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ABSTRACT

This paper uses institutional level data collected by the American Association of University Professors as part of their annual survey of faculty members' compensation to analyze faculty turnover. Analyses of aggregate data over almost a twenty-year period highlight how remarkably stable faculty retention rates have been nationwide and how little they vary across broad categories of institutions. Analyses of variations in faculty retention rates across individual institutions stress the role that faculty compensation levels play. Higher levels of compensation appear to increase retention rates for assistant and associate professors (but not for full professors) and the magnitude of this effect grows larger as one moves from institutions with graduate programs, to four-year undergraduate institutions, to two-year institutions.

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I. Introduction

For over 30 years Committee Z of the American Association of University Professors (AAUP) has been collecting data on faculty salaries and compensation (both levels and increases) by rank, for faculty at American colleges and universities. These data are published in summary form and, when permission is granted by an individual institution for its data to be released, for individual institutions each year in a special issue of Academe.[1] College and university administrators and faculty often use these data for various policy purposes for their campuses, including institutional comparisons, budget requests, fund raising, recruiting, and collective bargaining.

In contrast, these data have not been heavily used for research purposes. The AAUP has granted us access to a portion of the institutions' submissions and this paper describes how one may use these data to address issues relating to faculty turnover.[2] At our disposal are submissions for the 1970-71 to 1988-89 period; in recent years approximately 1,800 institutions have responded to the survey questionnaire.

Each year the AAUP asks institutions to report the number of full-time continuing faculty in each rank; continuing faculty are defined as people employed by the institution in the rank in the previous year who are still employed by the institution in the current year, regardless of their rank in the current year.[3] Institutions are asked to include faculty on leave with pay (e.g., sabbaticals) in both the current faculty numbers they report one year and in the continuing faculty numbers they report the next year.

If one divides the number of full-time continuing faculty in a rank in an institution in a year by the number of full-time faculty in the rank in the institution in the previous year, one obtains an estimate of the retention

rate or continuation rate for full-time faculty in the rank. Since the faculty turnover rate in a rank is simply one minus the retention rate, the higher the retention rate is, the lower is the faculty turnover rate in the rank at the institution.

Of course, faculty turnover means different things at each rank. At the assistant professor level, turnover reflects both voluntary movement to other institutions or to nonacademic jobs and involuntary mobility (i.e., denial of tenure). At the associate professor level, faculty turnover reflects primarily voluntary mobility. Finally, at the full professor level it reflects both voluntary mobility to other jobs and retirement decisions.

Surprisingly little is known about how faculty turnover rates have changed over time and the AAUP data are used to address this issue in the next section. In contrast, there have been a number of studies by social scientists that focus on faculty turnover and mobility using data on individual faculty members. These studies suggest, among other things, that a faculty member's salary level is one of the factors that influences his or her probability of mobility, that an individual's mobility across different quality strata of institutions depends upon his or her publication record and the quality of the institution in which he or she was trained, that mobility declines with age, and that mobility tends to be higher at lesser quality institutions.[4] However, no study has addressed the extent to which an institution's faculty turnover rate is related to its average level of faculty salaries or compensation. In section III we address this issue, which is important if institutions are to more accurately estimate the true costs and benefits of raising faculty salary and compensation.[5] Similarly, no prior study has addressed the extent to which an institution's turnover rate depends

on the dispersion of its faculty salaries. This issue is addressed in section IV. Finally, section V presents some brief concluding remarks.

II. Aggregate Faculty Retention Rates, 1971-72 to 1988-89

The decades of the 1970s and the 1980s saw major swings in the labor market for academics. For example, between academic years 1970-71 and 1980-81 the salary of the average faculty member in the United States fell by about 21.1 percent in real terms. In contrast, between 1980-81 and 1988-89, the salary of the average faculty member rose by about 15.6 percent in real terms.[6] To take another example, between 1970 and 1980 full-time equivalent employment of faculty in the United States rose from 402,000 to 522,000, an increase of more than 2.6 percent per year or nearly a 30 percent increase for one decade. In contrast, by 1987 full-time equivalent faculty had risen to only 547,000, an increase of less than 0.7 percent per year, and was projected to remain constant through 1990. Thus, total faculty growth during the second decade is likely to be less than 5 percent.[7] In contrast to these swings, new doctorate production between 1970 and the late 1980s was roughly constant at between 32,000 and 34,000 degrees a year.[8]

How might one expect these shifts to affect faculty retention rates? On the one hand, rapid growth of academic positions in the face of a roughly constant supply of new doctorates might lead to increased voluntary mobility and upward pressure on salary levels, especially for new Ph.D.s, somewhat less emphasis by faculty on academic activities in fields where nonacademic activities have economic payoffs (e.g., accounting, engineering, and clinical psychology) and decreased involuntary turnover and an easing of tenure standards, as institutions compete for faculty. A slowing growth of academic

positions might, of course, have the opposite effects. On the other hand, a fall in real salaries of academics might lead to increased voluntary mobility, as faculty may seek to preserve their real earnings positions by moving to the nonacademic sector and/or by searching more intensely for higher paying academic jobs. Of course, some faculty might try to maintain their real earnings by teaching "overloads", teaching during summers, and/or increasing consulting activities; all of which may reduce mobility.

The relative magnitude of these effects and thus the changes in permanent faculty retention rates that will occur will depend on two factors: First, whether the differing rates of growth in positions is evenly or unevenly distributed across the disciplines taught at the institution, since institutions may respond differently to a general phenomena than to specific disciplinary ones. Second, whether an institution's practices reflect a short run (one or two years) or long run view of scholarship and teaching, since the overall size of the undergraduate population can be fairly well predicated for a decade ahead and institutions can smooth out "unexpected" yearly changes in demands for faculty. To the extent that institutions try to smooth out "unexpected" changes, part-time or temporary faculty may be relied upon.

Some indication of institutions' reliance on part-time faculty during the past two decades can be seen by comparing the growth rates of full- and part-time faculty.[9] During the decade of the 1970s when the number of faculty increased at an annual rate of 2.6%, the numbers of part-time faculty grew at an annual rate of 8.9%, more than four times faster than the 2.0% growth in numbers of full-time faculty. Then in the 1980s, when the overall annual rate of faculty growth fell to 0.7%, the numbers of part-time faculty grew at an annual rate of 1.4% compared to the rate of 0.4% for full-time faculty. The

more rapid growth of part-time faculty, who constituted about one-third of all instructional faculty in 1986, may serve to absorb some of the shocks (such as reduced budget appropriations, declines in university endowments, and changes of student career interests) that colleges and universities face and help to stabilize the full-time faculty labor market.

