

## Characteristics and Salaries of Agricultural Economists\*

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Employment and salary characteristics for agricultural economists as of 1966 differ from those of general economists and other scientists in several respects. Educational institutions employed 58 percent of agricultural economists as against 45 percent of economists generally and 36 percent of all scientists. Only 9 percent were employed by business and industry as compared with a third of all economists and 41 percent of all scientists. The geometric mean basic salary received by agricultural economists was \$13,000 as compared with \$13,600 for all economists and \$12,100 for all scientists. Academic degree attained and length of service have a greater influence on salary variation than age, type of employer, or primary work activity.

THE NATIONAL SCIENCE FOUNDATION has biennially since 1956 compiled a "National Register of Scientific and Technical Personnel" to provide statistical information on the supply, utilization, and characteristics of the nation's scientists. Economists were first included in the 1964 register, at which time agricultural economists were grouped with specialists in forestry and fishery economics to form a subclass of land economists. In 1966, however, agricultural economics was identified as a separate specialty and 1,204 individuals, 9.2 percent of all economists responding, indicated it as the area in which they had greatest scientific competence.

In addition to their professional field and specialty, registrants reported salaries, professional incomes, and characteristics such as age, sex, highest academic degree, length of experience, type of employer, and primary work activity. After the 1964 and 1966 surveys, the American Economic Association published distributions of all registered economists by these characteristics, as well as analyses that attempted to isolate and quantify the influence of each characteristic on salaries received [1, 3]. Similar data and analyses are here presented for agricultural economists in the 1966 register. Insofar as possible, comparable data for all economists and all scientists are also shown.

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### Characteristics of the Profession

The NSF attempts to secure a report from every individual in each field of science covered by the National Register. It fails to reach such ultimate perfection, of course—first, because it probably does not get a questionnaire to every eligible individual, and second, because some individuals do not return their questionnaires. Thus, for the data that follow, neither universe coverage nor scientific sampling can be claimed; however, a representative group of agricultural economists appears to have responded, undoubtedly due in large part to use of the AAEA membership list.<sup>1</sup>

As a group, agricultural economists exhibited a relatively high level of formal training. Nearly three-fifths had a Ph.D. degree, compared with fewer than one-half of all economists (Table 1). Most of the remaining agricultural economists had received a Master's degree, whereas 21 percent of all economists and 29 percent of all scientists had only the Bachelor's degree.

Distributions of agricultural economists by age and length of experience resembled those of all economists and all scientists. Although a noticeably smaller proportion was under 30, this difference appears related to the finding that most agricultural economists obtain higher degrees and thus enter the profession at a more advanced age.

It is hardly news that most agricultural economists are employed by universities and the federal government, but still interesting to compare the relative proportions with those for other professions. Educational institutions employed 58 percent of agricultural economists, as against 45 percent of economists generally and 36 percent of all scientists. One-fourth worked for the federal government, about double the proportion among the other groups. Only 9 percent were employed by business and industry, compared with a third of all economists and 41 percent of all scientists.

Primary work activities most frequently reported by agricultural economists were research, management, and teaching, in that order. Forty percent listed research—mostly applied research—as their primary activity, which was more than twice the percentage among all economists and also slightly higher than the proportion among all scientists. Another 13 percent were engaged primarily in management of research activities, while 14 percent managed other endeavors. Only 18 percent named teaching as

<sup>1</sup>Distributions cited here have been restricted to persons who reported basic salary. As compared with all registrants, this group may be more representative of working members of the professions because respondents who did not report salary were concentrated among young persons who were likely still in graduate school and older persons who appeared likely to be retired.

Table 1. Distribution of scientists and geometric mean salaries, by selected characteristics, National Register, 1966

