Determinants of Agricultural Economic Faculty Salaries: A Quarter of a Century Later

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Abstract

Factors influencing the salaries of university agricultural economists were examined and compared to previous work. Results suggest the impact of publication output has remained relatively constant for the past 25 years, while other factors like grantsmanship have changed significantly. Additional analyses suggest significant impacts of appointment apportionment and Ph.D. programs.

Keywords: agricultural economists, faculty salaries, and survey results

Determinants of Agricultural Economic Faculty Salaries: A Quarter of a Century Later

Introduction

The economic profession has a rich history of analyzing salary determinants. In 1973, Katz examined the factors used to evaluate and reward professors, in different departments, at a single university. The evidence suggested that there was an arbitrary distribution of rewards among professors in various departments. Tuckman, Gapinski and Hagemann (1977) focused on a cross section of departments at multiple institutions. They found publication output and administration experience had positive impacts on the reward structure for university faculty. Siegfried and White (1973) and Diamond (1986) focused on individual departments at a single university. They concluded that research output and administration experience were fundamental to financial success. Hilmer and Hilmer (2003) focused on the determinants of salaries within the top ranked Ph.D. granting programs in agricultural economics. While publications in the top ranked agriculture and economic journals are important, Hilmer and Hilmer found that years of experience dwarfed the impact of a single publication.

Other studies have focused on refining the quantitative methods used to determine faculty salaries (Bratsberg, Ragan, and Warren; Ferber; DeLorme, Hill, and Wood; Hallock; Altonji and Shakotko). These studies have primarily been based on publicly available data, rather than private information obtained through surveys. This approach has an advantage in that it avoids self-reporting bias, but it does not enable the researcher to obtain private information.

While there is a vast body of literature pertaining to the determinants of university faculty salaries, little of it focuses specifically on the agricultural economic profession.

One parametric study that extended beyond a single university was a survey done by Broder and Ziemer. Their research focused on survey information from faculty members at various land-grant universities. They found that publishing, grantsmanship, rank, and experience contributed positively to salaries and that teaching actually exhibited a negative effect on salaries. Their general faculty salary model viewed salary as a function of the stock of faculty members' productive characteristics. Within the short run, these stock levels are relatively fixed. As the marketplace demands a higher stock level of a given skill, the price paid to faculty member having that skill tends to increase. This generates salary differentials among the faculty. In the long run, as more faculty members gain the desired skill, salary differentials associated with that skills diminish. The objective of this research is to evaluate how time has altered the demand for various determinants of salary within the agricultural economics profession.

Data

In the spring of 1980, Broder and Ziemer surveyed agriculture economists at land-grant universities and published the summary statistics and model results in 1982. In the spring of 2004, we surveyed agricultural economic professionals from academia, industry, and government institutions. The Web-based survey instrument used in our study was pre-tested and designed to obtain confidential personal information while the same time insuring anonymity. The survey yielded a total of 381 observations from the academic profession. Using the criteria established by Broder and Ziemer, 260 complete observations from university faculty members constitute the basis for this research.

Comparison with Broder and Ziemer

The general salary model, as defined by Broder and Ziemer, used salary on a 12-month basis as the dependent variable. Broder and Ziemer developed two models to

investigate the determinants of salary. Model 1 was specified as:

$$Salary = \beta_0 + \beta_1 Pubtotal + \beta_2 Years + \beta_3 Courses + \beta_4 Grants + \beta_5 Change + \beta_6 Full + \beta_7 Assoc$$

.

Model 2 was specified as:

$$Salary = \beta_0 + \beta_1 Pubrate + \beta_2 Years + \beta_3 Courses + \beta_4 Grants + \beta_5 Change + \beta_6 Full + \beta_7 Assoc$$

.

The two models are very similar, with the exception of how salary is impacted by publications. The first model assumes that faculty members are rewarded based on the cumulative publication output (*Pubtotal*) during their career. The second model assumes that the average rate at which publications are generated annually (*Pubrate*) is the more relevant measure.

