How similar are pay structures in ‘similar’ departments of economics?

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Abstract

Using a unique panel data set spanning 21 years, we estimate a fixed-effects model of pay determination for five Ph.D.-granting departments of economics in large Midwestern state universities. Despite program similarities, no two departments have comparable reward structures, which points to the perils of generalizing across universities.

We also explore the effects of faculty leaves. Although the first sabbatical leave typically has little effect on pay, a second sabbatical is usually associated with higher pay, consistent with the proposition that a second sabbatical restores more lost human capital than the first sabbatical. With some exceptions, leaves without pay are associated with lower pay.

Finally, in estimating rewards for research, we find that at four of the universities returns to quality overwhelm returns to quantity. At these universities, an article published in the *AER* boosts pay by as much as 11 percent, whereas an article in an unranked journal increases pay by at most 1 percent. © 1999 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Numerous studies have examined the determinants of faculty pay at a single university. For example, Hoffman (1976) and Ferber and Green (1982) tested for gender discrimination at the Universities of Massachusetts and Illinois, respectively. Focusing on the issue of monopsonistic discrimination, Ransom (1993) investigated the seniority profile at the University of Arizona; and Hallock (1995), based on data from a second university, challenged Ransom's findings. Diamond (1985) examined the returns to citations at the University of California at Berkeley, and Ragan and Rehman (1996) estimated earnings profiles of department chairs at Kansas State University.1

In interpreting case studies, a critical issue arises: Can findings be generalized to other universities? To address this issue, we study pay structures at five universities that have many common characteristics—all are large state universities in the Midwest, affiliated with the same (Big Twelve) conference. As such, they face common pressures, often compete for the same faculty candidates, and sometimes use the same universities for purposes of comparison. If pay structures differ substantially across such universities, the generalizability of case studies would appear to be limited. On the other hand, if these universities share a common pay structure, the issue becomes: How widely shared is their pay structure with other universities?

1 Among the many other case studies are those of Katz (1973); Siegfried and White (1973); Saks (1977); Kaun (1984) and Megdal and Ransom (1985).
At an early stage of our investigation one respected economist suggested that our sample of five institutions is equivalent to a single university, largely because of his belief that, except for elite universities, the structure of faculty pay is similar across Ph.D.-granting institutions. A major purpose of this paper is to test this proposition.

1.1. Distinguishing features of this study

This investigation contains several distinguishing features. First, it involves on-site visits to each of the five universities to carefully collect data from university records of tenure-track economics faculty. This procedure contrasts with those of most studies dealing with pay of ord's of tenure-track economics faculty. This procedure universities to carefully collect data from university rec-
tures. First, it involves on-site visits to each of the five
tutions. A major purpose of this paper is to test this prop-
ment chair and supervision of doctoral dissertations was actu-
ly a return to unobserved personal characteristics of faculty
model’s explanatory variables. For example, they found that
part of the cross-section premium attributed to service as depart-
chair and supervision of doctoral dissertations was actu-
ally a return to unobserved personal characteristics of faculty
who serve in these capacities. Similarly, the models of Harris
and Holmstrom (1982), Lazear (1986), and Ransom (1993)
imply that seniority is correlated with unmeasured faculty pro-
ductivity. As will be argued later, unmeasured productivity is
likely to also be associated with faculty leaves, key variables
in the present study.

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2. Theoretical framework

The underlying model for this paper is based on the assumption that each department of economics has a mission, generally in terms of research, teaching, and service, and that faculty are rewarded on the basis of their contributions to that mission. Because departments at different universities may weight the mission components differently (e.g., one department may place a relatively higher weight on research than another), different reward structures are possible at different universities.

Based on human capital theory and on prior research, the earnings of a faculty member are expected to increase with experience. Seniority may also affect pay. Seniority may be a proxy for institution-specific training, for service to the department, or even for teaching skills. In that event, returns to seniority would be expected to be positive, at least initially. Alternatively, returns to seniority may be negative, as argued by Ransom (1993), if universities have monopsony power over faculty.

We further anticipate returns to both quantity and quality of research, contributions to the department’s graduate program, administrative service, and such personal characteristics as leadership and motivation. Because the failure to account for personal characteristics may bias parameter estimates of the other variables, we adopt a fixed-effects model. The model allows for individual-specific constant terms that capture the effects of time-invariant personal characteristics of the faculty member. (For completeness, we also report results based on OLS and random-effects regression models.)

In addition, this study considers the effects of both sabbatical leaves and leaves without pay, neither of which has been examined in the literature. From the perspective of human capital theory, either type of leave can be regarded as an opportunity to enhance skills and hence might be rewarded through future pay increases. At issue is the extent to which the leave increases human

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\(^2\) For example, Tuckman and Leahey (1975) and Hansen, Weisbrod and Strauss (1978) relied on national survey data, while Broder and Ziemer (1982) and Sauer (1988) collected questionnaires. Providing an exception to this approach, Kenny and Studley (1995) obtained data from university records and then estimated salary as a function of faculty productivity. The study focused on faculty contracts and costs of faculty mobility.

\(^3\) Ragan and Rehman (1996) also uncovered evidence of a correlation between unmeasured faculty characteristics and their model’s explanatory variables. For example, they found that part of the cross-section premium attributed to service as department chair and supervision of doctoral dissertations was actually a return to unobserved personal characteristics of faculty who serve in these capacities. Similarly, the models of Harris and Holmstrom (1982), Lazear (1986), and Ransom (1993) imply that seniority is correlated with unmeasured faculty productivity. As will be argued later, unmeasured productivity is likely to also be associated with faculty leaves, key variables in the present study.

