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ARE AGRICULTURAL EXPERIMENT STATION FACULTY SALARIES COMPETITIVELY OR MONOPSONISTICALLY DETERMINED?

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Abstract: We examine the determinants of agricultural experiment station faculty salaries and find that productivity pays — as manifest by grantsmanship, publications, and the elicitation of competing offers — with no residual evidence of a negative seniority-salary relationship that could signal university monopsony power. This contrasts with findings in the previous literature on faculty salaries. Moreover, national market salary benchmarks, which may proxy for imperfectly observable productivity, correlate almost one-for-one with individual faculty salaries, with individual deviations from peers' salaries proving essentially random. This evidence is much more consistent with the hypothesis that experiment station faculty salaries are determined in a competitive labor market than with the prevailing wisdom that they are set monopsonistically.

Are Agricultural Experiment Station Faculty Salaries Competitively or Monopsonistically Determined?

Understanding the determinants of university faculty salaries is important both to academic career planning and to possible legal and institutional issues like discrimination, the incentive effects of the tenure system, the political economy of higher education funding, or the exercise of monopsony or oligopsony power by universities that might prompt faculty unionization. The recent labor economics literature generally supports claims of noncompetitive labor markets. Indeed, Boal and Ransom (p.99) claim in a recent survey that "[t]he case for monopsony in labor markets seems almost compelling." Of particular relevance to this paper, published empirical work on academic labor markets seems to reject competitive markets models, suggesting that universities face upward-sloping faculty labor supply curves and thereby exercise monopsony power (Gordon et al., Hoffman, Ransom, Hallock). For example, Ransom interprets his findings of negative marginal effects of faculty seniority on salary as evidence consistent with monopsonistic salary discrimination by universities, wherein individuals with high (unobservable) moving costs receive lower salaries and accumulate greater seniority at a university than do individuals with low moving costs.

As the next section explains, we doubt the hypothesis of university monopsony power for three reasons. First, it contradicts a long standing labor economics literature that cites seniority as contributing firm-specific human capital that enhances labor productivity. Second, it implies high moving costs that may be excessive. And third, the existing empirical evidence fails to account satisfactorily for either measurable faculty productivity or exogenous salary rates prevailing in the academic labor market. We then present empirical evidence, for university faculty with partial

research appointments to an agricultural experiment station, that is more consistent with the opposing hypothesis: that academic labor markets are competitive. Like Barbezat and Donihue's recent findings, our empirical results sugest that the marginal effect of seniority is positive until a faculty member is quite advanced. Moreover, when we incorporate measures of faculty productivity, and especially when we control for a benchmark salary from the national market, the statistical significance of demographic characteristics like experience and seniority falls precipitiously. In our data, it seems that productivity pays and any relationship between faculty demographics and salary are spurious relations attributable to omitted relevant variables bias.

There are four primary reasons to pursue this issue. First, the suggestion that universities exercise monopsonistic control over faculty colors the tone of faculty-administration relations on campuses and therefore demands careful scrutiny. The appearance of monopsony power exerted by a university over individual faculty members may elicit calls for unionization to achieve bargaining power and thus a potentially more efficient bilateral monopoly equilibrium. Faculty unionization is an active topic on several major research university campuses. Since the 1980 Supreme Court decision in National Labor Relations Board vs. Yeshiva University effectively denied collective bargaining rights to faculty at private universities, the number of unionized campuses has fallen. As of January 1997, faculty collective bargaining units or agreements existed at only 30% of U.S. college and university campuses (private and public), representing a similar proportion of full-time faculty in the country (NCCSCBHEP 1997). The debate over competition or monopsony in the academic labor market speaks directly to this topic. The results we present come from a nonunionized campus. Second, the institution of tenure is being carefully scrutinized by many institutions, perhaps especially in public universities, including the land grant system, because of popular perception that salary and

job security are unrelated to faculty productivity. The regression specifications employed in some recent studies (e.g., Ransom, Hallock, Barbezat and Donihue) may feed such perceptions by paying relatively little attention to the relationship between faculty salaries and productivity. We feel the issue deserves more careful review. Third, an understanding of which activities generally raise salary levels can aid faculty members in optimally allocating time and effort among competing time demands and in making strategic career decisions. Such information is too often lacking in mentoring of graduate students and junior faculty. Finally, higher education has suffered a steady decline in share of public expenditures. University administrators routinely decry what they perceive as insufficient faculty lobbying to support higher education generally, and claim that faculty salaries are determined primarily by the fiscal health of the higher education sector. Such claims are more likely true in a competitive national market than in one where universities exercise monopsony power locally.[1]

Previous Claims of Monopsony in the Academic Labor Market

Several previous studies of the academic labor market have found a negative marginal effect of seniority on faculty salary (Gordon et al., Hoffman, Ransom). Like Barbezat and Donihue and Moore et al., we find these results puzzling given that in most studies of non-academic labor markets, seniority seems to be financially rewarding, whether due to increased productivity, insurance motives, or other factors (Hashimoto, Harris and Holmstrom). Why should universities behave differently with respect to their faculty?

