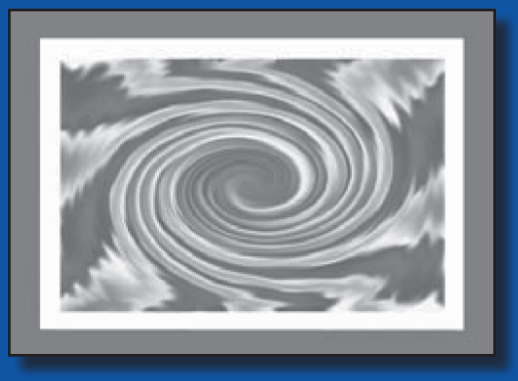

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New Approaches for Analyzing Two Key and Related Issues in Faculty Salaries: Compression and Cost of Living

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Abstract

In the university setting, the issue of faculty morale typically has been linked to a variety of perceived inequities, including inequities in faculty salary. New approaches for analyzing two different, but related, types of inequity are proposed. One approach addresses whether salary compression, often perceived by faculty to exist, actually does exist; the other approach addresses whether end-of-term annual salary increases, often perceived by faculty not to reflect a cost of living component, actually do. What sets these two approaches apart from the others suggested in the literature are that they lack a high level of mathematical complexity, yet they still have the ability to control for confounding sources of variation, they are easily carried out even by someone with minimal statistical expertise, and results from them are easily understood by a broad audience. The two new approaches are applied to real data from a private research university in the Northeast and results from these analyses are discussed.

Key Words: Faculty Salary; Faculty Salary Compression; Faculty Salary Cost of Living Increases, Assessing Faculty Salary Inequities.

New Approaches for Analyzing Two Key and Related Issues in Faculty Salaries:

Compression and Cost of Living

Much has been written to suggest that individuals' productivity and effectiveness in an organization rely heavily on employee morale (e.g., Cameron & Quinn, 1999; Drucker, 1991; Johnsrud, 2002; Skinner, 1986). Universities, like other organizations, are no exception. In the university setting, the issue of faculty morale typically has been linked to a variety of perceived inequities, including as a prominent entry on that list, inequities in faculty salary. One type of faculty salary inequity addresses possible

patterns of difference in base salaries related to ethnicity and gender, after controlling for a number of relevant variables (e.g., age, rank, tenure, years since highest degree, years of service at the institution, and administrative position held). Another type addresses possible patterns of difference in base salaries due to compression (a narrowing gap in salary between experienced faculty and relative newcomers). And still another type addresses to what extent end-of-year annual increases in salary exceed the cost of living or merely are on par with increases in the market, which, by their nature, also take into account inflation.

In this paper, we propose two new approaches of analysis, one for each of the last two types of salary inequity mentioned—to investigate whether salary compression, often perceived by faculty to exist, actually does exist, and whether end-of-term annual salary increases, often perceived by faculty not to exceed the cost of living, actually do. What sets these two proposed analyses apart from others written about in the literature are that (a) they control for confounding sources of variation without the burden of requiring the large sample sizes necessary to meet the assumptions underlying the other, more complex and sophisticated, methods of analysis that have been used to date; (b) they are easily carried out even by someone with minimal statistical expertise; and (c) results based on them are more easily understood by a general audience, who are not familiar with more sophisticated methods. The two related approaches are applied to real data from a private research university in the Northeast. Results obtained from these analyses indicate that at this institution there is no evidence of compression and that to attract, recruit, and hire top new faculty, this institution appears to have embarked on an aggressively competitive approach that sets starting salaries for assistant professors in excess of what would be expected by market forces.

Measuring Salary Compression: Reports from the Literature

According to Lillydahl and Singell (1992), "a very common definition or characterization of compression is the narrowing gap between experienced faculty and relatively new entrants" (p. 230). Such compression may result "when the demand for faculty members changes in external labor markets and institutions adjust their offers to new ('junior') faculty in order to attract applicants while failing to adjust salaries for the faculty already on staff ('senior faculty')" (Toutkoushian, 1998, p. 88). That is, when faculty first come to an institution, their salaries reflect market trends, but by the time they have been at that institution for some time, their competitive market salary advantage is lost, unless increases in salaries over the years reflect and are sensitive to a market model. As noted by Toutkoushian (1998), "[s]alary compression in this sense is a form of discrimination, arising from institutions compensating junior and senior faculty differently for the same characteristics" (p. 88). Perceived as a form of discrimination, faculty have been known to file grievances to protest alleged salary compression practice (Mooney, 1991).

Over the last 20 years, empirical investigations of salary compression in the academic setting have been reported in the literature (e.g., Dworkin, 1990; Johnson, Riggs, & Downey, 1987; Lamb & Moates, 1999; Lillydahl & Singell, 1992; McCulley & Downey, 1993; Seaman, 2005; Snyder, McLaughlin, & Montgomery, 1992; Toutkoushian, 1998), which have made use of a wide range of methodologies. Some (Dworkin, 1990; Snyder et al., 1992) have utilized a straightforward calculation of the ratio of mean salaries for senior to junior professors as the measure of compression; and, comparisons are made either across departments for one particular year or across years for each department. Others, by contrast (Johnson et al., 1987; Lamb & Moates, 1999; Lillydahl & Singell, 1992; McCulley & Downey, 1993; Seaman, 2005; Snyder et al., 1992; Toutkoushian, 1998), have utilized more complex models based on ordinary least squares (OLS) regression that have attempted to take into account differences in faculty experience and accomplishment.