\(^4\) Hamermesh, Johnson and Weisbrod (1982) studied pay of full professors at seven universities. For two of the universities, they obtained data on both quantity and quality of publications. At those two universities (based on a sample of 46 faculty), they found that quality of research was rewarded more highly than quantity. Using alternative measures of quality and a larger sample size, we will test whether the findings of Hamermesh et al. (1982) generalize to the universities covered in the present study.
3. A panel study of academic salaries

Based on the preceding discussion, a faculty member’s earnings each year are a function of that person’s contributions to the department and the value placed on these contributions by the employing university. The present section defines the variables used to proxy faculty contributions, describes the data set and model specification, and then presents empirical results, first for the full sample and then separately for each of the five departments comprising the sample.

3.1. Variables

The variables in this study include measures of research output, experience and seniority, service as department chair, years employed at the university, and gender. Specific variables and their definitions are as follows.

Service as department chair. To capture any shift in salary resulting from appointment as department chair, this study includes the variable CHAIR, whose value is equal to one if the faculty member currently is serving as department chair, zero otherwise. Alternatively, CHAIR is replaced with a pair of variables, CHAIR1 and CHAIR2, that designate whether a faculty member is serving as chair for the first time or has returned as chair after previously stepping down.

Years served as department chair. YRSCHAIR is the cumulative number of years a faculty member has served as department chair, whether or not that faculty member currently is chair.

Experience. Because prior research suggests that the relationship between experience and earnings typically is concave, we specify experience quadratically. EXPER is defined as the larger of two values: years since the doctoral degree was conferred and years employed at the university.

Seniority. SENIORITY measures the cumulative number of years the faculty member has been with the university and appears in the regression model as a quadratic polynomial. In the fixed-effects specification, the linear seniority term is dropped because it is perfectly correlated with experience. The square of seniority can be added, however, because this variable is not perfectly correlated with experience squared.

Quantity and quality of research articles. ARTICLES measures the number of articles published in journals listed in EconLit (adjusted for number of authors). Quality is measured by either of two variables. The first measure (QUALITY1) is based on pages published in 36 ‘top’ journals, as selected by Scott and Mitias (1996) from a base of journals identified by Graves, Marchand and Thompson (1982) and modified by deleting three and adding fifteen newer journals. As with all research variables in the current study, values refer to cumulative output through the preceding calendar year, with co-authored work deflated by the number of authors.

The second measure of quality (QUALITY2), derived by Enomoto and Ghosh (1993), assigns a different
numerical score to each of the 50 top journals based on a survey of economics department chairs.\(^8\) Because the score assigned to the highest ranked journal (the American Economic Review) was 4369, we divided the raw value of this variable by 4369 so that the variable can be interpreted as the number of AER-equivalent articles.\(^9\) EconLit (1969–96) was the data base used to construct both quality variables.

**Books.** Research books published by faculty constitute another form of research. Accordingly, we include the variable BOOKS, defined as the number of research books reported in EconLit (1969–96).\(^{10}\) Book chapters are excluded because many are not refereed and because some book chapters have been published separately as journal articles, which would lead to double counting.

**Supervision of completed dissertations.** Contributions to a department’s graduate program are proxied by the variable PHDCOMPL, the number of students earning Ph.D. degrees for whom the faculty member served as major professor. A positive coefficient for this variable will be an indication that faculty are rewarded for their work as major professor.

**Paid and unpaid leaves of absence.** Separate variables measure the impact of sabbatical leaves and leaves without pay. Because of the theoretical argument that a faculty member is likely to benefit relatively more from the second sabbatical than from the first sabbatical, separate dummy variables were included to designate whether a faculty member has had one or more sabbaticals (SAB1) or two or more sabbaticals (SAB2). For leaves without pay, we allow for a differential effect based on whether or not the faculty member is tenured. LEAVEPRE measures number of years of leave prior to tenure, and LEAVEPOST measures number of years of leave following tenure.\(^{11}\)

**Time and school dummies.** Dummy variables were added to allow wage profiles to shift from year to year during the 21-year sample period and to differ by university.

### 3.2. Data and empirical specification

Data were collected for economics faculty at Iowa State University, Kansas State University, University of Kansas, University of Missouri at Columbia, and University of Nebraska at Lincoln for the academic years 1975/76 through 1995/96. The sample was restricted to faculty with 0.5 or greater full-time-equivalent appointments in tenure-track positions that contained a research weight. The full sample consists of 1897 observations of 176 faculty in the departments of economics at these five universities. Summary statistics of the explanatory variables are reported in Table 1.

When QUALITY1 is used as the measure of research quality, the model estimated is:

\[
\begin{align*}
\text{LOG REAL SALARY}_t &= \gamma_0 + \gamma_1 \text{CHAIR}_t \\
&\quad + \gamma_2 \text{YRSCHAIR}_t + \gamma_3 \text{EXPER}_t + \gamma_4 \text{EXPER}^2_t \\
&\quad + \gamma_5 \text{SENIORITY}_t + \gamma_6 \text{SENIORITY}^2_t \\
&\quad + \gamma_7 \text{ARTICLES}_t + \gamma_8 \text{BOOKS}_t \\
&\quad + \gamma_9 \text{PHDCOMPL}_t + \gamma_{10} \text{SAB1}_t + \gamma_{11} \text{SAB2}_t \\
&\quad + \gamma_{12} \text{LEAVEPRE}_t + \gamma_{13} \text{LEAVEPOST}_t \\
&\quad + \gamma_{14} \text{FEMALE}_t + \gamma_{15} + u_t + \epsilon_t,
\end{align*}
\]

where LOG REAL SALARY\(_t\) is the log of the real annual salary of faculty member \(i\) in period \(t\) and \(\gamma_i\) captures the school-specific effect.\(^{12}\) Salaries of faculty on year-round appointments were multiplied by 9/11 to convert salaries to a nine-month basis as in other studies.\(^{13}\)