Building on the growing literature concerning monopsony in labor markets (Boal and Ransom), Ransom posits a competitive national faculty labor market pre-hire, but once a faculty member has joined a particular university, spatial dispersion endows universities with monopsony

power over their faculty, who face nontrivial moving costs if they choose to leave for another institution. Thus, new entrants to the academic labor market (i.e., new Ph.D.s or post-docs) and those with very low moving costs are paid a market wage equal to the professor's marginal revenue product, but then (except for those with very low moving costs) they begin to be exploited as their universities take advantage of their moving costs to pay them systematically less. Black and Loewenstein (1991) offer a model similar in spirit, in which new hires are initially paid more than their marginal revenue product as employers front-load salary schedules in order to entice workers into exploitable relations. In either model's equilibrium, this results in a negative salary-seniority profile because those with the highest moving costs — and thus those must subject to exploitation — move least often and are paid the least. Ransom finds this negative seniority-salary relationship in his oft-cited empirical work on faculty salaries, controlling for standard human capital variables (e.g., experience, gender, race, academic discipline) and publications.

One concern about the Black/Loewenstein/Ransom models is their implicit reliance on moving costs which may be implausibly large in order to inhibit faculty from changing universities. While individuals might face idiosyncratically high moving costs due to geographic preferences or family circumstances, it is unlikely that this is a characteristic of the full faculty population whose salaries are estimated in the regressions. According to the *Statistical Abstract of the United States* (1996), there are better than 3,600 colleges and universities in the United States, so the argument that spatial dispersion creates significant (psychic or pecuniary) moving costs has clear limits. Unless faculty systematically fail to consider the future salary effects of changing their seniority, one would expect faculty to compare the discounted net present value of the compensation stream available from an alternative potential employer with that from the incumbent university. Even using a conservative

annual discount rate of 10%, Ransom's results imply that switching research universities offers considerable net present added value, as much as 78% of annual salary over a ten year horizon for a faculty member with ten years' seniority.[2] We doubt such large estimates accurately represent the central tendency of frictions caused by moving costs in the faculty labor market. This argument applies to statistically significantly positive seniority-salary relationships as well; why would the average faculty member forego substantial estimated earnings to stay?[3]

The existence of a significant relationship between seniority and faculty salary might mask a more intuitive relationship between faculty productivity and salaries. Such would be the prediction of a model in which faculty salaries are competitively rather than monopsonistically determined. This relates to our third concern about the conditioning variables used in the existing empirical literature on faculty salary determination. A competitive markets model would suggest that the salary earned by a professor would be wholly determined by her productivity, by the salaries earned by her peers at other institutions (i.e., the salaries of her prospective substitutes), or both. Moore et al. share our concern that the negative seniority-salary profile presently accepted in the literature may stem from the use of insufficiently comprehensive measures of faculty productivity. Taking care to control for the quality of the journals in which a sample of economics faculty publish, as well as for the quantity of their publications, they find that faculty with greater seniority are rewarded less simply because, as a group, many have been relatively less productive than their colleagues with less seniority at similar stages in their careers. We likewise find that faculty productivity, defined more broadly than just a count of publications, seems to lie behind the statistical relation between salary and seniority found by others, as manifest in the sharp drop in statistical significance of the coefficient estimates on longevity variables once one controls well for productivity.

We have not found a study of faculty salary determination that includes a market benchmark among the regressors. But if faculty productivity is difficult to observe and measure, as a bevy of recent studies in higher education claim (CFAT, 1997), a reasonable and low-cost proxy university employers might employ is the benchmark salary for faculty of equal rank in the same discipline, i.e., the cost of a substitute hire.[4] Omission of a benchmark salary implies either (a) that faculty marginal value product can be readily observed, measured and used to set salaries, (b) that the greater marketplace exerts zero influence over faculty salary determination, i.e., that faculty salaries are locally determined without reference to the broader marketplace, or both. Assumption (b) could bias regression results in favor of supporting the monopsony hypothesis.

