Do Economists Swing for the Fences after Tenure?

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Abstract: Using a sample of all academics who pass through top 50 economics and finance departments from 1996 through 2014, we study whether the granting of tenure leads faculty to pursue riskier ideas. We use the extreme tails of ex-post citations as our measure of risk and find that both the number of publications and the portion consisting of "homeruns" peak at tenure and fall steadily for a decade thereafter. Similar patterns hold for faculty at elite (top 10) institutions and for faculty who take differing time to tenure. We find the opposite pattern among poorly-cited publications: their numbers rise post-tenure.

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Tenure is pervasive in American higher education: every one of the top 500 colleges and universities in the United States as ranked by *US News and World Report* has some kind of tenure-granting system. The "philosophical birth cry" of the academic tenure system (Metzger 1973) was the 1915 statement of the American Association of University Professors (AAUP). Formalized in the 1940 Statement of Principles on Academic Freedom and Tenure (available at https://www.aaup.org/report/1940-statement-principles-academic-freedom-and-tenure), a joint statement of the AAUP and the Association of American Colleges (AAC) proclaimed: "Tenure is a means to certain ends; specifically: (1) freedom of teaching and research and of extramural activities, and (2) a sufficient degree of economic security to make the profession attractive to men and women of ability. Freedom and economic security, hence, tenure, are indispensable to the success of an institution in fulfilling its obligations to its students and society."

It is clear why associations of professors favor the intellectual freedom and economic security provided by the institution of tenure. The benefits of tenure could also be more philosophical: academic freedom in teaching and research is important for reasons other than the generation of highly cited papers. But for economists, it is natural to ask a more specific question: Under what conditions is tenure part of an optimal contract? After all, the incentives provided by the threat of termination are perhaps the starkest incentives faced by most employees, and tenure removes those incentives.

A variety of additional justifications for tenure have been proposed (for a discussion in this journal, see McPherson and Shapiro 1999). For example, the carrot of tenure can incentivize effort pre-tenure, allow for lower salaries, induce more selective hiring, or attract risk-averse but talented individuals to academia. As one example of prominent work in this area, Ito and Kahn (1986) argue that tenure-style assurances of the possibility of long-lived employment—not only in academia, but also in civil service, law and accounting firms, and a number of other workplaces—can be viewed as an efficient method of risk-sharing when an employer wants an employee to make a risky human capital investment. Other reasons for tenure can arise due to peculiarities in the nature of academia. For example, professors are the members of a university best able to identify talented prospective hires, and without tenure, they might fear losing their jobs

if they hire too well (Carmichael 1988; see also Friebel and Raith 2004; Siow 1988). In addition, tenure, which both protects senior faculty from dismissal and makes them residual claimants on any rents in the institution, gives senior faculty the incentive to monitor university leadership (Brown 1997).

Finally, society may benefit more from research which is truly groundbreaking than research which is more incremental. Trying to do something innovative and failing looks a lot like shirking, so motivating risky innovation may require the assurance of tenure (Manso 2011).[1] Our focus is on this last argument: do academics respond to receiving tenure by being more likely to attempt ground-breaking "homerun" research and in this way "swinging for the fences"?

In order to answer this question, we hand-collect a sample of all academics who pass through economics or finance departments at top 50 U.S. schools from 1996 through 2014. From this sample of over 2,000 faculty, we consider two variables in the years before and after each academic receives tenure: the total number of publications and the number of "homerun" publications. The number of publications is a measure of the quantity of output; the number of homerun publications, with its focus on *highly influential* output, is a measure of the quality of output.

We find that both variables have values that peak at tenure and decline thereafter. The average number of annual publications falls by approximately 30 percent over the two years after tenure is granted and falls by an additional 15 percent over the subsequent eight years. The average number of annual homerun publications also falls by 30 percent over the two years following tenure, but falls by an additional 35 percent over the subsequent eight years. Combining these facts, we find that not only do both the overall publication rate and the homerun rate fall, but the likelihood of a given publication being a homerun falls by approximately 25 percent during the 10 years following tenure. Conversely, papers in the bottom 10 percent of citations are actually published more frequently in the years following tenure than in the tenure year.

[1] Some additional theories relevant to academic tenure include the discussion of "up-or-out" employment settings, where workers either receive a promotion or are let go at some stage. Kahn and Huberman (1988) examine employers with "up-or-out" promotion practices in a situation of two-sided uncertainty and moral hazard, while Waldman (1990) emphasizes the role of signaling in up-or-out settings. Demougin and Siow (1994) consider careers within hierarchies, and the conditions under which firms will prefer to promote from within.

These patterns suggest two insights. First, the fall in publication rates over the two years following tenure is consistent with the notion that tenure tends to be granted when publication success has been achieved, and so a degree of reversion to the mean is expected. The timing of tenure is at least in part endogenous: faculty can advance early if they are highly productive early in their careers, and they can switch employers if they are unlikely to get tenure at a first institution. Further, the timing of publication is endogenous: faculty can time their efforts on various projects to maximize the number of publications before their tenure clock expires.

A second insight, more relevant for our paper, is that publication behavior from years two through ten after tenure suggests that after receiving tenure, economics faculty reduce risk-taking and the quality of their output falls. This might occur in a number of ways: adding co-authors; advertising new papers less at conferences and seminars; working on easier topics, which can be published in good journals but have less impact; or any number of other behaviors. We consider several alternatives to our explanation—increased non-research service work post-tenure or an increased tendency of tenured researchers to branch out into new subject areas--and show that none can fully explain what we find.

This paper does not evaluate the broad and multidimensional case for and against tenure. But it does suggest that at least for economists, tenure is not providing incentives to undertake research in the same quantity and quality that led up to the tenure decision.

Quantity and Quality of Research: Pre- and Post-Tenure

To construct our sample, we hand-collected employment and publishing data among economics and finance professors. We began by including all faculty who were employed at any of the top 50 economics or finance departments in the United States in any year from 1996 through 2014. This process involved use of the Wayback Machine (waybackmachine.org) and hand-collection of curriculum vitae (CVs). We collected a total of 2,763 names, 2,092 of whom are eventually granted tenure at some point prior to 2014. After collecting the set of faculty and their tenure years, we match this database to a database of publications and citations for 51 leading economics and finance

journals. More detail, including the list of journals, is provided in the online appendix available with this paper at http://e-jep.org.

Quantity of Research

We begin by evaluating a subset of faculty who are present in our data for at least five years prior to their tenure year and 10 years after. We require pre- and post-tenure data for all faculty. We exclude two other groups, which are people who would mechanically strengthen the increase in observed publication rates prior to tenure and the decrease post-tenure. First, some faculty were granted tenure less than five years from their first appearance in our sample. This was usually because they began their careers at government agencies, in which they may not have been expected to publish to the same degree as in academia. Also, some faculty left academia prior to tenure, less than 10 years post-tenure, or received tenure after 2004, and thus were unlikely to publish as often post-tenure. Including these faculty would severely bias downward pre-tenure publication rates, relative to post-tenure rates (especially if we were to include faculty who never receive tenure). We therefore drop them.

The final dataset contains 980 faculty, all of whom received tenure prior to 2004. To address the issue of co-authored papers, we define an author's contribution to a publication as 1/N, where N is the number of authors on the publication. We show in the online appendix that, if we do not adjust for co-authorship, our qualitative results remain essentially unchanged.

Figure 1 presents the per-capita author-adjusted number of papers published by this subset relative to the year that the academic was first tenured. The year marked "tenure" is the first year in which the researcher was tenured, the year marked "-1" is the year before, and so on. The figure shows annual publications increasing monotonically prior to tenure, peaking in the neighborhood of the granting of tenure and declining steadily thereafter.

In order to interpret magnitudes, note that the height of the solid line in year -2 is 0.57. This means that our 980 researchers produced, on average, 0.57 author-adjusted papers in solid journals in the year prior to the one in which they were put up for tenure. This number would imply $0.57 \times 980 = 559$ solo-authored papers, $0.57 \times 2 \times 980 =$

1,117 dual authored papers, or higher numbers of three-or-more authored papers. In fact, the number is an average of these.

Homeruns

We also calculate the number of homerun publications, defined as publications that, as of 2014, were among the 10 percent most cited of all papers published in a given year. The plot of the number of homeruns shown in Figure 1 is largely similar to the plot of publications, peaking in the tenure year and falling thereafter. The number of homeruns is anywhere from 1/7 to 1/5 of the number of publications. These numbers are greater than 10% for two reasons. First, the faculty in our sample are mostly associated with prestigious departments and presumably publish more cited papers. Second, we only include economists who get tenure, and these are likely more cited as well.

We can calculate the ratio of the two plots in Figure 1: homerun publications divided by all publications. The series is noisy, but clearly exhibits a substantial decrease from 2 through 10 years post-tenure. This decrease will be important in teasing out potential explanations for the patterns we see.

Together, these facts provide suggestive evidence that tenure is associated with peak academic production, in terms of the quantity of publications, the quantity of homerun publications, and the likelihood that a given publication becomes a homerun.

A Closer Look at Risk-Taking in Economic Research

In order to better measure risk-taking in publication we also plot the rate of non-homerun publications. In Figure 2 we assign each paper a category based on its citations; if it was in the top 10 percent of citations for papers published in that year it is called a "homerun." If it is in the lowest 10% we call it a "bomb." We split papers further into 10^{th} to 25^{th}, 25^{th} to 50^{th}, 50^{th} to 75^{th}, and 75^{th} to 90^{th} percentile groups. We calculate the number of papers published by authors from 5 years before to 10 years after tenure. We calculate the number of papers in each citation bucket in the year of tenure, and normalize that value to 100.

