Comparison of Factors Influencing Salaries of Agricultural Economics Professionals in Academic and Federal Employment

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Paper Abstract:

Results of two ordered probit models find differences in the major factors that influence salaries of agricultural economists employed in academia and in federal government. However some similarities were found; both sets of salaries were influenced by factors that measure job performance and neither set of salaries were significantly influenced by gender or ethnicity.

Introduction

Salary studies have been of great interest to researchers across many disciplines for many decades; agricultural economics is no exception. In the 1990s, three American Agricultural Economics Association subcommittees developed an agricultural economics professionals tracking system. The purpose of this tracking system was to identify the factors that influence agricultural economics professionals' job choices, to identify factors that influence salary and to track the professionals and these factors over time. Their first salary study of AAEA membership found significant positive correlations of salary and with type of position, years of experience, and publications whereas significant negative correlations existed between salary and teaching loads. These results supported research across other disciplines that suggested that performance is what determines salary levels; ethnicity and gender do not.

In 2007-2008 the salary survey was revived and revised to specifically address choices, performance and salary of government and academic professionals separately as well as for the profession as a whole. While the survey changed, the main hypothesis stayed the same. That is performance, not gender nor ethnicity, was expected to be predictive of salary. The purpose of this paper is to present and compare factors identified as influences on the salaries of agricultural economics professionals in academia and in government.

Literature Review

Research covering the salaries and status of professionals, including those in academia, dates back to the early 1900s (Table 1). Differences between whites and non-whites had been some of the earliest research.   Until mid 19th century, research suggested real differences (up to 40%) in salaries existed between whites and negro/African American teachers (Boykin, 1949). However, more recent research suggests that often those wage differentials can be attributed to the lack of experience of a worker, the kind of job they perform and the geographic location of the work assignment (Perloff, 1960). Early studies suggested that differences existed in salaries of equally qualified men and women (Joy, 1990). But recently, studies suggest that it is the lack of women in tenured, full professor rank positions that is the cause of the salary differences (Bellas, 1994; Ginther and Hayes, 1999; Ehrenberg, Pieper and Willis, 1998; Rees, 1993).

Table 1: Summary of Salary Studies by Topic

Topic	Studies
Salary differences between whites and non-whites	Boykin, 1949; Editor, 1998; Heckman, Lyons and Todd, 2000
History and status of African Americans in academia	Gregory, 2001; Holzer, 2000; JBHE, 1998; Jones, Nelson and Parks, 1983; NCES, 2000; Robbins and Evans, 1983; Touchton, 1995; Katz, 1971; Bereman and Scott, 1991; Cohn, 1973
Salary comparisons between men and women in academia	Cohn, 1973; West, 1995; Bellas, 1994; Bellas, 1997; Khan, 1995; Ginther and Hayes, 1999; Ehrenberg, Pieper and Willis, 1998; Rees, 1993
Salaries and choices of careers	Amatea and Fong, 1991;Cole and Zuckerman, 1984; Hine and Cheney, 2000; Moses, 1989; Teevan, Pepper and Pellizzari, 1992; Zepeda, Marchant and Chang, 1993; Burke, 2000; Jensen and Owen, 2000; Friedman and Kuznets, 1945
Salaries & advancement opportunities in economics and agricultural economics	Barrett and Bailey, 1999; Formby, Gunther and Sakano, 1993; Hilmer and Hilmer, 2003; Koplin and Singell, 1996; Lane, S. 1981; Lee, 1981; Marchant and Williamson, 1994; Marchant and Zepeda, 1995; McDowell, Singell and Ziliak, 2001; Siegfried and Stock, 2001; Ehrendberg, 1999; Ginther and Kahn, 2004; Abdula, 2009; CNSFEF, 1965

Other studies focused specifically on agricultural economists (ex., Ahearn, 1989; Jones, Nelson, and Parks, 1983; Marchant and Williamson, 1994; Marchant and Zepeda, 1995; Cheney, 2000; Hine and Cheney 2000; Thilmany, 2000). As noted above, the first tracking salary survey identified factors that showed significant correlations with salary. However that study provided no insights into the potential differences in factors that might exist between different types (e.g., government and academic) of agricultural professionals. Our study offers two ordered probit models to explain some of the similarities and differences that exist in the influence of factors on salary of those in federal government and academic employment.