The Data

The data we use come from base salary information on a twelve-month basis for 1995 on the 123 faculty with research appointments in both the Utah Agricultural Experiment Station (UAES) and academic departments at Utah State University (USU), a land-grant university and a Carnegie I Research University. The full suite of productivity data were not available for the entire University faculty, hence our restricted examination of faculty affiliated with the UAES. Administrators and non-tenure track appointments are excluded; only those designated as professor, associate professor, or assistant professor are considered. Table 1 presents descriptive statistics on salaries by rank and gender. Table 2 provides gender specific information regarding age, experience, seniority, quality of terminal degree granting institution, grant activity, publications and teaching. Mean salaries for women are less than men, but women also tend to be younger, have fewer years of experience and

seniority, have won fewer grant dollars and have fewer publications and lower teaching evaluations than their male counterparts.

This sample, while small, is likely biased in favor of finding the sorts of monopsony effects that Ransom models. USU's faculty are not organized into a union. The nearest college is two counties and fifty miles away, and the nearest Ph.D.-granting, Carnegie Research University I is four counties and ninety miles away. Professors cannot easily switch university employers from USU without relocating and entailing moving costs. The University provides an unusually generous fringe benefits package, including a 14.2% pension contribution to TIAA-CREF. Moreover, a significant proportion of USU's faculty are Mormons[5] — exact figures are unavailable for privacy reasons — who place considerable psychic value on living in Utah, a place of great cultural importance to members of that church. Consequently, if faculty psychic and pecuniary moving costs enable universities to exercise monopsony power locally over their faculties, then surely such effects should appear in the data from a place such as USU. This known bias makes our results — which are inconsistent with the claim that research faculty salaries are monopsonistically-determined — all the more interesting and compensates somewhat for the modest sample size involved.

The Regression Model

Our contribution to this line of research is that we consider how both more detailed measures of productivity and the broader academic labor market might influence faculty salary levels. We proceed in two steps. First we estimate models like those used in previous studies (Barbezat and Donihue; Gordon et al.;Hallock; Hoffman; Ransom), maintaining the common exclusion of extramural salary benchmarks from the regression specification. In addition to measuring the effects of

traditional demographic variables (gender, race, seniority, and experience) on faculty compensation, we also control for the faculty member receiving an outside job offer, number of scholarly publications, teaching evaluations, and faculty grant activity.

We assume that universities raid other campuses in an attempt to poach highly productive faculty members. In particular, anecdotal evidence suggests that raids are often related not only to historical research productivity and teaching effectiveness, which would be captured in measures of publications, teaching evaluations and grants won, but also to a faculty member's prospective administrative abilities, prominence in a field of growing importance, or the extraordinary quality of the professor's research or teaching. While it is a crude method, the existence of a recent outside offer may convey information on faculty quality that is otherwise unmeasurable.[6]

Research publications are the common currency of academic productivity and we expect to find a positive relationship between publication activity and salaries. While we would like to control for journal quality, as Moore et al. do in studying economists' salaries, this is essentially impossible in a pool containing many distinct disciplines. One would like to believe that universities care about and reward teaching quality, although student evaluations are a noisy indicator of a faculty member's performance in the classroom. Promotion often captures productivity attributes — e.g., publications quality, service, past productivity, professional reputation — otherwise omitted, so we include rank (assistant, associate or full professor) as an instrumented variable. We instrument for rank because of potential endogeneity. Finally, given the increasing financial dependence of research universities on extramural contracts and grants, we hypothesize that faculty compensation is positively related to grantsmanship activity, a *de facto* revenue-sharing arrangement between the university and its principal investigators.

After augmenting the traditional human capital earnings model with those more detailed measures of faculty productivity, we subsequently introduce national peer average salaries in order to test whether the external benchmark for a particular rank and discipline significantly affects individual professors' salaries. If faculty productivity were perfectly observable, universities could readily compute the employee's marginal revenue product and set salaries accordingly. But since the measurement of faculty productivity is notoriously difficult, and since casual conversation with university administrators suggests that they indeed pay attention to market benchmark data, we explore whether perhaps external benchmarks explain individual faculty salaries better than either human capital or measurable productivity variables. Since a strong positive correlation between individual faculty salaries and the appropriate external benchmark could be evidence of either competitive or monopsonistic limit pricing, we subsequently test whether the deviation of salaries from external benchmarks exhibits any patterns consistent with one or the other explanation.

Following tradition, we define seniority in this paper as the number of years the faculty member has been employed by the university. Experience is defined as the number of years since completion of the terminal degree. We include detail on the number of refereed papers the faculty member published, average teaching evaluations, and grant activity, measured in thousands of dollars, all during the most recent five-year period, as well as a dummy variable to represent whether the faculty member received an external competitive offer during the preceding five years. The basic regression model is thus as follows:

$$\ell nS_i = \beta_0+\beta_1 EXP_i+\beta_2 EXP_i^2+\beta_3 SEN_i+\beta_4 SEN_i^2+\beta_5 RANK+\beta_6 HWT+\theta_1 GRT_i+\theta_2 \text{sign}(GRT) GRT_i^2+\theta_3 OFFER_i$$
$$+\theta_4 PUB_i+\theta_5 \text{sign}(PUB) PUB_i^2+\theta_6 TCH_i+\theta_7 \text{sign}(TCH)*TCH_i^2+ \phi_i RACE_i+\phi_i FEM_i+\textstyle\sum_j \phi_j DPT_{ij}+\epsilon_i \qquad (1)$$

where S_i is the 1996 salary of the i^{th} faculty member, EX is years of experience since the terminal degree was awarded, and SEN is years of seniority at the institution.