Publications are often viewed as a measure of both the quantity and quality of research. Katz (1973), Tuckman, Gapinski, and Hagemann (1977), found a positive relationship between salary and an individual's total number of publications. Hilmer and Hilmer (2003), DeLorme, Hill, and Wood (1979), and Baser and Pema (2003) found that the quality of publication, as measured by the publication source, is also an important determinant of salary. In order to incorporate both the quantity and quality of publication into a single index Broder and Ziemer used the following weighting scheme:

$$Pubtotal = 5 * Books + 2 * AJAE + 1 * Other + .333 * Ext$$

where *Pubtota*l is a measure of lifetime publications, *Books* represents the number of books published, *AJAE* represents the number of articles published in the American Journal of Agricultural Economics, *Other* represents the number of articles published in other national, regional, foreign, and international journals, and *Ext* represents the number of experiment station and extension publications. While the weighting scheme is somewhat *ad hoc* it is consistent with approaches used in previous research to quantify

the somewhat subjective nature of publications (Baser and Pema; DeLorme, Hill, and Wood; Hilmer and Hilmer). *Pubrate* is the average rate of publication output, computed by dividing *Pubtotal* by the total years of experience. This variable considers the time required to produce a publication.

Years is defined as the years of professional experience accumulated since earning a Ph.D. Research has consistently shown a statistically significant and positive relationship between salary and years of experience. Several researchers have included a quadratic term to quantify the impact of diminishing marginal returns to experience. Negative parameter estimates on the quadratic term tend to support the concept of diminishing marginal returns. However, these estimates are not always statistically significant (Hilmer and Hilmer; Diamond; Hallock; Ransom).

Courses is a measure of teaching load, and is calculated based on the number of graduate and undergraduate courses taught per year. Most research indicates a negative return to teaching. Broder and Ziemer suggested that returns to teaching are lower than returns to research due to less professional recognition, lower opportunity cost, and less employment mobility.

Grants is a measure of total research funds obtained on an annualized basis. To maintain consistency with the 1982 study, no distinction was made between grants obtained individually or jointly. As a result, *Grants* is not solely a measure of individual grantsmanship. The ability to obtain research funds is thought to enhance the flexibility, productivity, and prestige of research programs. This ability is easily quantified and can be a metric used to motivate and reward faculty. While grantsmanship is generally assumed to positively impact faculty salary, its impact is rarely modeled due to the

difficulty in obtaining this information as it is often not publicly available.

Research has shown that employment mobility has a positive impact on salary (Broder and Ziemer; Ransom; Altonji and Shakotko). *Change* is a measure of employment mobility, calculated as the number of employment changes since earning a Ph.D. Altonji and Shakatko (1987) found that experience and 'job shopping' accounted for most of career wage growth. They suggested that the relationship between wage and tenure was based on heterogeneity bias.

To some extent, a faculty member's rank is a measure of past performance and generally viewed as a strong determinant of salary. Rank is quantified with binary variables. The variable *Full* is equal to one if a faculty member has obtained the rank of full professor and zero otherwise. When *Assoc* is equal to one, this indicates the faculty member is classified as an associate professor. These variables are measured relative to the entry-level position of assistant professor.

A comparison of the summary statistics between the Broder and Ziemer 1982 (BZ 1982) survey data and the data obtained by the Kansas State University researchers in 2004 (KSU 2004) is presented in table 1. Over the past 25 years mean salaries, on a 12 month basis, have increased by over 200%, at an annualized rate of approximately 5% per year. This is considerably higher than the approximate 2.5% increase reported by Zepeda and Marchant (1998) for the 1985 to 1996 time period. The variability in salaries has increased slightly. The discrepancy between the rates of salary increases is probably related to an increasing prevalence of 9 month appointments. Approximately 39% of our sample had 9 month appointments. Average lifetime publications per faculty member have doubled, and the publication rate has increased by nearly 52%, while the variability

in both categories has decreased. The average faculty member is approximately four years older, and teaching loads have increased about 5%. The average faculty member currently obtains slightly more than one hundred thousand dollars per year in grants. While annual grants obtained has increased by over 60%, the variability across faculty members decreased significantly. Although faculty members are changing jobs more often, there are about the same percent of faculty members ranked as full professors.

A comparison of the regression results is provided in table 2. Parameter estimates, between the Broder - Ziemer study and our analysis are not directly comparable due to inflation. As such, elasticity estimates are provided as the relative comparative measure. Generally, the signs and significance levels of explanatory variables are similar between the two studies.

Over the past 25 years, the relative importance of total publications has increased slightly, with a 1% increase in total publications generating a 0.077% increase in salary. Based on the BZ weighting system, each article published in the AJAE increases annual salary by approximately $407. Publishing a book increases yearly salary by approximately $1,000.