Thus, Figure 2 shows that publication rates of all paper types increase in tandem up to the year of tenure, but there is substantial divergence afterward. The one category

of paper with consistently higher quantity post-tenure is the "bombs." Indeed, 10 years after tenure, the most common category (the highest value) is bombs, second-highest is publications in the 10-25th percentile, and so on down to the least-common category of homeruns.

Table 1 shows the results of regressions which provide a sense of the statistical significance of the changes in overall and "homerun" publication rates shown in Figure 1. Column numbers refer to those containing data. We estimate variants of the following linear model:

$$Pub_{i,t} = \alpha + \beta_t + \gamma_i + \delta_{i,t}^{-5,-1} I_{i,t}^{-5,-1} + \delta_{i,t}^{+1,+5} I_{i,t}^{+1,+5} + \delta_{i,t}^{+6,+10} I_{i,t}^{+6,+10} + \varepsilon_{i,t}$$

where β_t is a year fixed effect designed to capture differential publication rates over time; γ_i is a researcher fixed effect designed to capture differential publication rates across researchers; $I_{i,t}^{m,n}$ is a dummy variable taking a value of 1 if, in year *t*, researcher *i* is between *m* and *n* years from tenure (with positive values of *m* and *n* representing post-tenure dates, and negative values representing pre-tenure dates) and zero otherwise; and $\delta_{i,t}^{m,n}$ is the coefficient on the tenure time dummy variable associated with years *m* to *n* after tenure.

The excluded year for researcher *i* is her tenure year so all coefficients are average publication rates relative to a professor's tenure year. Depending on the regression, $Pub_{i,t}$ may represent the overall author-adjusted number of publications, or the author-adjusted number of homerun publications for researcher *i* in year *t*.

In Table 1, Column 1, we perform the analysis with no year or author fixed effects. That is, this regression ignores the facts that publication rates have increased over time and that some authors publish more than others. On average, 0.155 fewer author-adjusted publications occur in the five years prior to tenure, 0.178 occur in the five years after, and 0.237 occur in the five years following that. Publications are lower before and after tenure, and even lower the longer after tenure one goes.

In Table 1, Column 2, we add year fixed effects to account for the fact that publication rates have increased over time, and in Column 3 we add year and researcher fixed effects. The inclusion of year fixed effects increases the R^2 but has a relatively small

effect on the coefficients: relative to the first column, the publications before tenure are a little lower and those after tenure are a little higher, but the peak at tenure remains. The inclusion of researcher fixed effects, however, has a substantial effect. It's no surprise that the R^2 is again higher; by design, researcher fixed effects will absorb variation in across-researcher publication rates. However, the coefficients shift in a way that the peak at tenure and the decline post-tenure are strengthened.

In Table 1, Columns 4-6, we repeat the analyses of the first three columns using data on home-run papers and find substantial reductions in the rate at which authors produce homerun papers, in periods both before and after tenure. As in Columns 1-3, the number of homeruns produced decreases in the 5 years following tenure and continues to decrease in the 5 years after that.

We test whether we can statistically differentiate the coefficients on the dummy variables for the periods 1-5 years and 6-10 years post-tenure. We perform a Wald F-test for the equality of the coefficients on the dummy variables for years +1 to +5 and years +6 to +10. In all six cases, we strongly reject the null hypothesis that the coefficients are equal. Not only do the rates of publications and homeruns fall in the five years following tenure, but they continue to fall in the five years after that.

Summarizing Patterns

In sum, we have shown that: 1) Publication and homerun rates rise to tenure, peaking in the year a researcher comes up for tenure and a researcher's first year as tenured faculty. 2) Publication and homerun rates fall markedly in the two years following tenure. 3) Publication and homerun rates fall by 15 and 35 percent, respectively, from years two through ten after tenure, while bomb rates increase by 35 percent.

Our interpretation of these facts is: 1) Junior faculty get better at publishing in their first few years and publication lags are long, leading to an increase in the publication rate of all paper qualities as tenure approaches. 2) Tenure is typically granted when success is achieved. Because of publication lags, this leads to high publication rates in the year that the researcher is coming up for tenure as well as during the following year. 3) As tenured faculty age, there is a decade-long decline in the production of publications and homeruns and an increase in the production of bombs. We believe that

the most consistent explanation for these two declines is a change in risk-taking by academic researchers.

Alternative Explanations for Productivity Declines Post-Tenure

In this section we consider five alternative explanations for the patterns shown thus far that could help explain our findings. We will show that none can fully explain the patterns that we see. While they all may be at work, a reduction in risk-taking by academic researchers seems to be relevant as well.

Perhaps this is a "Time Since Ph.D." Effect

A number of studies have shown that research productivity follows a hump-shape over age, first rising and then falling (for example, Oster and Hammermesh 1998; Levin and Stephan 1989; Gingras et al. 2008). This could be because aging directly affects the ability of an academic to produce top-rate research, or it may be because the marginal effect of an additional top publication on an academic's professional outcome decreases as the number of publications increases. These studies have not, however, looked at the timing of tenure. It could be a coincidence that the various factors that lead to the rise and fall of academic productivity over a lifetime just happen to peak at the year tenure was granted. Can we separate out a specific effect of tenure in our data?

To investigate this possibility, we split the sample by the year in which a researcher was granted tenure: fifth year, sixth year, and so on. Naturally, the sample in each case is substantially smaller than for the full sample, adding noise to our plots, so we make several adjustments to boost the sample: details and plots can be found in the appendix.

For those tenured in five years, the year of peak production of both papers and homeruns is the tenure year. For those tenured in six years, the publication rate is highest in the year before tenure and the tenure year; the homerun publication rate peaks in the tenure year and the year after. For those tenured in seven years, both publications and homeruns peak in the year the candidate is up for tenure. As the data become noisier (fewer people are tenured each year after seven), the peaks are less clear but the general shape persists: people publish more and better papers in the run-up to tenure and fewer after.

These patterns suggest that it is not simply aging that is causing the patterns observed in Figures 1 and 2. The year of tenure itself is special, not just the number of years since graduate school.

Perhaps the Rise in Service, Teaching, and Non-Academic Obligations Post-Tenure

It is possible – even likely – that many faculty in our sample experience increased expectations of university service after tenure, including advising, department chairing, serving as a dean, and other administrative and committee member responsibilities. Indeed, these additional administrative and service responsibilities are one of the aforementioned justifications for tenure, and thus generally consistent with a tenure-based explanation for the data. Also, tenured faculty often have more opportunities for outside opportunities after tenure, like consulting or book writing. These factors tend to reduce publication rates, even if the researcher's aggregate effort over all activities increased post-tenure.

To investigate this explanation for our findings, we return to Figure 2. Suppose that authors have some ability to distinguish between projects likely to be successful and those likely to fail. A researcher who experiences an increase in non-research obligations post-tenure would presumably seek to reduce effort on low-impact projects. Thus, one might expect the number of publications to fall, but the number of homeruns to remain similar and the share of homeruns to rise. We do not see this result.

Instead, the likelihood that a given publication becomes a homerun falls from 20 percent the tenure year to 15 percent 10 years later. This decline is substantial. Moreover, this reduction is not due solely to mean reversion and the endogenous timing of tenure. The decline begins in earnest three years after the tenure year, which is four years after the researcher is up for tenure. Any papers that led the researcher to get tenure would likely have been published before then.

We can also point to Figure 2, in which we show that the production of bombs actually rises in the 10 years following the granting of tenure. Service obligations should not drive an *increase* in the production of low-citation papers! These patterns suggest that while non-research post-tenure obligations may affect productivity there is more to the story.

Perhaps Tenure Encourages Researchers to Branch Out

Tenure may not lead to an increase in homerun publications, but it may lead to an increase in interdisciplinary work, which may take time and perhaps not lead to papers with high citations counts, but still help ideas to germinate in important ways. There are several ways in which branching out could appear in our data: choosing new co-authors, publishing in new journals, and publishing in new areas.

To consider this possibility, consider the set of faculty in our dataset who eventually received tenure and for whom we can observe their first 15 years in academia. Then, for those 15 years, we estimate variants of the following linear probability model, in which each observation is a single publication:

$$Y_{i,t,r,s} = \alpha + \beta_t + \gamma_r + \delta_s + T_r + X_i + \varepsilon_{i,t,r,s}$$

where $Y_{i,t,r,s}$ is a dummy variable measuring whether paper *i* written at time *t* by researcher r, who has been a professor for *s* years, represents branching out (defined in three ways below); β_t is a year fixed effect designed to capture differential tendencies to branch out over time; γ_r is a researcher fixed effect designed to capture differential tendencies to branch out across researchers; δ_s is an event-time fixed effect designed to measure different tendencies to branch out as a researcher ages; and T_r is a dummy variable indicating whether the researcher has tenure.