What changes in full-time faculty retention rates actually have occurred? Tables 1 through 3 present estimates respectively of the weighted (by faculty size) retention rates for full professors, associate professors, and assistant professors for academic years 1971-72 through 1988-89 computed from the AAUP data. Retention rates are presented for all institutions (ALL), all four-year institutions (ALL-E), doctoral level institutions (A), comprehensive institutions with some graduate programs (B), general four-year institutions (C), and two-year institutions (E). The sample sizes used in the computations are found in parentheses; in recent years only about half of the institutions responding to the AAUP survey have reported consistent information in adjacent years that permit us to compute continuation rates.

What is remarkable from the data shown in these tables is how stable aggregate faculty retention rates have been and how little they appear to vary across categories of institutions. Without any apparent systematic movements over time, full professors and associate professors' aggregate retention rates only varied from roughly 90 to 92 percent during the period (Tables 1 and 2) and assistant professors' retention rates only varied from 84 to 86 percent (Table 3).[10] This small variation over time is matched by the small variation in retention rates across categories of institutions. While retention rates at two-year colleges are somewhat higher than those at other institutions, one observes no other patterns across categories of four-year institutions.

Might the apparent stability of the aggregate faculty retention rates over time be a statistical artifact caused by the changing number and type of institutions that report data to the AAUP each year? Table 4 presents estimates of the weighted mean retention rates, by rank, for the subset of four-year institutions that reported data to the AAUP in every year. For each of these three professorial ranks, one also observes a virtual stability of the faculty retention rates in these institutions during the twenty year period.

Several factors may help explain why, on average, retention rates have remained roughly constant over time. First, changing average real earnings levels will influence faculty job search behavior only if they believe such changes have been associated with changes in their institution's compensation level relative to compensation levels at other institutions to which they might consider moving. Second, faculty in many fields do not face good nonacademic alternatives and, even in those fields where good alternatives do exist, faculty often become tied to the academic profession because of the investments they have made in academic-specific human capital. Third, at the assistant professor level, it is more costly to a department to deny tenure to candidates for promotion during periods when many other assistant professors are voluntarily leaving their positions and thus the need to hire replacements is already great. Thus, involuntary mobility of assistant professors may be low in periods when their voluntary mobility is high, leaving their aggregate retention rate roughly constant over time. Finally, as noted above, it may well be the case that reliance on part-time faculty helps stabilize the full-time faculty labor market.

It is worth exploring one of the implications of a .85 retention rate for assistant professors. A college or university that hired the same number of assistant professors each year, had none of them voluntarily leave, but denied all of them tenure in their seventh year of employment, would have a retention rate for assistant professors of 6/7 or .857. That is, a retention rate of .85 for assistant professors implies that an institution must replace its complete stock of assistant professors roughly every seven years. While there are obvious benefits to an institution of having a continual flow of new faculty entering the institution, one may question whether such "churning" of young faculty is socially desirable.

III. Why do Retention Rates Vary Across Colleges and Universities?

The bottom rows of Tables 1, 2 and 3 present estimates of the standard deviations of retention rates across institutions in 1988-89. These data suggest that the stability of aggregate faculty retention rates over time masks the considerable variation in retention rates that exists across institutions at a point in time. For example, while the mean retention rate of assistant professors in general four-year institutions was .85 in 1988-89, the standard deviation across institutions was .12 (Table 3). This section reports our analyses of why retention rates vary across colleges and universities in the United States. Our focus is on the role that faculty compensation policies play.

Table 5 presents estimates of retention rate equations for faculty at each rank in 1988-89. The retention rate (number of continuing faculty in 1988-89/number of faculty in 1987-88) within a rank is specified to be a function of two economic variables, the average compensation level in the rank

in the institution in 1987-88 (COMPi88) and the percentage increase in average compensation in the rank in the institution from 1986-87 to 1987-88 (COMP8i7), as well as a vector of control variables.[11] The latter include the percentage growth in the institution's faculty size from 1986-87 to 1987-88, a set of dichotomous variables for region of the country (REGNE, REGNC, REGNW) to help control for price differences across areas, a set of six dichotomous variables (R1, R2, R3, R4, R5, R6) to control for the selectivity of the college's undergraduate admissions process, the proportion of female faculty in the rank in 1987-88 (SRi88), the proportion of tenured faculty in the rank in 1987-88 (RTRi88), five dichotomous variable to indicate the type of institution (CATB, CATC, CATE) and whether it was privately controlled (PRIV) and/or church affiliated (CHURCH), and the proportions of Ph.D.'s on the faculty (FPHD) and part-time faculty in a recent year (PTFAC).[12] To correct for heteroscadescity, each observation is weighted in the analyses by the square root of the number of faculty in the rank in the institution in 1987-88.

The most striking finding that emerges from these regressions is that an institution's compensation level does affect its faculty retention rates for assistant and associate professors, but does not for full professors.[13] That the latter result occurs is not surprising. Full professors are older and more likely to be "tied" to their communities and institutions for noneconomic reasons. What is somewhat surprising, however, is that even in the former two cases the magnitudes of the compensation-retention relationship is not very large. The estimates imply that raising the average compensation of assistant and associate professors by $5,000 would increase the former's retention rate by .019 and the latter's by .012.[14]

To a casual observer these effects may seem quite small when contrasted to the mean retention rates in the sample of .85 for assistant professors and .92 for associate professors (tables 2 and 3). However, when cumulated over a number of years these effects can be seen to be more important. For example, a .85 annual retention rate for a cohort of assistant professors at an institution implies that at the end of a five-year period about .44 of the cohort would still be employed at the institution. In contrast, if the annual retention rate rose to .869 (.85 + .019), just under .50 of the cohort would still be employed at the end of the period. Similarly, a .92 annual retention rate for a cohort of associate professors at an institution implies that at the end of a decade about .43 of the cohort would still be employed at the institution. If the annual retention rate rose to .932 (.92 + .012), .49 of the cohort would still be employed at the end of the decade.

Several other findings warrant mention here. First, more rapidly growing institutions have lower retention rates for assistant professors. This may reflect that institutions do poorer jobs searching for new faculty when their new hiring needs are larger and perhaps more immediate and thus, to the extent that the job matches they make tend to be less suitable, they experience a greater number of subsequent involuntary and voluntary separations.

Second, the pattern of coefficients for both professors and associate professors on the dichotomous variables for "undergraduate admissions selectivity" suggest that retention rates for these ranks are lower, other things equal, at more selective institutions. Put another way, tenured faculty at more prestigious institutions appear to "turn over" more than those at less prestigious institutions. At the assistant professor level retention

rates are higher at the most selective institutions, perhaps reflecting less voluntary turnover because new faculty view these institutions as desirable places to begin their careers.