The regression model in Eq. (1) is specified with a two-part error term, where one component \((u_t)\) varies across individuals but not across time and the other \((\epsilon_t)\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOG REAL PAY</td>
<td>10.53</td>
<td>0.24</td>
<td>9.92</td>
<td>11.29</td>
</tr>
<tr>
<td>CHAIR</td>
<td>0.047</td>
<td>0.21</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>YRSCHAIR</td>
<td>0.61</td>
<td>2.41</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>EXPER</td>
<td>15.65</td>
<td>9.87</td>
<td>0</td>
<td>42</td>
</tr>
<tr>
<td>EXPER(^2)</td>
<td>342.17</td>
<td>351.93</td>
<td>0</td>
<td>1764</td>
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<td>SENIORITY</td>
<td>13.55</td>
<td>9.72</td>
<td>0</td>
<td>42</td>
</tr>
<tr>
<td>SENIORITY(^2)</td>
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<td>319.16</td>
<td>0</td>
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</tr>
<tr>
<td>ARTICLES</td>
<td>4.45</td>
<td>5.96</td>
<td>0</td>
<td>63</td>
</tr>
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<td>14.56</td>
<td>23.99</td>
<td>0</td>
<td>153.62</td>
</tr>
<tr>
<td>QUALITY2</td>
<td>0.79</td>
<td>1.19</td>
<td>0</td>
<td>7.75</td>
</tr>
<tr>
<td>BOOKS</td>
<td>0.034</td>
<td>0.22</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PHDCOMPL</td>
<td>1.54</td>
<td>2.76</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>SAB1</td>
<td>0.24</td>
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</tr>
<tr>
<td>SAB2</td>
<td>0.042</td>
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<td>0</td>
<td>1</td>
</tr>
<tr>
<td>LEAVEPRE</td>
<td>0.043</td>
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<td>2</td>
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<tr>
<td>LEAVEPOST</td>
<td>0.19</td>
<td>0.63</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>FEMALE</td>
<td>0.050</td>
<td>0.22</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Number of observations = 1897; number of faculty = 176.

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\(^8\) See Appendix A.

\(^9\) Replies, rejoinders, notes, and comments were excluded.

\(^{10}\) Textbooks are excluded for two reasons. As argued by Laband (1990), they represent compilations of existing knowledge and contain little or no previously unpublished knowledge. Second, in their study of faculty pay, Ragan and Rehman (1996) found statistically significant coefficients for research books but not for textbooks.

\(^{11}\) Because the leave variables refer to completed leaves, they do not assume a positive value until the year after the leave is taken.

\(^{12}\) Salaries of faculty on year-round appointments were multiplied by 9/11 to convert salaries to a nine-month basis as in other studies.

\(^{13}\) The regression model in Eq. (1) is specified with a two-part error term, where one component \((u_t)\) varies across individuals but not across time and the other \((\epsilon_t)\)
is the classical regression error. There are three common estimation strategies for this specification: ordinary least squares (OLS), random effects, and fixed effects. OLS implicitly sets \( u_i \) equal to zero for all individuals, and the random-effects model relies on the assumption that the time-invariant error is uncorrelated with the explanatory variables of the regression model.

Diagnosis checks concerning the proper treatment of the error structure of Eq. (1) favor the fixed-effects model over OLS and random effects. Both a Lagrange multiplier test for random effects and a Wald test for fixed effects overwhelmingly reject the OLS specification at conventional levels of significance. Moreover, a Hausman specification test rejects the random-effects model over the fixed-effects model. Because both OLS and random effects may yield biased parameter estimates when unmeasured individual characteristics are correlated with the explanatory variables, we proceed with the fixed-effects model in the empirical analyses of the following section.

The major drawback of the fixed-effects procedure is that it does not identify parameters of variables that do not change over time (gender and school) and does not separate the first-order effects of experience and tenure on faculty pay. For this reason, and for purposes of comparison, we also estimated OLS and random-effects models. Results appear in Appendix B.

For both models the coefficient of the gender variable is statistically insignificant, indicating that for this sample there is no evidence that female academics receive different rates of pay than males with comparable characteristics. But characteristics are far from comparable. Males average 14.0 years of seniority versus 4.4 years for females. Similar differences exist for experience and publications. Further inquiry into pay differences by gender must focus on reasons for gender differences in the distribution of seniority.

Appendix B also reveals that SENIORITY has a negative effect on faculty pay (although statistically insignificant in the random-effects model). These results are consistent with the findings of Ransom (1993) and Brown and Woodbury (1995), who also study nonunion universities. Although not reported in the table, the coefficients of the university indicator variables show that the level of pay at the other four schools is between 6 and 8% below that at Iowa State University.

### 3.3. Results from fixed-effects estimation

#### Full sample.
Table 2 presents fixed-effects estimates of Eq. (1) and of alternative specifications based on QUALITY2 and on inclusion or exclusion of the quantity of articles. The different specifications provide a test of the robustness of results with respect to different combinations of quantity and quality of journal articles. Results are reported for the full sample of five universities.

Consistent with expectations, each of the six models estimated reveal significantly positive but diminishing returns to experience. The diminishing returns to experience, however, are at least partially offset by increasing returns to seniority. Those who serve as department chair receive significantly higher pay, as expected, and the premium for serving as chair rises with tenure as chair. Because the sample includes five faculty who served two nonconsecutive stints as department chair (14 observations), model 6 estimates the compensation for first stint as chair and second stint. The estimated pay premiums are 7 and 10% respectively, a difference that is not statistically significant (\( t = 1.61 \)).

