so different. Could it be that in less-research-oriented institutions, the criteria for tenure are less clear, since research is less important? Yet the coefficient on cumulative publications in the economics models was practically identical in Research Very High (1.60, $p<.001$) and Research Less-Intensive (1.61, $p<.02$), which belies that conjecture. Our results parallel those found in the CEMENT mentoring experiment (Ginther *et al.* 2020). There, women who received the mentoring treatment were significantly more likely to be promoted to tenure at top 50 economics departments but significantly less likely to receive tenure at unranked economics departments. Our results for Research Very High institutions may differ from previous studies because other researchers measure promotion at a particular university, and we measure promotion in the economics profession.

In an atmosphere where success is difficult to assess, bias may be more likely to prevail. Indeed, the academic hiring literature has found that for positions where the criteria and qualifications are clear – as in an assistant professor hiring experiment by Williams and Ceci (2015) – there is actually a preference for hiring women relative to men. This result is in contrast to the lab manager position experiment of Moss-Rascusin *et al.* (2012) that found bias against female job applicants. Nevertheless, these experimental differences cannot explain why the stark difference between very high research institutions and others appears only in the field of

economics. Sarsons (2017) argues that the alphabetical ordering of author's names – which makes it impossible to know each individuals' contributions – are what distinguishes the tenure process in economics and most other science and social science fields. She studied only highly-rated research institutions. Is this imperfect information about people's individual contributions even more important in less-research-intensive institutions, and if so why? It is possible that teaching is a more important criteria in less-research oriented universities and there is some evidence of gender bias in student evaluations. Yet once again, one is left with the question of why this does not extend to other fields.

We have no answers. We hope these findings open new avenues for research and new conversations about how to make promotion decisions more equitable in economics in all academic institutions.

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Table 1: Proportional Hazard Estimates of Gender Differences in Promotion to Associate Professor, 2009-2018.

VARIABLES	(1) No Controls	(2) Institution Controls	(3) SDR	(4) Productivity Controls	(5) Research Very High	(6) Research Less-Intensive
Female	0.815**	0.810**	0.617*	0.851*	0.898	0.546*
	(0.078)	(0.077)	(0.165)	(0.079)	(0.089)	(0.172)
Public University		1.081	1.183	1.130	1.268**	1.414
		(0.104)	(0.499)	(0.110)	(0.135)	(0.349)
Carnegie: Research		12.908***	2.681**	12.033***		
Very High		(12.430)	(1.151)	(102.430)		
Carnegie: Research		10.545**	2.114	2.114		1.186
High		(10.214)	(1.206)	(1.206)		(0.480)
Degree Year		1.004	0.950	0.950	1.000	0.983
		(0.024)	(0.069)	(0.069)	(0.027)	(0.056)
IHS Cumulative				1.009	1.042	0.978
Citations				(0.035)	(0.038)	(0.102)
IHS Cumulative				1.611***	1.575***	1.514**
Publications				(0.115)	(0.122)	(0.303)
IHS Cumulative				2.057***	1.931**	5.300
Grants				(0.528)	(0.506)	(6.272)
IHS Cumulative				0.966	0.983	0.812*
Grant Dollars				(0.023)	(0.024)	(0.096)
Observations	4,571	4,571	399	4,571	3,910	661
Individuals	798	798	399	798	668	130