Using the more straightforward ratios approach, salaries in one department are said to be compressed relative to another in any given year if the senior-to-junior salary ratio in that department is relatively smaller than in the other. Typically, a

senior faculty member is defined as a full professor regardless of the number of years on rank and a junior faculty member is defined as an assistant professor, also regardless of the number of years on rank. In addition, because "the relationship between salary and seniority for faculty hired directly at either the associate or full professor levels is likely to be quite different than that for those faculty who began their career at the institution" (Toutkoushian, 1998, p. 92), the definition of a senior faculty member typically is further restricted to only those full professors who began their careers as assistant professors at the institution under study. When tracked across years, compression is said to exist if the senior-to-junior salary ratio shrinks over time.

This approach has been criticized by Toutkoushian (1998) and others because it fails to take into account, in addition to changes in the labor market, faculty characteristics, such as experience and accomplishment as these characteristics are likely to influence these ratios. By pooling all full professors together into one group, regardless of the number of years on rank, the analysis has the effect of ignoring experience as a faculty characteristic. Given the uncapping of mandatory retirement in 1992, which allows senior faculty to remain on rank anywhere from say, 1 to 40 years, such pooling can seriously mask the full magnitude of the compression effect, especially for longer-serving faculty. A biased or inaccurate estimate of the compression effect may also result from ignoring faculty accomplishment. To the extent that longer-serving faculty are not producing at the level of junior faculty, for example, a smaller or even shrinking ratio would not necessarily provide evidence for compression due to labor market changes.

The more complex approaches based on OLS regression typically do take into account faculty characteristics, such as academic experience and accomplishment, and, as such, may be considered to represent an improvement over the salary ratio approach for identifying compression.

One such approach, based on OLS, was proposed by Toutkoushian (1998), who then applied it to data from the University of Minnesota. The approach utilizes a set of faculty qualifications (experience, highest educational degree attained, tenure, administrative positions held) as independent variables and the logarithm of faculty salary as the dependent variable. Taking the logarithm of a positively skewed dependent variable, like faculty salary, is customary for such regression analyses. The approach uses what might be considered to be a traditional cross-validation design in regression, in which, in this case, the original regression model is developed on the senior faculty member sample (the calibration sample) and then cross-validated on or fitted to the junior faculty member sample. A residual value is obtained for each member of the junior faculty sample, which is calculated as the difference between each junior faculty member's actual salary and his or her predicted salary based on the model developed on the senior faculty member (calibration) sample. One may think of the predicted salary as the salary the junior faculty member would earn if he or she were "paid in the same manner as the senior faculty" (Toutkoushian, 1998, p. 92). As noted by Toutkoushian, "[t]his residual represents the estimated amount by which each junior faculty member is being overpaid [or underpaid] (in logarithms), relative to what he or she would receive if paid according to the same formula as senior faculty" (p. 92). A positive residual would suggest that the junior faculty member is receiving more than he or she would be predicted to earn if paid according to the calibration (senior faculty) model. A negative residual would suggest the opposite. To determine whether the average residual is statistically significantly different from zero, Toutkoushian (1998) proposed using a Student's t-test with degrees of freedom equal to one less than the number of junior faculty in the sample, assuming a large enough sample size. In applying this approach to the University of Minnesota data, Toutkoushian (1998) found evidence of salary compression at two of the five schools at the University, no compression at another of the schools, and salary expansion at the remaining two schools. In addition, he found that in the aggregate, across the entire University, there appeared to be no overall salary compression at this public institution.

While clearly an improvement over the more straightforward junior-to-senior salary ratio comparisons, for such regression-based approaches to be valid, they typically require relatively large sample sizes, which may often not be found in practice, especially in the private university or college setting. They also require a reasonably sophisticated knowledge of statistics on the part of both the investigator and the audience for whom the report is intended. The current paper presents a new approach that institutions may use to assess salary compression. This new approach may be considered a hybrid of the two general techniques proposed in the literature to date, and it offers a fresh, never-been-used-before look at an existing problem. Like the ratio of mean salaries approach discussed earlier in this paper, the new approach is statistically straightforward and accessible as it is based on a comparison of relevant faculty salary ratios, yet, like the regression approach, it takes into account a faculty member's qualifications, thus providing a way to isolate the effects on salary due to market forces from those due to faculty experience and accomplishment.

Measuring Salary Compression: A New More Accessible Approach that Implicitly Takes into Account Faculty Qualifications

This approach is based on a series of analyses that compares the salary of junior and senior faculty at each year within the range of years selected for investigation. If, for example, as in the case presented in this paper, the years selected for investigation span 20 years and range from, say, 1986 to 2005, then 20 separate analyses would be conducted, one per year. Although each of the 20 analyses is likely to be based on a relatively small number of data points, a conclusion regarding compression is drawn from the total number of data points collected over the span of 20 years and, as such, is likely to be large enough to produce reliable results. In the illustration provided in this paper, the number of data points on which a conclusion about compression is drawn is 257. Although a conclusion of compression based on the overall trend in salary ratios across the 20 years may be described simply as positive or negative, one may also, as was done in this paper, conduct a simple *t*-test to address whether the observed trend, based on the particular sample of 20 years studied, differs from zero by more than chance (Weinberg & Abramowitz, 2008).

In this series of analyses, a junior faculty member is defined as an assistant professor in the first year of hire, and the collection of such assistant professors constitutes the group of junior faculty for that year. Correspondingly, a senior faculty member is defined as a full professor in the first year on rank as a full professor, and the collection of such full professors constitutes the group of senior faculty for that year. As noted earlier, to eliminate a known confounding effect on the relationship between seniority and salary, lateral hires who are in their first year on rank as full professors are not included in these analyses. That is, only those full professors in their first year on rank as full professors who began their careers at the institution as assistant professors are included in this series of analyses.