Faculty are rewarded for both quantity and quality of journal articles. Regardless of which quality variable is considered and whether quality and quantity variables are included individually or jointly, all parameter estimates are significantly greater than zero. In specifications that include both quality and quantity, each article published raises faculty salaries by approximately 0.8–1.2%. A 10-page article published in a Scott and Mitias (QUALITY1) journal raises faculty pay an additional 2.4% (column 4). Alternatively, based on the second measure of quality, which differentiates among ranked journals, an article in the American Economic Review raises pay by 7.6% more than an unranked article (column 5). Table 2 indicates that faculty are also rewarded for writing books and supervising dissertations.

The effect of faculty leaves depends on the nature of

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12 Nominal salaries were deflated by the Consumer Price Index—all urban consumers, not seasonally adjusted, base period: 1982–84 = 100.

13 See Hamermesh et al. (1982); Hansen (1985); Rees (1993); and Ragan and Rehman (1996).

14 The \( \chi^2(1) \) test statistic for the Lagrange multiplier test is 6.289.44 and the \( F(175,1689) \) test statistic for the Wald test is 29.95. Critical values at the 1% level are 6.63 for the \( \chi^2(1) \) distribution and 1.28 for the \( F(175,1689) \) distribution. [See StataCorp (1997) for details on computation of test statistics.]

15 Depending on the specification, e.g., choice of QUALITY1 or QUALITY2, the Hausman test generally rejects random effects at the 1% level of significance and always at the 10% level.

16 When we allow for differential effects by decade, the coefficient of FEMALE is significantly less than zero in the 1970s (\( \text{Exp} (0.073) = 0.976 \)) but insignificant in the 1980s (0.027, \( t = 0.87 \)) and 1990s (0.027, \( t = 0.87 \)). For further discussion of changes in the male/female differential in academic labor markets, see Barbezat (1991).

17 Hoffman (1997) points out that negative returns to seniority appear restricted to nonunion samples.

18 Exp (0.073) − 1 = 0.076.
The sample consists of faculty in the departments of economics at five public universities in the Midwest; the sample period is 1975/76–1995/96. A fixed-effects model is estimated in which the dependent variable is the natural logarithm of real faculty salaries. Also included is a set of yearly time dummies. Excluding time dummies reduces $R^2$ values, but other results are broadly similar. For example, in model 4, $R^2$ within falls to 0.5323 but only the coefficient of PHDCOMPL loses statistical significance.

Number of observations = 1897; number of faculty = 176.

Numbers in parentheses are $t$-values. *Statistically significant at the 0.10 level; **at the 0.05 level; ***at the 0.01 level (two-tailed tests).

Assume that certain faculty tire out during their careers and that such faculty are less likely to receive a second sabbatical. In that case, the positive coefficient of SAB2 will capture unmeasured productivity associated with activity level as well as any productivity-enhancing effects of a second sabbatical. To estimate the true effect of a second sabbatical, it is necessary to first account for the changing (unmeasured) activity level of faculty.

Because activity level is not time-invariant, it cannot be treated as a component of the fixed-effect term included in the model. But a change in activity level can be introduced into the model by adding a second fixed effect. It is not clear at which stage in their career that

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### Table 2
Contributions to faculty salaries, full sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
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<tr>
<td>CHAIR</td>
<td>0.081</td>
<td>0.073</td>
<td>0.085</td>
<td>0.076</td>
<td>0.084</td>
<td>0.070</td>
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<tr>
<td></td>
<td>(9.06)***</td>
<td>(7.98)***</td>
<td>(9.83)***</td>
<td>(8.74)***</td>
<td>(9.87)***</td>
<td></td>
</tr>
<tr>
<td>CHAIR1</td>
<td>0.070</td>
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<td></td>
<td></td>
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<td>0.070</td>
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<td></td>
<td></td>
<td></td>
<td>(7.42)***</td>
</tr>
<tr>
<td>CHAIR2</td>
<td>0.10</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(5.32)***</td>
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<tr>
<td>YRSCHAIR</td>
<td>0.013</td>
<td>0.017</td>
<td>0.013</td>
<td>0.013</td>
<td>0.016</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>(6.71)***</td>
<td>(13.64)***</td>
<td>(11.34)***</td>
<td>(6.85)***</td>
<td>(9.63)***</td>
<td>(9.74)***</td>
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<td>(12.28)***</td>
<td>(13.95)***</td>
<td>(11.34)***</td>
<td>(9.71)***</td>
<td>(9.63)***</td>
<td>(9.74)***</td>
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<td>EXPER$^2$</td>
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<td>−0.00041</td>
<td>−0.00038</td>
<td>−0.00041</td>
</tr>
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<td>SENIORITY$^2$</td>
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<td>(−7.65)***</td>
<td>(−7.12)***</td>
<td>(−7.92)***</td>
<td>(−7.45)***</td>
<td>(−7.80)***</td>
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<td>ARTICLES</td>
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<td>0.012</td>
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<tr>
<td></td>
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<td>(7.56)***</td>
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<td>(17.75)***</td>
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<td>BOOKS</td>
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<td>(4.41)***</td>
<td>(3.55)***</td>
<td>(2.80)***</td>
<td>(2.78)***</td>
<td>(2.80)***</td>
</tr>
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<td>PHDCOMPL</td>
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<td>0.0022</td>
<td>0.0025</td>
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<td>(1.78)***</td>
<td>(1.97)***</td>
</tr>
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<td>SAB1</td>
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<td>−0.0063</td>
<td>−0.0084</td>
<td>−0.0073</td>
</tr>
<tr>
<td></td>
<td>(−0.59)***</td>
<td>(0.25)***</td>
<td>(−0.91)***</td>
<td>(−1.02)***</td>
<td>(−1.38)***</td>
<td>(−1.17)***</td>
</tr>
<tr>
<td>SAB2</td>
<td>0.040</td>
<td>0.044</td>
<td>0.024</td>
<td>0.039</td>
<td>0.026</td>
<td>0.040</td>
</tr>
<tr>
<td></td>
<td>(3.88)***</td>
<td>(4.15)***</td>
<td>(2.36)***</td>
<td>(3.89)***</td>
<td>(2.64)***</td>
<td>(3.94)***</td>
</tr>
<tr>
<td>LEAVEPRE</td>
<td>−0.040</td>
<td>−0.038</td>
<td>−0.030</td>
<td>−0.042</td>
<td>−0.034</td>
<td>−0.041</td>
</tr>
<tr>
<td></td>
<td>(−3.56)***</td>
<td>(−3.28)***</td>
<td>(−2.78)***</td>
<td>(−3.78)***</td>
<td>(−3.19)***</td>
<td>(−3.77)***</td>
</tr>
<tr>
<td>LEAVEPOST</td>
<td>−0.031</td>
<td>−0.046</td>
<td>−0.038</td>
<td>−0.038</td>
<td>−0.035</td>
<td>−0.038</td>
</tr>
<tr>
<td></td>
<td>(−7.38)***</td>
<td>(−10.66)***</td>
<td>(−9.45)***</td>
<td>(−9.26)***</td>
<td>(−8.82)***</td>
<td>(−9.32)***</td>
</tr>
<tr>
<td>R$^2$ within</td>
<td>0.6771</td>
<td>0.6616</td>
<td>0.7007</td>
<td>0.6962</td>
<td>0.7105</td>
<td>0.6967</td>
</tr>
<tr>
<td>F-value</td>
<td>114.32</td>
<td>106.60</td>
<td>127.60</td>
<td>120.98</td>
<td>129.51</td>
<td>117.50</td>
</tr>
</tbody>
</table>
faculty are most likely to slow down, so we selected (a priori) three possibilities: immediately after receiving tenure, at ten years of experience, and at twenty years of experience. For reasons provided below, we chose QUALITY1 as our measure of journal quality and re-estimated (4) of Table 2 after allowing for a second fixed effect.