In addition, assistant professors at two-year (CATE) and four-year (CATC) undergraduate institutions have higher retention rates than faculty at institutions with graduate students (CATA, CATB). Presumably this reflects both the differences in other opportunities that faculty at different institutional types have and that it is more difficult for assistant professors to obtain tenure at research oriented universities than it is at more heavily undergraduate teaching oriented institutions. To put it another way, these results suggest that the human capital built by faculty at teaching-oriented institutions may be relatively more specific to their own institutions than the human capital accumulated by faculty at more research-oriented institutions.

Third, at the full professor level, other things held constant, the higher the proportion of females in the rank the lower the retention rate appears to be. However, no such relationship exists for associate and assistant professors. While others have hypothesized that female faculty will have higher turnover rates than male faculty, either because they are less likely to hold tenure track positions or because historically they have been more likely to move to follow a spouse's career or to leave the labor force during their child-rearing period, apparently younger generations of female faculty exhibit turnover behavior which is similar to their male counterparts.[15]

Finally, retention rates for associate and full professors are higher at church affiliated institutions than at nonaffiliated institutions, and rates

for full professors are higher at private institutions than at public ones. The former result may reflect the greater institutional commitment that individuals employed at church affiliated institutions have, while the latter may reflect the greater ability of private institutions to make discretionary salary adjustments and to respond to external job offers that senior professors receive. This latter finding suggests that measures of intrarank salary dispersion at an institution may also affect retention rates. We test for this in the next section.

Our findings concerning the roles that compensation levels and the gender composition of the faculty play in influencing retention rates are of perhaps the greatest interest and one wonders how robust these findings are across categories of institutions and econometric specifications. Table 6 reports the compensation level and gender composition coefficients one obtains when one reestimates the retention rate equations stratifying the data into doctoral level (CATA), comprehensive (CATB), general baccalaureate (CATC), and two-year institution (CATE) subsamples. The compensation coefficients now reflect the effects of variation in an institution's compensation level relative to the mean compensation level in the institutional category, rather than the effects of the institutional variations relative to the overall mean compensation level, as are reported in the previous table (coefficients from this previous table are reproduced in the row marked ALL).

The results reported in Table 6 confirm that compensation levels, on average, affect retention rates for associate and assistant professors. Most striking, however, is that the magnitude of the relationship gets larger as we move from graduate institutions, to four-year institutions, to two-year institutions. Put another way, the responsiveness of retention rates to a

given dollar change in compensation appears to be greater for two-year colleges than it does for institutions with graduate programs; not a surprising result since average compensation levels are lower at the former and thus a given dollar change represents a greater percentage change. In addition, because of the importance to faculty involved in research at graduate level institutions of nonpecuniary conditions of employment, such as the presence of good research facilities, libraries, graduate students, and colleagues, current earnings and compensation are likely to be relatively less important factors in their mobility decisions.

The coefficients of the gender composition variable confirm that retention rates are negatively associated with the proportion of faculty in the rank that are female only for professors. However, this negative association does not appear to exist for doctoral level institutions. While retention rates of female professors are lower than their male counterparts at comprehensive institutions, four-year institutions and two-year institutions, females who have achieved full professorships at doctoral level institutions do not exhibit lower retention rates than their male colleagues.

To test for the sensitivity of our estimates to the econometric specifications and data used, we conducted numerous additional analyses that warrant brief mention here.[16] The estimates presented in Tables 5 and 6 treat the error terms in the retention rate equations for professors, associate professors, and assistant professors as being independent. If, however, the error terms are correlated across equations (perhaps because of omitted institutional specific variables such as tension existing between faculty and administration in a year) then it is well-known that efficiency in estimation can be improved by taking account of this correlation and using the method of

seemingly unrelated regressions.[17] When we reestimated the models underlying Table 6 using this method and the subset of institutions that report usable data for all three ranks, we found that while the level of statistical significance of some of the coefficients was lower (because of the somewhat smaller sample sizes), in the main the pattern of coefficients was the same. One exception, however, was that retention rates were higher for female than for male associate professors at comprehensive institutions.[18]

Second, the estimates presented ignore that the retention rates can not exceed one. When we reestimated the retention rate equations for the entire sample using the Tobit method to take account of this upper bound, the pattern of coefficients obtained was very similar to that in Table 5.[19]

Third, the estimates also ignore the limited range of the retention rate (0 to 1) which prevents the error terms from being normally distributed. To correct for this, one can restrict the sample to institutions whose retention rates are less than one, and reestimate the retention rate equations using the logarithm of the retention rate divided by one minus the retention rate as a dependent variable. This "log-odds" transformation permits the dependent variable to vary from minus to plus infinity and thus allows for normally distributed error terms. When this was done the pattern of coefficients was again very similar to those previously reported.

Fourth, data at the institutional level on faculty retention rates in 1987-88 and all of the explanatory variables (lagged one year) that are derived from the annual AAUP surveys were available to us. This permitted us to pool observations across the two years (1987-88, 1988-89) and reestimate the retention rate equations that underlie Table 6, with a dichotomous variable for year added in to control for changes in mean compensation levels

across years. These pooled estimates confirmed that compensation levels are positively associated with retention rates for assistant and associate professors and that the magnitude of these associations decline as we move from doctoral to two-year institutions.[20] We found no associations, however, between the gender ratio of an institution's faculty and its faculty retention rates in these pooled data.

Finally, one may be concerned that the partial correlations we observe between institutions' average compensation levels and their retention rates reflects an omitted variables problem. For example, suppose the average age of associate professors varies systematically across institutions. We know from prior studies of the academic labor markets that, other things equal, faculty salaries increase with age and that voluntary turnover of faculty decreases with age.[21] Thus, even if there were no behavioral relationship between associate professor retention rates and average associate professor compensation levels, one might observe a spurious positive correlation between them when average associate professor age is omitted because both of the former variables are positively related to average associate professor age.

One approach to handling this problem is to treat any omitted variables as having a "fixed-effect" over time (in our case two years), first-difference the data to eliminate the fixed effect, and then estimate the model in first-difference form. This can be done only for institutions that appear in the sample in both 1987-88 and 1988-89 and consequently our sample sizes are reduced. When this was done the results did <u>not</u> provide strong support for the view that assistant and associate professors' compensation levels are positively associated with their retention rates. Most of the compensation level coefficients were statistically insignificant.[22]

We must caution, however, that it is well-known that measurement error in dependent variables that is negatively correlated over time leads to reduced precision of estimates when a fixed effect model is used.[23] If measurement errors in the retention rates are negatively correlated over time, this may explain the poor performance of the fixed effects model. In the appendix we show that the measurement error in retention rates may well be negatively correlated over time if, as appears to be the case, over time institutions do not consistently include faculty on sabbatic leave as part of their reported current and continuing faculty.[24] Thus, while these fixed effects estimates weaken our confidence in the finding that retention rates for assistant and associate professors are positively associated with their compensation levels, they do not cause us to reject the finding.