Because of prospective endogeneity, as identifed by a Hausman test, we instrument for the variable RANK using an ordered probit model with assistant, associate, and full professors assigned a value of 0, 1, and 2 , respectively.[7] HWT is a dummy variable equal to one if the faculty member was hired with tenure and zero otherwise,[8] OFFER is a dummy variable taking unit value if the faculty member received a competitive external offer in the 1991-1995 period, GRT is thousands of dollars from grants awarded between 1991 and 1995 inclusive, measured as a deviation from the department mean, PUB is the number of "Type I" publications (this includes refereed journal articles, books, and chapters in books) between 1991 and 1995 inclusive, again measured as a deviation from the department mean,[9] TCH is the deviation of the professor's average teaching evaluations over the past five years from the department mean,[10] DPT are binary variables representing the i^{th} faculty member's department, with the Department of Sociology, Social Work, and Anthropology as the base, RACE is a binary variable equal to 1 for non-Caucasians and 0 otherwise, FEM is 1 for females and 0 for males, and ϵ_i is the iid, normal disturbance term. The squared terms for experience and seniority are scaled by dividing by 100 while those for grants, refereed publications, and teaching evaluations are multiplied by the sign of the deviation from the mean to capture universities' likely asymmetric preference for above-average performance.[11]

A White (1980) test revealed no significant heteroskedasticity, so we estimate the model using ordinary least squares. Multicollinearity does not seem an issue. The correlation matrix of the regressors reveals that other than the intuitive collinearity of experience and seniority (r=0.92) ominpresent in this literature, no two regressors have a correlation coefficient in excess of 0.32. The

single-log specification permits interpretation of the parameter estimates as percentage marginal effects.

The notation on the parameter estimates reveals our strategy in researching this question. The β parameters relate to longevity variables (experience and seniority) on which the previous literature has focused especially, the θ parameters are associated with indicators of productivity, and the ϕ parameters relate to demographic conditioning variables beyond the faculty member's control. Previous studies (Moore et al. excluded) have either omitted the θ parameters or included only one variable (publication quantities), entered linearly. We are concerned that this omission leads to mistaken inference about the nature of the labor market for research university faculty.

The productivity measures enter as deviations from the faculty member's department mean for two reasons. First, it makes interpretation of the results easy in the case of an "average" performing faculty member. Second, the recent literature on labor contracts emphasizes the role of tournaments and the use of relative performance measures in designing optimal multiagent incentive contracts when employees' effort is not observable, and thus subject to moral hazard, as is the case with university faculty (Lazear and Rosen; Bhattacharya and Guasch). Since theory tells us tournaments are best designed as cohort-specific, and because of unobservable heterogeneity between disciplines in teaching, grantsmanship and publications standards, we use deviations from faculty member's department mean, rather than from the mean of the full sample, to generate these relative measures of faculty productivity.

The Role of Productivity In Determining Faculty Salaries

We first estimate the model in equation (1) using the specifications found in the previous literature on faculty salaries, omitting productivity indicators and faculty rank and concentrating on what might be termed the human capital earnings relationship. Like Barbezat and Donihue, we find the traditional increasing and concave salary-experience and salary-seniority profiles, with the returns to experience effectively nondecreasing over a career (the peak is after 58 years) and the returns to seniority peaking after ten years (Table 3). As Table 4 shows, the p-values of joint statistical significance of the linear and quadratic terms suggest that the experience (0.002) matters more than seniority (0.132).

Once we introduce the range of faculty productivity variables (model 2), none of the coefficient estimates on the longevity variablesare statistically significantly different from zero, individually or jointly.[12] The sharp increase in the p-values of the hypothesis tests of joint (linear and quadratic) statistical significance of the longevity variables, from 0.002 to 0.816 for experience and from 0.132 to 0.906 for seniority, suggests that their increasing, concave profile in model 1 largely reflects an indirect relation through productivity variables, rather than direct effects of faculty longevity. Indeed, the key productivity measures — publications, grantsmanship and teaching — likewise exhibit increasing concave effects on faculty salaries, although the effect is jointly statistically significant only in the case of publications (Table 4). The coefficients on two disciplinary dummy variables were likewise statistically significant, in Biological and Irrigation Engineering and Economics, at 19.1% and 18.1% premia over Sociology, Social Work and Anthropology, respectively (Table 5). The point estimate on the OFFER and HWT variables have the correct sign but are of small magnitude and statistically insignificant. The clear implication is that the university rewards research productivity as evinced by scholarly publications, and little else matters.[13] The coefficient

estimates on the gender and race variables are negative and positive, respectively, but not statistically significantly different from zero and of small magnitude.