As Table 3 indicates, results are largely insensitive to when we allow activity level to change. For all three specifications, the coefficient of SAB2 is significantly greater than zero at the 0.01 level, and parameter estimates, 0.029–0.039, are close to the value reported in Table 2 (0.039). These results demonstrate that the estimated effect of a second sabbatical is real, and not the result of spurious correlation with activity level. Apart from the second fixed effect, second sabbaticals have a positive effect on salary, consistent with their increasing unmeasured productivity of faculty. Interestingly, the best fit (as judged by the \( R^2 \) and \( F \)-values of Table 3), occurs when we allow for the second fixed effect after twenty years, which suggests that reduced activity, when it occurs, tends to take place considerably after faculty receive tenure.

Unlike sabbaticals, leaves without pay are associated with significantly lower pay. Because females are more likely to take leaves, especially pre-tenure leaves, the negative effect of leaves may contribute to the generally lower pay of female faculty.19 There is no evidence, however, that pre-tenure leaves are more detrimental to pay than post-tenure leaves. Overall, the pattern of results for the four leave variables is consistent with the argument that, in general, leaves without pay are less likely than sabbaticals to lead to academically valued human capital.

A technical issue not yet addressed is whether results are sensitive to sample attrition. Those who leave the sample may differ from those who remain. To the extent these differences remain constant over time, they will be captured by the personal fixed effects. But if differences are related to unobserved, time-variant characteristics, even fixed-effect estimates may be biased. To deal with this issue, the equations were re-estimated for ‘stayers’—the subsample of the 82 faculty still with the university in the final year of the sample (1189 observations). Qualitative results are broadly similar.20 Faculty receive significantly higher pay for service as chair, experience, quantity and quality of research, and second sabbaticals and significantly lower pay for pre- and post-tenure leaves. We conclude that our findings are not driven by attrition bias.

**Results by institution.** Table 4 reports parameter estimates separately for each university when ARTICLES and QUALITY1 are selected to measure journal publications (model 4 in Table 2). Results of the specification with ARTICLES and QUALITY2 are reported in Appendix C. A comparison of results reveals that, for four of the five universities, \( F \)-values and \( R^2 \) within are higher when QUALITY1 is the measure of journal quality, but overall results are similar regardless of the specification.

Results from Table 4 indicate numerous differences in salary structure across the five economics departments. For example, although service as department chair contributes positively to salary at four of the departments, such service initially has a negative effect at Iowa State University. Years served as department chair contributes positively and significantly at all universities except Kansas State University.

Faculty receive positive but diminishing returns to experience except at the University of Missouri, where experience is associated with lower pay. Reasons for this anomalous finding are unclear but may result from unique institutional developments.21 Quantity of journal publications is positively related to pay at all five universities, and quality is significantly rewarded at four of the universities. Similarly, at a majority of the universities faculty are rewarded for serving as major professor of a student who completes the

<table>
<thead>
<tr>
<th>Variable</th>
<th>Tenure</th>
<th>Exper = 10</th>
<th>Exper = 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAB2</td>
<td>0.0340</td>
<td>0.0294</td>
<td>0.0394</td>
</tr>
<tr>
<td>( R^2 ) within</td>
<td>(3.52)***</td>
<td>(3.17)***</td>
<td>(4.02)***</td>
</tr>
<tr>
<td>( F )-value</td>
<td>0.6547</td>
<td>0.6371</td>
<td>0.6950</td>
</tr>
<tr>
<td></td>
<td>97.61</td>
<td>89.70</td>
<td>115.98</td>
</tr>
</tbody>
</table>

Specification is identical to column 4, Table 2. Full results are available on request.

---

19 We thank an anonymous referee for making this point. In our sample, 23.5% of females took a pre-tenure leave, compared to 7.5% of males.

