INTERUNIVERSITY MOBILITY OF ACADEMIC SCIENTISTS*

PAUL D. ALLISON
University of Pennsylvania

J. SCOTT LONG
Washington State University

Previous longitudinal studies of scientists' movements in academic jobs found no evidence that research productivity affects prestige attainments. In this paper, however, we find a weak, but significant effect of productivity on the destination prestige of 274 job changes by academic physicists, chemists, mathematicians, and biologists. Major determinants of the prestige of the destination department are prestige of the prior job, prestige of the doctoral department, and the number of articles published in the six years prior to the move. Measures of citation frequency have no detectable effect, however. For promotion in rank at the occurrence of a job change, the major determinants are origin rank, professional age, and citation frequency.

A major focus of studies of stratification has been the relative importance of achievement versus ascription in determining the allocation of rewards. The issue has had a special significance to sociologists of science, however, since Merton identified "universalism" as one of the fundamental norms in science. Universalism requires that "scientific careers be open to talent," and that "recognition and esteem accrue to those who have best fulfilled their roles, to those who have made original contributions to the body of scientific knowledge" (Merton 1973, pp. 272, 293).

There are many kinds of rewards for the performance of scientific roles; many are not controlled by a scientist's employer—for example, the esteem awarded informally by colleagues. Nevertheless, some of the most important rewards come only to those who get "good" jobs. For most scientists oriented toward basic research, a good job is a teaching position in a graduate department of a university. Academic jobs are themselves highly stratified along such dimensions as institutional prestige, salary, teaching load, academic rank, and the quality of colleagues, students, libraries, and laboratory facilities. With a few exceptions—notably climate and urban environment—such rewards tend to be highly correlated with prestige of the department or university (Hagstrom 1971; Cartter 1966). Thus, jobs in the most prestigious departments have higher mean salary, more eminent colleagues, lower teaching loads, more able students, better laboratory facilities, and better libraries. Since good measures of the prestige of graduate departments are readily available (Cartter 1966; Roose and Andersen 1970), studies of occupational rewards in science have generally focused on this dimension.

Two findings stand out in the early literature (1965–77) on the prestige of scientists' jobs. First, the two most important determinants of prestige attainments are research productivity, as measured by numbers of publications or numbers of citations to them, and the prestige of the department in which scientists received their doctorates (Crane 1965; Hargens and Hagstrom 1967; Hagstrom and Hargens 1968; Crane 1970; Cole and Cole 1973; Allison [1976] 1980). Most studies found that these factors have approximately equal weight. Second, when both counts of articles ("quantity") and counts of citations to them ("quality") are considered, the latter has substantially more impact than the former (Cole and Cole 1973).

A positive effect of research productivity on prestige attainment is consistent with the norm of universalism. Although the effect of doctoral prestige suggests the operation of particularistic processes, alternative interpretations are possible. For example, the prestige of the doctoral department may be an indicator of scientific talent or of unpublished research, and thus may legitimately be taken into account by universalistic recruiters. This explanation should be especially relevant in the early stages of scientific careers when scientists have had little time to demonstrate their capabilities.

Virtually all the early work on scientists' prestige attainments relied on cross-sectional data. Many investigators recognized that the association between research productivity and prestige of the job could be explained in two different ways. As Crane (1965) put it

Various explanations for the success of

* Direct all correspondence to Paul D. Allison, Department of Sociology, University of Pennsylvania, 3718 Locust Walk, Philadelphia, PA 19104-6299.

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> scientists in certain academic environments are equally plausible, however. The best universities attract the most talented students and hire the most promising graduates. Alternatively, the institution itself, by providing opportunities and encouragement for research, may stimulate a man to greater productivity than he would exhibit in a less favorable setting.

More recent work by Long, McGinnis, and Allison suggests that it is the latter process that predominates. Using longitudinal data, they showed that prior productivity has virtually no effect on where scientists take their first positions, where they take subsequent positions, and whether and where they get postdoctoral fellowships (Long 1978; Long, Allison, and McGinnis 1979; Long and McGinnis 1981; McGinnis, Allison, and Long 1982). On the other hand, these same studies show that the prestige and sector of a scientist's job substantially affect later research productivity.