Even omitting broader academic labor market signals, this one, non-unionized university does not seem to discriminate monopsonistically against its research faculty despite an unusual opportunity to do so afforded by its location, fringe benefits package,and the cultural characteristics of many of its faculty. Controlling appropriately for faculty productivity, it appears that faculty are compensated primarily based on their productivity, a finding that suggests the academic labor market is at least workably competitive.

The Role of the Broader Academic Labor Market in Determining Salaries

The foregoing analysis implies that to the extent that research faculty salaries are set at the employing institution, research productivity is the primary determinant of compensation, consistent with the competitive markets condition that a worker's wage equal her marginal revenue product and the widespread perception that research is the principal task of faculty at research universities. But are faculty salaries really determined locally? While we can introduce better measures of faculty productivity than the previous literature has — as the previous section and Moore et al. demonstrate — it is nonetheless extraordinarily difficult for either an econometrician or a university administrator to establish a faculty member's true productivity across all assigned activities. Given imperfectly observable productivity, many administrators may look to external indicators of what similar faculty elsewhere are paid.

To investigate this possibility, we introduce the natural logarithm of national mean salary for faculty of the same rank and discipline (PEER), derived from a 1995 survey of 93 institutions

belonging to the National Association of State Universities and Land Grant Colleges (NASULGC) that also award doctoral degrees in at least five different programs (reported in OSU). This is an appropriate peer group for research faculty at USU. This external benchmark permits us to assess the degree to which faculty salaries may be based on national peer averages from the broader marketplace , a question overlooked to date in the literature. While the national average salaries are clearly external to USU, the choice of individuals' benchmark partly depends on a faculty member's rank, which we previously found to be endogenous. So we again ran a Hausman test for endogeneity, instrumenting with the other regressors. We could not reject the hypothesis that PEER was exogenous at any reasonable level of statistical significance.[14]

In Table 3, model 3 we thus report estimates of equation (1), absent the intercept, rank and department dummy variables and including instead the natural logarithm of the faculty member's peer average salary (PEER). The results are striking. There is nearly a one-to-one correspondence between peer salaries and USU faculty salaries, and neither demographic nor productivity variables exhibit any strongly statistically significant effect on faculty salaries. Indeed, the joint null hypothesis that the coefficients equal zero on all the regressors except PEER is only just rejected at the ten percent level (Table 4). This specification also brings out the effects of outside offers, which are now statistically significant at the 11% level and estimated to increase salary almost 15 percent. In these data, salaries appear to respond directly and almost exclusively to signals from the broader academic labor market. Making the assumption that 3,600+ U.S. universities — or even the 93 NASULGC institutions in the benchmark survey — cannot collude in setting faculty salaries, this is consistent with the hypothesis of a competitive faculty labor market.

Since the findings of model 3 could also be consistent with the university engaging in monopsonistic limit pricing of its research faculty — due to market power afforded by (pecuniary or psychic) moving costs, tenure, or both — we next explore whether either longevity or productivity variables explain the deviation of individual faculty salaries from peer national averages. Replicating models 1 and 2, now with percentage difference between individual and national peer average salary as the dependent variable [ln(salary)-ln(peer avg. salary)], we find no systematic pattern to deviations. The longevity profiles are all now decreasing convex, with estimated minima at 10 and 46 years for experience and seniority, respectively. Note in particular that seniority is jointly significant at approximately the 10 percent level if one omits productivity variables, but once these are introduced, the p-value on the hypothesis test of joint significance jumps to 0.418, suggesting that a negative seniority-salary differential profile, akin to that found by Ransom, is spurious. Productivity variables continue to have a positive, concave relationship to salary but none of the coefficient estimates are statistically significant. These regressions explain roughly half the observed variation in deviations from national peer average salaries, but the high p-values associated with the coefficient estimates suggests there is no clear pattern driving these deviations. Given that these regressions are equivalent to having imposed a unit coefficient, instead of the 0.993 point estimate, on the ln(peer average salary) variable in model 3, it is little surprise that the coefficients on the regressors in models 4 and 5 are little changed from their point estimates or t-statistics in model 3. Apart from their relation to the elicitation of competing outside offers, deviations from market benchmark salary levels appear to be largely random.