20 Results are available on request.

21 Following a period of turmoil and dissatisfaction with the pay structure, among other things, the Department of Economics at the University of Missouri was placed in receivership and a faculty member from the Department of History was appointed to administer the department. This person was succeeded by an external candidate, an economist selected after a national search. When we examined the pay structure in different time periods, we found that returns to experience in this department have been positive and significant in recent years, as in the other economics departments of the sample. Thus, negative returns to experience appear to be a temporary anomaly.
Table 4
Contributions to faculty salaries for five economics departments

<table>
<thead>
<tr>
<th>Variable</th>
<th>ISU</th>
<th>KSU</th>
<th>KU</th>
<th>MU</th>
<th>UNL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHAIR</td>
<td>-0.048</td>
<td>0.13</td>
<td>0.071</td>
<td>0.026</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>(-1.85)*</td>
<td>(6.41)***</td>
<td>(6.10)***</td>
<td>(1.71)*</td>
<td>(8.76)***</td>
</tr>
<tr>
<td>YRSCHAIR</td>
<td>0.0088</td>
<td>0.0058</td>
<td>0.019</td>
<td>0.040</td>
<td>0.013</td>
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<tr>
<td></td>
<td>(2.85)***</td>
<td>(0.85)</td>
<td>(5.53)***</td>
<td>(8.47)***</td>
<td>(4.90)***</td>
</tr>
<tr>
<td>EXPER</td>
<td>0.030</td>
<td>0.014</td>
<td>0.019</td>
<td>-0.0080</td>
<td>0.015</td>
</tr>
<tr>
<td></td>
<td>(13.24)***</td>
<td>(4.95)***</td>
<td>(10.24)***</td>
<td>(-2.55)***</td>
<td>(7.21)***</td>
</tr>
<tr>
<td>EXPER²</td>
<td>-0.00049</td>
<td>-0.000029</td>
<td>-0.00029</td>
<td>-0.00010</td>
<td>-0.00054</td>
</tr>
<tr>
<td></td>
<td>(-4.54)***</td>
<td>(-3.62)***</td>
<td>(-0.75)</td>
<td>(-6.92)***</td>
<td></td>
</tr>
<tr>
<td>SENIORITY²</td>
<td>-0.00015</td>
<td>-0.00044</td>
<td>-0.00030</td>
<td>0.00015</td>
<td>0.00038</td>
</tr>
<tr>
<td></td>
<td>(-1.56)</td>
<td>(-2.35)***</td>
<td>(-3.57)***</td>
<td>(1.15)</td>
<td>(4.83)***</td>
</tr>
<tr>
<td>ARTICLES</td>
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<td>0.0097</td>
<td>0.0029</td>
<td>0.0042</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td>(5.11)***</td>
<td>(2.67)***</td>
<td>(2.17)***</td>
<td>(1.77)*</td>
<td>(11.99)***</td>
</tr>
<tr>
<td>QUALITY1</td>
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<td>-0.0018</td>
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<td></td>
<td>(7.13)***</td>
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<td>(5.89)***</td>
<td>(-1.61)</td>
</tr>
<tr>
<td>BOOKS</td>
<td>0.0047</td>
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<td>0.059</td>
<td>-</td>
<td>0.036</td>
</tr>
<tr>
<td></td>
<td>(0.43)</td>
<td>(3.94)***</td>
<td>(1.31)</td>
<td></td>
<td>(1.73)*</td>
</tr>
<tr>
<td>PHDCOMPL</td>
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<td>0.0049</td>
<td>0.0055</td>
<td>-0.0068</td>
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<tr>
<td></td>
<td>(1.48)</td>
<td>(2.37)***</td>
<td>(2.33)***</td>
<td>(1.85)*</td>
<td>(-3.09)***</td>
</tr>
<tr>
<td>SAB1</td>
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<td>-0.047</td>
<td>-0.014</td>
<td>-0.0059</td>
<td>-0.0020</td>
</tr>
<tr>
<td></td>
<td>(-2.06)***</td>
<td>(-3.04)***</td>
<td>(-1.18)</td>
<td>(-0.48)</td>
<td>(-0.18)</td>
</tr>
<tr>
<td>SAB2</td>
<td>0.071</td>
<td>0.048</td>
<td>0.096</td>
<td>0.031</td>
<td>-0.062</td>
</tr>
<tr>
<td></td>
<td>(4.20)***</td>
<td>(2.41)***</td>
<td>(5.76)***</td>
<td>(1.46)</td>
<td>(-2.10)***</td>
</tr>
<tr>
<td>LEAVEPRE</td>
<td>-</td>
<td>0.023</td>
<td>-0.021</td>
<td>0.023</td>
<td>-0.12</td>
</tr>
<tr>
<td></td>
<td>(0.96)</td>
<td>(-2.23)***</td>
<td>(0.79)</td>
<td></td>
<td>(-2.18)***</td>
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<tr>
<td>LEAVEPOST</td>
<td>-0.087</td>
<td>0.053</td>
<td>-0.035</td>
<td>-0.063</td>
<td>-0.012</td>
</tr>
<tr>
<td></td>
<td>(-7.37)***</td>
<td>(4.64)***</td>
<td>(-8.35)***</td>
<td>(-3.62)***</td>
<td>(-1.57)</td>
</tr>
<tr>
<td>Number of faculty</td>
<td>34</td>
<td>25</td>
<td>43</td>
<td>41</td>
<td>33</td>
</tr>
<tr>
<td>Number of observations</td>
<td>445</td>
<td>261</td>
<td>411</td>
<td>385</td>
<td>395</td>
</tr>
<tr>
<td>R² within</td>
<td>0.9211</td>
<td>0.8477</td>
<td>0.8000</td>
<td>0.6612</td>
<td>0.8398</td>
</tr>
<tr>
<td>F-value</td>
<td>143.17</td>
<td>35.48</td>
<td>42.01</td>
<td>19.70</td>
<td>54.05</td>
</tr>
</tbody>
</table>

Based on fixed-effects model in which the dependent variable is the natural logarithm of real faculty salaries; also included is a set of yearly time dummies. The sample period is 1975/76–1995/96. Numbers in parentheses are t-values. *Statistically significant at the 0.10 level; **at the 0.05 level; ***at the 0.01 level (two-tailed tests).

doctoral degree. The coefficient of BOOKS is consistently positive and is statistically significant for one or two universities (depending on significance level).