Because these two groups, full and assistant professors, are at similar points in their career paths, this comparison controls for time on rank, an acknowledged important variable to take into account in such comparative salary studies. Not only can time on rank be considered a proxy for experience, but also in controlling time on rank to the first year, the analysis implicitly controls for other faculty qualifications related to past and expected performance (e.g., research or scholarly accomplishment as well as evidence of teaching excellence). We hire faculty as assistant professors because their past and expected performance are judged to be outstanding; likewise, we promote faculty to the rank of full professor because their past and expected performance are judged to be outstanding. In short, because salary data are less noisy at time of hire or promotion, salary comparisons between the junior and senior faculty, so defined, can be expected to more free of extraneous sources of variation that could otherwise contaminate a study based on faculty pooled from across more than one year within a rank.

Accordingly, we may now utilize the straightforward ratio comparison methodology on a set of real data from a private university in the Northeast to investigate whether salary compression exists at this university. Using this approach, we may have greater confidence in the accuracy of our results given that faculty experience and accomplishment are taken into account, either explicitly or implicitly. In particular, for each year under study, we calculate the ratio of the average salary of full professors to the average salary of assistant professors, both of whom are in their first year on rank. If, for example, there are 20 years under study, as there are for the case to be presented, then we would calculate 20 such ratios. If a review, and even a graphical plot, suggests that these ratios remain consistent across time, there would be cause to infer that the relationship between the salaries of full professors and assistant professors, controlling for time on rank and accomplishment, is a stable one. If, on the other hand, these ratios fall over time, there would be evidence to infer that there is salary compression. Finally if these ratios rise over time, there would be evidence to infer that there is salary expansion, rather than compression. Basing comparisons on salary ratios, rather than on salary differences, is supported by the fact that faculty salaries typically increase on a percentage (e.g., 3% raise per year) rather than on a flat dollar basis (e.g., $750 per year). While for the purpose of comparison, the application of the OLS approach to these real data would no doubt be interesting and informative, because the OLS approach would also require the collection and inclusion of faculty experience measures as covariates, it was not used. At this university, and, indeed, according to one anonymous reviewer, at most universities, the collection of such measures would be exceedingly difficult and time-consuming, providing another argument against the use of OLS for the analysis of salary compression. To repeat, the new approach avoids the necessity of collecting such faculty experience measures by implicitly controlling for these measures by making salary comparisons based on one's first year in rank, whether as assistant or full professor. In addition, as traditionally has been the case for such compression analyses, we also exclude lateral hires in all analyses.

Measuring Salary Compression: The New Approach Applied to Real Data from a Private University

The salaries of a total of 257 faculty who were currently active at this university in AY 2005 were analyzed in this paper. In particular, 64 tenured full professors in their first year on rank as full professors who began their academic careers as full-time tenure track assistant professors at this institution were compared to those of 193 first-year full-time tenure track assistant professors over the 25-year span from 1986 to 2005. To control for differences that may exist in compensation patterns across schools at an institution, if there is more than one school at an institution, it is recommended that the analysis be carried on each school separately. Accordingly, the analysis and results for only one of the schools at this institution are presented in this paper, however, the methodology is generalizable to any school, whether it be at this institution or any other.

For each of the 20 years studied, a ratio was computed between the mean salary for full professors, who were in their first year on rank during that year, and the mean salary for assistant professors, who were in their first year of hire. These 20 ratios are given in Table 1 and illustrated graphically in Figure 1 with a best-fit line superimposed on the scatterplot.

While the ratios in the scatterplot of Figure 1 show variation from one year to the next, they do not display a tendency to decline over time, which would be the case if there were compression. In fact, the non-negative slope of the best-fit line superimposed on the scatterplot and the associated non-negative correlation of .231 ($t = 1.01$, $p > .05$) between year and salary ratio do *not* suggest salary compression over time. While the correlation is not statistically different from zero, it is not negative, which would be required to suggest a narrowing gap between experienced faculty and relatively new entrants.

To rule out the possibility that our overall results are skewed by the fact that our new hires or

Table 1
Ratios of Mean Salaries—Full to Assistant Professors

Year	No. Full Professors 1st Year on Rank	No. Assistant Professors 1st Year of Hire	Mean Salary Ratio Full to Assistant
1986	4	4	1.54
1987	3	3	1.61
1988	5	5	1.40
1989	1	4	1.25
1990	2	6	1.28
1991	1	5	1.17
1992	3	4	1.29
1993	3	9	1.46
1994	3	6	1.70
1995	5	7	1.55
1996	4	6	1.36
1997	5	8	1.49
1998		10	
1999		7	
2000	1	20	1.34
2001	1	14	1.49
2002	5	16	1.28
2003	4	19	1.50
2004	7	24	1.58
2005	7	16	1.65
	Sum = 64	Sum = 193	Mean = 1.44

promotions to full professors are concentrated in particular disciplines that may be known to have unique compensation patterns, the disciplinary distributions of new hires and promotions to full professors are detailed in Table 2. Of particular concern would be a concentration of particular

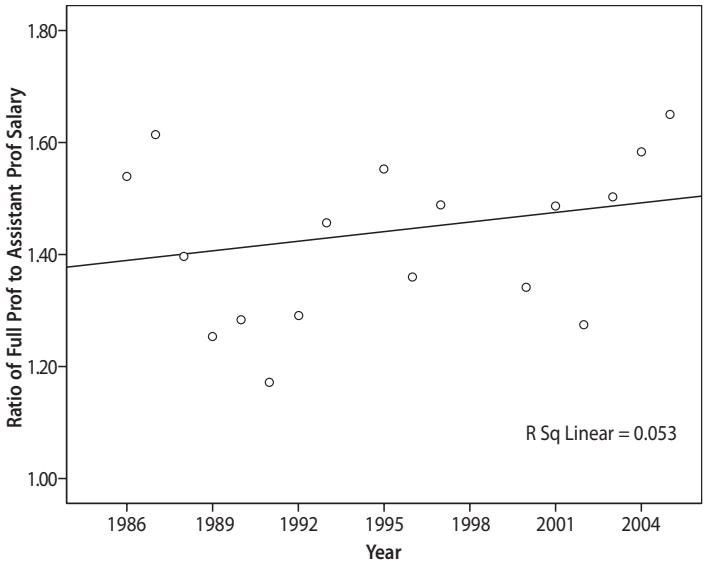

Figure 1. Scatterplot of mean salary ratios (full to assistant professor) by year: 1986 to 2005.