The relative importance of experience, as measured by the difference in elasticities, has increased by nearly 50% since 1980 with each year valued at approximately $961. Since the Broder-Ziemer study, the relative negative impact of teaching load has decreased, and is no longer statistically significant. One of the most notable differences between the two time frames is the impact that grantsmanship has on expected salary. The relative importance of grants has nearly tripled. For each $100,000 in grants obtained today, salary is expected to increase by $1,606.

Faculty members that exhibit greater mobility, as measured by the number of times they have changed positions, receive higher salaries. The elasticity for this factor has doubled in magnitude over the time frame. Each position change is expected to increase salary by $4,314.

The positive impact of professional rank has declined slightly over time. The current relative value of being classified as a full professor has approximately 87% of the impact it had in 1982, as measured by the elasticity of the mean. Consistent with Broder and Ziemer, the rank of associate professor does not statistically impact salary in relation to the ranking of assistant professor.

A comparison of the regression results for the second model specification indicates the signs and significance levels of explanatory variables are similar between the BZ study and our results. Additionally, parameter estimates are very robust between model specifications. The second model specification enables one to evaluate the impact of publication rate on salary. Parameter estimates imply that a faculty member who has one additional publication per year, as compared to other faculty, has an expected salary increase of $2,925. The relative impact of *Pubrate* has nearly doubled over time when measured as an elasticity.

The predictive ability, as measured by R^2, of our model is somewhat less than the Broder and Ziemer model. To examine unaccounted for information, a residual analysis was conducted. If our model under (over) predicts faculty salary, then the faculty member receives more (less) compensation than the industry standard. table 3 provides a comparison of the means of selected variables for the entire sample, the 25% most under predicted faculty, and the 25% most over predicted faculty. Using a t-test, based on large

independent samples from a normal population with known variances, we analyze the null hypothesis that the means of each group is equal to the sample mean.

Focusing on the determinants of salary included in the Broder - Ziemer model, we see that faculty classified as under predicted average $134,168 in annual compensation as compared to the sample mean of $100,037. Other than receiving a higher annual compensation, this group does not differ statistically from the sample in other characteristics. The faculty members classified as over predicted make significantly less money and have statistically more experience than the sample mean. They also have a statistically higher percentage of full professors and a lower number of associate professors within their ranks.

Several interesting results are observed by analyzing potential determinants of salary that were not included in the Broder-Ziemer model. Reviewing select performance related variables, faculty members that are under predicted statistically differ from the sample in that they advise more Ph.D. students and are employed at Ph.D. granting universities. Faculty members that are over predicted statistically differ from the sample in that they obtained fewer grants as the primary investigator and teach fewer Ph.D. level courses.

Past research has shown that regional influences may impact faculty salary (Zepeda and Marchant). To test these impacts regional categories were compiled based on the regional definition provided by Zepeda and Marchant (1998). We examined both the geographic region in which the faculty member was employed and the geographic region from which the faculty member received their degree. Due to space considerations, only the results based on employment regions are reported in table 3.

There was no statistical difference between the groups based on degree received region. The north central region has a statistically higher percent of faculty in the under predicted group, while the southern region has a statistically lower number. In the over predicted group, the north east has statistically fewer observations, while the western region has statistically more faculty members within the category. These findings are consistent with those of Zepeda and Marchant (1998).

In regard to the appointment status, the under predicted group has a statistically lower number of faculty members with 12 month contracts. The over predicted group has a statistically higher number of faculty members with both 12 month contracts and research appointments. Both groups had a statistically higher number of tenured faculty members within their ranks.

From a demographic standpoint, the group of under predicted faculty has a statistically higher amount of outside consulting income. There are statistically fewer married and minority faculty members in the over predicted group.

Several other variables were evaluated in initial models, but were found to have no significant impact, so are not reported. Utilizing the American Agricultural Economics Association's definition of area of specialization, we could find no statistical difference in salaries among the different specialty areas. Applying multiple definitions for top ranked programs in Agricultural Economics (Perry, 1999), we found no statistical differences within the under or over predicted groups.