IV. Faculty Salary Distributions

Each year the AAUP asks institutions to report the number of faculty members by rank in each of 40 to 50 salary intervals. These data have never been published by institution; they have been used only to compute the salary distribution of faculty, by rank, nationwide. Special tabulations provided to us for 84 institutions (which are distributed roughly equally among the doctoral level, comprehensive, and general baccalaureate categories) for 1988-89 enable us to compute measures of the intrarank dispersion of salaries for each professorial rank by institution. The two measures we compute are the logarithm of the variance of the salaries within a rank (VAR) and the coefficient of variation of salaries within a rank (CV).[25] Descriptive statistics for these measures appear in Table 7. As is evident from this table, intrarank salary dispersion varies substantially across institutions.[26]

Why might the intrarank dispersion of salaries vary across institutions? First, especially for tenured faculty, the age distribution of faculty may vary across institutions and, to the extent that there is an "age" component in salaries, greater dispersion in faculty ages, other things equal, will lead to great faculty salary dispersion. Second, merit pay policies may vary across institutions and, other things equal, the greater the discretion exercised by administrators in granting salary increases, the greater the intrarank dispersion of salaries will be. Finally, to the extent that salaries and salary increases vary across fields in an institution, other things equal, the greater the dispersion of rewards by field, the greater the intrarank salary dispersion will be.

Data is currently not reported by institution on faculty age distributions, the extent of discretionary salary adjustments, or the extent of interfield differences in compensation. The best one can do is to attempt to analyze whether institutional characteristics that are likely to influence these variables also appear to influence the extent of salary dispersion. Results of regressions that attempt to do this are reported in Table 8 where the two measures of dispersion for each rank are specified to be functions of the proportion of female faculty in the rank, the proportion of tenured faculty in the rank, the growth in faculty size between 1987 and 1988, whether the institution is a doctorate (omitted class), masters, or general baccalaureate institution, whether it is private and/or church-related, and the number of faculty in the rank.

These results suggest that, other things equal, salary dispersion is lower at masters level (CATB) than doctorate level institutions (the omitted category) and lower at baccalaureate institutions (CATC) than at masters level

institutions. Salary dispersion also appears to be larger at private than at public (PRIV) institutions and at church-related than at nonchurch-related (CHUR) institutions especially at the full professor rank, reflecting perhaps the differing degrees of discretion, interest in equality, and rules that operate at the various institutions. There is somewhat weaker evidence that salary dispersion is larger at larger institutions (FACi88) and lower when a greater proportion of faculty in the rank are female (SRi). Whether these results are due to correlations with the unobservable age distribution, the extent of discretionary salary adjustments, or the extent of differences in interfield salary differences can of course not be directly determined from the data.

However, to the extent that intrarank salary dispersion does reflect discretionary pay policies or pay policies that allow for salary differences by field, it may well affect faculty turnover. On the one hand, institutions that pursue merit pay policies and/or allow for salary differences by field may find it easier to retain their "best" faculty and faculty in "higher paying" fields. On the other hand, "lesser" faculty and faculty from "lower paying" fields may be more likely to try to leave in such circumstances. One suspects that the opportunities for alternative employment of the "lesser" faculty and faculty in lower-paying fields will be more limited, than those of the "best" faculty and faculty in "higher paying" fields, so that on balance increased salary dispersion might be expected to reduce turnover and hence increase the retention rate. However, ultimately this is an empirical question.

To test the above hypotheses, each of the models reported in Table 5 was reestimated with a measure of the intrarank dispersion of salaries in the rank

in the institution added as an additional explanatory variable.[27] When either the logarithm of the variance of salaries of faculty in the rank or the coefficient of variation of salaries of faculty in the rank was used as the measure of dispersion, salary dispersion never proved to be statistically significant.[28]

Of course, one may argue that the effect of salary dispersion on turnover, and thus retention rates, is nonmonotonic. Faculty may object to what they perceive as "inappropriate" salary compression or salary dispersion. This "equity argument" suggests that turnover rates may increase and retention rates may decrease if salary dispersion is either too high or too low. Following this line of reasoning one might expect to observe retention rates first increasing and then decreasing as salary dispersion increases.

To test for this, quadratic terms in the dispersion measures were also added to the retention rate equations and the latter were again reestimated. When either measure of dispersion was used, only for assistant professors did we observe statistically significant coefficients for both the dispersion of faculty salaries and its square. However, these estimates implied that increases in this measure of salary dispersion first decrease the retention rate and then increase it, with the latter occurring only at levels of dispersion that exceed the mean level of dispersion in the sample.[29] So while the relationship between this measure of salary dispersion and retention rates for assistant professors is nonmonotonic, it does not reflect the pattern that the equity argument leads one to expect.

V. Concluding Remarks

Our analyses of the data institutions report annually to the AAUP has allowed us to draw some tentative conclusions about faculty turnover in American colleges and universities. The aggregate faculty retention rate analyses presented in section II highlight how remarkably stable faculty retention rates have been nationwide over almost a twenty year period and how little they appear to vary across categories of institutions. The analyses of variations in faculty retention rates across institutions presented in section III stress the role faculty compensation levels play. Higher levels of compensation appear to increase retention rates for assistant professors and associate professors (but not for full professors) and the magnitude of this effect, grows larger as we move from institutions with graduate programs, to four-year undergraduate institutions to two-year institutions. Finally, our analyses of the intrarank dispersion of faculty salaries at an institution presented in section IV suggest that salary dispersion affects retention rates only for assistant professors and that increased salary dispersion leads to higher retention rates only for assistant professors employed in institutions whose salary dispersion is already above the mean in the sample.

We have been careful to test for, and note, the sensitivity of our findings about the relationship between an institution's faculty compensation policies and its retention rate, to the specific econometric models and data set used and to the way various theoretical constructs (e.g., dispersion) are measured. While our results vary somewhat across specifications, on balance, the conclusion that faculty compensation policies do affect faculty retention rates appears warranted.

We should caution, however, that while studies like ours can suggest to an institution of higher education what the effects of its changing its compensation policies are likely to be on its faculty retention rates, they cannot tell an institution whether its retention rate is currently too high or too low. To answer such a question requires one to weigh the benefits and costs of faculty turnover and to identify where, within the institution, the costs and benefits are borne. A complete analysis requires knowledge of things like the benefits of having new faculty, the costs to the institution of recruiting new faculty, and the effect of higher compensation levels on both the "quality" of new faculty that can be attracted to the institution and the behavior of continuing faculty. These questions are far beyond the scope of our paper.