In the first regression in Table 2, a paper is defined as branching out (that is, $Y_{i,t,r,s} = 1$) if it involves a new coauthor. In this case, X_i represents a "coauthor count" fixed effect, which accounts for the fact that researchers with more prior coauthors tend to add new coauthors more rarely.[2]

In our second regression, a paper is defined as branching out if it is published in a journal in which the researcher has never before published. For example, if a researcher has published only in finance journals and then publishes a new paper in the *Journal of Labor Economics*, then $Y_{i,t,r,s} = 1$ for this paper. In this case, X_i represents a "prior journal count" fixed effect, which accounts for the fact that it is more difficult to publish in a new journal when one has already published in many different journals previously.

[2] A coauthor count fixed effect is actually a set of fixed effects. The first takes a value of one if the author has never had a coauthor on any of her prior papers, and zero otherwise. The second takes a value of one if the author has only ever worked with one other coauthor previously, and zero otherwise. Etc.

In our third regression, a paper is defined as branching out if it is published in a new subject matter area. For example, the *Journal of Labor Economics* is defined as being in the area of labor economics, whereas the *Journal of Financial Economics* is defined as being in the area of finance. General interest journals are more difficult to categorize, so we define them to be in their own area.[3] In this case, X_i represents a "prior areas count" fixed effect, which accounts for the fact that it is more difficult to publish in a new area when one has already published in many areas previously.

Results are displayed in Table 2. In the first three data columns, we do not include researcher fixed effects, and in the last three we do. Based on regressions 1 and 4 there do not appear to be substantial differences in the tendency to add new coauthors pre- and post-tenure. Based on regressions 2 and 5, it does not appear to be more common for researchers to publish in new journals post-tenure. If anything, regression 2 suggests a weak tendency to publish in new journals less often. Importantly, this is not because tenured faculty have been out longer; this is accounted for with event-time fixed effects. It is also not because tenured faculty have already published in more journals, making it harder to publish in a new one; this is accounted for with journal count fixed effects. Finally, based on regressions 3 and 6, there is no evidence that tenured faculty branch out more by publishing in a new journal. If anything, there is weak evidence of a tendency to branch out less.

Risk-Taking May Decline on Average, but Perhaps not for Elite Faculty

The preceding results are averages. Perhaps faculty at the most prestigious departments, who produce the lion's share of truly influential papers, exhibit a different pattern of publication after tenure.

In Figure 3, we perform the same analysis as in Figure 1, and plot publications and homeruns for 5 years pre- to 10 years post-tenure, but restrict the sample to faculty who begin their careers at a subset of particularly prestigious schools: University of California-Berkeley, University of Chicago, Columbia University, Harvard University, Massachusetts Institute of Technology, Northwestern University, University of Pennsylvania, Princeton University, Stanford University, and Yale University.

[3] Interested readers can find the assignment of journals to areas in Table 2a in the appendix.

As in each of our subsamples thus far, publications and homeruns peak in the year the researcher is up for tenure and in her first year of tenure. Both fall markedly in the first two years post-tenure and then consistently from years two through ten post-tenure. The smaller sample size means that there is more noise than for the full sample, but the pattern is striking. Faculty who begin their careers at elite schools have the same publication pattern as those who begin elsewhere. Indeed, from years two through ten post-tenure, the drop in the publication rate is 15 percent and the drop in the homerun rate is 35 percent— precisely the same as in the full sample. The patterns we identify are present for faculty at both higher- and lower-ranked schools.

Perhaps it Takes Time for Truly Novel Research to Gain Traction

Perhaps truly influential papers take time to become known and cited. Perhaps Manso (2011) is correct in suggesting that the type of innovation for which tenure seeks to provide incentives is precisely the riskier type, which may take more time to catch on. To analyze whether this is the case, we restrict our sample to faculty who were tenured by 1994, and therefore papers published no later than 2004. As we evaluate the citations as of 2014, this allows at least 10 years for a paper to catch on. As in other subsample analyses, there is more noise, but the pattern is still present. In fact, we once again see a 15 percent reduction in the publication rate, and a 35 percent reduction in the homerun rate, in years two through ten post-tenure. The persistence of these ratios is surprisingly stable.

Perhaps this is True Only for Faculty at Schools with Poor Post-Tenure Contracting

It may be the case that some schools employ contracting techniques that encourage their faculty to swing for the fences, but the positive outcomes at these schools are outweighed by faculty at schools with poor contracting. We cannot observe the quality of contracting at every school at our sample, but one natural decomposition would be to separate public and private universities in the United States (US). Public institutions are subject to a variety of laws governing the compensation, hiring, and retention of state employees. Private institutions are largely free to design compensation programs at will.

If we split the sample into those faculty first tenured at US private schools and those first tenured at US public schools (and drop those first tenured elsewhere), we find that, at public schools, publication (homerun) rates fall 36% (43%) in the two years following tenure, and a further 16% (44%), in the subsequent eight years. At private schools, publication (homerun) rates fall 30% (25%) in the two years following tenure, and a further 12% (32%) in the subsequent eight years. At public schools, the likelihood that a publication becomes a homerun falls by 11% in the two years following tenure, and a further 33% in the subsequent eight years. At private schools, the likelihood that a publication becomes a homerun actually rises by 7% in the two years following tenure, but then falls 22% in the subsequent eight years.

In sum, the patterns are similar at public and private schools. Publication rates fall by similar amounts at both types of school, but homerun rates fall substantially less at private schools, providing weak evidence that contracting might help schools avoid this problem. Figures and additional discussion can be found in the online Appendix.

Perhaps our Definition of Homerun is too Generous

In our sample approximately 1/7 of papers become homeruns. Are there that many papers that are truly impactful? Perhaps researchers are publishing fewer above average papers, but really are producing more spectacular papers.

Choosing a cutoff for homeruns is a balancing act. Increasing the cutoff selects for papers that are more influential, but it reduces the number of papers defined as homeruns and thus injects noise. We choose top 10% as our threshold as a balance between the objectives of accurately measuring influence and minimizing noise. But perhaps we choose incorrectly.

We therefore consider an alternative to the homerun, which we call the grand slam. A paper is defined to be a grand slam if it is in the top 5% of all papers published in its publication year, measured by citations as of 2014. We find that the rate of grand slams is approximately half of the rate of homeruns, which is to be expected, and the pattern is similar. The rate of grand slam publications falls by 29% in the two years following tenure, and falls a further 32% in the subsequent eight years. These numbers closely align to those for homeruns. Further discussion and the associated figure can be found in the online Appendix.

Conclusion

This paper should not be read as an indictment of the institution of tenure. As noted at the start of the paper, tenure has an array of costs and benefits. In this paper, we consider only one aspect of tenure, and only for researchers in economics and finance. However, focusing on that one aspect, it does not appear that academic economists respond to the greater professional and intellectual freedom that tenure should provide by sustaining their earlier research effort or by taking the chances that lead to more homerun research. Among academic economists at research-oriented institutions, rates of publication and homerun publications rise up to the year of tenure and fall for a decade thereafter.

From one point of view, our paper contributes to a small empirical literature on the effect of tenure on academic output. Holley (1977) evaluates the productivity, both in terms of quantity and quality, of 97 sociologists surrounding their tenure dates. He finds decreased performance on both dimensions post-tenure. Li and Ou-Yang (2010) focus on economics and finance faculty from the top 25 schools and find no statistically significant difference in impact pre- and post-tenure. This result appears to be due to the substantial increase in statistical power that we achieve by including more faculty from more schools and a wider set of journals. Yoon (2016) analyzes the publication and citation rates for U.S. law school professors and finds that those rates rise to tenure and fall slightly thereafter. He analyzes only the first 10 years of a professor's career, little of which is post-tenure, so he cannot separate the effect of endogenous timing of tenure from the longer-run effects on productivity or effort.

We also believe that our findings raise some practical questions for academic economists and their institutions. For economists, the findings suggest that they should be wary of allocating their research time in a way that seems likely to lead to low-impact papers, and instead consider if there is a way for them to continue their earlier research efforts—at least in terms of quality, if not necessarily in quantity. When making a tenure decision, departments of economics and their home institutions should be aware that the research productivity of the person receiving tenure is likely to decline, in both quantity and quality terms, over the following decade. Thus, institutions should

consider whether there are methods to sustain (or at least not to impede) high-quality research efforts.

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Figure 1: Publications and Homeruns around Tenure

This figure plots the number of publications and the number of those publications that were "homeruns" in event time, where the event is tenure. A publication in an economics or finance journal is defined as a homerun if it has more citations than 90% of all economics and finance publications appearing in the same year. The sample consists of 980 faculty whose publication activity we observe for at least 5 years before tenure and 10 years following tenure. Each author on a publication is credited with the inverse of the number of authors on the publication (e.g., an article with four authors counts as .25 of a publication for each author). Per-capita author-adjusted publications is the sum of the cohort's publications, divided by 980. Per-capita author-adjusted homeruns is the sum of the cohort's homeruns, divided by 980. The height of each curve therefore represents the average number of publications (left axis) and homerun publications (right axis) for a member of our sample in each year of her career, measured from her year of tenure, where she only receives 1/N credit on an N authored paper.