Characteristic	Percent of total number reporting salary			Average salary (geometric mean in dollars)		
	Agricultural economists	Economists	All scientists	Agricultural economists	Economists	All scientists
Total	100.0	100.0	100.0	13,000	13,600	12,100
Type of employer:						
Educational institution						
Academic year base	3.6	26.3	17.7	10,400	10,800	9,800
Calendar year base	49.5	14.4	14.6	12,800	13,200	12,000
Base not reported	5.1	3.9	4.1	13,100	11,900	10,900
Government						
Federal	23.9	11.7	12.2	13,300	14,400	12,200
Other	4.0	4.2	4.0	12,900	13,400	10,000
Nonprofit organization	3.2	3.9	4.4	16,000	15,900	12,900
Industry and business	9.3	33.9	40.7	14,200	16,000	13,300
Self-employed	.7	1.0	1.3	9,800	18,100	16,700
Other or not reported	.7	.8	.9	13,000	15,200	11,800
Years of experience:						
1	3.2	2.7	3.1	9,900	9,000	8,000
2-4	13.3	11.6	12.7	9,700	9,300	8,700
5-9	19.7	18.0	21.1	11,300	11,100	10,300
10-14	15.0	15.4	18.1	12,700	13,100	12,400
15-19	17.8	18.0	16.5	14,100	15,100	13,700
20-29	17.4	19.2	16.3	16,300	17,200	15,100
30 and over	11.4	11.5	9.2	16,200	18,100	15,400
Not reported	2.2	3.6	3.0	15,000	14,600	12,500
Highest academic degree:						
Professional medical	—	—	2.5	—	—	16,100
Ph.D.	58.9	45.6	41.5	14,000	14,000	13,300
Master's	34.6	32.1	25.1	11,600	12,300	11,000
Bachelor's	6.4	20.6	28.8	12,900	14,900	11,100
Other or not reported	.1	1.7	2.1	6,000	15,900	11,600
Primary work activity:						
Management of:						
R & D	13.4	10.9	23.0	16,300	17,500	15,400
Other than R & D	13.6	20.3		14,900	17,600	
Basic research	5.4	4.8	35.4	11,500	12,500	11,700
Applied research	34.5	13.0		12,000	12,800	
Teaching	18.3	30.4	19.9	12,000	10,800	10,000
Production and inspection	2.7	9.4	7.9	12,100	13,000	10,900
Other or not reported	12.1	11.3	13.8	13,600	14,500	11,900
Age:						
Under 30	7.4	9.6	13.8	9,700	9,100	8,300
30-34	15.3	15.6	17.6	10,000	10,700	10,300
35-39	18.1	17.5	19.2	12,000	12,700	12,100
40-44	17.9	17.0	17.0	13,700	14,700	13,400
45-54	26.3	26.7	22.0	15,000	16,300	14,500
55-64	12.6	11.2	8.8	16,000	17,200	14,800
65 and over	2.2	2.2	1.4	15,600	15,500	13,800
Not reported	.2	.2	.2	12,200	13,800	10,800
Sex:						
Male	99.5	96.4	93.4	13,000	13,700	12,300
Female	.5	3.6	6.5	10,500	10,500	9,100
Agricultural economic specialty:						
Finance and marketing	40.5	—	—	13,200	—	—
Processing of farm products	2.7	—	—	13,000	—	—
Farm management	20.3	—	—	12,500	—	—
Production economics	21.7	—	—	12,300	—	—
Other	14.9	—	—	14,500	—	—

their primary activity, compared with 30 percent of all economists. "Extension" was not listed on the questionnaire.

In the 1966 survey, agricultural economists were offered a choice of four specialties—finance and marketing (chosen by 40 percent), farm management (20 percent), production economics (22 percent) and processing of farm products (3 percent). The NSF appears to have been

poorly advised in formulating these groupings. An improved selection of specialties has since been offered in the 1968 survey: demand and supply analysis, situation and outlook, policy, finance, marketing, farm management, and land reform.

### Salaries

The geometric mean basic salary received by agricultural economists in 1966 was \$13,000—somewhat below the mean of \$13,600 for all economists but considerably above that of \$12,100 for all scientists.<sup>2</sup> Direct comparison of these averages may be misleading, however. For instance, most agricultural economists employed by educational institutions worked for a full calendar year, whereas most other university economists reported a basic salary covering only an academic year of 9 to 10 months. Or, as already noted, agricultural economists on average were older and had more advanced degrees—factors that should also tend to increase salaries, other things being equal. Thus a regression analysis of economists' salaries that allowed for the influence of such characteristics revealed that specialization in agricultural economics was associated with slightly greater salary disadvantage than indicated by gross salary averages. Along with specialists in economic history and land economics, agricultural economists were found at the lower end of the pay range—tending to have basic salaries 5.7 percent below the average for all economists and about 10 percent below those paid to persons in specialties at the top of the range—monetary and fiscal theory and international economics [3, pp. 76-77].<sup>3</sup>

<sup>2</sup> The NSF has always used salary medians rather than other averages in its National Register publications—a sound practice in that medians are less affected by extreme values [4]. However, because salary medians were not available for many classes used in this paper except at prohibitive cost, geometric means (means of logarithms of salaries) were chosen in preference to arithmetic means because the geometric means are also less affected by extreme values and because their use parallels the use of logarithms of salaries in the regression analysis that follows. For comparison, the following were national median, geometric mean, and arithmetic mean salaries, respectively, in agricultural economics: \$12,900, \$13,000, and \$14,000; in economics: \$13,100, \$13,600, and \$15,000; in all fields: \$12,000, \$12,100, and \$13,000.

<sup>3</sup> A comparison in terms of total professional income would probably be still more unfavorable to agricultural economists. Salary supplements received by economists in 1964 were found to be relatively low among (1) academically-employed persons paid a calendar-year basic salary and (2) persons employed by the federal government [3, pp. xxix-xxxv]. Three-fourths of all agricultural economists belonged to one or the other of these groups in 1966.