In addition, information on the retention rate in an institution tells one little about the types of faculty who are leaving the institution. So, for example, while we found that at the associate professor level increased salary dispersion has no affect on the retention rate of faculty in the rank, it is possible that given an institution's average associate professor salary level, at low salary dispersions the most productive faculty are the ones who tend to leave (because they feel undercompensated relative to their colleagues), while at high salary dispersions it is the lesser productive faculty who tend to leave the institution (because they feel underpaid in such circumstances). Knowledge of "such "compositional" types of effects are important for the framing of compensation policies and to analyze them will require merging individual and institutionally based data sets.[30]

Finally, in many institutions substantial compensation differences exist across disciplines and individuals' retention decisions may well be a function of their compensation relative to their opportunities at other institutions.

This suggests that analyses of faculty retention might also profitably be undertaken using discipline-specific data bases.

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Arnold Zellner, "An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias," Journal of the American Statistical Association (June 1962): 348-368.

Endnotes

1. The results for 1988-89 are found in "The Annual Report on the Economic Status of the Profession, 1988-89", Academe, March/April 1989.

2. Kasper is chair and Ehrenberg a member of AAUP Committee Z. Because of the confidential nature of the submissions of some institutions, access to these data is limited.

3. So, for example, an assistant professor in an institution in 1987-88 who is promoted to associate professor in 1988-89 and remains at the institution should be reported as a continuing assistant professor in 1988-89. These continuing faculty data are used each year to compute the average salary increase for faculty who were on the payroll in the previous year.

4. Examples of these studies include D. E. Ault, G. Rutman and T. Stevenson (1979), Peter Blau (1974), David Brown (1965, 1967), Dolores Burke (1988), Theodore Caplow and Reece McGee (1958), Rachel Rosenfeld and Jo Ann Jones (1986), Darwin Sawyer (1981), Lewis Solmon (1978) and William Weiler (1985).

5. The costs of turnover, such as subsequent recruiting costs, disruptions of course offerings, discontinuities in departmental and student planning, and loss of graduate student advisors, are borne at individual, departmental and institutional levels.

6. See American Association of University Professors (1989), Table I, for the annual percentage changes.

7. See American Council on Education (1989), Table 105.

8. See American Council on Education (1989), Table 127. This relative stability masks, however, substantial changes in the composition of doctorates which may affect the academic labor market. For example, the share of doctorates in the arts and sciences decreased, the percentages of doctorates granted to foreign residents and women increased, and the field composition of doctorates changed significantly. See Bowen and Sosa (1989) for more details about these changes.

9. See National Center for Education Statistics (1988).

10. For comparison purposes, we note that the annual retention rate of Ph.D.'s employed by the U.S. government (a single large employer with numerous opportunities for within-employer moves) in 1987 was .95. See U.S. Merit Systems Protection Board (1989), Table 5.

11. Preliminary estimates suggested that compensation levels (salaries plus benefits) had slightly more explanatory power than salary levels.

12. Precise variable definitions and their sources are found in the notes to Table 5. Since data from an institution's 1986-87, 1987-88, and 1988-89 submissions to the AAUP are used to construct various variables, only institutions who reported data in all three years could be included in these analyses. Hence, the sample sizes in Table 5 are somewhat lower than the sample sizes that appear in the 1988-89 rows of Tables 1, 2 and 3.

13. In contrast, neither the growth rate of compensation in the prior year (1986-87 to 1987-88), nor the growth rate of compensation from 1987-88 to

1988-89 (assuming faculty can accurately predict their average compensation increase if they stay at an institution), proved to have a statistically significant effect on retention rates. In the main then, compensation levels, not recent increases, appear to influence faculty retention rates.

14. The small magnitude of these compensation-retention relationships may be caused by two factors. First, faculty voluntarily accept offers of employment from colleges and universities. To the extent that they know an institution's compensation levels vis-a-vis its competitors' at the time they accept these offers, it may be deviations in an institution's relative ranking over time, not its current compensation level that influence turnover. As noted in the preceding footnote, however, attempts to test this hypothesis by including recent compensation increases as an additional explanatory variable did not yield significant results.

Second, economists' (for example) decisions to consider leaving an institution presumably depend on economists' earnings at the institution, vis-a-vis economists' earnings at other institutions at which they have alternative opportunities, not on comparisons of average earnings of all faculty across institutions. The AAUP does not collect information by institution on compensation by discipline; our use of average compensation data for all disciplines at the institution may create measurement error that causes us to understate the true retention-compensation relationship.

15. Using individual level data on academic psychologists, Rosenfeld and Jones (1986) found that females were more likely to turnover than males, but they did not test if this gender difference in turnover probabilities occurred for all ranks. Since we are analyzing grouped data, we can not rule out an

alternate explanation for our findings, namely the possibility that the proportion of women who are full professors is a proxy measure for the curriculum offered by the institution, distinguishing in some ways institutions which have colleges of agriculture or engineering (where historically the proportion of female faculty was low) from institutions with colleges of education or library science (where historically the proportion of female faculty was high). To the extent that for field related reasons turnover is higher in the latter set of institutions, we may mistakenly be attributing this difference to gender related factors.

16. Tables of results documenting these analyses are available from the authors upon request.

17. See Arnold Zellner (1962).

18. In this specification, the compensation level of associate professors in two-year colleges also did not appear to influence their retention rates.

19. See James Tobin (1958) for the Tobit method.

20. Indeed, the doctoral level coefficients are now insignificant.

21. See Debra Barbezat (1989) for evidence on the age (seniority)-faculty compensation relationship and Rosenfeld and Jones (1986) for evidence on the age-faculty mobility relationship.

22. Indeed, the coefficient for associate professors in four-year colleges is actually statistically significant and negative.

23. See Hamermesh (1989).

24. The instructions that accompanied the AAUP's Annual Survey of Faculty Compensation, Academic Year 1988-89 specifically indicate that "Faculty on sabbatical leave should be reported .... Replacements for those on leave without pay should not be reported; replacements for those on leave with pay should be."

25. The latter is computed as the standard deviation of salaries within a rank in an institution divided by the mean salary in the rank in the institution.

26. Across institutions for a given rank, the two measures of salary dispersion are highly correlated (always greater than .93). Each measure is also highly correlated across institutions across ranks (usually greater than .7).

27. Since we only have salary dispersion data for 84 institutions, the salary dispersion variable is set equal to zero for nonrespondents and a dichotomous variable for nonrespondents is also included in the equation. See G. S. Madalla (1977), pp. 201-205 for a discussion of this method.