Methods

The 1998 survey questionnaire was revised to clarify some questions and remove excess detail. The survey was also broken into two stand-alone versions, one for land grant (academic) institution professionals and one for federal government professionals. The academic questionnaire included 66 questions and the government survey included 55 questions. Both surveys were divided into five parts involving: 1) education and professional experiences, 2) employment preferences and factors that can impact job choices, 3) job responsibilities, appointment, tenure (academic survey only), performance and challenges faced in the job, 4) job benefits, and 5) demographic questions.

The survey population included all known agricultural economists (MS or PhD) working at USDA Economic Research Service and in agricultural economics disciplines at 1862 (52 schools), 1890 (18 schools) and 1994 (33 schools) land grant academic institutions in the US. Others were included who were part of a broader USDA department-wide list-serv. Lists were obtained through internet searches. A total of 2201 agricultural economists (543 in government

and 1668 in academia) were identified and surveyed. The survey was delivered via the internet using the Snap Survey Software (UITS, 2007).

Summary statistics were generated for each of the 253 (238 only for government professionals) variables included in the survey. Chi square tests were used to test for differences in responses by gender regarding (where applicable): 1) employment institution, 2) highest degree earned, 3) academic rank, 4) marital status, 5) dependents, 6) caregiver responsibilities, 7) US citizenship, 8) ethnicity, 9) age, 10) factors important in choosing their job, and 11) potential problems in their job. Due to limitations in space here, details regarding respondent demographics and chi-square results can be found in Abdula (2008), Newton et al. (2009) and Popp et al. (2009).

The dependent variable, adjusted salary, was placed into different ordered categories in the survey, starting at *less than $30,000* and ending at *greater than $150,000*. Two ordered probit models were developed to identify factors that influence salary. Based on a review of the literature and the demographics of the sample, the models were developed as follows:

Academic Salary = f (current employment, highest academic position (rank), years in highest position, years experience, tenure, appointment split number of journal articles, other publications, grant dollars, gender, white, importance of time for child care, importance of time for family care, and dependents).

Government Salary = f (years in government employment, highest government position (rank), years in highest position, number of journal articles, government documents, other publications, grant dollars, gender, white, importance of time for child care, importance of time for family care, and dependents).

Results

Survey of Academic Professionals

Of those surveyed, 333 responded (or 20.08%). Of the respondents, 253 (or almost 76%) were men and 74 were female (6 did not respond to this question). Most (80%) respondents were from 1862 institutions. Over 92% held PhD degrees. Of those in a faculty position, close to 60% were full professors. Respondents were married (85.22%), single (11.64%) and partnered (3.14%). Nearly 17% had dependent children; 60.58% of those respondents shared responsibility with spouses/partners for the children, 7.69% held the responsibility themselves and 31.73% said their spouse had the main responsibility. Most (90.88%) respondents were US citizens. Most (87.30%) were white, while 4.67% were Asian, and 3.81% were African American, among others. Respondents varied in age from mid 20s to over 75 but the largest percentage of respondents were in the 46 to 50 and 51 to 55 year categories. The respondents listed working at 1862s (69.8%), 1890s (6.35%) and government/international organizations (4.76%) as their job choice upon graduation. Of the respondents, 78.19% said their first job was a good or a perfect match to their preferences. More details regarding the academic survey responses, and differences in respondents between men and women can be found in Abdula (2008) and Popp et al. (2009).

Factors That Influence Salary of Academic Professionals

As explained in the methods, 13 variables were examined in the ordered probit model. The final model contained 7 of the 13 (Table 2). Note that not all levels of the categorical variables (family time, grant and rank) are significantly different from their baseline lowest level. However, the Likelihood Ratio tests (Table 3) suggest that these variables are still relevant and were therefore kept in the final model.