Conclusions

Contrary to some recent evidence in the literature on faculty salaries and the academic labor market, our results suggest that productivity and external benchmarks provided by national peer average salaries are the principal determinants of faculty compensation and that one cannot reject the null hypothesis of zero seniority effect on faculty salaries. Keep in mind that these results come from a nonunionized campus; the salary determination process may well be different on the 30 percent or so of American campuses on which faculty are represented by a collective bargaining agreement. Others claim to find evidence that universities exercise monopsonistic control over faculty. Using data from research faculty affiliated with the agricultural experiment station at one Carnegie Research I University that should have uncommon opportunity to exploit faculty members' pecuniary and psychic moving costs, if these are significant, our results favor instead the hypothesis of a competitive academic labor market.

Our results represent conditions among faculty with research appointments at only one land-grant university and the inferences we draw from these results should clearly be checked using data from other institutions. But these provisional results nonetheless have interesting implications. The finding that measures of research excellence are important determinants of salary challenges the increasingly popular cry that faculty salaries are unrelated to productivity. Our findings suggest that calls for faculty unionization based on the perception that universities exercise monopsonistic power in the academic labor market may be misinformed or premature. Interuniversity faculty organization to influence aggregate funding for higher education, by contrast, is perhaps more advisable since individual faculty salaries appear to be determined largely in the national marketplace. There are, however, formidable collective action problems involved in organizing such a large and spatially dispersed group as university professors.

References

Barbezat, Debra A. "The Effect of Collective Bargaining on Salaries in Higher Education." *Industrial and Labor Relations Review,* April 1989, 42(3), pp. 43-55.

Barbezat, Debra A. and Michael R. Donihue, "Do Faculty Salaries Rise With Job Seniority?" *Economics Letters*, February 1998, 58(2): 239-244.

Bhattacharya, Sudipto and J. Luis Guasch, "Heterogeneity, Tournaments, and Hierarchies," *Journal of Political Economy*, August 1988, 96(4): 867-881.

Black, Dan A. and Mark A. Loewenstein, "Self-Enforcing Labor Contracts With Costly Mobility: The Subgame Perfect Solution to the Chairman's Problem," *Research in Labor Economics*, 12 (1991): pp. 63-83.

Boal, William M., and Michael R. Ransom, "Monopsony in the Labor Market," *Journal of Economic Literature*, March 1997, 35(1),pp. 86-112.

Carnegie Foundation for the Advancement of Teaching, *Scholarship Assessed: Evaluation of the Professoriate* (San Francisco: Jossey-Bass, 1997).

Gordon, Nancy M., Thomas E. Morton, and Ina Braden, "Faculty Salaries: Is There Discrimination By Sex, Race, and Discipline?" *American Economic Review*, June 1974, 64(3): pp. 419-427.

Hallock, Kevin F. "Seniority and Monopsony in the Academic Labor Market: Comment." *American Economic Review*, June 1995, 85(3), pp. 654-7.

Harris, Milton and Holmstrom, Bengt. "A Theory of Wage Dynamics." *Review of Economic Studies*, July 1982, 72, pp. 716-24.

Hashimoto, Masanori, "Firm-Specific Human Capital as a Shared Investment," *American Economic Review*, June 1981, 71(3), pp. 475-482.

Hausman, J. A. "Specification Tests in Econometrics." *Econometrica*, 46(1978):1251-1271.

Hoffman, Emily P. "Faculty Salaries: Is There Discrimination by Sex, Race, and Discipline? Additional Evidence." *American Economic Review*, March 1976, 66(1), pp. 196-98.

Lazear, Edward P. and Sherwin Rosen , "Rank-Order Tournaments as Optimum Labor Contracts," *Journal of Political Economy* (October 1981) 89: 841-864.

Moore, William J., Robert J. Newman and Geoffrey K. Turnbull, "Do Academic Salaries Decline with Seniority?" *Journal of Labor Economics*, forthcoming.

National Center for the Study of Collective Bargaining in Higher Education and the Professions, *Directory of Faculty Contracts and Bargaining Agents in Institutions of Higher Education*. Volume 23. New York: 1997.

Oklahoma State University, Office of Planning, Budget and Institutional Research, *1995-96 Faculty Salary Survey By Discipline*. Stillwater, OK: 1996.

Ransom, Michael R. "Seniority and Monopsony in the Academic Labor Market." *American Economic Review*, March 1993, 83(1), pp. 221-33.

White, Halbert. "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity." *Econometrica*, May 1980, 48(4), pp. 817-38.