Overall several insights can be gleaned from the residual analysis. For both groups, being employed at a Ph.D. granting university, teaching Ph.D. level courses, and advising Ph.D. students appears to be important determinants of salary. Although highly

correlated, these variables would indicate that the correct specification for a salary model should control for these factors. Additionally it would imply that the parameter estimate on *Courses,* which does not differentiate between the level of courses taught, may be downward biased. It appears that salary models should differentiate between course loads taught at the graduate and undergraduate levels. Based on the residual analyses we conclude that appointment status should be included as a determinant of salary. It is often suggested that an appointment to the administrative level would have a positive impact on salary, and an extension appointment would have a negative impact on salary.

The implied impact of grants obtained as a principal investigator provides somewhat counterintuitive results. Our expectation was that the under predicted group would have a higher level of grants obtained as a principal investigator. While this group obviously has a higher mean, it is not significantly different than the overall sample. On the other hand the over predicted group has a significantly lower amount of grants obtained as a principal investigator. These results imply that grantsmanship, while having a positive impact on salaries, might have become an expectation of administration. However, it appears that the lack of grantsmanship is penalized by a lack of salary increases.

Alternative Model and Results

Based on the residual analysis, we estimated an alternative model:

$$Salary = \beta_0 + \beta_1 Pubtotal2 + \beta_2 Years + \beta_3 Courses\_ugrad + \beta_4 Courses\_masters + \beta_5 Courses\_phd + \beta_6 Advisor\_Load + \beta_7 Grants\_PI + \beta_8 Change + \beta_9 Match\_offer + \beta_{10} Full + \beta_{11} Assoc + \beta_{12} Admin + \beta_{13} Ext + \beta_{14} Phd\_granting + \beta_{15} Contract$$

where *Pubtotal2* represents a revised measure of total publications. Since the Broder-Ziemer study, the profession has placed a greater emphasis on publications in peer-reviewed economic journals (*Econ*). For the revised model we defined *Pubtotal2* as:

$$Pubtotal2 = 5*Books + 2*AJAE + 2*Econ + 1*Other + .333*Ext \; .$$

The residual analysis also suggested that the yearly teaching load should differentiate between courses taught at the undergraduate level (*Courses_ugrad*), courses taught at the masters level (*Courses_masters*), and courses taught at the Ph.D. level (*Courses_phd*). Additionally, *Advisor_Load* was included as an independent variable to capture the impact of the cumulative number of students that a professor has advised at the Ph.D. level. Only grants obtained as a principal investigator (*Grants_PI*) was included in this model.

As a generality, *Changes* may not adequately represent the negotiating ability of a faculty member. Often, rather then losing an outstanding faculty member, the administration will match credible offers. To capture this impact the number of matching offers (*Match_offer*) received by a faculty member was included in the model.

To differentiate between faculty members that are primarily extension (over 75% extension appointment) and administration (deans, department heads, and program heads) the binary variables *Ext* and *Admin* were included. Based on the residual analysis, the binary variable *Phd_granting* was incorporated to distinguish between employment at a Ph.D. granting institution and employment at a non-Ph.D. granting institution. *Contract* is a binary variable equal to one if the faculty member has an 11 or 12 month contract and zero if the contract is 9 or 10 months. The summary statistics for the alternative model are included in table 1.

Table 4 provides the parameter estimates and associated elasticities. The revised model indicates, based on the new definition of *Pubtotal2*, that the impact of publications on salary is lower than previously estimated. One publication in a top journal will yield

approximately $204 compared to the previous estimate of $407. The lower value is a likely more precise estimate, due in part to the inclusion of research related variables such as *Advisor_Load, Courses_phd,* and *Phd_granting* in the model specification. The impact of experience, as defined by *Years*, is very robust between the models specifications.

Financial rewards, associated with course load, vary by the level of courses taught. This research suggests that the discount associated with teaching undergraduate courses may be more severe than previously estimated. Each course taught at the undergraduate level reduces salary by an estimated $2,878. There appears to be no statistically significant discount associated with teaching master level courses or Ph.D. level courses. We also find that those professors who advising Ph.D. level students received a significant bonus. Each Ph.D. student advised increases yearly salary by an estimated $825.

The impact of grantsmanship is positive and significant in the revised model. The implication is that for every hundred thousand dollars in grants obtained as a principal investigator, salary increases by $2,140. The impact of *Change* has approximately half the positive impact as previously predicted. However, it appears that it is not necessary to change jobs in order to receive higher compensation. Credible threats to change jobs, defined as the number of matching offers received, generates substantial salary increases. Each time a faculty member is offered a competing job and a counter offer is received generates approximately $7,038 in increased salary.