These factors positively added to salary level: employment at an 1862, having an administrative component of the appointment split, publishing refereed articles and attaining tenure. The coefficients on the categorical variables represent differences from the lowest categorical value for that variable. For example, the base for family time is that family time is not important. It was expected that the more importance placed on family time, the lower the salary. Three of the four coefficients hold a negative sign but they are not increasingly more negative. However, somewhat unimportant and important have similar values which suggests there is not much salary impact difference across most levels of importance of family time.

Table 2. Parameter Estimates for Probit Model for Academic Professionals

Variable	Coefficient	St. Error	b/St.Error	Pr	Mean of X
Constant|	-0.700423	0.531792	-1.317	0.1878	
Employment in 1862	0.433609	0.234603	1.848	0.0646	1.898876
Fam Time (2) Somewhat Unimp	-0.588780	0.263744	-2.232	0.0256	0.097378
Fam Time (3) Neutral	0.020868	0.208087	0.1	0.9201	0.217228
Fam Time (4) Somewhat Imp	-0.243665	0.200347	-1.216	0.2239	0.250936
Fam Time (5) Important	-0.629784	0.203102	-3.101	0.0019	0.247191
Grants (2) $1-$9,999	-0.058047	0.415640	-0.14	0.8889	0.033708
Grants (3) $10,000-$19,999	0.448230	0.416705	1.076	0.2821	0.033708
Grants (4) $20,000-$29,999	-1.151832	0.619033	-1.861	0.0628	0.014981
Grants (5) $30,000 -$39,999	0.107982	0.460873	0.234	0.8148	0.026217
Grants (6) $40,000-$49,999	-1.050660	0.431615	-2.434	0.0149	0.033708
Grants (7) $50,000-$99,999	-0.300440	0.300442	-1	0.3173	0.127341
Grants (8) $100,000 - $199,999	-0.163989	0.286259	-0.573	0.5667	0.183521
Grants (9) $200,000-$299,999	0.281739	0.302818	0.93	0.3522	0.116105
Grants (10) $300,000-$399,999	-0.241923	0.342114	-0.707	0.4795	0.071161
Grants (11) $400,000-$499,999	0.767616	0.361727	2.122	0.0338	0.059925
Grants (12) $500,000+	0.411281	0.284008	1.448	0.1476	0.217228
# Articles in Refereed Journals	0.029031	0.006395	4.54	0	9.325843
Administrative percentage	0.006889	0.003429	2.009	0.0445	8.504370
Rank (4) Assoc Prof	-0.096145	0.265556	-0.362	0.7173	0.198502
Rank (5) Full Prof	0.736557	0.262351	2.808	0.005	0.460674
Rank (6) Administrator	1.064106	0.334190	3.184	0.0015	0.146067
Tenure	0.735716	0.227747	3.23	0.0012	1.749064

Table 3. Likelihood Ratio Tests Results for Academic Professionals

Parameter	DF	L-R ChiSquare	Prob>ChiSq
Employment in 1862	1	3.415104	0.0646
Family Time Importance	4	164.9963	0.0000
Share of grant 5-year total	11	144.7080	0.0000
# Articles in Refereed Journals	1	20.6116	0.0000
Administrative percentage	1	4.036081	0.0445
Highest academic rank achieved	3	154.1181	0.0000
Tenure	1	10.4329	0.0012

The model suggests that grant dollars actually decrease salaries unless the dollar values are very large. This is not expected, however, many of the coefficients are not significant. When considering rank from assistant professor to full time administrator, results are mixed. Moving from assistant to associate professor would result in a salary decrease but this coefficient is not significant. Expected positive significant coefficients exist for full professors and administrators.

The threshold parameters associated with each salary level are presented in Table 4. These parameters suggest how each level of each variable can influence the movement from one salary level into another. If an individual was at salary level $70,000 to $79,999, attaining tenure would likely move them to into the $80,000 to $89,999 level because 0.735716 is more than 0.616288 the threshold level for salary level $80,000 - $89,999.