disciplines that occurs over a continuous span of several years. As Table 2 suggests, this is not the case for our data.[2] It may be noted that as reported in Table 1, the average ratio of mean salaries over the 20 years studied is 1.44. This suggests that across this span of 20 years, the average salary of first-year full professors is approximately one and one-half times the average salary of first-year assistant professors; or that explicitly controlling for time on rank and implicitly controlling for accomplishment, newly hired assistant professors earn approximately 67% of the salary of full professors. An important and related question is to what extent can a full professor's salary at 1.44 times that of a first-year assistant professor's salary 20 years earlier be said to exceed the cost of living, as reflected by market forces, which includes inflation. The next sections address that question and describe a new and accessible approach for doing so.

[1] Humanities and Social Science faculty traditionally have lower salaries than do those in the Sciences. The percentage of those in the Humanities and Social Sciences relative to all three disciplines was computed for each year for each of the two ranks. Over all years, in contrast to the Sciences, 73% of Assistant Professors were hired in the Humanities and Social Sciences and a comparable 79% of Professors in their first year as Professors were also from the Humanities and Social Sciences.. Neither set of Assistant or Associate percentages was related to year, meaning that there was no systematic trend in the concentration of hiring particular disciplines.

Table 2

Disciplinary Distributions of Assistant and Full Professors (1st Year on Rank)

	Assistant Professors			Full Professors		
Year	Humanities	Social Sciences	Sciences	Humanities	Social Sciences	Sciences
1986	2	2	0	2	2	0
1987	2	1	0	1	1	1
1988	0	3	2	2	2	1
1989	0	2	2	1	0	0
1990	2	1	3	2	0	0
1991	1	3	1	1	0	0
1992	2	1	1	1	3	0
1993	4	2	3	1	1	1
1994	2	2	2	1	2	0
1995	3	3	1	1	4	0
1996	2	1	3	2	0	2
1997	3	3	2	2	1	2
1998	7	0	3	0	0	0
1999	3	4	0	0	0	0
2000	8	4	8	0	1	0
2001	7	2	5	0	0	1
2002	6	5	5	3	1	1
2003	11	5	3	1	2	1
2004	11	8	5	2	2	3
2005	4	8	4	2	4	1

Do End-of-Year Salary Increases Exceed the Cost of Living? Reports from the Literature and Web

The extent to which end-of-year increases in salary exceed salary increases set by market forces, particularly among those members of faculty who have been loyal to an institution and who have remained at that institution for long periods of time, is an issue that is often raised by faculty as a serious morale-related concern.

A report of the faculty council of Colorado University (Dodge, 2000) offers one of many expressions of such concern that may be cited. In that report, a faculty member is quoted as saying, "I think it is absolutely unacceptable that a faculty member who met expectations received a salary increase that was less than the cost of living." As noted further in that report, "Concern about the allocation of salary raises is not a new issue for the council." As suggested in another report of the Merit Review Committee, Rochester Institute of Technology (2009), and reinforced in the research literature (Arne, 2008; Miller, 1988; Nelson & Watt, 1999), "one major reason that the incremental merit raise is found to be undermining, both within the College and in independent research, is that it obscures and thus forestalls egalitarian cost of living or inflationary adjustments for faculty." The report goes on to note that "this lapse corrodes faculty morale and obscures the collective supports upon which individual productivity rests."

The following section offers a new and straightforward approach to answer the question of whether merit-based raises reflect market factors (including inflation) as a way to address this noted perennial concern. The approach is illustrated through its application to the same data and time frame within which evidence of compression was examined.

Measuring Whether End-of-Year Salary Increases Exceed the Cost of Living: A New and Accessible Approach with an Application to Real Data

We begin by tracking the mean salary of a single cohort of assistant professors hired in the first year of the study who remained at the institution through the last year of the study. For this analysis, the first year of the study was chosen as 1986 and the last year as 2005. The increase in mean salary of this cohort over this 20-year time period, from 1986 to 2005 from one year to the next represent a cumulative "end-of-year" salary increase and may be compared to the increase in cost of living over

the same time period. From the overall, cumulative end-of-year salary increase we may obtain, using Equation (1), an annualized end-of-year salary increase, or annualized "end-of-year" growth rate in salary from 1986 to 2005.

$$(1+R)^{(n-i+1)} = \frac{salary(year_n)}{salary(year_i)} \quad (1)$$

where $n-i+1$ is the number of years included in the analysis

R is the annualized (uncompounded) rate based on the $n-i+1$ years

$salary(year_n)$ is the salary in the *last* year of the study (i.e., $n = 2005$)

$salary(year_i)$ is the salary in the i^{th} year (i.e., $i = 1986$).