28. This result may have been expected by those who believe that faculty who at one time would have "exited" because of their unhappiness with a salary structure now only, to use Hirschman's (1970) terms, "voice" their concern.

29. When the logarithm of the variance was used, the coefficient of the linear term was -.747 and that of the quadratic was .021. Hence, only for values of the logarithm of the variance of that exceed 17.78 (.747/.042) does

increased dispersion lead to higher retention rates. When the coefficient of variation was used, the linear term's coefficient was -.665 and the quadratic term's coefficient was 1.662. Hence, only for values of the coefficient of variation that exceed .2(.665/3.324) does increased dispersion lead to higher retention rates. Both of these critical values exceed the mean values of dispersion in the sample.

30. While the question of how an individual's compensation relative to his colleagues affects his sense of well-being has been studied primarily by psychologists, Robert Frank (1985) has addressed this issue and its implications for academic salary structures and mobility.

Table 1

Retention Rates for Full Professors in the AAUP Sample[a]
(number of schools reporting)

	Category					
Year	All	All-E	A	B	C	E
1988-89	.92 (832)	.92 (740)	.92 (126)	.91 (234)	.93 (380)	.95 (92)
1987-88	.92 (651)	.92 (578)	.92 (108)	.92 (182)	.93 (288)	.91 (73)
1986-87	.92 (899)	.92 (788)	.92 (130)	.92 (249)	.93 (409)	.95 (111)
1985-86	.91 (806)	.91 (717)	.90 (120)	.93 (190)	.93 (349)	.95 (89)
1984-85	.92 (807)	.92 (718)	.91 (113)	.93 (200)	.93 (342)	.95 (89)
1983-84	.92 (700)	.92 (632)	.91 (116)	.94 (232)	.93 (284)	.93 (68)
1982-83	.92 (713)	.92 (647)	.91 (100)	.93 (264)	.94 (283)	.88 (66)
1981-82	.91 (743)	.91 (671)	.90 (125)	.93 (267)	.93 (279)	.93 (72)
1980-81	.91 (986)	.91 (879)	.90 (164)	.94 (367)	.93 (348)	.95 (107)
1979-80	.91 (770)	.91 (707)	.91 (158)	.93 (300)	.93 (249)	.95 (63)
1978-79	.92 (737)	.92 (688)	.92 (142)	.92 (314)	.93 (232)	.95 (49)
1977-78	.91 (740)	.91 (703)	.91 (132)	.92 (321)	.93 (250)	.96 (37)
1976-77	.92 (550)	.92 (532)	.92 (104)	.93 (198)	.93 (230)	.94 (18)
1975-76	.92 (603)	.92 (579)	.92 (114)	.92 (231)	.92 (234)	.94 (24)
1974-75	.90 (642)	.90 (612)	.89 (111)	.91 (260)	.92 (241)	.93 (30)
1973-74	.91 (605)	.91 (588)	.90 (107)	.91 (251)	.92 (230)	.95 (17)
1972-73	.91 (621)	.90 (593)	.91 (116)	.89 (259)	.91 (218)	.92(28)
1971-72	.91 (599)	.91 (576)	.90 (114)	.91 (252)	.91 (210)	.93 (23)
1988-89 Std. Deviation Across Inst.			.05	.10	.09	.12

[a]Weighted means - the weight is the number of faculty in the institution in the rank in the previous year.

and the categories are:
- A - doctoral level institutions
- B - comprehensive institutions
- C - general baccalaureate institutions
- E - two-year institutions

Category totals may sum to less than the overall total.

Table 2

Retention Rates for Associate Professors in the AAUP Sample
(number of schools reporting)

	Category					
Year	All	All-E	A	B	C	E
1988-89	.92 (863)	.92 (764)	.93 (126)	.92 (244)	.92 (394)	.94 (99)
1987-88	.92 (675)	.92 (592)	.92 (106)	.92 (194)	.92 (292)	.93 (83)
1986-87	.93 (909)	.93 (788)	.93 (125)	.93 (259)	.91 (404)	.94 (121)
1985-86	.92 (838)	.92 (730)	.91 (121)	.93 (200)	.92 (349)	.93 (108)
1984-85	.92 (832)	.92 (737)	.92 (117)	.92 (203)	.92 (354)	.94 (95)
1983-84	.92 (707)	.92 (615)	.92 (122)	.93 (229)	.92 (264)	.94 (92)
1982-83	.91 (726)	.91 (676)	.91 (100)	.92 (282)	.92 (294)	.86 (86)
1981-82	.91 (819)	.91 (719)	.89 (125)	.93 (277)	.93 (317)	.94 (100)
1980-81	.91 (1091)	.91 (936)	.90 (169)	.92 (364)	.91 (403)	.92 (155)
1979-80	.92 (864)	.92 (760)	.91 (156)	.93 (294)	.91 (310)	.94 (104)
1978-79	.92 (850)	.92 (761)	.91 (149)	.92 (318)	.92 (294)	.94 (89)
1977-78	.92 (877)	.92 (789)	.91 (139)	.92 (334)	.93 (316)	.92 (88)
1976-77	.92 (595)	.92 (569)	.91 (103)	.93 (212)	.92 (254)	.95 (26)
1975-76	.92 (668)	.92 (620)	.92 (113)	.93 (251)	.92 (262)	.93 (42)
1974-75	.91 (692)	.91 (643)	.90 (109)	.92 (266)	.92 (268)	.90 (49)
1973-74	.92 (692)	.92 (621)	.92 (114)	.91 (255)	.92 (252)	.96 (34)
1972-73	.91 (680)	.91 (632)	.91 (112)	.91 (277)	.90 (243)	.91 (48)
1971-72	.90 (653)	.90 (618)	.90 (114)	.91 (270)	.91 (234)	.91 (35)
1988-89 Std. Deviation Across Inst.			.05	.09	.10	.12

[a]See Table 1 for categories and table notes.