Table 4. Threshold Parameters for Academic Professionals

Salary Level	Coefficient	St.Er.	b/St.Error	Pr.
Mu ($80,000 - $89,999)	0.616288	0.089199	6.909	0.0000
Mu ($90,000-$99,999)	1.392560	0.089428	15.572	0.0000
Mu ($100,000-$109,999)	2.141577	0.088373	24.233	0.0000
Mu($110,000-119,999)	2.445614	0.090393	27.055	0.0000
Mu ($120,000-$129,999)	3.014171	0.097809	30.817	0.0000
Mu($130,000-$139,999)	3.196286	0.101962	31.348	0.0000
MU ($140,000 - $149,999)	3.586759	0.113229	31.677	0.0000
Mu(150,000+)	3.809718	0.123783	30.777	0.0000

Finally, the marginal effects associated with each variable are presented in Table 5. These values suggest how much a one unit change in any of the independent variable will change the

Table 5. Marginal Effects for Academic Professionals

Variable	Salary 1	Sal Lev 2	Sal Lev 3	Sal Lev 4	Sal Lev 5	Sal Lev 6	Sal Lev 7	Sal Lev 8	Sal Lev 9
Employed at 1862	-0.0238	-0.0434	-0.0774	-0.0264	0.015	0.0535	0.0188	0.0352	0.0153
Fam Time (2) Somewhat Unimp	0.052	0.0715	0.0938	-0.0021	-0.0317	-0.0765	-0.0228	-0.039	-0.0156
Fam Time (3) Neutral	-0.0011	-0.0021	-0.0037	-0.0013	0.0007	0.0026	0.0009	0.0017	0.0007
Fam Time (4) Somewhat Imp	0.0152	0.0259	0.0429	0.0109	-0.0099	-0.0309	-0.0104	-0.0189	-0.008
Fam Time (5) Important	0.0487	0.0722	0.1042	0.0108	-0.03	-0.0803	-0.0253	-0.0447	-0.0185
Grants (2) $1-$9,999	0.0034	0.006	0.0103	0.0031	-0.0022	-0.0073	-0.0025	-0.0046	-0.002
Grants (3) $10,000-$19,999	-0.0164	-0.0353	-0.077	-0.0483	0.0049	0.0441	0.0192	0.04	0.0193
Grants (4) $20,000-$29,999	0.1736	0.1496	0.1119	-0.0874	-0.0727	-0.1332	-0.034	-0.0537	-0.0198
Grants (5) $30,000 -$39,999	-0.0054	-0.0102	-0.0193	-0.008	0.0032	0.0128	0.0047	0.0091	0.004
Grants (6) $40,000-$49,999	0.1432	0.1371	0.1181	-0.0662	-0.0656	-0.1259	-0.033	-0.053	-0.0199
Grants (7) $50,000-$99,999	0.0207	0.0334	0.0521	0.0092	-0.0136	-0.0388	-0.0125	-0.0224	-0.0093
Grants (8) $100,000 - $199,999	0.01	0.0173	0.029	0.0077	-0.0065	-0.0208	-0.007	-0.0128	-0.0055
Grants (9) $200,000-$299,999	-0.0126	-0.025	-0.0498	-0.0245	0.0064	0.0316	0.0123	0.0243	0.0111
Grants (10) $300,000-$399,999	0.0164	0.0267	0.0421	0.008	-0.0108	-0.0313	-0.0101	-0.0182	-0.0076
Grants (11) $400,000-$499,999	-0.0226	-0.0514	-0.123	-0.097	-0.003	0.058	0.0301	0.0682	0.0355
Grants (12) $500,000+	-0.0182	-0.0362	-0.0722	-0.0362	0.0088	0.0454	0.0178	0.0354	0.0163
Article	-0.0016	-0.0029	-0.0052	-0.0018	0.001	0.0036	0.0013	0.0024	0.001
# Articles in Refereed Journals	-0.0004	-0.0007	-0.0012	-0.0004	0.0002	0.0009	0.0003	0.0006	0.0002
Rank (4) Assoc Prof	0.0056	0.0099	0.0171	0.0051	-0.0036	-0.0121	-0.0041	-0.0077	-0.0033
Rank (5) Full Prof	-0.0408	-0.0712	-0.126	-0.0472	0.0218	0.0844	0.0308	0.0594	0.0267
Rank (6) Administrator	-0.0313	-0.0688	-0.1628	-0.133	-0.0082	0.0691	0.0386	0.0905	0.0488
Tenure	-0.0404	-0.0737	-0.1313	-0.0448	0.0255	0.0908	0.0319	0.0598	0.026