We repeat this process for $i = 1987$ to 2005; that is, for all succeeding cohorts of assistant professors hired in years subsequent to 1986 who remained at the institution through 2005. The complete set of annualized end-of-year increases in salary for all 20 cohorts of assistant professors, from their dates of hire until AY 2005 is given in column 3 of Table 3. In particular, for example, the salaries of assistant professors who began in 1986 and who are still at this institution in 2005, as either associate or full professors, show, on average, an actual annualized end-of-year increase of 7.9%. Furthermore, with the exception of the last several years, AY 2000 through AY 2004, annualized end-of-year increases range from 5.2% to 7.9%, and as such, may be described as relatively homogeneous in their variability. Overall, the distribution of annualized end-of-year increases in salary appears to be centered at approximately 6%.

A comparison of these annualized end-of-year increases with the growth in market salaries over this same time period is achieved by calculating an estimate of the annualized market growth rate over this same time period. To do so, the mean salary for each separate cohort of assistant professors, defined by time of hire, is calculated. Because the time span for this study covers 20 years, 20 mean salaries are computed, one per each of the separate cohorts included in the study, from 1986 to 2005. Once again, only those assistant professors who remained at the institution through the last year of the study, 2005, were included in this analysis. Given the competitive nature of hiring assistant professors, external market forces play a significant role in shaping the salary offers made to this group of individuals. Accordingly, the annualized salary increases of first-year assistant professors

Table 3

Per-Year Comparisons of End-of-Year and Market Growth Rates in Salary Over a 20-Year Period: 1986 to 2005

Year	Cohort Size	Annualized End-of-Year Increase in Salary	Annualized Market Increase in Salary	Difference Between Annualized End-of-Year and Market Increases
1986	4	0.079	0.045	0.033
1987	3	0.077	0.042	0.035
1988	5	0.060	0.032	0.028
1989	4	0.070	0.032	0.038
1990	6	0.054	0.030	0.024
1991	5	0.052	0.025	0.027
1992	4	0.059	0.028	0.031
1993	9	0.053	0.028	0.025
1994	6	0.059	0.033	0.026
1995	7	0.078	0.031	0.048
1996	6	0.053	0.017	0.036
1997	8	0.075	0.026	0.049
1998	10	0.061	0.022	0.039
1999	7	0.067	0.035	0.032
2000	20	0.039	0.017	0.022
2001	14	0.035	-0.003	0.037
2002	16	0.027	-0.018	0.046
2003	19	0.030	0.038	-0.009
2004	24	0.016	0.045	-0.029
2005	16	N/A	N/A	N/A

measured over time may be considered to represent annualized salary increases due to the effect of the market. In this case, as in the case for compression, by analyzing the salaries of assistant professor level in their first year of hire, we are able to control for faculty time on rank and, thereby, isolate market forces as a component of salary level. The set of annualized market increases in salary for each of the 20 separate cohorts of assistant professors is given in Table 3, column 4. Based on these values in Table 3, we know, for example, that based on the average salary of the cohort of assistant professors whose year of hire was 1986 and the average salary of the cohort of assistant professors whose year of hire was 2005, the annualized market increase in salary from 1986 to 2005 to be 4.5%. Likewise, we know, applying the same methodology, that the annualized market increase in salary from 1987 to 2005 is 4.2%, and so on. A review of the entire distributions of both annualized market increases in salary given in column 4 of Table 3 and annualized end-of-year increases in salary given in column 3 suggests that these values are similarly homogeneous in their variability (the standard deviation for column 3 is .018, and for column 4 it is .016). Unlike the values in column 3, the values in column 4 (market salary increases) show an upturn in AY 2003 and AY 2004 relative to their immediately preceding years. Furthermore, we may note that the distribution of market salary increases appears to be centered at approximately 3% (2.66%), while the annualized increase has an average of 5.49%.

Given these two sets of values, we compute the difference between corresponding end-of-year and market increases for each of the 20 cohorts given in Table 3. These differences are given in column 5 of Table 3. For example, based on column 5, we know that the difference between the corresponding end-of-year and market annualized increases for the 1986 cohort to be 3.3%. This difference, which is significantly greater than zero ($t = 6.66$, $df = 18$, $p < .001$), suggests that annualized end-of-year increases over this 20-year period exceed market increases over the same time period, and argue in favor of the existence of a true end-of-year increase that is over and above a cost-of-living increase, at least for this 1986 cohort (it should be noted that the annual rate of inflation is embedded within market growth values).

Results related to those given in Table 3 for cohorts 1986, 1991, 1996, 2001, 2003, and 2004 are illustrated in Figures 2 through 7, respectively. In particular, Figure 2 shows as a dashed line the

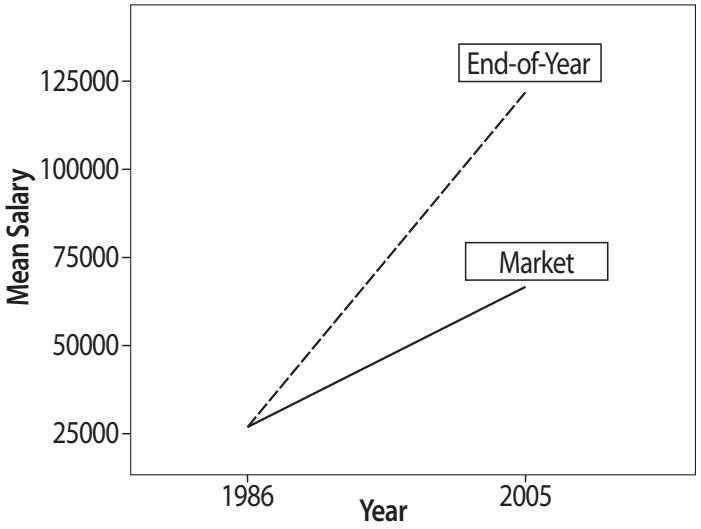

Figure 2. A comparison of end-of-year and market growth rate in salary: 1986 to 2005.