In an interesting parallel, agricultural scientists had one of the lower salary medians among all professions, 17 percent below that for all scientists, whereas the median for economists was 9 percent above that figure. When salary was regressed on professional characteristics, specialization in economics continued to show a net positive influence on salary—second only to that exerted by mathematics—while specialization in the agricultural sciences had by far the most adverse influence on salaries among the 13 fields covered. Net regression coefficients indicated that salaries of agricul-

Intra-profession differences in average salaries among classes such as employer and age groups may also be misleading because of intercorrelations. For example, economists with more experience, or higher degrees, or management responsibilities tend to be paid more; but these characteristics are often associated. How much of the higher pay, therefore, can be attributed to each characteristic—e.g., how much of the higher salary of older economists is a reward for their added experience rather than for their generally higher degrees or the management responsibilities they have assumed?

To separate and quantify intercorrelated effects, multiple regression analysis is indicated. Thus, for agricultural economists, salary (in logarithmic form) was regressed upon the six major characteristics listed in Table 1 (sex was omitted). The logarithm of salary was used as the dependent variable, so that the net influence of each characteristic would be measured in proportional rather than absolute terms, with the cumulative effect of all characteristics multiplicative rather than additive. A dummy variable was used to represent each class of each discrete characteristic and each class interval of the age and experience characteristics, in the latter case permitting anticipated nonlinear effects to be picked up [2]. A two-way interaction expected between type of employer and length of experience was represented in the regression model by providing a separate set of dummy variables to represent length of experience for each of the three major employer groups—educational institutions, government, and other (primarily industry and business). Similar regression models were also estimated for all economists and all scientists.

#### Relative net influence of characteristics

The relative contribution of each characteristic toward explanation of salary variation is indicated by the coefficients of partial determination listed in Table 2.

The academic degree attained by the respondent exerted the greatest net influence on salary, not only among agricultural economists but also among all economists and all scientists. Length of experience likewise explained a relatively high proportion of salary variation among agricultural economists, whereas the type of employer and the primary work activity had less effect. Age was relatively unimportant after experience and degree were taken into account. The agricultural economic specialty, as specified in the 1966 questionnaire, proved least important in explaining total salary variation, though it was just significant at the .05 probability level. Similarly, the specialty within economics was relatively unimportant in this respect, though as already noted a substantial salary difference was

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tural scientists tended to be 21 percent below those of economists and 16 percent below the average for all scientists [3, pp. 66-68].

Table 2. Importance of selected characteristics in explaining salary variation, National Register, 1966

Characteristic	Importance of net relationship (partial $R^2$ )		
	Agricultural economists	Economists	All scientists
Years of experience and type of employer	.132	.130	.149
Years of experience (separately for each major employer group)	.091	.068	.054
Type of employer	.056	.020	.041
Highest academic degree	.105	.076	.159
Primary work activity	.043	.051	.065
Age	.022	.011	.019
Sex	—	.016	.024
Agricultural economic specialty	.011*	—	—
Economic specialty	—	.008	—
Profession	—	—	.066
Multiple $R^2$	.41	.49	.54

\* Significant at the .05 probability level. All other relationships are significant at the .01 probability level.

found between the specialties at the high and low extremes of the salary range. Among all scientists, the field of work did exert considerable net salary influence.

#### Net relationships

Net relationships between salary and the various characteristics are quantified by regression coefficients and presented in Table 3 as net percentage differences from the geometric mean salary of each of the three professional groups. For agricultural economists, the net relationships that emerged from the regression of salary on all six characteristics simultaneously (column 2) may be compared with gross relationships (column 1) computed from actual geometric salary means (or obtained by regression on only the characteristic concerned).

**Experience and employer.**—For agricultural economists with each major employer, the net progression of salary with added experience was less marked than gross salary averages might have led one to suppose, as some of the progression is ascribed to attainment of higher degrees, movement into management positions, and advance in age.

At the beginning of their career, agricultural economists employed by business appeared to be at a salary disadvantage compared to their counterparts in government and universities. Such early disadvantage in business employment was not found among all economists or all scientists. At the other end of the experience range, however, all three professional groups obtained higher salaries from business than from other employers.