If these results are correct, then science is much less universalistic than is commonly believed. In fact, the findings are consistent with the early claim of Caplow and McGee (1958) that hiring departments pay attention only to where a candidate comes from and who recommends him, while virtually ignoring written work. Nonetheless, although superior in design to previous studies, the research of Long and his colleagues was limited in two important respects. First, they studied only biochemists, leaving open the question of whether the results hold for other fields. Second, the bulk of their data were for scientists' first jobs, when they had had only a short time to establish a publication record.[1] It could be argued that the first job is not an auspicious site for observing the influence of universalism. The analysis of second and later positions (Long 1978), on the other hand, was based on an extremely small sample (47 cases), raising questions of statistical reliability.

In this study, we attempt to remove both of those limitations by analyzing longitudinal data for a sample of 274 academic job changes in four disciplines: physics, chemistry, mathematics, and biology. We focus on job changes because prestige attainments can only be redistributed at such points of discontinuity. Moreover, the fact that job changes occur at isolated points in time reduces ambiguities in casual ordering. Although it would have also been desirable to compare movers with stayers, resources were insufficient to collect data on stayers.

[1] Despite this fact, numbers of publications and citations prior to the first job are the best predictors of research productivity 10 years later (Long, Allison, and McGinnis 1979).

DATA

The Sample

The sample consisted of 274 job changes by scientists from one academic institution to another between 1961 and 1975. The distribution of these changes across disciplines was biology 27%, mathematics 27%, physics 19%, and chemistry 27%.

This sample had its origin in a survey of academic scientists conducted by Warren Hagstrom (1974). Hagstrom constructed a probability sample of 2,248 scientists in four disciplines who held faculty positions in graduate university departments in the U.S. in 1965. We searched through several editions of *American Men and Women of Science* (Cattel Press) for information about the educational background and subsequent career histories of all the scientists in Hagstrom's sample. Using the career history data, we selected all job changes meeting the following criteria:

1. Both origin and destination were four-year colleges or universities.
2. The origin department was rated for faculty quality by Roose and Andersen (1970).
3. The move occurred between 1961 and 1975, inclusive.
4. Academic rank in the origin job was assistant professor or higher.

Of the 274 changes meeting these criteria, 242 were made by unique scientists with the remaining 32 coming from 16 scientists with two moves each. We have retained these repeated changes in the analyses, but all the results reported in the tables have been replicated after restricting the sample to the first move made by each scientist.

Prestige of Department

To measure prestige of both the origin and destination departments we used the ratings of faculty quality obtained by Roose and Andersen (1970). Although these were published only as rankings, we have obtained the unpublished three digit mean scores for all the departments in the study. These are properly regarded as prestige measures since they were obtained by surveying large numbers of faculty in each discipline and asking them to rate the overall quality of the faculty in each graduate department on a 6-point scale. In the analysis reported here, we have used the mean score multiplied by 100 to get a scale ranging from 0 to 500.

As noted above, all the origin jobs were necessarily in departments rated by Roose and

Andersen, but about 27 percent of the moves were to destination departments that were not rated in that study.[2] For the most part, these unrated departments were small, not well known, or only recently established. Most of these would have probably received low scores had they been rated—an inference consistent with results reported below—but some of the newer unrated departments (e.g., those at SUNY Buffalo) undoubtedly would merit more respectable ratings.

The prestige of the departments in which scientists received their doctorates was measured by the ratings in Cartter (1966). These are quite similar to the Roose and Andersen ratings, except that they were made five years earlier. Again, we have obtained the complete, unpublished three-digit scores for all the rated universities.

Bibliographic Measures

For each of the 274 job changes, we collected complete bibliographic data for all journal articles published during the six years prior to the move. These were obtained from the appropriate abstracting source for each discipline. Our basic measure is the square root of the number of articles in the six-year interval.

We counted the number of times each *article* was cited in the *Science Citation Index* (Institute for Scientific Information), hereafter *SCI*, in the year of the job change. These counts were summed over articles to get the number of citations to each *scientist's* previous work. By counting citations to articles rather than to scientists, we alleviated two problems that have plagued most citation counts (Long, McGinnis, and Allison 1980). First, the citations appearing under a given scientist's name in *SCI* are only to articles for which that scientist was first author. Our procedure, by contrast, yields citation counts to all articles regardless of authorship position. Second, since *SCI* only identifies scientists by their first two initials, there is often confusion between different scientists with the same surname and initials. The problem is much less severe in locating articles in abstracting sources, since complete names are listed and because only a single discipline is involved. Once the correct articles are located, there is no longer a problem with similar names when consulting *SCI*.