Table 3

Retention Rates for Assistant Professors in the AAUP Sample[a]
(number of schools reporting)

	Category					
Year	All	All-E	A	B	C	E
1988-89	.85 (908)	.85 (804)	.85 (134)	.85 (252)	.85 (418)	.89 (104)
1987-88	.85 (714)	.84 (631)	.84 (117)	.85 (202)	.85 (312)	.83 (89)
1986-87	.86 (956)	.86 (825)	.86 (136)	.87 (269)	.85 (420)	.89 (131)
1985-86	.84 (887)	.84 (768)	.84 (124)	.85 (211)	.84 (376)	.89 (119)
1984-85	.85 (891)	.85 (781)	.85 (119)	.86 (222)	.84 (376)	.90 (110)
1983-84	.86 (799)	.85 (698)	.85 (127)	.86 (251)	.86 (320)	.91 (101)
1982-83	.84 (839)	.84 (728)	.83 (104)	.85 (297)	.86 (327)	.85 (111)
1981-82	.85 (919)	.85 (810)	.83 (131)	.87 (308)	.86 (371)	.92 (109)
1980-81	.84 (1243)	.84 (1031)	.82 (170)	.87 (387)	.82 (474)	.90 (212)
1979-80	.85 (1024)	.84 (878)	.83 (157)	.87 (326)	.83 (395)	.89 (146)
1978-79	.84 (1032)	.85 (888)	.81 (144)	.86 (362)	.85 (382)	.89 (144)
1977-78	.85 (1043)	.85 (895)	.83 (142)	.87 (367)	.84 (386)	.90 (148)
1976-77	.85 (688)	.85 (648)	.84 (112)	.87 (245)	.85 (291)	.91 (40)
1975-76	.85 (751)	.85 (697)	.84 (118)	.86 (274)	.85 (305)	.91 (54)
1974-75	.84 (778)	.83 (716)	.82 (117)	.85 (304)	.83 (295)	.90 (62)
1973-74	.85 (754)	.85 (700)	.85 (115)	.85 (282)	.84 (303)	.90 (54)
1972-73	.85 (772)	.85 (709)	.84 (115)	.86 (302)	.85 (292)	.92 (63)
1971-72	.86 (736)	.86 (694)	.85 (119)	.87 (291)	.86 (284)	.88 (92)
1988-89 Std. Deviation Across Inst.			.07	.09	.12	.13

[a]See Table 1 for categories and table notes.

Table 4

Retention Rates for the Subset of Institutions That Reported Data to the AAUP for a Rank for All Years (number of schools reporting)

Year	Prof. (42)	Assoc. Prof. (36)	Asst. Prof. (80)
1988-89	.93	.92	.85
1987-88	.93	.93	.85
1986-87	.93	.93	.86
1985-86	.94	.92	.85
1984-85	.93	.91	.86
1983-84	.94	.92	.85
1982-83	.94	.93	.84
1981-82	.93	.94	.85
1980-81	.95	.91	.85
1979-80	.94	.92	.85
1978-79	.93	.92	.84
1977-78	.93	.92	.84
1976-77	.93	.92	.87
1975-76	.94	.92	.86
1974-75	.93	.92	.85
1973-74	.94	.92	.86
1972-73	.93	.92	.84
1971-72	.93	.90	.86

where the distributions of institutions across categories are:

Professors:	A-14	B-6	C-22
Associates:	A-11	B-13	C-12
Assistants:	A-18	B-15	C-47

Table 5

1988-89 Weighted Retention Rate Equations[a]
(absolute value t statistics)

Variable/Group	Professors (i=1)	Associate Professors (i=2)	Assistant Professors (i=3)
INTERCEP	.557 (5.7)	.757 (8.2)	.893 (8.4)
COMPi88[b]	-.002 (0.5)	.024 (4.3)	.038 (4.1)
COMP8i7	-.021 (0.3)	-.011 (0.1)	-.075 (0.9)
FAC877	.031 (0.7)	-.004 (0.1)	-.140 (2.5)
REGNE	.019 (2.8)	-.001 (0.1)	.010 (1.1)
REGNC	.001 (0.1)	.001 (0.1)	-.002 (0.4)
REGNW	.003 (0.4)	-.000 (0.0)	-.008 (0.8)
R1	-.021 (1.1)	-.049 (2.3)	.062 (2.3)
R2	-.023 (1.5)	-.035 (2.1)	.007 (0.2)
R3	-.015 (1.0)	-.023 (1.6)	.024 (1.1)
R4	-.012 (0.9)	-.013 (1.0)	.033 (1.6)
R5	-.010 (0.7)	-.012 (0.8)	.025 (1.1)
R6	-.001 (0.0)	.007 (0.5)	.025 (1.0)
SRi88	-.061 (1.9)	.011 (0.5)	-.031 (1.0)
RTRi88	.383 (7.7)	.114 (6.3)	.077 (3.4)
DTR	.368 (6.4)	.043 (1.7)	-.006 (0.5)
CATB	.004 (0.7)	.005 (1.0)	.006 (0.7)
CATC	.008 (0.9)	.007 (0.9)	.034 (3.1)
CATE	.013 (0.6)	.007 (0.4)	.085 (3.0)
PRIV	.020 (2.6)	.010 (1.4)	-.016 (1.7)
CHUR	.022 (2.5)	.021 (2.7)	.011 (1.0)
FPHD	-.000 (0.1)	-.007 (1.0)	.007 (0.8)
PTFAC	-.020 (1.2)	-.033 (2.3)	.003 (0.1)
$\bar{R}^2$	.114	.096	.079
n	669	695	726

Table 5 (continued)

[a]Weighted by the square root of the number of faculty in the rank in the institution in 1987-88.

[b]Coefficient has been multiplied by 100, so a one unit increase is equal to an increase of $10,000.

and where

COMPi88 - average compensation in rank i in the institution in 1987-88 in hundreds of dollars

COMP8i7 - percentage increase in average compensation in rank i in the institution from 1986-87 to 1987-88

FAC877 - percentage growth in the institution's faculty size from 1986-87 to 1987-88

REGNE - 1=northeast region, 0=other) south is
REGNC - 1=northcentral region, 0=other) omitted
REGNW - 1=northwest region, 0=other) region

R1 - 1=most competitive admissions, 0=other)
R2 - 1=highly competitive admissions, 0=other) ommitted category is specialized professional schools of art, music, or
R3 - 1=very competitive admissions, 0=other) theater arts, where admission is not
R4 - 1=competitive admissions, 0=other) based primarily on academic criteria,
R5 - 1=less competitive admissions, 0=other) most 2-year and a few 4-year colleges
R6 - 1=noncompetitive admissions, 0=other) not included in Barrons

SRi88 - proportion female in rank i in the institution in 1987-88

RTRi88 - proportion tenured faculty in rank i in the institution in 1987-88 (equals zero if number of tenured faculty not reported)

DTR - 1=proportion of tenured faculty not reported, 0=proportion reported

CATB - 1=comprehensive institutions, 0=other) doctoral-level institutions
CATC - 1=general baccalaureate institutions, 0=other) are the omitted
CATE - 1=two-year institutions, 0=other) category

PRIV - 1=private control, 0=public control

CHURCH - 1=church affiliated, 0=other

FPHD - proportion of Ph.D.s on the faculty in the institution in 1985-86

PTFAC - proportion of part-time faculty in the institution in 1985-86

Source: 1) College Entrance Examination Board, Annual Survey of Colleges Research Tape, 1985-86 (FPHD, PTFAC).
2) Barron's Profiles of American Colleges, 14th ed. (Woodbury, NY: Barron's Educational Services, Inc., 1984 (R1 to R6).
3) American Association of University Professors, Committee Z, unpublished data files containing information from institutional submissions to the AAUP Annual Surveys of Faculty Compensation (various years) (all other variables).