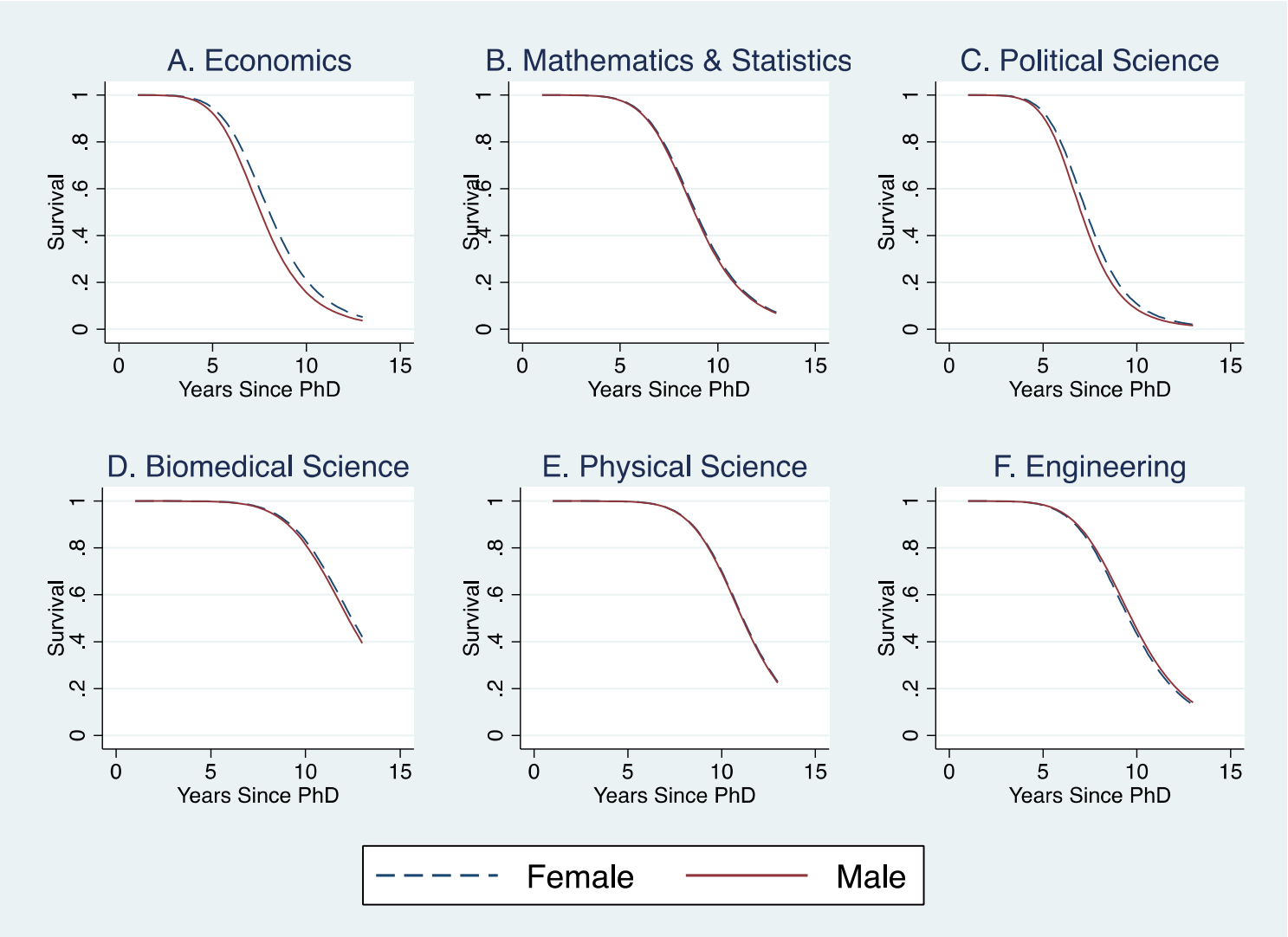
Notes: Hazard Ratios and robust standard errors in parentheses from Cox Proportional Hazard model estimates of promotion to associate professor. Models in Columns 2, 4-6 also include controls for economics department (agricultural, general, applied). SDR model is not time-varying. *** p<.01, ** p<.05, * p<.10.

Table 2: Proportional Hazard Estimates of Gender Differences in Promotion to Associate Professor by Field and Institution Type, 2009-2018.

VARIABLES	Economics	Political Science	Biomedical Science	Physical Science	Engineering	Math & Statistics
Full Sample						
Female	0.851*	0.928	0.924	0.915	0.976	0.979
	(0.079)	(0.071)	(0.061)	(0.077)	(0.049)	(0.071)
Observations	4,571	4,281	18,201	8,341	19,768	7,571
Individuals	798	765	3,664	1,594	3,650	1,449
Research Very High						
Female	0.898	0.879	0.899	0.961	0.980	1.022
	(0.089)	(0.077)	(0.072)	(0.086)	(0.054)	(0.081)
Observations	3,910	3,390	13,027	6,899	16,132	6,152
Individuals	668	602	2,604	1,295	2,944	1,165
Research Less-Intensive						
Female	0.546*	1.248	1.083	0.694	1.017	0.907
	(0.172)	(0.222)	(0.125)	(0.159)	(0.128)	(0.166)
Observations	661	891	5,174	1,442	3,636	1,419
Individuals	130	163	1060	299	706	284

Notes: Hazard Ratios and robust standard errors in parentheses from Cox Proportional Hazard model estimates of promotion to associate professor. Full Sample uses Table 1 Column 4 specification; Research Very High and Research Less-Intensive use specification in columns 5 and 6 of Table 1 respectively. Models include controls for department.
*** p<.01, ** p<.05, * p<.10.

Figure 1: Predicted Survival Probability of Remaining Assistant Professors, 2009-2018



See paper for notes.