distribution of individuals within each salary level. For example, for the variable being employed in an 1862 institution, moving employment from a non-1862 to an 1862 reduces the probability of being in salary levels 1 to 5 and increases the probability of being in salary levels 6 through 10. The same result holds for increases in number of journal articles, increase in percentage of administrative appointment and moving from non-tenure to tenure. As one places more importance on family time (with the exception importance of neutral family time) the probability of moving into a lower salary range increases where as the probability of moving into a higher salary level decreases. For 5-year grant levels of $0 to $200,000 (with the exception of the $10,000-$19,999) a one unit increase in grant dollars level the probability of being in the $80,000 to $99,999 (salary levels 3 and 4) and decreases the probability of being in other ranges. However once an individual reaches $200,000 in grant funds, a one unit increase in grants increases the probability that this income will be at $100,000 or more. In terms of academic rank, moving from assistant professor to associate professor suggested a probability of moving into lower salary levels. However, the marginal effects associated with full professors and administrators shows an expected relationship. More details on the interpretation of the thresholds and marginal effects can be found in Popp et al. (2009).

Survey of Government Professionals

For the government survey, not only was the initial sample population smaller but the final response rate was smaller as well. Of those surveyed, 87 responded (or 16.02%). Of the 87 respondents, almost 75% were men and 25% were female (3 did not respond to this question). Nearly 70% held PhD degrees. Nearly half (49.42%) worked for ERS; the rest were employed across a number of other USDA agencies. When asked for their highest position held in

government, 7 (8.86%) listed program analyst, 39 (49.37%) listed researcher, 23 (29.11%) listed middle management and 10 (12.66%) listed executive. Ten did not respond. Respondents listed themselves as married (85%) and single (15%). Nearly 23% had children of dependent age; 42.86% of those, respondents shared responsibility for the children, 14.29% held the responsibility themselves, 33.33% said their spouse had main responsibility and 9.52% said the responsibility rested with someone else.

Most (89.77%) were white, while 4.55% were Asian, and 3.41% were African American, among others. Respondents varied in ages from mid twenties to over 75 but the largest percentages of respondents were in the 51 to 55 year (25%) and 56 to 60 year (19.32%) categories. In listing their job preferences upon receiving their highest degree, 51.22% listed government as their first choice, 28.05% listed government employment as their second choice and 20.73% listed government as their third choice. Of the respondents, 42.70 % said their first job was a good or a perfect match to their preferences.

Factors That Influence Salary of Government Professionals

Twelve variables were examined in the ordered probit model. The final model contained only one – years of government employment (Table 6). The threshold and marginal impacts are presented in Tables 7 and 8. Interpretations are similar to those presented above.

Table 6. Parameter Estimates for Probit Model for Government Professionals

Variable	Coefficient	St. Error	b/St.Error	Pr	Mean of X
Constant	1.099249	0.58279	1.886	0.0593	
Years Experience, 5-10	3.093565	0.77895	3.971	0.0001	0.146667
Years Experience, 11-20	4.097828	0.709709	5.774	0	0.28
Years Experience, 21+	5.309588	0.661947	8.021	0	0.426667

Table 7. Threshold Parameters for Government Professionals

Salary Level	Coefficient	St.Er.	b/St.Error	Pr.
Mu ($80,000 - $89,999)	2.773006	0.386292	7.179	0
Mu ($90,000-$99,999)	3.596126	0.339261	10.6	0
Mu ($100,000-$109,999)	5.273252	0.269857	19.541	0
Mu($110,000-119,999)	5.891798	0.265261	22.211	0
Mu ($120,000-$129,999)	6.743158	0.288446	23.378	0
Mu($130,000-$139,999)	7.209407	0.320092	22.523	0
MU ($140,000 - $149,999)	8.616838	0.521172	16.534	0
Mu(150,000+)	8.926729	0.595349	14.994	0

While these results were admittedly unexpected, a closer look at the data provides a rational explanation. Before the ordered probit model was developed, preliminary tests showed significant relationships between salary and years of experience, highest position in government, years in highest position in government and publications. Of important note, neither gender nor ethnicity were found to be significant. Once the model was constructed further tests were run to determine whether significant associations (Somers D and Pearson Correlation tests) existed between years in government employment and the following: highest government position, years in highest position in government, publications (defined as government documents) and awards. Results are found in Table 9.