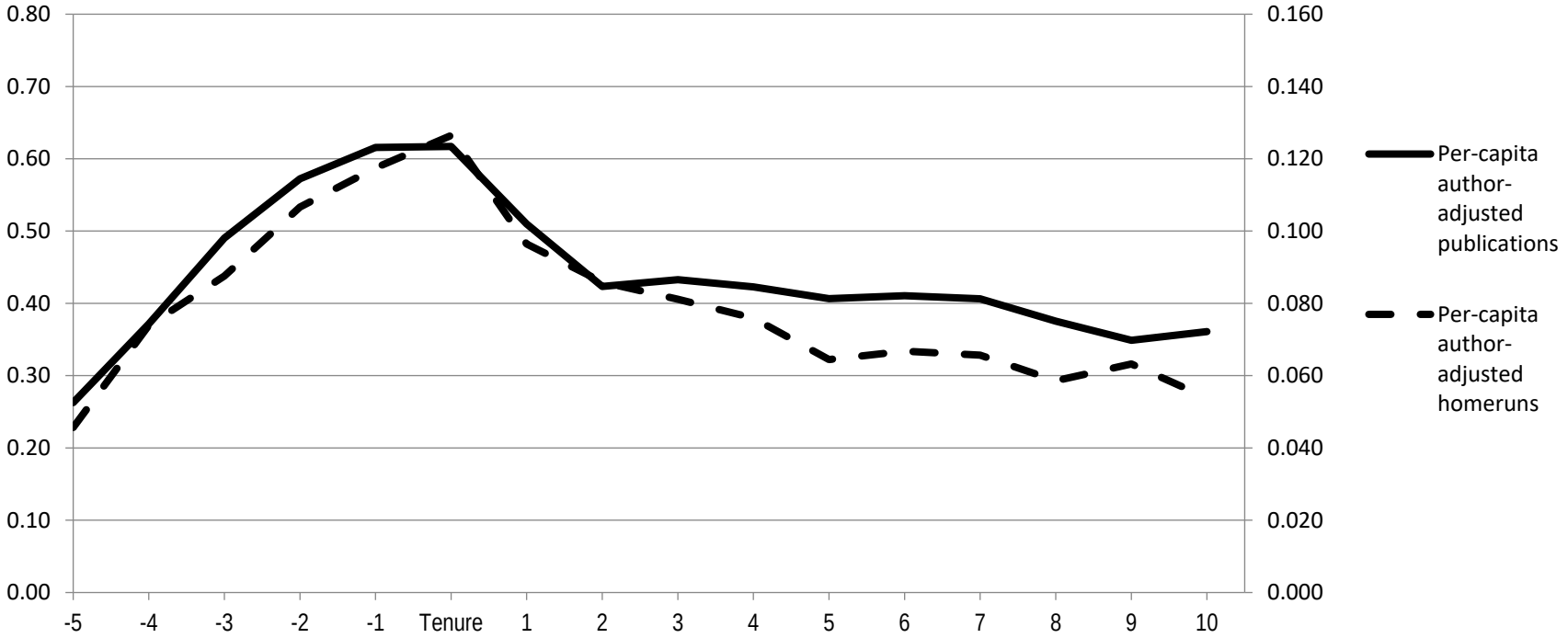


Figure 2: Publications around Tenure by Citation Percentile

This figure plots the relative frequency of author-adjusted publications by citation percentile around tenure. Homeruns (Bombs) are those above the 90th (below the 10th) percentile of all economics and finance papers in the same year. Pubs: 75th-90th, Pubs: 50th-75th, 25th-50th, and Pubs: 1oth-25th are similarly defined. Each series is normalized to 100 in the year of tenure.

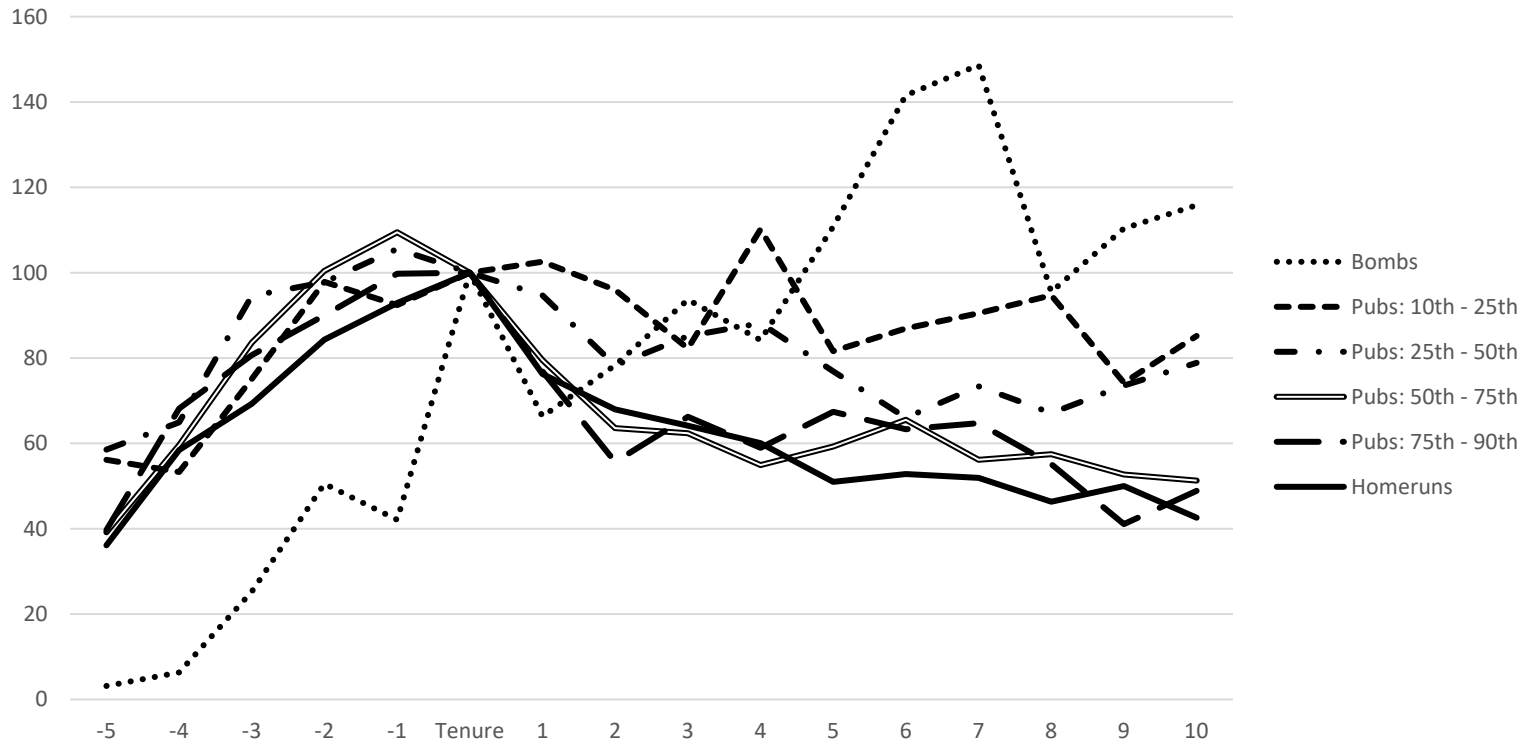


Figure 3: Publications and Homeruns around Tenure in Elite Schools

This figure plots the number of publications and the number of those publications that were "homeruns" in event time, where the event is tenure. A publication in an economics or finance journal is defined as a homerun if it has more citations than 90% of all economics and finance publications appearing in the same year. The sample consists of 333 faculty whose publication activity we observe for at least 5 years before tenure and 10 years following tenure, and who initially placed at one of the following schools: University of California-Berkeley, University of Chicago, Columbia University, Harvard University, Massachusetts Institute of Technology, Northwestern University, University of Pennsylvania, Princeton University, Stanford University, and Yale University. Each author on a publication is credited with the inverse of the number of authors on the publication (e.g., an article with four authors counts as .25 of a publication for each author). Per-capita author-adjusted publications is the sum of the cohort's publications, divided by 333. Per-capita author-adjusted homeruns is the sum of the cohort's homeruns, divided by 333. The height of each curve therefore represents the average number of publications (left axis) and homerun publications (right axis) for a member of our sample in each year of her career where she only receives 1/N credit on an N authored paper.