Table 3. Relationships between salary and specified characteristics, National Register, 1966

Characteristic	Percentage difference from national geometric mean salary of respective professional group			
	Gross	Net		
	Agricultural economists	Agricultural economists	Economists	All scientists
	(1)	(2)	(3)	(4)
Years* of experience (by selected employer group):				
Educational institution				
1	-20.0	-11.8	-19.4	-28.8
2-4	-23.6	-16.8	-19.7	-23.4
5-9	-13.9	-10.7	-15.5	-16.5
10-14	-7.5	-9.4	-11.8	-7.3
15-19	7.2	-3	-4.8	-5
20-29	20.5	12.9	2.7	7.6
30 and over	14.0	10.4	8.2	12.4
Federal government				
1	-23.4	-17.1	-26.3	-26.0
2-4	-25.5	-12.0	-18.7	-15.8
5-9	-15.1	-5.4	-6.3	-5.7
10-14	0	.5	-1.4	.9
15-19	9.1	6.6	8.1	7.2
20-29	26.5	18.6	20.5	16.0
30 and over	32.7	30.3	27.2	24.7
Industry or business				
1	-41.4	-29.7	-15.4	-10.8
2-4	-35.4	-28.4	-15.8	-6.0
5-9	-6.9	2.4	-.9	2.7
10-14	19.4	20.1	12.5	11.5
15-19	10.9	8.9	23.9	20.2
20-29	38.0	45.0	40.4	30.5
30 and over	51.0	44.5	61.5	40.8
Primary work activity:				
Management of:				
R & D	25.0	10.1	11.7	14.9
Other than R & D	14.5	10.6	12.7	
Basic research	-11.7	-8.1	.9	-1.5
Applied research	-8.2	-4.9	-1.5	-9.4
Teaching	-8.2	-1.9	-9.1	-5.5
Production and inspection	-6.9	-8.6	-8.4	
Highest academic degree:				
Ph.D.	7.4	8.7	12.5	15.5
Master's	-11.3	-10.7	-9.3	-8.5
Bachelor's	-.9	-13.5	-10.0	-13.6
Age:				
Under 30	-25.9	-5.6	-11.9	-12.8
30-34	-22.9	-11.5	-6.5	-4.2
35-39	-8.0	-.1	.1	1.9
40-44	5.4	5.1	3.2	4.7
45-54	15.3	2.1	4.8	5.9
55-64	23.0	6.7	4.1	2.7
65 and over	19.7	-.6	-1.8	-2.8
Agricultural economic specialty:				
Finance and marketing	1.6	.2	—	—
Processing of farm products	-.2	.1	—	—
Farm management	-4.3	-4.6	—	—
Production economics	-5.6	-.1	—	—
Other	11.1	5.8	—	—

\*Calendar years.

For example, agricultural economists with 30 or more years of experience tended to earn 11 percent more in business than in the federal government and 31 percent more in business than at educational institutions.

For both agricultural economists and all economists, net salary progression with added experience was greatest in business and least at educational institutions. Between the class of agricultural economists with 2 to 4 years of experience and that with 30 or more years, the total net salary gain attributed to added experience was 102 percent in business, 48 percent in government, and 33 percent at colleges. If one assumes that this period covers 30 years, the net average annual rate of such progression was 2.4 percent in business, 1.3 percent in government, and 1.0 percent at colleges. These large differences made interaction terms necessary in the regression analysis; conversely, the differences were picked up in the analysis only because the interaction terms were included. In contrast to the finding for economists, salary progression among all scientists was about the same for all three major employer groups, averaging about 1.5 percent annually.

**Highest academic degree.**—Among agricultural economists possession of the Ph.D. degree tended to yield a 22 percent net salary advantage over the Master's, a shade less than among all economists and all scientists. The Master's degree carried a negligible advantage over the Bachelor's among both agricultural and all economists, but a more significant advantage among all scientists. The relative salary value of these degrees was thus clarified by the multivariate analysis, for gross salary averages had shown that holders of the Bachelor's degree earn more than persons with the Master's. This perverse gross relationship was found among all three professional groups and was particularly pronounced among economists.

**Primary work activity.**—Compared with all economists and all scientists, agricultural economists were rewarded slightly less for management duties, substantially less for research, and considerably more for teaching. Teaching exhibited a small salary advantage over research among agricultural economists, whereas research had a large advantage over teaching among both all economists and all scientists. The joint research-teaching appointments commonly used in agricultural economics may be responsible for this difference.

#### Future Analyses of National Register Data

The preceding structural data and analysis of salary variation for agricultural economists represent only an initial instalment of the flow of information potentially available from the biennial NSF survey of the profession. In addition to updating the cross-sectional view, future studies may profitably employ some of the many additional characteristics about



which data are obtained, such as colleges attended or institutions where now employed. The NSF has also arranged its files to permit studies of factors affecting the mobility and progress of individuals after data have been collected over a longer time span.

These potential analyses of the profession of agricultural economics clearly hinge on continued support of the NSF survey through a high and representative level of voluntary response to the NSF questionnaires. As economists, we are more often engaged in surveying others rather than in being surveyed and thus can readily appreciate that high participation rates are needed to provide the degrees of freedom required for more detailed and sophisticated analyses, and that repeated biennial participation is necessary if future longitudinal studies are to be possible. Every member of the profession should take care to fulfill his seemingly small but very vital role in this endeavor.

### References

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