There does not appear to be a statistical salary differential between being classified as an associate professor relative to being classified as an assistant professor.

We do find that there is a significant financial advantage to obtaining the administrative level, and a significant negative financial impact associated with having an extension appointment. Additionally, faculty salaries at Ph.D. granting institutions are approximately $10,024 higher than comparable salaries at non-Ph.D. granting institutions.

The discount associated with being on a 12 month contract, rather than a 9 month contract, is an estimated $27,026, and statistically significant. Following Broder and Ziemer, we adjusted the salary for faculty members on a 9 month salary upward to achieve a 12 month basis. Our sample included 94 faculty members on a 9 month contract, and the average upward adjustment was $27992. Estimating the model without salary adjustments led to an intercept reduction of $27033 and a parameter estimate on *contract* of -$288, which was not statistically significant. Therefore, a salary adjustment essentially acts as an intercept shifter. Parameter estimates for the remaining explanatory variables are robust to this specification change. We suggest that this evidence does not necessarily indicate a salary adjustment, but the opportunity for one based on the ability to fund those additional months. The ability to fund those 3 months is an issue that needs further study.

The predictive ability of the revised model, as defined by R_2, is higher than the previous models. The current model appears to more accurately capture the factors that impact university faculty salary. Reviewing the residuals of this model, there is no significant difference between the sample mean of model variables and the mean of the most under predicted sample or over predicted sample. Since the mean of model variables, and other select variables, are not significantly different, we hypothesize that

the difference between actual salary and predicted salary may well be associated with the unobservable variables such as the negotiating ability of individual faculty members.

Several potential determinants of university faculty salary were tested within the framework of our model specification. The quadratic specifications for *Years*, *Pubtotal2*, *Grants_PI*, and *Advisor_Load* were tested and found to be not statistically significant. Our data set included the number of national, regional, and university level awards received for excellence in teaching, research, and extension. These performance measures proved to be not statistically significant. The regional variables as defined by Zepeda and Marchant (1998) were statistically not significant. Graduation from or employment at a top university, as defined by Perry, did not have a statistical impact on university faculty salaries nor did a faculty members area of specialty, as defined by the AAEA. Additionally we could find no evidence of sexual or racial differences in salary. Parameter estimates and significance levels for the model variables remained robust throughout the testing of these alternate specifications.

The revised salary model can be viewed as a predictor of an individual faculty member's market value based on their productivity. When these market values are aggregated to the university level and compared to the actual salaries at that university, we have a measure of how the university's pay scale relates to the market. The Wilcoxon matched-pairs signed rank test was used to test whether or not an individual university's faculty salary distribution was over or under the market standard. For our purposes the market standard was defined as the estimated salary based on the salary model in table 4.

The Wilcoxon test is a non parametric test which incorporates information about both the sign and the magnitude of the residual. This test is similar to the two sample t-

test without the underlying assumption of normality. For small samples with unknown distributions, the Wilcoxon test is more sensitive than the two sample t-test. The null hypothesis is that the population distribution for the observed salaries and the estimated salaries are identical. The results of the Wilcoxon test are presented in table 5. In general the Wilcoxon test indicates that the majority of universities have salary distributions consistent with market expectations based on our productivity measures. Iowa State University salaries are statistically higher, while Oklahoma State University, Pennsylvania State University and Purdue University are statistically lower than market expectations. Due to the limited sample size, it could be inappropriate to make any stronger statements about the distributional properties of individual university salaries.

Summary and Conclusions

The replication of the Broder - Ziemer model has provided insights into the evolution of faculty salaries for agricultural economic professionals. This research suggests that over the past 25 years the relative importance of research has increased. Grantsmanship has appeared to become significantly more important, with potential salary discounts impacting those faculty members with low output.

Our data set allowed us to identify teaching load as undergraduate level courses, master level courses or Ph.D. level courses. Evidence suggests that negative returns to teaching undergraduate level courses are much more severe than previously thought. On the other hand there does not appear to be a discount associated with course load at the Ph.D. level. However, there are significant benefits associated with being involved with Ph.D. programs. Both employment at a Ph.D. granting institution and advising Ph.D. students generate positive financial rewards.