To facilitate comparisons with other studies, we also collected citation counts in the standard fashion. That is, using *SCI* for the year in which the move occurred, all citations under the scientist's name (excluding self-citations) were counted. We tried to resolve any problems with similar names by using biographical information. While these counts suffer from the difficulties noted above, they have the advantage of measuring the impact of a scientist's total bibliography, not just works published in the six years prior to the move. This could be important for eminent, older scientists who may not have published much in the years immediately preceding a job change.

Since the mean numbers of publications and citations vary greatly across fields, the counts were standardized with chemistry as a reference group. Following Allison (1980), this was done by multiplying counts in each field by a constant chosen to make the mean the same as the mean for chemists.[3] For publications, the constants were biology 1.06, physics 1.56, and mathematics 2.26. For citations, the constants were biology 1.31, physics 1.81, and mathematics 4.08.

Other Variables

The career history data also included several other variables included in the regression models as controls: the calendar year in which the move occurred; academic rank in the origin job (coded as two dummy variables, for associate and full professor); career age (year of the move minus year that the doctorate was awarded); and field (coded as a set of three dummy variables).

ANALYSIS

The Pattern of Mobility

As expected, there is a moderate correlation between origin and destination prestige. Among the 198 moves between rated departments, the correlation was .45. This association can be seen in more detail in Table 1, which is an outflow mobility table based on four intervals of origin and destination prestige, plus a fifth category for unrated destination departments. For each level of origin prestige, there are two sets of row percentages. The first set is conditional on moving to a rated department; the

[2] The reason for this asymmetry in sample selection is that choosing cases by values of the independent variables will not ordinarily bias coefficient estimates. On the other hand, choosing cases by values of the dependent variable may bias the estimates (Heckman 1979; Little 1985).

[3] Allison (1980) suggested that disciplinary differences in productivity are essentially scale differences, i.e., the effect of being in a certain discipline is to raise or lower the expected number of articles or number of citations by a fixed percentage. He estimated these scale constants from productivity data for 2,248 scientists in chemistry, mathematics, physics, and biology.

Table 1. Prestige Rating of Destination Department by Prestige Rating of Origin Department for 274 Job Changes

	Prestige of Destination Department						
Prestige of Origin Dept.[a]	400–499	300–399	200–299	0–199	Unrated	Total %	N
400–499	15%	51	27	7	—	100%	47
	13%	45	23	6	13	100%	
300–399	15%	29	39	17	—	100%	84
	12%	23	31	13	21	100%	
200–299	5%	19	54	21	—	100%	82
	4%	13	38	15	30	100%	
0–199	0%	15	41	44	—	100%	61
	0%	8	23	25	44	100%	
Total	10%	28	41	21	—	100%	274
	7%	20	30	15	28	100%	

[a] Examples of departments of *physics* at each prestige level: 400–499 (Princeton, Chicago, Columbia, Berkeley), 300–399 (Purdue, Yale, Wisconsin, Michigan), 200–299 (Penn State, Arizona, Kansas, Rice), 0–199 (Kentucky, Missouri, Texas A & M, Kansas State).

second set includes unrated departments as a destination.

The percentage of moves to unrated departments varies greatly by origin. Fully 44 percent of those leaving jobs in the lowest prestige interval (0–199) go to unrated departments, compared with only 13 percent of those leaving jobs in the highest interval. In fact, the pattern for the unrated destination departments is almost exactly what would be expected if these departments were actually in the (0–199) interval.[4]

It is also noteworthy that the dominant pattern is one of downward mobility. The mean for origin prestige is 304 while the mean for destination prestige is 279, a statistically significant drop of 25 points. Most of this loss was incurred by assistant professors, many of whom undoubtedly changed jobs involuntarily after being denied tenure. They suffered an average decline of 42 points on the prestige scale. On the other hand, associate and full professors, who make up 62 percent of the sample, had a statistically insignificant average decline of 5 points.

Table 2 gives correlations among the variables of major interest. After origin prestige, destination prestige is most highly correlated with doctoral prestige (.40), followed by article counts (.26) and citation counts (.23). Article counts are correlated more highly with destination than with origin, suggesting that the job change brings some improvement in fit between merit and reward. But the reverse is true for citations, with the correlation declining from .29 to .23.

Determinants of Destination Prestige

These patterns are accentuated in Table 3 (first two columns), which gives the results of an OLS regression of destination prestige on these and other variables for the 198 scientists moving to rated departments.[5] Although destination prestige is the dependent variable, the results are equivalent to a regression in which the dependent variable is the *difference* between destination and origin prestige. Such a regression would have coefficients that are exactly the same as those reported here for all the variables except origin prestige (whose coefficient would be smaller by 1.00). Thus, the observed effects can be interpreted as effects on the change in prestige from origin to destination (Kessler and Greenberg 1981, p. 9).