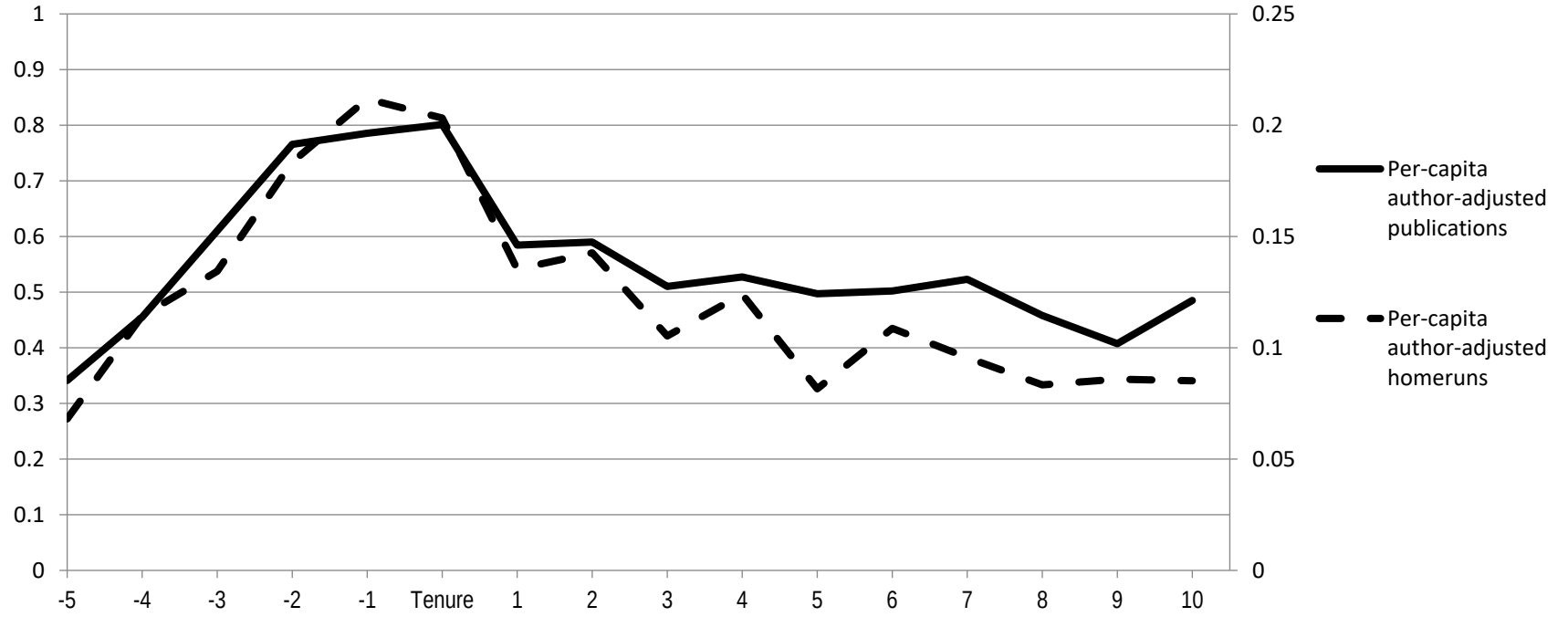


Table 1: Publications and Homeruns around Tenure

The dependent variable in the first (last) three data columns is author-adjusted publications (homeruns). Years -5 to -1, Years +1 to +5, and Years +6 to +10 are the 5 years before tenure, the first 5 years after tenure, and the next 5 years after tenure, respectively. The final row reports the *p*-value from a linear restriction test, which tests the equality of coefficients on Years +1 to +5 and Years +6 to +10. OLS standard errors are in parentheses and *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

Dependent Variable	Publications	Publications	Publications	Homeruns	Homeruns	Homeruns
Years -5 to -1 (Pre-tenure)	-0.155***	-0.168***	-0.092***	-0.040***	-0.046***	-0.032***
	(0.028)	(0.028)	(0.027)	(0.112)	(0.011)	(0.011)
Years +1 to +5 (Post-tenure)	-0.178***	-0.153***	-0.226***	-0.046***	-0.038***	-0.052***
	(0.028)	(0.028)	(0.027)	(0.011)	(0.011)	(0.011)
Years +6 to +10 (Post-tenure)	-0.237***	-0.186***	-0.373***	-0.065***	-0.049***	-0.085***
	(0.028)	(0.028)	(0.037)	(0.011)	(0.011)	(0.015)
Observations	15680	15680	15680	15680	15680	15680
Year Fixed Effects	NO	YES	YES	NO	YES	YES
Person Fixed Effects	NO	NO	YES	NO	NO	YES
R-Squared	0.0072	0.0233	0.2780	0.0037	0.0161	0.2164
P-value for Test: Years +1 to +5 = Years +6 to +10	0.0000	0.0167	0.0000	0.0000	0.0260	0.0000

Table 2: Other Forms of Risk-taking

Each observation is a professors' publication. The dependent variable in the first and fourth data columns is a dummy variable equal to one if the publication is with a new coauthor and zero otherwise. In the second and fifth data columns it is a dummy variable equal to one if the publication is in a new journal for the professor, and in the third and sixth data columns it is a dummy variable equal to one if it is in a new subject area for the professor. "Subject areas are grouped into accounting, econometrics, finance, general interest, industrial organization, international economics, labor economics, law and economics, macroeconomics, microeconomics, monetary economics, and public economics. Each professor's first publication is excluded (because "new" is trivially equal to one). OLS standard errors are in parentheses and *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

Dependent Variable	New Coauthor	New Journal	New Area	New Coauthor	New Journal	New Area
Tenure	-0.006	-0.053***	-0.041***	0.005	0.012	0.009
	(0.011)	(0.011)	(0.008)	(0.014)	(0.014)	(0.010)
Observations	16280	16280	16280	16280	16280	16280
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Event Year Fixed Effects	YES	YES	YES	YES	YES	YES
Coauthor Count Fixed Effects	YES	NO	NO	YES	NO	NO
Journal Count Fixed Effects	NO	YES	NO	NO	YES	NO
Area Count Fixed Effects	NO	NO	YES	NO	NO	YES
Person Fixed Effects	NO	NO	NO	YES	YES	YES
R-Squared	0.060	0.131	0.098	0.235	0.272	0.307

Online Appendix – Text:

Data and methodology

To determine the top 50 departments, we rely on the rankings of Conroy et al. (1995). Table 1a reports the schools, listed in alphabetical order.

Insert Table 1a About Here

We use a department ranking created before the sample period so as to minimize any bias due to a department growing or falling in prestige during the period of study.

To determine the current faculty at the departments in the sample, we visit each school's website and collect all tenure-track names listed on the website. For each faculty member, we download his or her most recent *curriculum vitae* (CV) as a record of current and past academic positions, and level of the position (Assistant, Associate, Full, Visiting, Emeritus).

Next, we look at department websites from past years. We can see previous versions of department websites using waybackmachine.org, a website dedicated to archiving all content on the internet. Waybackmachine.org collects data periodically back to 1996. Most schools in the sample have websites going back to 1996, although several start in later years. This allows us to construct a sample of nearly all faculty employed at these schools in any year from 1996 through 2014. For each faculty member, we use an internet search to find her most recent CV, so that we have data for appointments even if she left the top 50 prior to 2014. In total, we collect 2,763 names, 2,092 of whom are eventually granted tenure at some point prior to 2014. In our work below, we require a researcher to be in academia for at least 5 years prior to tenure, and 5 or 10 years after tenure. This reduces our sample to 1,331 researchers who are in academia for at least 5 years after being granted tenure, and 980 who are in the sample for at least 10 years post-tenure.

Typically, schools grant tenure at the same time that a faculty member is promoted to Associate Professor, though there are exceptions at each school. Some regularly grant tenure only a few years after promotion to Associate and some grant

tenure only upon promotion to Full Professor. To determine when a faculty member was granted tenure, we employ a multi-step process.

First, we determine the prevailing policy for when tenure is granted at each school. This requires finding faculty who disclosed the year that they were granted tenure on their CVs. If all disclosing faculty from a single school received tenure at the same position (for example, immediately upon appointment to Associate professor), then we determine that this is the standard for the school. This accounts for the vast majority of schools in the sample. Next, we contact department representatives, most often faculty, to inquire about the standard at each school. The standards resulting from this process match the standards determined from CVs.

Second, for schools with ambiguous standards (most notably Carnegie Mellon, which changed its tenure timing midway through the sample period), determining tenure dates requires contacting department faculty who would know the tenure status of the faculty member in question. For schools that grant tenure several years after an appointment to Associate Professor, we contact department faculty who are aware of the professor's date of tenure.

Third, for a random sample of faculty, we contact either them or their colleagues to confirm the assigned tenure year. This process is surprisingly consistent, with few examples where our tenure time assignment is incorrect. Data error typically occurs when (i) a faculty member moves to a new school and is simultaneously promoted from Assistant to Associate Professor, (ii) the new school tenures internal candidates at the Associate level, and (iii) the new faculty member receives tenure after only 1 or 2 years at the new school. It is not possible to fully correct for this potential error in the data, but the number of observations subject to this potential problem is well under 1/10 of the sample, and the fraction of those observations that are likely to be in error is small. Furthermore, this error can only serve to weaken our results.

After collecting the set of faculty and their tenure years, we match this database to a database of publications and citations for 51 leading economics and finance journals. The collection and composition of this database adds another 21 journals to the 30 journals in Brogaard et al. (2014). Merging the datasets requires standardizing school and faculty names. The former is straightforward but, because we cannot systematically distinguish publications among faculty members with common names

(e.g., Beth Allen, Belinda Allen, Brandon Allen, Bryant Allen and Bryon Allen all share the Web of Science name Allen, B), we remove those faculty with identical name listings. Readers or researchers who access the data underlying our work online should note that missing faculty likely share Web of Science names with other important faculty, leading to their exclusion. Also note that there is some discretion here: William J Adams of University of Michigan shares a Web of Science name with Walter Adams, but William has many publications and Walter has one, in 1951. In cases like this, the error from assigning the name to William is less than the loss to data from excluding him from the sample, so we keep his observations.

The data collection process introduces some errors, but that number is likely to be small, and any errors in the tenure date are likely to be one year or two at most. These errors, when present, will weaken our results, not strengthen them.

Adjusting for the number of co-authors on a paper

In our analysis, we credit an academic who publishes an N-authored paper with 1/N of a publication. We believe that this most accurately represents the productivity of that professor. It is reasonable, however, to use other weights. One natural weight is to credit an author with one publication, regardless of the number of co-authors.