Results for the faculty leave variables are for the most part consistent with the results reported in Table 2. The first sabbatical either has no effect on pay or is associated with lower pay. More important, the marginal effect of the second sabbatical is positive for four of the five universities and significantly so for three. This finding further supports the proposition that a second sabbatical typically is more beneficial to faculty than the first sabbatical.

Pre-tenure leaves without pay have a significantly negative effect at two of the four universities at which pre-tenure leaves were taken. At most of the universities, post-tenure leaves are also associated with significantly lower pay. Only at Kansas State University do post-tenure leaves correspond with higher pay. This finding underscores the fact that the effect of a leave without pay depends on how that leave was used and whether it generated an outside offer (as occurred for certain faculty at Kansas State University). Thus, not only are universities likely to differ in their treatment of faculty leaves, but the impact of a leave may also vary across individuals within the same university.

In summary, leaves often are associated with significant impacts on faculty pay; these impacts vary across
universities and depend on the type of leave. Second sabbaticals are generally associated with significantly higher pay, whereas post-tenure leaves without pay are associated with significantly lower pay at most universities.

Table 5 reports the estimated pay premium for selected characteristics by university. For example, five years of experience and seniority are associated with a pay increase of 14.3% at Iowa State University but with a 3.8% reduction in pay at the University of Missouri. After 20 years, the combined effects of experience and seniority are estimated to be 41.1% at Iowa State University and minus 13.1% at the University of Missouri.

Table 5 further reveals that a 10-page article in a QUALITY1 journal (the 36 journals with which Scott and Mitias ranked faculty and departments) increases pay as much as 5.1%, at the University of Missouri. An article in the American Economic Review (or the equivalent) has an even greater impact on pay at four of the universities. In fact, at the first four universities listed in Table 5, the average return to a sole-authored publication in the American Economic Review is 7.9% of salary. In contrast, an article in an unranked journal increases pay by as little as 0.29% at the University of Kansas to a high of 1.61% at the University of Nebraska. A comparison of rows 3–5 underscores the fact that quality overwhelmingly dominates quantity at four of the five universities studied.

Finally, for a person still holding the position, the estimated pay premium for a five-year term as department chair ranges from 25.4% at the University of Missouri to a low of minus 0.4% at Iowa State University.

Do any of the five institutions share a common salary structure with a second institution? To answer this question we individually compared each department with every other department. Data for the two departments were combined and interaction terms added for all thirteen independent variables in Table 4. For each of the ten comparisons, the hypothesis that two departments share a common pay structure can be rejected at the 0.00005 level.

To provide added insight, we next addressed the issue of whether returns are similar across universities for any variables. To answer this question, we re-estimated the basic model after adding interaction terms that allow coefficients of each variable to differ by university. Through a series of F-tests, for each variable in turn, we then tested the hypothesis that coefficients of the particular variable are the same at all five universities. As indicated in Table 6, the hypothesis of identical coef-

<table>
<thead>
<tr>
<th>Variable</th>
<th>F-statistic</th>
<th>Prob &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHAIR</td>
<td>8.19</td>
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</tr>
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<td>YRSCHAIR</td>
<td>8.64</td>
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</tr>
<tr>
<td>EXPER</td>
<td>34.51</td>
<td>0.0000</td>
</tr>
<tr>
<td>EXPER$^2$</td>
<td>4.24</td>
<td>0.0020</td>
</tr>
<tr>
<td>SENIORITY$^2$</td>
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</tr>
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<td>ARTICLES</td>
<td>14.27</td>
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<tr>
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<td>0.0090</td>
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<td>BOOKS</td>
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<td>PHDCOMPL</td>
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<td>SAB1</td>
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<tr>
<td>SAB2</td>
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<tr>
<td>LEAVEPOST</td>
<td>18.22</td>
<td>0.0000</td>
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</tbody>
</table>

An unconstrained wage equation was estimated that permitted parameters for each variable to differ by university. The equation was then reestimated with the restriction that, for the single variable under consideration, the coefficient is identical at all five universities. F-values are for the hypothesis of identical coefficients for this variable.

Because there were no pre-tenure leaves at ISU and no research books at MU, the F-tests for LEAVEPRE and BOOKS are for equality at four rather than five universities.

Table 5
Estimated pay premiums for selected characteristics by university (as a percentage of salary)

<table>
<thead>
<tr>
<th></th>
<th>ISU</th>
<th>KSU</th>
<th>KU</th>
<th>MU</th>
<th>UNL</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 years experience and seniority</td>
<td>14.3</td>
<td>6.0</td>
<td>8.3</td>
<td>−3.8</td>
<td>7.4</td>
</tr>
<tr>
<td>20 years experience and seniority</td>
<td>41.1</td>
<td>9.7</td>
<td>15.5</td>
<td>−13.1</td>
<td>26.6</td>
</tr>
<tr>
<td>10-page article in QUALITY1 journal$^a$</td>
<td>3.0</td>
<td>4.9</td>
<td>2.2</td>
<td>5.1</td>
<td>−0.2</td>
</tr>
<tr>
<td>Article in AER$^a$</td>
<td>5.2</td>
<td>11.5</td>
<td>5.9</td>
<td>9.0</td>
<td>−1.5</td>
</tr>
<tr>
<td>Article in unranked journal</td>
<td>0.77</td>
<td>0.97</td>
<td>0.29</td>
<td>0.42</td>
<td>1.61</td>
</tr>
<tr>
<td>5-year term as department chair$^b$</td>
<td>−0.4</td>
<td>17.2</td>
<td>18.1</td>
<td>25.4</td>
<td>20.3</td>
</tr>
</tbody>
</table>

$^a$Includes the combined effect of ARTICLES and QUALITY1 or QUALITY2.