Table 1. Average Salaries for Male and Female Faculty Members by Academic Rank

Rank	No. of Observations	Average Salary	Maximum	Minimum
Female Assistant Professors	10	$50,764	$63,632	$43,908
Male Assistant Professors	19	$50,817	$65,864	$38,322
Female Associate Professors	5	$53,519	$62,592	$48,590
Male Associate Professors	34	$57,482	$72,000	$40,619
Female Professors	3	$64,323	$71,684	$58,811
Male Professors	52	$70,938	$94,515	$49,890
Total	123	$61,601	$94,515	$38,322

Table 2. Personal Characteristic and Productivity Measures by Gender

Item	Female	Male
Mean Age	42.9 years	49.2 years
Mean Experience	10.5 years	18.7 years
Mean Seniority	8.1 years	16.0 years
Proportion of Terminal Degrees from Carnegie I Research Universities	82%	90%
Mean Dollars in Grants During the Study Period	$16,228	$23,672
Mean No. of Type I Publications During the Study Period	10.1	10.7
Mean Teaching Evaluation	3.32	3.43
Mean Salary	$53,789	$62,831

Table 3. Returns to Longevity, Productivity and Market Benchmark Salaries

	PARAMETER ESTIMATES				
Indep.Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Experience	0.021**	0.006	0.009	-0.002	-0.001
	(0.001)	(0.011)	(0.011)	(0.007)	(0.009)
Experience^2/100	-0.018	-0.004	-0.012	0.010	0.005
	(0.022)	(0.023)	(0.023)	(0.019)	(0.020)
Seniority	0.008	0.007	-0.016	-0.012	-0.014
	(0.009)	(0.017)	(0.011)	(0.009)	(0.011)
Seniority^2/100	-0.038	-0.014	0.023	0.013	0.023
	(0.024)	(0.038)	(0.025)	(0.024)	(0.025)
Female	-0.029	-0.022	-0.030	-0.058	-0.049
	(0.041)	(0.049)	(0.043)	(0.040)	(0.042)
Non-Caucasian	0.058	0.044	-0.102	-0.114	-0.115
	(0.071)	(0.068)	(0.073)	(0.072)	(0.073)
Rank		0.043			
		(0.096)			
Grants ($1000s)		0.001	0.0007		0.0009
		(0.001)	(0.0007)		(0.0007)
Grants^2		-2.32×10^{-6}	1.39×10^{-8}		6.10×10^{-7}
		(2.5×10^{-6})	(2.0×10^{-6})		(2.0×10^{-6})
Publications		0.006*	0.002		0.002
		(0.003)	(0.004)		(0.004)
Publications^2		-0.0001	-0.0001		-0.0001
		(0.0002)	(0.0002)		(0.0002)
Teaching		0.113	0.080		0.053
		(0.112)	(0.124)		(0.124)
Teaching^2		-0.054	-0.085		-0.034
		(0.172)	(0.183)		(0.181)
Outside Offer		0.015	0.148		0.134
		(0.094)	(0.093)		(0.093)
Hired With Tenure		0.046	-0.015		0.001
		(0.068)	(0.074)		(0.074)
Ln(Peer Avg. Salary)			0.993†		
			(0.005)		
Adjusted R^2	0.467†	0.527†	0.441†	0.489†	0.489†

The dependent variable in modesl 1-3 is the natural logarithm of annual salary on a twelve month basis. Models 1 and 2 also include an intercept term and dummy variables for the faculty member's department; model 3 includes only an intercept. The dependent variable in models 4 and 5 is the difference between the natural logarithm of annual salary and the natural logarithm of peer national average salary. Those regressions include an unreported intercept term. All models estimated off 123 observations.

* Indicates statistically significantly different from zero at the 10% level.

** Indicates statistically significantly different from zero at the 5% level.

† Indicates statistically significantly different from zero at the 1% level.

Table 4. Joint Tests of Statistical Significance
(p-values from asymptotic χ^2 distributions)

Independent Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Experience	0.0016	0.8159	0.7315	0.7912	0.9676
Seniority	0.1318	0.9058	0.3059	0.1001	0.4182
Grants ($1000s)		0.1846	0.1989		0.1541
Publications		0.0417	0.8327		0.8225
Teaching		0.4230	0.8125		0.8835
All Other Than Ln(Peer Average Salary)			0.0978		

Table 5. Department Dummy Variable Coefficient Estimates

Independent Variable	Model 1	Model 2
Agricultural Systems, Technology & Education	-0.091 (0.103)	-0.112 (0.101)
Animal, Dairy & Veterinary Science	0.058 (0.069)	0.090 (0.082)
Biological & Irrigation Engineering	0.215 † (0.092)	0.191 † (0.093)
Biology	-0.026 (0.069)	-0.040 (0.068)
Chemistry	0.112 (0.125)	0.184 (0.123)
Economics	0.213 † (0.070)	0.181 † (0.067)
Experiment Station (no department affiliation)	0.231 (0.166)	0.122 (0.166)
Family & Human Environments	0.035 (0.101)	0.029 (0.095)
Fisheries & Wildlife	-0.044 (0.103)	-0.021 (0.099)
Forest Resources	0.063 (0.070)	0.042 (0.070)
Nutrition & Food Science	-0.024 (0.070)	-0.031 (0.067)
Plants, Soils & Biometeorology	-0.063 (0.067)	-0.083 (0.064)
Rangeland Resources	0.018 (0.072)	0.019 (0.070)