Origin prestige has the strongest effect, followed by a positive effect of doctoral prestige, a negative effect of the year of the move, and a positive effect of article counts. The decline in destination prestige with calendar year is probably the result of the rapid expansion of graduate education, primarily among less prestigious institutions, which took place during this period. To interpret the coefficient of 10.1 for article counts, recall that this independent variable is actually the square root of article counts, which implies diminishing returns from articles in their natural metric.[6] Thus, going from zero to one article means a gain of about

[4] This is confirmed by fitting a log-linear model to the 4 × 5 table, constraining the 0–199 column and the unrated column to have the same interaction parameters. The likelihood ratio chi-square is only .27 with 3 degrees of freedom, indicating that these two columns can be collapsed into one with no significant detriment to the fit.

[5] All reported significance tests are two-sided to be conservative. OLS standard errors were checked against standard error estimates obtained with White's (1980) method, which gives consistent estimates even in the presence of heteroscedasticity. Differences were minimal.

[6] Tests of a quadratic specification indicated strong evidence for concave nonlinearity. The square root specification was chosen to be consistent with earlier work by Long et al., but a logarithmic transformation does equally well.

Table 2. Correlation Matrix for 198 Job Changes Between Rated Academic Employers

	Origin Prestige	Destination Prestige	Doctoral Prestige	Articles	Citations
Destination prestige	.45				
Doctoral prestige	.38	.40			
Articles	.20	.26	.11		
Citations	.29	.23	.19	.62	
Career age	.07	.09	.09	.26	.22

10 points in destination prestige, but an increase from one to four (or four to nine) articles yields only the same 10-point gain. Cumulating such increases, the expected difference in destination prestige between scientists with zero and those with 16 articles is about 40 points. To further understand the magnitude of the effect of publications on job prestige, consider the effect of changing from the least productive to the most productive sample member. The least productive scientists had zero articles, while the most productive had 73 articles during the six-year period. This is a change of 8.6 on the transformed metric. The expected change in destination prestige is 87 points, approximately the change from a position at Arizona State University to a position at University of California at Riverside in physics, or a change from UCLA to California Institute of Technology in chemistry.

There also appear to be some field differences, with biologists doing much better than those in the other three fields. Academic rank does not have a statistically significant impact, but the coefficients are in the expected direction with those at higher rank making larger gains.

The effect of citation counts is tiny, both in magnitude and statistical significance. Since previous, cross-sectional studies have reported that citation counts had a stronger effect than article counts, we explored this contrary result further. When article counts are removed from the equation, the effect of the citation measure is still far from significant. We tried various alternative transformations of citation counts, but none produced results that approached statistical significance. Since we suspected that our citation counts to publications in the previous six years might be biased against older scientists whose major works appeared earlier in their careers, we substituted counts of citations to all previous first-authored publications. This resulted in a slight increase in the coefficient and its significance level, but the t-statistic was still only .47. Try as we might, we could not find a plausible specification that yielded a significant effect of citation counts.

Are these results consistent across fields? When the regressions were run separately for the four fields, there were no obvious differences. Moreover, a global Chow test (Gujarati 1978) for any differences in the regression coefficients across the four fields was not significant. We also performed more specific tests for interactions between field and article counts, origin prestige, and doctoral prestige. In no case was there any evidence or field differences in the effects of these variables.

Rated vs. Unrated

Of the 274 job changes, 75 were not included in the preceding regression because the destination departments were not rated in the Roose-Andersen (1970) study. Because these appeared to be departments of generally low visibility and prestige, we expected that similar processes would determine both destination prestige and whether or not a scientist moved to a rated department. The logistic (logit) regression reported in the right-hand side of Table 3 shows that this is generally the case.[7] The dependent variable was coded 1 if the move was to a rated department, otherwise 0. Two of the strongest determinants are origin prestige and number of articles, both of which have positive effects on the odds of moving to a rated department. The coefficient for citations is negative and small. The year of the move has a strong negative effect, as it did on destination prestige, and biologists are much more likely to move to rated institutions compared with those in the other three fields. Contrary to the results for destination prestige, however, we find no effect of

[7] It would be desirable to estimate a combined model for rated and unrated destinations, for two reasons: (a) the power of statistical tests would be increased; and (b) the exclusion of the unrated jobs may be producing a downward bias in the estimation of the coefficients for destination prestige. One way to achieve a combined model is to use the sample selection methods of Heckman (1979). We did this using LIMDEP (Greene 1984), but the results were not very satisfactory. The two-stage least squares estimates were not consistent with the maximum likelihood estimates, and both sets of estimates tended to be closer to zero than the original OLS estimates for destination prestige. Given recent criticism of Heckman's method (Little 1985), we decided not to pursue this approach further.