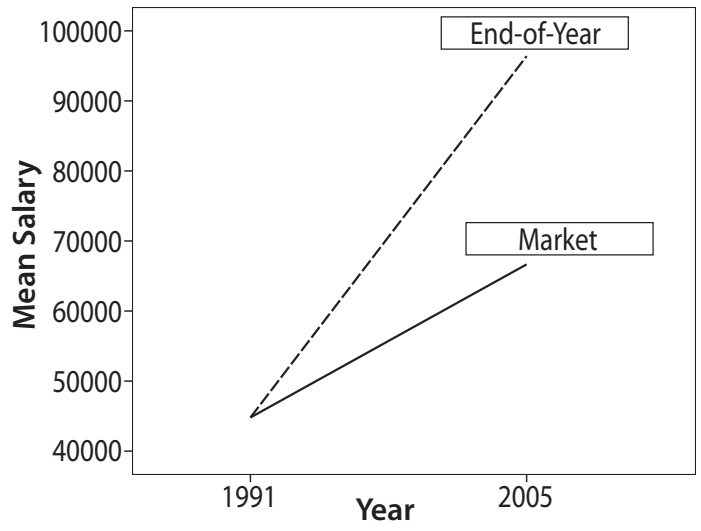

Figure 3. A comparison of end-of-year and market growth rate in salary: 1991 to 2005.

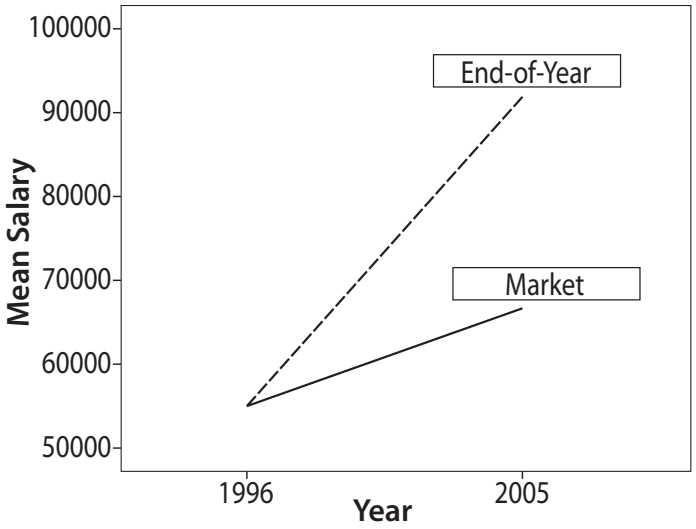

Figure 4. A comparison of end-of-year and market growth rate in salary: 1996 to 2005.

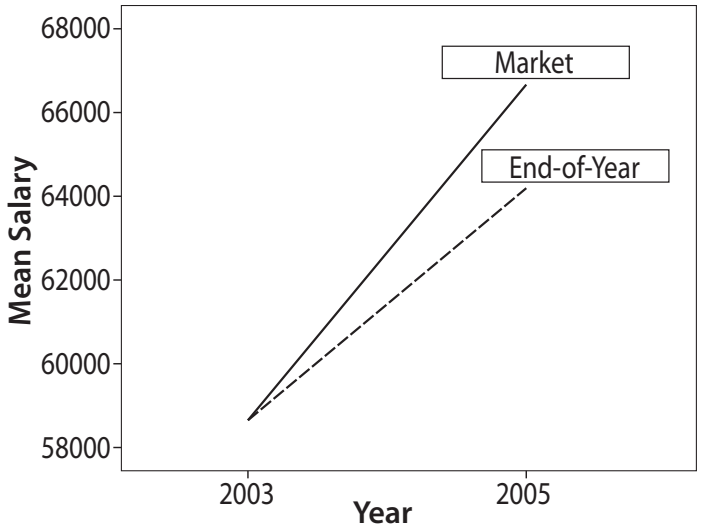

Figure 6. A comparison of end-of-year and market growth rate in salary: 2003 to 2005.

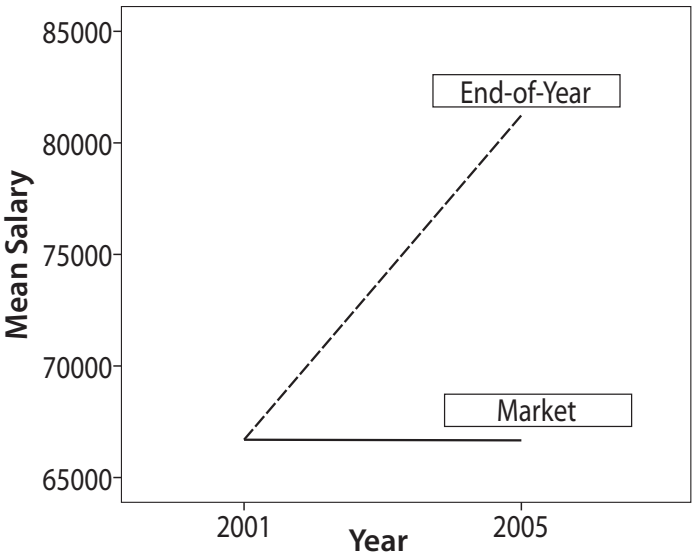

Figure 5. A comparison of end-of-year and market growth rate in salary: 2001 to 2005.