Table 6

Selected Coefficients From 1988-89 Weighted Retention Rate Equations Estimated Within AAUP Categories (absolute value t statistic)[a]

Variable/Group	Professors (i-1)	Associate Professors (i-2)	Assistant Professors (i-3)
COMPi88[b]			
ALL	-.002 (0.5)	.024 (2.4)	.038 (4.1)
CATA	.011 (1.3)	.025 (1.8)	.027 (1.1)
CATB	-.011 (1.2)	.020 (1.8)	.062 (3.7)
CATC	.002 (0.3)	.033 (2.6)	.067 (3.6)
CATE	.026 (1.3)	.059 (2.4)	.083 (2.1)
SRi88			
ALL	-.061 (1.9)	.011 (0.5)	-.031 (1.1)
CATA	.173 (1.1)	.058 (0.7)	-.009 (0.1)
CATB	-.175 (2.3)	.043 (1.0)	.023 (0.4)
CATC	-.056 (1.9)	.014 (0.4)	-.017 (0.5)
CATE	-.177 (2.0)	-.067 (0.9)	-.019 (0.2)
where sample sizes are			
ALL	699	695	726
CATA	110	109	116
CATB	191	202	212
CATC	298	306	323
CATE	70	78	75

and

[a]Coefficients for within category equations come from specifications similar to those found in Table 5, except for the omission of the category dichotomous variables and dichotomous variables for region (REG) and selectivity ranking (R) for cells in which no observations appear.

[b]"One unit" increase in compensation is equivalent to a $10,000 increase.

Table 7

Intrarank Salary Dispersion Statistics in 1988-89
for the 84 Institutions in the AAUP Sample

Variable	Mean	Std. Dev.	Minimum	Maximum
CV				
Professors	0.17	0.06	0.03	0.31
Associates	0.14	0.06	0.04	0.29
Assistants	0.16	0.07	0.05	0.51
VAR				
Professors	17.965	1.111	14.213	19.667
Associates	17.049	0.958	14.033	18.632
Assistants	16.850	1.065	14.669	19.711

where

CV = coefficient of variation of salaries in the rank in the institution

VAR = variance of salaries in the rank in the institution

Table 8

Correlates of Intrarank Salary Dispersion
(absolute value t statistics)

	Professors		Associate Professors		Assistant Professors	
	CV1	VAR1	CV2	VAR2	CV3	VAR3
INTERCEPT	-.067 (0.3)	13.517 (3.4)	.174 (1.4)	16.814 (8.6)	.105 (0.6)	15.899 (7.0)
SRi88	-.123 (1.7)	-1.988 (1.5)	-.162 (3.5)	-2.762 (3.7)	-.085 (1.4)	-1.241 (1.6)
RTRi88	.209 (1.5)	4.666 (1.9)	-.025 (0.7)	-0.190 (0.3)	-.011 (0.1)	0.421 (0.4)
FAC877	.044 (0.3)	-0.084 (0.0)	.035 (0.3)	1.133 (0.6)	.121 (0.7)	1.643 (0.7)
CATB	-.059 (3.2)	-1.000 (3.0)	-.043 (3.2)	-0.714 (3.2)	-.063 (2.8)	-0.771 (2.7)
CATC	-.069 (3.7)	-1.073 (3.2)	-.068 (4.5)	-1.217 (5.0)	-.108 (4.7)	-1.573 (5.3)
PRIV	.037 (2.3)	.893 (3.1)	.015 (1.1)	.390 (1.8)	.021 (0.9)	0.381 (1.3)
CHUR	.039 (1.9)	.603 (1.6)	.030 (1.7)	.460 (1.7)	.045 (1.7)	0.746 (2.2)
FACi88[a]	.069 (1.6)	.001 (1.7)	.128 (2.0)	.002 (1.3)	.078 (0.7)	.002 (1.6)
$\bar{R}^2$	.432	.438	.516	.581	.423	.524
n	82	82	82	82	82	82

[a]Coefficient has been multiplied by 1,000.

and

CVi = coefficient of variation of salaries in rank i for 1988-89
VARi = logarithm of the variance in salaries in rank i for 1988-89
FACi88 = number of faculty in the rank in 1988-89

all other variables are defined in Table 5.

Appendix

Let E_t be the number of full-time faculty in an institution in a rank in year t and C_t be the number of continuing full-time faculty in the institution in the rank in year t. Then, the true retention rate, $R\dagger_t$, for the institution for the rank in year t is defined by

$$(1) \qquad R\dagger_t = C_t/E_{t-1}.$$

Now suppose that in 1988-89 an institution reports it number of full-time (E_{89}) and continuing full-time faculty (C_{89}) correctly. Suppose in 1986-87 it similarly correctly reports full-time (E_{67}) and continuing full-time (C_{67}) faculty. Finally, suppose that in 1987-88 it incorrectly omits the number of people on sabbatical leave (A_{78}) from its reported full-time and continuing full-time faculty totals. That is, it reports $E_{78}-A_{78}$ full-time faculty and $C_{78}-A_{78}$ continuing faculty.

Using these data we will estimate its retention rates for 1988-89 (R_{89}) and 1987-88 (R_{78}) to be

$$(2) \qquad R_{89} = C_{89}/(E_{78}-A_{78})$$

$$(3) \qquad R_{78} = (C_{78}-A_{78})/E_{67}.$$

The measurement error, the difference between the true ($R\dagger_t$) and measured (R_t) retention rates in both years will be respectively

$$(4) \qquad \epsilon_{89} = R\dagger_{89} - R_{89} = (C_{89}/E_{78}) - (C_{89}/(E_{78}-A_{78}))$$
$$= -C_{89}A_{78}/(E_{78}-A_{78})E_{78}$$

and

$$(5) \qquad \epsilon_{78} = R\dagger_{78} - R_{78} = (C_{78}/E_{67}) - ((C_{78}-A_{78})/E_{67}) = A_{78}/E_{67}.$$

It is straightforward to see that $\epsilon_{89} < 0$ and $\epsilon_{78} > 0$. Furthermore, as the magnitude of the reporting error increases (A_{78} grows larger), ϵ_{78} will increase and ϵ_{89} will decrease. Hence, this type of reporting error causes the measurement error in the retention rates to be negatively correlated over the two years.