Evidence suggests that there is a negative impact of $9,683 associated with an extension appointment. Extension faculty are also adversely impacted by the discount on 12 month employment contracts. Approximately 77% of the extension faculty in our sample had 12 month contracts while 49% of the research faculty in our sample had 12 month contracts.

One implication of our research is that faculty members at Ph.D. granting institutions fare considerably better than their counterparts. Additionally, those faculty members with research appointments receive higher salaries than those with teaching or extension appointments. Overall, the evidence suggests that our profession values the development of new knowledge much more than the conveyance of existing knowledge.

Endnotes

[1] Salary is defined as (gross salary received from the university during an academic year)*(12/months in employment contract).

[2] For a complete description of the Wilcoxon matched-pairs signed rank test see Wackerly et al. (2002).

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Table 1. Summary Statistics for the Broder-Ziemer Comparison and the Alternative Model

	BZ (1980)			KSU (2004)		
Variable	Mean	SD	CV	Mean	SD	CV
Salary	$31,436	$7,108	22.6%	$100,037	$32,740	32.7%
Pubtotal	18.16	49.25	271.2%	37.66	38.35	101.8%
Pubrate	1.5	2.26	150.7%	2.30	1.96	85.3%
Years	13.61	8.97	65.9%	17.30	10.05	58.1%
Courses	2.07	1.58	76.3%	2.22	1.71	76.9%
Grants	$65,736	$207,041	315.0%	$108,379	$192,620	177.7%
Change	0.86	1.19	138.4%	1.13	1.11	98.1%
Full	48.0%	50.0%	104.2%	53.1%	50.0%	94.2%
Assoc	27.0%	44.0%	163.0%	18.1%	38.6%	213.3%
				Alternative Model		
Pubtotal2	NI	NI	NI	41.56	42.30	101.8%
Courses_Ugrad	NI	NI	NI	1.37	1.46	107.1%
Courses_Masters	NI	NI	NI	0.50	0.76	150.5%
Courses_Phd	NI	NI	NI	0.35	0.65	183.7%
Advisor_Phd	NI	NI	NI	3.81	7.79	204.3%
Grants_PI	NI	NI	NI	$62,617	$149,077	238.1%
Matchoffer	NI	NI	NI	0.31	0.66	213.1%
Admin	NI	NI	NI	38.5%	48.7%	126.7%
Ext	NI	NI	NI	18.8%	39.2%	207.9%
Phd_Granting	NI	NI	NI	65.8%	47.5%	72.3%
Contract	NI	NI	NI	61.2%	48.8%	79.9%

Note: NI = not included in the Broder and Ziemer study.

Table 2. Comparison of Regression Output

	Model 1				Model 2			
	BZ (1980)		KSU (2004)		BZ (1980)		KSU (2004)	
Variable	Coefficient	Elasticity	Coefficient	Elasticity	Coefficient	Elasticity	Coefficient	Elasticity
Intercept	23773.52 ***	NA	62420.096 ***	NA	22242.05 ***	NA	55057.33 ***	NA
Pubtotal	91.77 ***	0.053	203.62158 ***	0.077	NA	NA	NA	NA
Pubrate	NA	NA	NA	NA	737.65 ***	0.035	2924.51 ***	0.067
Years	258.16 ***	0.112	961.21597 ***	0.166	353.37 ***	0.153	1343.14 ***	0.232
Courses	-474.90 ***	-0.031	-502.6372	-0.011	-378.27 ***	-0.025	-273.58	-0.006
Grants	301.85 *	0.006	1606.3261 *	0.017	359.29 **	0.008	1557.91 *	0.017
Change	865.96 ***	0.024	4313.9851 ***	0.049	908.95 ***	0.025	4611.64 ***	0.052
Full	5082.82 ***	0.162	14106.545 **	0.141	5805.70 ***	0.185	15869.81 ***	0.159
Assoc	1072.78	0.034	3514.5773	0.035	1646.56 **	0.052	3242.26	0.032
Observations	222		260		222		260	
R^2	0.64		0.45		0.65		0.44	

Dependent variable: salary

**** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level

Note: NA = not applicable

Table 3. Comparison of Selected Variables for Over and Under Predicted Faculty Salary based on Duplicated Broder-Ziemer Model