Insert Figure 1a About Here

In Figure 1a, we reproduce Figure 1, but without any adjustment for the number of authors on a paper. The pattern clearly persists, with a drop in the publication (homerun) rate of 29% (33%) in the two years post-tenure. From years two to 10 post-tenure, per-capita publications drift down, and the per-capita homerun rate falls an additional 24%. The likelihood that a publication is a homerun falls 24% from year two to year 10 post-tenure. This compares with a 26% fall from year two to year 10 post-tenure with the adjusted numbers. Author-adjustment does not substantially affect the overarching story.

Separating faculty by years-to-tenure

In order to separate the effect of tenure from the effect of time, we split our sample from Figure 1 into several sub-samples based on how long it took a researcher to get tenure. Specifically, we split the sample by whether a researcher was granted tenure in her fifth year, sixth year, etc. The sample in each case is substantially smaller than for the full sample, adding noise to our plots, so we make two adjustments to improve the sample. First, we adjust our sample to include faculty who are in the sample for at least 5 years after tenure, as opposed to 10. This increases the sample size by nearly 40%, to 1,331 members, relative to requiring that faculty must be in the sample for 10 years post-tenure. Second, the number of faculty receiving tenure more than a decade after a PhD is too low to meaningfully display in a plot, so we group together all faculty who receive tenure after 10-15 years. Note that the number of faculty differs by tenure year, so the fact that faculty tenured in 6 years publish more papers than those tenured in 5 should not suggest that they are more productive on a per-researcher basis. Figure 2a displays the results.

Insert Figure 2a About Here

For those tenured in 5 years (Panel A), the year of peak production of both papers and homeruns is the tenure year. For those tenured in 6 years, the publication rate is highest in the year before tenure and the tenure year; the homerun publication rate peaks in the tenure year and the year after. For those tenured in 7 years, both publications and homeruns peak in the year the candidate is up for tenure. As the data become noisier (fewer people are tenured each year after seven), the peaks are less clear but the general shape persists: people publish more and better papers in the run-up to tenure and fewer after.

These facts suggest that it is not simply aging that is causing the patterns observed in Figures 1 to 3. The year of tenure itself is special, not simply the number of years since graduate school.

Public versus private schools

State-affiliated universities in the United States are often subject to labor laws that apply to all state employees. Rules determining raises, promotions, work

assignments, etc., may not be particularly well suited to an academic setting. Private universities, which are able to design rules to cater to their unique situations, might be better able to solve the problem of post-tenure productivity declines.

Insert Figure 3a About Here

In Figure 3a, we split the sample into 564 faculty who are tenured at US public schools (Panel A), and 365 faculty who are tenured at US private schools (Panel B). Note that $564 + 365 < 980$, because some faculty in our sample are tenured at non-US schools. We do not account for moves that take place after tenure because moving after tenure generates substantial selection issues that we wish to avoid.

The basic pattern is clear in both figures. Publication rates drop substantially in the two years following tenure, and steadily decline for the subsequent eight years. In both cases, homerun rates fall faster than publication rates, so the likelihood of a publication becoming a homerun falls.

How good must a paper be to be a homerun?

In our sample, approximately 1/7 of all publications are defined as homeruns. It is possible that we are not capturing true risk-taking, because we define many papers as homeruns even though they are merely above average. As we increase the threshold defining a homerun, the number of papers that meet the threshold falls. While these papers are certainly, on average, more impactful, there is also more noise in measuring rates when numerators are small. Nonetheless, we consider an additional variable here, which we call a grand slam. A grand slam is a paper that is in the top 5% of all papers published in its year, ranked by citations as of 2014.

Insert Figure 4a About Here

In Figure 4a, we reproduce Figure 1, with all 980 faculty, but plot grand slams instead of homeruns. Grand slams are produced approximately half as often as

homeruns, which should not be surprising since they comprise the top 5% rather than the top 10% of publications in a given year.

The pattern is the same. Grand slam publication rates fall by 29% in the two years following tenure, and a fall a subsequent 32% in the eight years following that. These patterns are quantitatively similar and qualitatively identical to the results concerning homeruns.

Online Appendix – Tables and Figures:

Figure 1a: Publications and Homeruns around Tenure

This figure plots the number of publications and the number of those publications that were "homeruns" in event time, where the event is tenure. A publication in an economics or finance journal is defined as a homerun if it has more citations than 90% of all economics and finance publications appearing in the same year. The sample consists of 980 faculty whose publication activity we observe for at least 5 years before tenure and 10 years following tenure. Per-capita publications is the sum of the cohort's publications, divided by 980. Per-capita homeruns is the sum of the cohort's homeruns, divided by 980. The height of each curve therefore represents the average number of publications (left axis) and homerun publications (right axis) for a member of our sample in each year of her career, measured from her year of tenure.

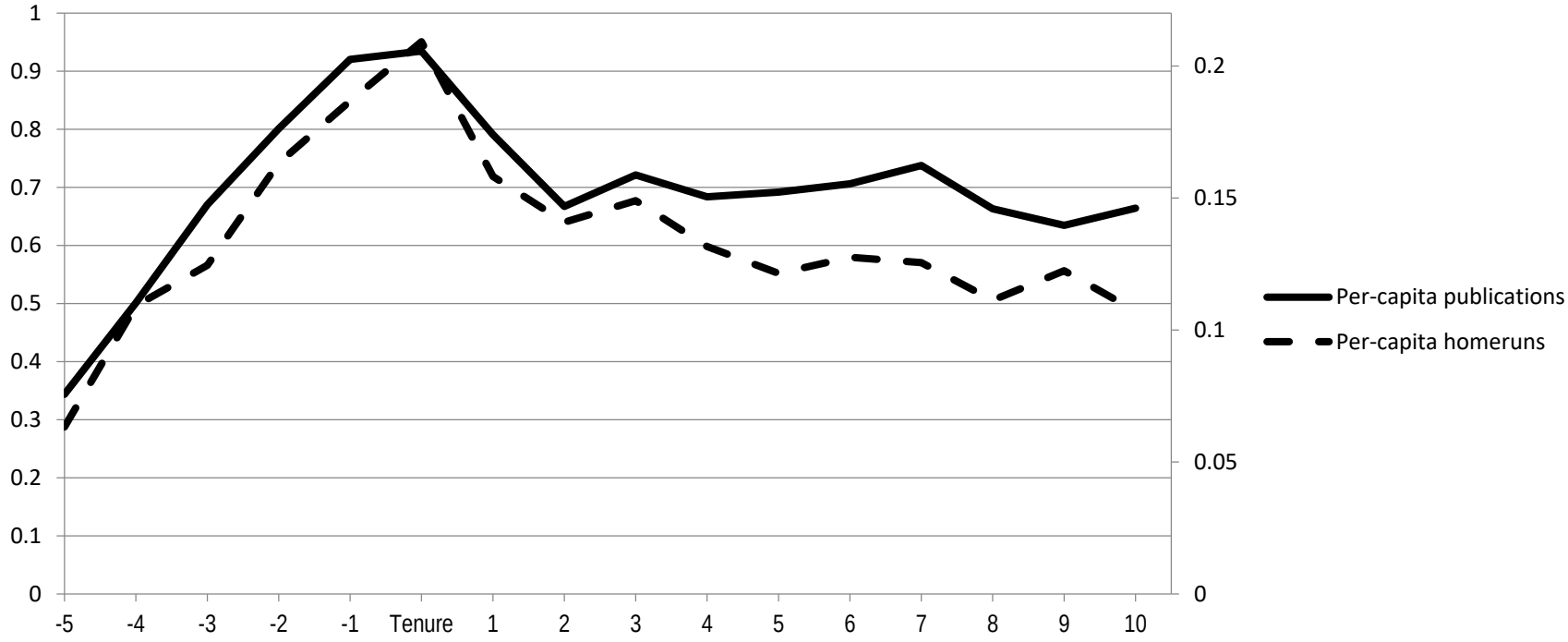
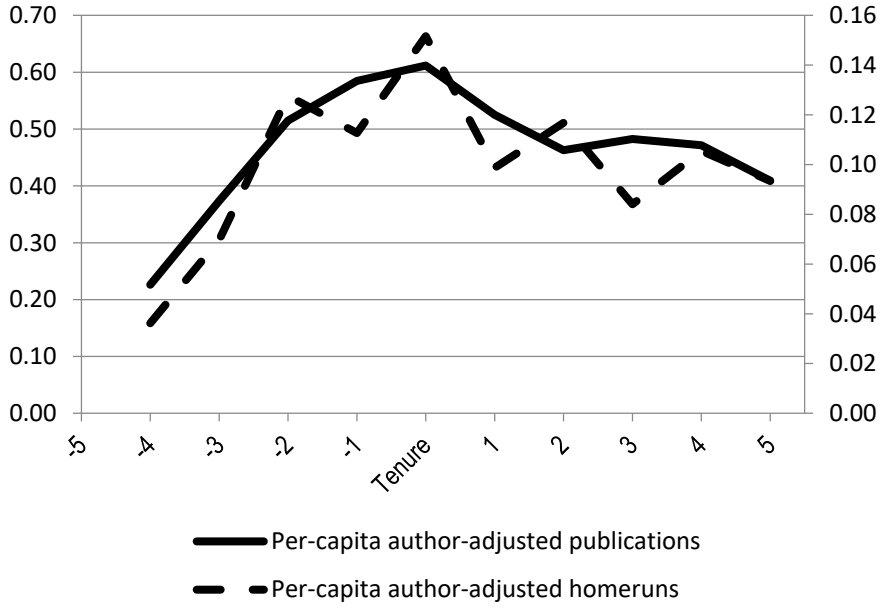


Figure 2a: Publications and Homeruns by Year of Tenure

Each figure plots both the number of per-capita author-adjusted publications and homeruns in event time, where the event is tenure. A publication in an economics or finance journal is defined as a homerun if it has more citations than 90% of all economics and finance publications appearing in the same year. Each panel considers a different time to tenure: 5, 6, 7, 8, and 9 years. The final panel considers all faculty tenured in 10-15 years. The sample includes 1,331 faculty who were tenured before 2009.