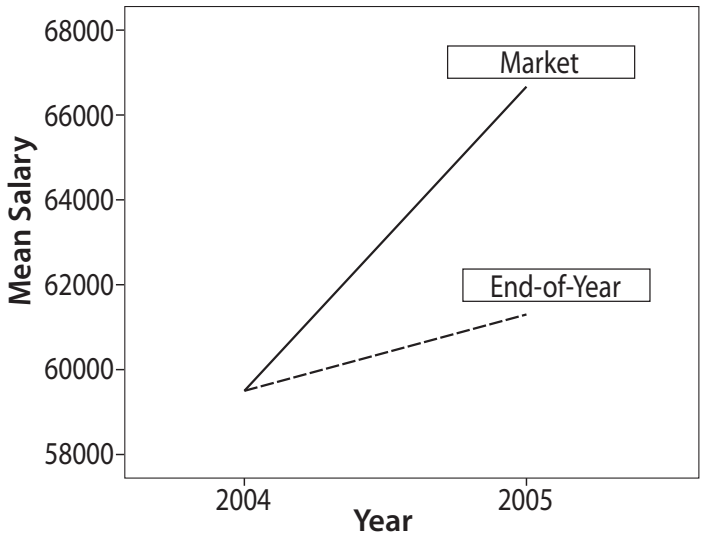

Figure 7. A comparison of end-of-year and market growth rate in salary: 2004 to 2005.

increase in the average salary for the single cohort of assistant professors who began in 1986. Because only two points in time are represented by the dashes (the average salary for this cohort in 1986 and the average salary for this same cohort in 2005) a line connects the two points, and the relationship across time appears linear. Using an analogous approach, a solid line in Figure 2 is drawn to connect the two points (the average starting salary for the group of assistant professors hired in 1986 and the average starting salary for the group of assistant professors hired in 2005) that represent the increase in salary due to market growth over the same 20-year time frame. We may note that in Figure 2,

as well as in subsequent Figures 3 through 5, the dashed and solid lines diverge across time, with the dashed end-of-year line showing the greater rate of increase than the solid market line. One would expect this outcome if end-of-year increases in salary are above and beyond salary increases set by market demand. Accordingly, as suggested by these data, end-of-year increases, at least through 2002, are not merely adjustments in response to market pressures at this institution, but rather, they appear to contain a component that exceeds the forces due to market demand, including inflation. As shown in Figures 6 and 7, however, a different picture emerges beginning in 2003. That is, in 2003 and 2004, the solid market trend lines increase at a faster rate than the corresponding end-of-year trend lines.

A closer look at the differences between the annualized increases in end-of-year and market salaries given in Table 3 suggests, as do Figures 2 through 7, that annualized end-of-year growth exceeds annualized market growth for all cohorts from 1986 until 2003, when the differences between the respective end-of-year and market growth rates become negative. That is, for example, the annualized end-of-year increase over the two-year period (from 2003 to 2005) for the 19 assistant professors who were hired in 2003 is shown to be 3.0%, whereas, the annualized market increase in salary based on the two new cohorts of 24 and 16 assistant professors hired respectively in 2004 and 2005, is 3.8%. In this case and the next (for 2004), market growth exceeds end-of-year growth and reflects the establishment in 2003 of a new program at this institution to become more aggressive in recruiting and hiring top new faculty, including those starting out in their first year at the assistant professor rank. These negative differences stand out as exemplars of a commitment on the part of this institution to a new, more competitive strategy, one that allocates resources for hiring new assistant professors at salaries in excess of normal market levels. As such, this proposed approach for analyzing the degree to which end-of-year salary increases contain a component over and above market levels also has the potential to uncover shifts in the recruitment and hiring policies of an institution; and, it is important that such shifts be taken into account when interpreting results.

Considering an Alternative Explanation of the No-Compression Finding

One may question whether the finding of no compression reported earlier in this paper relates to a survival bias; that is, those faculty members who stayed through a promotion to full professor did so because they personally did not experience salary compression, or other perceived salary inequity, whereas those who left did experience such compression. To address this question for this private university, the salaries of stayers are compared to those of leavers. In this context, *stayers* are defined as those who stayed through promotion to full professor; and, to control for possible performance effects that may contribute to a faculty member's leaving before being granted tenure, *leavers* are defined as those who left the university at some point after promotion to associate professor (a rank that coincides with the granting of tenure at this institution), but before promotion to full professor. The choice to restrict the leavers to those who left before being promoted to full professor was to eliminate those from the analysis who left the university due to retirement and also to take into account the fact that mobility typically is greatest during mid-career, before promotion to full professor. Consistent with the compression analyses presented earlier in this paper, compression is once again evaluated in terms of a salary ratio. For this particular analysis, that ratio is defined as the salary of a faculty member in his/her first year as an associate professor divided by the salary of that faculty member in his/her first year as an assistant professor. If, overall, a *t*-test reveals leavers to have a statistically significantly lower mean salary ratio than stayers, this might suggest that leavers personally had experienced greater compression than stayers, which, in turn, would be consistent with the existence of a possible survival bias.

As noted earlier, in AY 2005 there were 64 tenured full professors who began their academic careers as full-time tenure-track assistant professors at this

institution. Of these, salary information with respect to their first year on rank as associate professors was available on 41. There were only 18 faculty in the data set who were promoted to the rank of associate professor, who left the university before being promoted to the rank of full professor, and for whom relevant associate level salary information was available. According to the results given in Table 4, the effect size (ES) or magnitude of the mean difference in salary ratios of -.052 between leavers and stayers relative to the pooled standard deviation of salary ratios is small (ES = 0.25), and is not statistically significant (t = -.902, df = 57, p = .371).

For completeness, in addition to comparing leavers and stayers in terms of salary ratios, they also were compared in terms of salary differences computed as the difference between a faculty member's salary as a first-year associate professor and that faculty member's salary as a first-year assistant professor. Once again, as Table 5 suggests, the ES or magnitude of the mean difference between leavers and stayers relative to the pooled standard deviation of salaries is small (ES = 0.25), and is not statistically significant (t = .870, df = 57, p = .388). Furthermore, in this case, the direction of the difference favors leavers as opposed to stayers, contradicting the notion that leavers may have left the university because of personally experienced compression.