Variable	Sample Mean	Under Predicted Mean	Over Predicted Mean
	Broder-Ziemer Model Variables		
Salary	$100,037	$134,168 *	$83,570 *
Pubtotal	37.66	42.42	46.78 *
Pubrate	2.30	2.42	2.43
Years	17.30	18.42	22.54 *
Courses	2.22	2.21	1.94
Grants	$108,379	$95,247	$83,969
Change	1.13	1.08	1.17
Full	53.1%	60.6%	76.9% *
Assoc	18.1%	19.7%	9.2% *
		Performance	
Grants Obtained as PI	$62,617	$70,794	$37,199 *
PhD Courses Taught (number)	0.35	0.44	0.22 *
PhD Students Advised (number)	3.81	6.89 *	2.85
Employed at Phd Granting University	0.7	0.8 *	0.6
Matching Offers	30.8%	47.0% *	26.2%
		Regional	
Employed in the NE Region	0.15	0.17	0.12 *
Employed in the NC Region	0.31	0.42 *	0.17
Employed in the W Region	17.3%	18.2%	20.0% *
Employed in the S Region	34.6%	19.7% *	50.8%
		Appointment	
Extension Appointment	22.8%	17.2%	34.7% *
Currently Tenured	68.5%	83.3% *	78.5% *
Employment Contract (months)	10.8	9.8 *	11.8 *
		Demographics	
Consulting Income	$13,419	$22,605 *	$10,324
Married	0.87	0.89	0.85 *
Member of a Minority	0.2	0.2	0.1 *

* significant at the 10% level

Table 4. Regression Output for the Alternative Model

Variable	Estimate		Elasticity
Intercept	77078.202	***	NA
Pubtotal*	104.130	***	0.043
Years	1099.062	***	0.190
Courses_ugrad	-2877.769	***	-0.039
Courses_masters	-1592.403		-0.008
Courses_phd	-2752.399		-0.010
Advisor_load	825.173	***	0.002
Grants_PI	2140.499	***	0.013
Change	2184.865	**	0.025
Match_offer	7038.197	***	0.022
Full	11134.518	***	11.130
Assoc	2009.667		2.009
Admin	7111.074	***	7.108
Ext	-9683.722	***	-9.680
Phd_granting	10023.520	***	10.020
Contract	-27026.015	***	-27.016
Observations	260		
R^2	0.73		

Dependent variable: salary

**** significant at the 1% level; *** significant at the 5% level; * significant at the 10% level

Table 5. Summary of the Wilcoxon Matched-Pairs Signed Rank Test

University	N	Average Salary	Average Prediction	Residual	STD Residual	Wilcoxon P Value
Cornell University	7	107795	101074	8530	28501	0.6875
Iowa State University	9	114066	102774	11292 *	17343	0.0742
Kansas State University	12	102324	100759	1565	15481	0.9697
Michigan State University	6	108154	109448	7625	14556	0.4375
Mississippi State University	8	91708	80914	10794	13682	0.1484
North Carolina State University	8	111852	117278	-5426	16061	0.3125
Ohio State University	7	125576	115340	10236	23598	0.4688
Oklahoma State University	8	85087	97012	-11926 *	14820	0.0781
Oregon State University	9	84261	89553	-5292	10106	0.1641
Pennsylvania State University	8	84033	96981	-12949 *	16060	0.0547
Purdue University	9	105544	114432	-8888 *	13882	0.0977
Texas A&M University	11	107607	110554	-961	14173	1.0000
University of Arkansas	6	88550	90436	-1886	5043	0.6875
University of Florida	8	80763	81553	-790	8799	0.5469
University of Georgia	10	83660	85295	-1636	16619	1.0000
University of Illinois	6	139111	129591	9520	31652	0.6875
University of Kentucky	8	86717	85642	1075	11894	1.0000
University of Maryland	6	133278	126535	14700	30247	0.5625
University of Minnesota	7	112332	109927	2405	27209	1.0000
University of Missouri	13	95587	96997	-1410	13932	0.5879
University of Tennessee	6	84553	82074	2479	9340	0.6875
University of Wisconsin	5	107367	108002	-636	16860	0.8125
Virginia Tech	5	89780	90427	-647	18638	1.0000
Washington State University	7	108952	117137	-8185	22051	0.4688
Model	260	100036	101071	-1035	17001	0.4034

* Significant at the 10% level.