Of the four variables tested, three were found to be significantly correlated with years in government employment. While rank of highest government position was not significantly correlated with years in government, the years spent in that highest government position was significantly (<0.0001) and highly (0.7094) correlated with years in government. Performance, in terms of number of government documents developed and number of awards received were also significantly correlated with years in government experience. Thus it is concluded that the

Table 8. Marginal Impacts for Government Professionals

Variable	Salary 1	Sal Lev 2	Sal Lev 3	Sal Lev 4	Sal Lev 5	Sal Lev 6	Sal Lev 7	Sal Lev 8	Sal Lev 9
Years Experience, 5-10	-0.1046	-0.1264	-0.3252	-0.0531	0.0401	0.0715	0.2841	0.0518	0.1987
Years Experience, 11-20	-0.1811	-0.1772	-0.3128	-0.0273	0.0589	0.0756	0.3136	0.0626	0.2609
Years Experience, 21+	-0.3164	-0.1852	-0.1701	0.0151	0.0902	0.0837	0.3291	0.0664	0.2836

impact of years in rank (highest government position) and performance are being captured in the ordered probit model by years of experience in government.

Table 9. Tests of Association Using Years in Government for Government Professionals

Variable	Somers D pvalue	Pearson Correlation Coefficient	Pearson pvalue
Highest government position	0.1296	0.1515	0.1891
Years in highest government position	<0.0001	0.7094	<0.0001
Government documents written	0.0119	0.2117	0.0050
Awards received	0.0396	0.2470	0.0125

Discussion

The ordered probit models identified factors that influence salary for agricultural economics professionals in government and academia. A comparison of those two models reveals the following similarities and differences.

The two models share the following similarities. In both cases (either revealed directly or indirectly) rank/position and job performance matter. Individuals in academic and government who were in higher ranked positions tended to earn higher salaries. Individuals who published appropriate types of manuscripts (refereed journal articles for academics, government documents for federal employees) tended to have higher salaries. It is also important to note that neither model found gender or ethnicity to have a significant influence on salary earned.

While similarities were found, differences also existed. Grant dollars tended to influence salaries of academics but not government employees. In our sample, however, only 20% of government employees received competitive grant funding. Type of institution was significant (employed at an 1862 vs other land grants) for the academic model but insignificant (employed at ERS vs other government agencies) for the government model. This may be explained by the

greater potential for consistency in pay (government pay scale) that may exist across agencies which does not exist across academic institutions. Attitudes were found to be influential in the academic model but not in the government model. And finally, as expected, achieving tenure was found to be very influential in the academic model yet had no relevance to the government employment system.

Conclusion

Labor issues have been a focus of study in the economics and agricultural economics disciplines for decades. Early studies suggested that differences in salaries existed between men and women as well as between non- minorities and minorities. More recent research conducted in the 1990s suggested that those differences disappear when performance measures are taken into consideration.

This study builds upon earlier work by developing and comparing salary models specific to academic professionals and government professionals for the first time. The study revealed many similarities – that is, salaries of both types of professionals are influenced by performance, not gender or ethnicity – but found differences in important factors as well.

It is important to note that this study is not without limitations. As our profession evolves, further improvements are needed in the survey instrument itself to better capture salary, performance and preferences of professionals. Second the population of agricultural economics government professionals was limited to ERS employees and other government employees who participated in a USDA list-serve. Efforts are needed to extend that reach to all agricultural economists employed throughout all of the USDA agencies. Finally, our study did not include any agricultural economics professionals within the private sector. The salary survey is expected

to be revived in 2012-2013. Efforts will be made to improve upon this study then in order to better explain salaries, satisfaction and performance of agricultural economics professionals across the U.S.

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