Caveats and Conclusions

This set of analyses requires data that span a reasonably long period of time in a university's history. It is this author's belief that it is the responsibility of an institutional research office to collect and report such data on a routine basis, and to maintain such data so that it may carry out long-term trend analyses over time. Without a long-range view, blips in the data may be interpreted

Table 4

Associate to Assistant Salary Ratios for Leavers vs. Stayers: t-test Results

Ratio of Salaries (First Year on Rank as Associate/First Year on Rank as Assistant)

TERMINATED	N	Mean	Std. Deviation	Std. Error Mean
YES	18	1.4826	.20160	.04752
NO	41	1.5346	.20539	.03208

Independent Samples t-test on Salary Ratios to Test for a Possible Survival Bias

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	.187	.667	-.902	57	.371	-.05208	.05776	-.16774	.06357

Table 5

Salary Differences at Associate and Assistant Levels for Leavers vs. Stayers: t-test Results

Salary Differences (First Year on Rank as Associate - First Year on Rank as Assistant)

TERMINATED	N	Mean	Std. Deviation	Std. Error Mean
YES	18	18536.17	7227.05961	1703.434
NO	41	17028.83	5596.29078	873.99378

Independent Samples Test on Salary Differences

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	1.653	.204	.870	57	.388	1507.3374	1732.7415	-1962.42	4977.092

erroneously as steady trends. Another issue with the proposed type of analysis is that there is a potential for secular forces to be operating that could exert confounding influences on results. For example, institutional changes in the number of hires across disciplines over time or changes in the quality of an institution could pose threats to the direction of trends across time in terms of ratios or differences. For example, a university may decide to specialize more strongly in the humanities and hire faculty in this discipline at a relatively greater number than in the social or natural sciences. Such policy changes may appear as instances of compression or expansion, depending upon the discipline-based change, when in reality they merely reflect a change in policy at the institutional level. Results of any data analysis need to be contextualized, and these analyses are no different. Accordingly, known changes in policy at a university or institution level would need to be considered and taken into account when reviewing the results of such analyses—as was done in the case presented with the inclusion of Table 2 and elsewhere—before a claim is made that compression exists or that end-of-year increases in salary are on par with or even lower than the cost of living.

Although these analyses compare faculty who are in their first year as full professors to those who are recently hired, first-year assistant professors, one could easily also have compared those who are five years into these respective ranks if one were particularly concerned, for example, that compression occurs most often after a faculty member reaches the rank of full professor. A likely cost, however, of carrying out such analyses beyond five years into the professorial rank would be in terms of a loss of sample size. Finally, it should be reiterated that although the individual cell sizes by

year for the analyses presented in this paper are relatively small, having cohorts of data over a long time span (e.g., for 20 years) will provide a sufficient number of data points to uncover a reliable positive or negative trend in salary growth.

Whether salaries are compressed and whether end-of-year increases in salary merely reflect cost of living are concerns that have been documented for some time. Universities must establish regular procedures for addressing these concerns on an ongoing basis, and they must do so in a way that is both substantively defensible and highly accessible to all faculty members, not simply to those who are quantitatively minded. With caveats noted, the proposed methods to address these concerns on a university-wide basis satisfy both conditions of defensibility and accessibility and are offered as useful alternatives to current methods for dealing with these important matters.

Editor's Note:

Over the last several decades, few administrative processes have attracted the focus of our profession more than faculty salaries. There are several probable reasons for this focus. First of all, faculty salaries are a major expense of most institutions. Our attention does tend to follow the money. The fact that there are various laws that relate to salaries and the equitable treatment of various groups has also had a role in our focus, as lawsuits and the desire to avoid lawsuits does attract our interest.

The laws involve equity in pay for comparable responsibilities regardless of gender and/or race/ethnicity or—in some cases—age. Recent work, particularly the two volumes edited by Toutkoushian, has explained and summarized many of the issues in this on-going discussion.

What is much less resolved is what many faculty are talking about when they raise concern about the equity or fairness of the salary structure: competitiveness and compression. Have the salaries of continuing faculty kept pace with the market? Those who have found significant and negative time-based quadratic terms in regression models can attest to a possible foundation of this concern. The question of compression is a bit more difficult to judge. Who compressed whom? And when did it start?

Weinberg offers some new and unique lenses for looking at both compression and keeping up with the market price as defined as entry-level salaries and then applies her methodology to a select subset of faculty at a large research institution. Her controls are definitional rather than statistical. This removes many of the concerns about non-additively and non-linearity of measures. It removes these concerns, however, in exchange for several possible limiting factors. First, her methodology involves some 20 years of data. Do you have this much hiring and salary data? If not, she makes a good argument for building as accurate a historical database as possible. Second, she looks at faculty as they are entering their ranks. While this controls for time-in-rank, does it allow for compression and loss of competitiveness for those who have been in their ranks for multiple years, especially those at the rank of professor? Finally, she makes several assumptions of random comparability and then tests some of them. Are there other tests you would do to check that the error in change is random? The analysis of compound raises for continuing cohorts would seem to build some confidence for the comparability for market salaries, but this then excludes leavers. This is then dealt with in an additional analysis.

In viewing this contribution, it would seem that three key aspects should remain with the reader. First, the ability to generalize methodology, just like the ability to generalize the results from a methodology, requires that there is a firm grasp and an adequate description of the situation. The author does the description of the situation; the reader must do the understanding. Second, as in grounded theory and nested studies, the issue of appropriateness of salaries needs multiple analyses and multiple views. This article makes a major contribution in that vein. Third, by using logic and a strong knowledge of the data, interesting new ways can be found for taking an analytical look at traditional questions.

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