$^b$For person still chair.

Premiums are constructed from estimated coefficients of Table 4 except for the AER premium, which is based on estimated coefficients of Appendix C.
Coefficients can be rejected at the 0.01 level for 11 of 13 variables and at the 0.05 level for a twelfth variable (SAB1). Only for pre-tenure leave without pay do coefficients not differ significantly. Thus, not only do overall pay structures differ by university, they also differ in almost every dimension, which further undermines the possibility of generalizing results by appealing to similarity of institutions.

4. Summary and implications

This paper examined salary structures for the departments of economics at five ‘similar’ universities—Midwestern public universities with doctoral programs and affiliated with the same (Big Twelve) conference. To account for differences across faculty in personal characteristics, a fixed-effects model was estimated.

The central question posed was whether the universities share a common salary structure. The answer to this question is an emphatic ‘no.’ For each pair of universities, the hypothesis of a common pay structure can be rejected at the 0.00005 level of significance. Indeed, parameter estimates vary significantly across universities for all but one explanatory variable. Although the five universities may have common goals—publishing economics research, maintaining a Ph.D. program, etc.—the reward structures differ greatly by university, which suggests that the weights assigned to these goals also differ by university.

This study further distinguishes itself from previous research by investigating the effects of sabbatical leaves and leaves without pay. Whereas the first sabbatical either has no effect or is associated with lower pay, the marginal effect of the second sabbatical is positive for four of the five universities—consistent with our argument that a second sabbatical is likely to restore a larger volume of depreciated human capital than is the first sabbatical. This finding is not the result of spurious correlation with changing faculty productivity. The addition of a second fixed effect that allows unmeasured productivity to shift does not appreciably affect the estimated coefficient or significance level of SAB2.

In contrast to the positive effect of a second sabbatical, in most cases leaves without pay are associated with lower faculty pay. The pattern of estimated coefficients suggests that, in general, leaves without pay are less likely than sabbaticals to lead to academically valued human capital. Although additional research on faculty leaves is clearly warranted, the present study finds that leaves often are associated with significant impacts on faculty pay and further suggests that the effect of a leave depends on how it is used. The general rule across universities is for positive but diminishing returns to experience, rewards for quantity and especially quality of publications, compensation for serving as department chair, and pay that rises with the number of doctoral dissertations supervised. Exceptions to these rules are common, however; and even when universities reward a particular faculty contribution, the rate of compensation frequently differs.

In summary, even examining what appear to be comparable economics departments at comparable universities, faculty pay structures differ dramatically. This finding suggests that case studies of faculty pay, although they may provide valuable insights, should not be generalized across universities.

Acknowledgements

We acknowledge the helpful comments of Daniel Hamermesh, Andy Barkley, John Morrill, and Mike Podgursky.

Appendix A

Values of QUALITY1 and QUALITY2 for an n-page article

<table>
<thead>
<tr>
<th></th>
<th>QUALITY1</th>
<th>QUALITY2</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Economic Review</td>
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</tr>
<tr>
<td>Journal of Political Economy</td>
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<td>0.87</td>
</tr>
<tr>
<td>Econometrica</td>
<td>n</td>
<td>0.84</td>
</tr>
<tr>
<td>Quarterly Journal of Economics</td>
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<tr>
<td>Review of Economics and Statistics</td>
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</tr>
<tr>
<td>Review of Economic Studies</td>
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<td>0.57</td>
</tr>
<tr>
<td>Journal of Economic Theory</td>
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</tr>
<tr>
<td>Southern Economic Journal</td>
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<tr>
<td>Economic Journal</td>
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<td>Journal of Economic Literature</td>
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<td>QUALITY2</td>
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Values of QUALITY1 are from Scott and Mitias (1996). Values of QUALITY2 are based on data in Enomoto and Ghosh (1993), standardized relative to AER. For QUALITY1, pages are normalized relative to pages in AER. QUALITY2 does not consider length of article.

### Appendix B

**Contributions to faculty salaries (OLS and random-effects estimates)**

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a The sample consists of faculty in the departments of economics at five public universities in the Midwest; the sample period is 1975/76–1995/96. The dependent variable is the natural logarithm of real faculty salaries. Also included are year and school dummies.

b Number of observations = 1897; number of faculty = 176.

Numbers in parentheses are t-values. *Statistically significant at the 0.10 level; **at the 0.05 level; ***at the 0.01 level (two-tailed tests).
### Appendix C

**Estimated salary structure using QUALITY2**

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<th>KU</th>
<th>MU</th>
<th>UNL</th>
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<td>TEN²</td>
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<td>(−8.38)***</td>
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<td>(−1.85)*</td>
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Based on fixed-effects model in which the dependent variable is the natural logarithm of real faculty salaries; also included is a set of yearly time dummies. The sample period is 1975/76–1995/96.

Numbers in parentheses are t-values. *Statistically significant at the 0.10 level; **at the 0.05 level; ***at the 0.01 level (two-tailed tests).

**References**


StataCorp (1997). *Stata statistical software: release 5.0*. College Station, TX: Stata Corporation.