Sociology, Social Work, and Anthropology is the default department against which comparisons are being made. The dependent variable is the natural logarithm of annual salary on a twelve month basis. Each model also includes an intercept term and the variables reflected in Table 3. All models estimated off 123 observations.

* Indicates statistically significantly different from zero at the 10% level.

** Indicates statistically significantly different from zero at the 5% level.

† Indicates statistically significantly different from zero at the 1% level.

Notes

1. This assumes the aggregate supply of faculty to the *national* market is not perfectly elastic, but that any single university perceives itself as facing perfectly elastic labor supply.

2. We assume universities are engaged in limit pricing, setting wages equal to market wage less moving costs.

3. For example, using a 1989 data set for faculty salaries from the University of Massachusetts (UMASS), Hallock finds a positive seniority-salary relationship. Those estimates imply faculty utility that is decreasing in income to justify any faculty leaving UMASS and thereby not only incurring moving costs, but also foresaking the seniority premium Hallock seems to find. For instance, the stylized faculty member with ten years' seniority and an annual discount rate of 10% considered earlier would reap up to 54% of annual salary in net present value added over the next ten years from staying at UMASS versus leaving for another research university. We suspect faculty unionization at UMASS largely explains the positive seniority-salary profile Hallock reports, since Barbezat (1989) found that collective bargaining arrangements in higher education increase the returns to seniority.

4. A reviewer rightly points out that total compensation (i.e., salary plus fringe benefits) is a more appropriate basis for comparison since fringe benefits differ across institutions and may inhibit some faculty from moving from their incumbent employers. Unfortunately, national data on total compensation are not available at a sufficiently disaggregated to offer the individual-level controls needed in our regressions.

5. "Mormons" is a nickname commonly used to refer to members of the Church of Jesus Christ of Latter-Day Saints.

6. We should point out that while most of these outside offers were (at least partially) matched by the incumbent university in order to retain the faculty member, we are measuring whether an outside offer was received and presented to the incumbent employer by the faculty member, not whether it was matched, either fully or partially.

7. Detailed results from the instrumenting equation are available from the authors.

8.We include this dummy variable because Hallock claims that a statistically significantly positive coefficient on it implies the exercise of market power by the employer. However, he does not explain this claim, which has no support in labor markets theory. It seems an imperfect control for faculty quality, in the spirit of our OFFER variable, with the important difference that HWT may capture quite dated information on a senior faculty member hired with tenure decades earlier, while the OFFER variable captures only more recent market activity. The better indicator of the faculty member's current productivity is not whether she was hired with tenure at some unknown prior date but whether other universities currently bid for her. We include HWT nonetheless in order to fully nest Hallock's specification within ours.

9. We initially treated sole- and jointly-authored publications separately, but found they had basically the same impact on salary levels. Consequently, they are combined here to conserve degrees of freedom. We also estimated this relationship including non-refereed publications and presentations as separate regressors to capture service-oriented research publications. This had no significant impact on salaries for any of the specifications estimated, so we use only refereed publications as a proxy for all research publication. Finally, we also included a dummy variable representing quality of the professor's Ph.D.-granting institution, but found this had no significant effect in any specification, so we omit it here.

10. We also tried controlling for teaching load, expressed both as number of courses and number of students taught in the previous five years. The regression results are qualitatively identical when we supplement or substitute for teaching evaluations with either teaching load measure. The detailed results are available from the authors by request.

11. We also ran these models using the more standard quadratic specification, with no qualitative change in results.

12. It is worth noting, moreover, that while the experience profile continues to be increasing over an entire career (peaking after 75 years), the estimated returns to seniority now peak at 25 years, a substantial prolongation of the nonnegative effects of institutional seniority.

13. The coefficient estimates in model 2 suggest that a "star" ("superstar") — defined as a professor with publications, grants and teaching evaluations one (two) standard deviation(s) above the sample mean and who has elicited an outside offer — earns 4.4 (7.2) percent more than a colleague from the same discipline with identical demographic characteristics and mean performance across the board.

14. The qualitative results are anyhow unchanged by using instrumental variables methods to obviate any prospective endogeneity of the PEER variable. Details of the endogeneity test, the instrumenting equation, and the instrumental variables estimates are available from the authors.