PANEL A: Tenured in 5 Years



PANEL B: Tenured in 6 Years

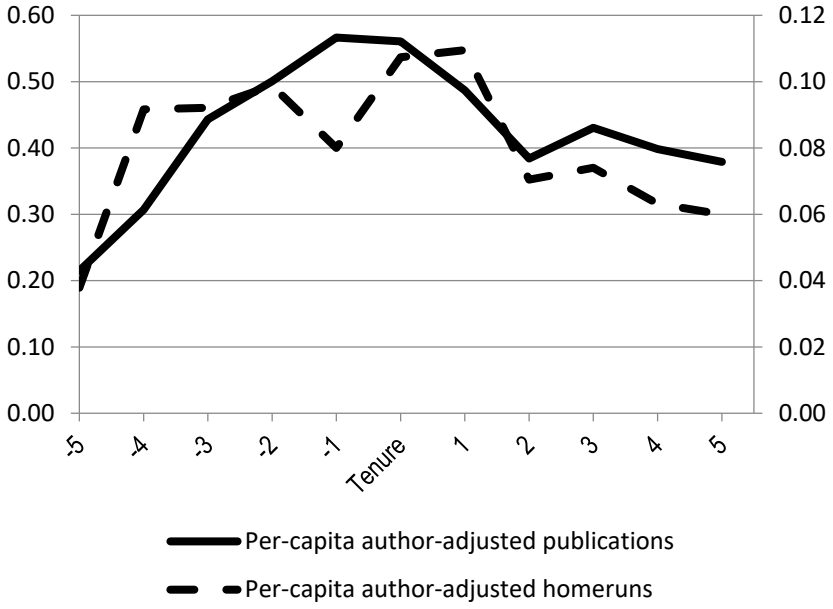
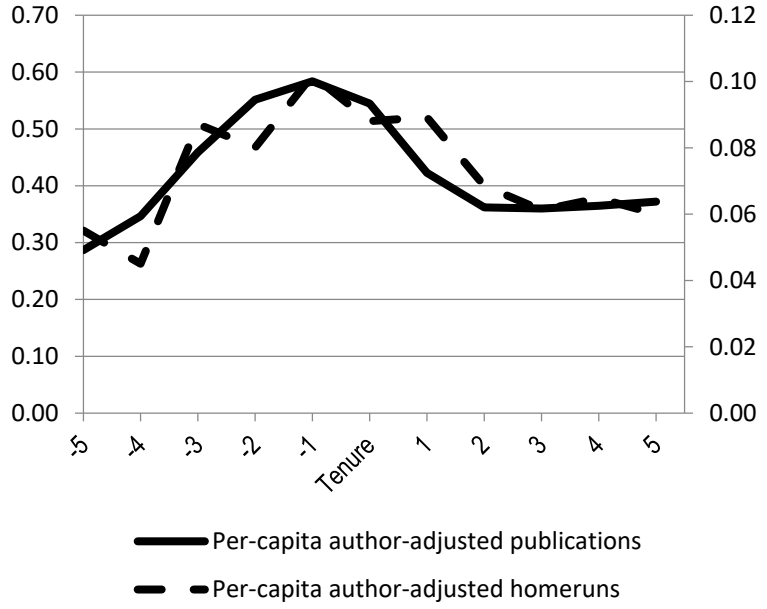


Figure 2a Continued

PANEL C: Tenured in 7 Years



PANEL D: Tenured in 8 Years

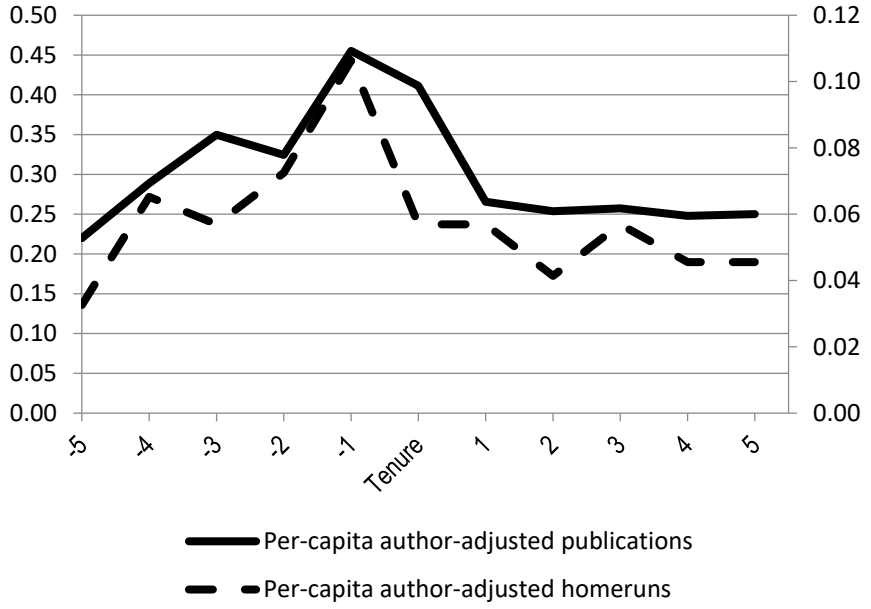
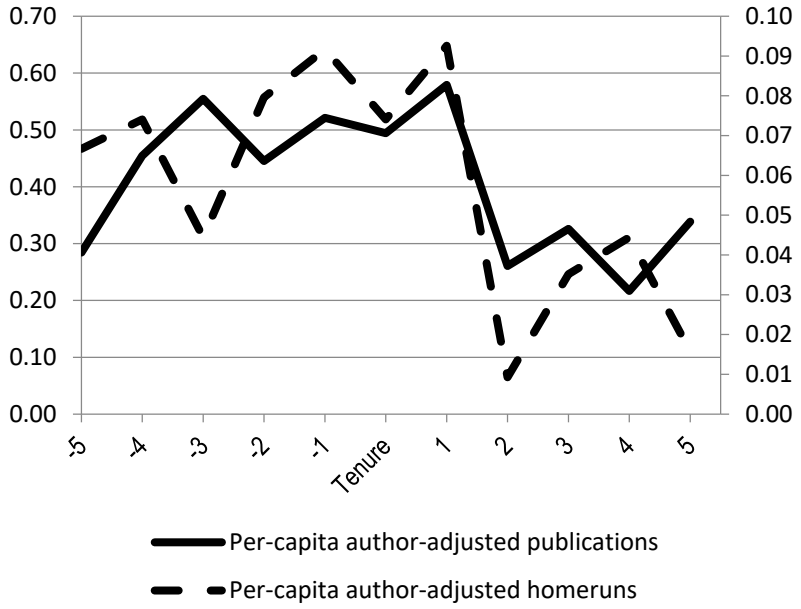


Figure 2a Continued

PANEL E: Tenured in 9 Years



PANEL F: Tenured in 10-15 Years

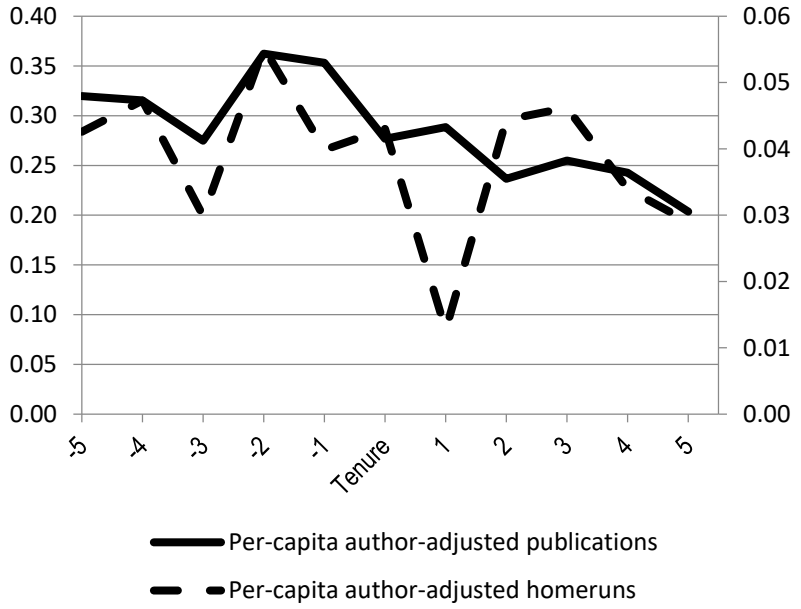
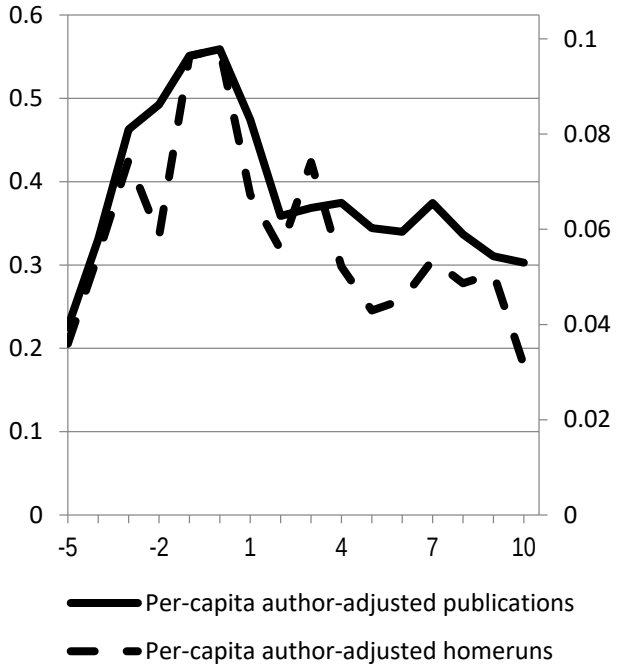


Figure 3a: Publications and Homeruns for Private and Public US Schools

Each figure plots the number of publications and the number of those publications that were "homeruns" in event time, where the event is tenure. A publication in an economics or finance journal is defined as a homerun if it has more citations than 90% of all economics and finance publications appearing in the same year. The sample consists of US faculty whose publication activity we observe for at least 5 years before tenure and 10 years following tenure. Each author on a publication is credited with the inverse of the number of authors on the publication (e.g., an article with four authors counts as .25 of a publication for each author). Panel A plots the data for 524 faculty tenured at US public universities. Panel B plots the data for 365 faculty tenures at US private universities. Per-capita author-adjusted publications (homeruns) is the sum of the cohort's publications (homeruns), divided by 524 in Panel A, and 365 in Panel B. The height of each curve therefore represents the average number of publications (left axis) and homerun publications (right axis) for a member of our sample in each year of her career, measured from her year of tenure, where she only receives 1/N credit on an N authored paper.

PANEL A: US Public Universities



PANEL B: US Private Universities

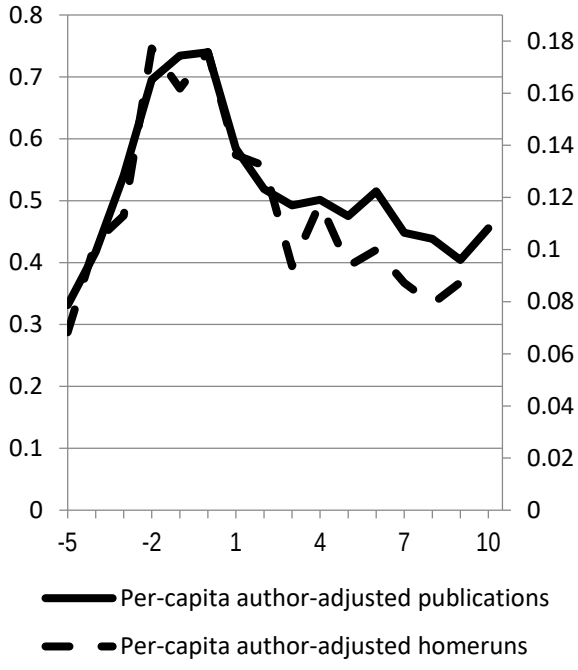


Figure 4a: Publications and Grand Slams around Tenure

This figure plots the number of publications and the number of those publications that were "grand slams" in event time, where the event is tenure. A publication in an economics or finance journal is defined as a grand slam if it has more citations than 95% of all economics and finance publications appearing in the same year. The sample consists of 980 faculty whose publication activity we observe for at least 5 years before tenure and 10 years following tenure. Each author on a publication is credited with the inverse of the number of authors on the publication (e.g., an article with four authors counts as .25 of a publication for each author). Per-capita author-adjusted publications is the sum of the cohort's publications, divided by 980. Per-capita author-adjusted grand slams is the sum of the cohort's grand slams, divided by 980. The height of each curve therefore represents the average number of publications (left axis) and grand slam publications (right axis) for a member of our sample in each year of her career, measured from her year of tenure, where she only receives 1/N credit on an N authored paper.

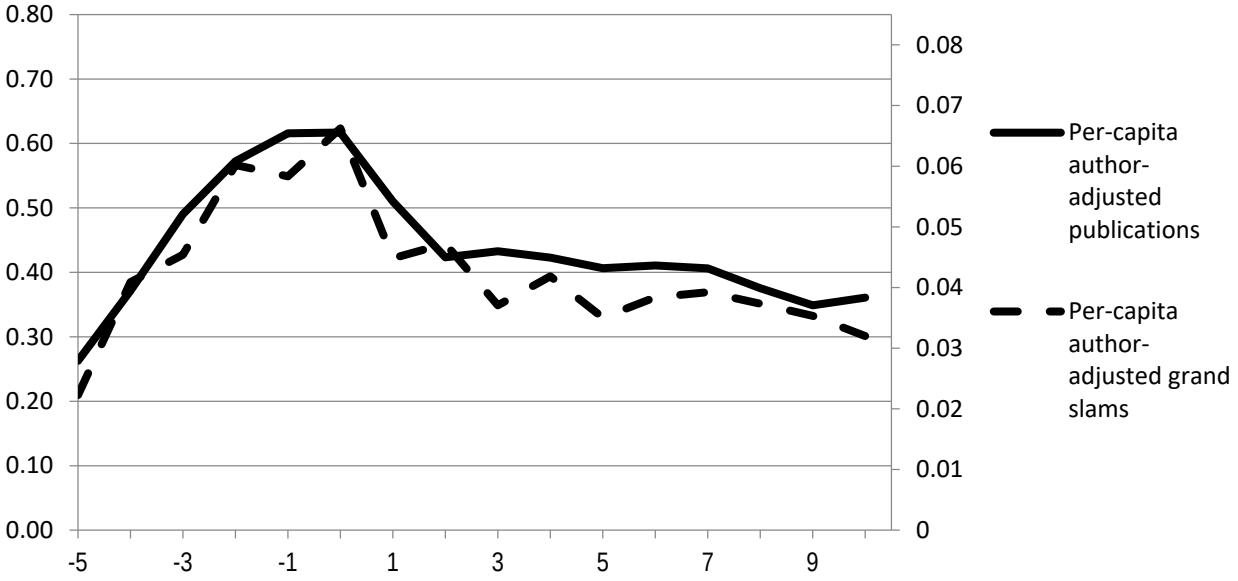


Table 1a: Schools

Table 1 lists the schools used in this research. To determine the top 50 departments, we rely on the rankings of Conroy et al. (1995). The schools are listed in in alphabetical order.

Boston College	SUNY-Stony Brook
Boston U.	Texas A&M
Brown U.	U. of Arizona
Cal Tech	U. of California-Berkeley
Carnegie Mellon	U. of California-Davis
Columbia U.	U. of California-Los Angeles
Cornell U.	U. of California-San Diego
Duke U.	U. of California-Santa Barbara
Harvard U.	U. of Chicago
Houston U.	U. of Colorado-Boulder
Iowa State U.	U. of Florida
Johns Hopkins U.	U. of Illinois-Urbana
Michigan State U.	U. of Indiana-Bloomington
MIT	U. of Iowa
New York U.	U. of Maryland
North Carolina State U.	U. of Michigan
Northwestern U.	U. of Minnesota
Ohio State U.	U. of North Carolina-Chapel Hill
Penn State U.	U. of Pennsylvania
Pittsburgh U.	U. of Rochester
Princeton U.	U. of Texas, Austin
Rice U.	U. of Virginia
Rutgers U.	U. of Washington
Southern Methodist U.	U. of Wisconsin-Madison
Stanford U.	Yale U.

Table 2a: Categories of Journals

A list of journal categories, the number of journals in each category, and the journals in each area

Journal Category	Number in Category	Web of Science Journal Abbreviations
Accounting	3	ACCOUNT REV J ACCOUNT ECON J ACCOUNTING RES
Econometrics	3	J APPL ECONOMET J ECONOMETRICS J FINANC ECONOMET
Finance	13	FINANC ANAL J FINANC MANAGE J BANK FINANC J CORP FINANC J FINANC J FINANC ECON J FINANC INTERMED J FINANC MARK J FINANC QUANT ANAL J FINANC RES MATH FINANC REV FINANC REV FINANC STUD
General Interest	16	AM ECON J-APPL ECON AM ECON J-ECON POLIC AM ECON REV ECON J ECONOMETRICA INT ECON REV J APPL ECONOM J BUS J BUS ECON STAT J ECON LIT J ECON PERSPECT J POLIT ECON MANAGE SCI Q J ECON REV ECON STAT REV ECON STUD
Industrial Organization	2	J IND ECON RAND J ECON
International	1	J INT ECON
Labor	2	J HUM RESOUR J LABOR ECON
Law and Economics	1	J LAW ECON
Macroeconomics	3	AM ECON J-MACROECON J ECON GROWTH REV ECON DYNAM
Micro Theory	4	AM ECON J-MICROECON ECON THEORY GAME ECON BEHAV J ECON THEORY
Monetary	2	J MONETARY ECON J MONEY CREDIT BANK
Public Economics	1	J PUBLIC ECON