Table 3. Dependence of Destination Job on Origin Job and Characteristics of Scientists

	OLS Regression for Prestige		Logistic Regression for Rated vs. Unrated	
Independent Variable	Coefficient	Partial r	Coefficient	Partial r^a
Origin prestige	.328***	.37	.0064***	.20
Articles	10.095*	.17	0.487***	.22
Citations	.021	.00	−.054	−.05
Ph.D prestige	.287***	.30	.000	.00
Career age	−.566	−.04	−.078*	−.15
Year of move	−6.476***	−.27	−.284***	−.28
Field[b]				
Mathematics	−31.378	−.15	−1.727***	−.18
Chemistry	−31.992*	−.16	−1.726***	−.21
Physics	−29.139	−.13	−1.746***	−.20
Origin Rank[c]				
Assoc. prof.	8.105	.04	.112	.02
Full prof.	18.635	.06	.522	.06
Intercept	484.762		18.886	
R^2	.37		.28[d]	

[a] Partial correlation analog computed by $r = \sqrt{[X^2/(n - K + X^2)]}$ where X^2 is the Wald chi-square for testing H_0: $\beta\beta = 0$, n is the number of observations, and K is the number of coefficients estimated. This is equivalent to a formula given by Theil (1971: p. 174) for the partial correlation in the usual linear model.

[b] The omitted category is biologists.

[c] The omitted category is assistant professors.

[d] Squared correlation between dependent variable and predicted value.

* $p<.05$.

** $p<.01$.

*** $p<.001$.

doctoral prestige and a modest negative effect of career age.

Rank Promotion

A change in prestige of the employing department is hardly the only consequence of moving to a new institution. Another outcome that we coded from *American Men and Women of Science* is a change in academic rank. Table 4 is a rank mobility table for the 274 job changes. Downward mobility is rare; only nine scientists moved down in rank when they changed institutions. On the other hand, of those who left as assistant professors, 60 percent moved up in rank, most to the associate level, while 52 percent of the associates moved up to full professor. This degree of upward mobility suggests that promotion (and accompanying salary increases) may be an important inducement for changing institutions.

Who gets promoted? If the norm of universalism is operative, we would expect that prior research productivity would play a major role. To test this hypothesis, we estimated a logistic regression in which the dependent variable was coded 1 if a promotion occurred, otherwise 0. Full professors were excluded from the sample since they could not be promoted. Independent variables were the same as in the previous regression analyses.

Panel A of Table 5 shows that research productivity does have an impact, but now citations rather than number of publications is the statistically significant indicator. To give some sense of the magnitude of the citation effect, the odds of a promotion for someone with 25 citations (slightly above the mean) are about four times as great as the odds for someone with no citations. On the other hand, we find no effects for prestige of origin job or prestige of doctoral institution. Instead, the most important factors affecting promotion are rank in the origin job (associates were less likely to be promoted), and career age (older scientists were more likely to be promoted). We also observe some field differences, with mathematicians much more likely to be promoted than biologists.

As in the analysis of destination prestige, we further explored the effect of article counts to see if alternative specifications might yield a statistically significant effect. Although we tried a number of different transformations, none made a noticeable difference. However, article counts did show up as significant at the .05 level when the citation measure was deleted from the

Table 4. Destination Rank by Origin Rank

	Destination Rank				
Origin Rank	Assistant	Associate	Full	Total	N
Assistant	37%	59	4	100%	101
Associate	8%	40	52	100%	73
Full	0%	3	97	100%	100
Total	16%	36	51	100%	274

Table 5. Logistic Regressions for Promotion in Rank

Variable	A Coefficient	A Partial r^a	B Coefficient	B Partial r^a
Origin prestige	−.001	.02	.001	.04
Articles	.132	.06	.193	.09
Citations	.278**	.21	.316**	.23
Ph.D. prestige	−.001	−.03	−.001	−.05
Career age	.378***	.34	.382***	.33
Year of move	−.099	−.12	−.170*	−.18
Assoc. prof[b]	−2.396***	−.32	−2.537***	−.33
Field[c]				
Mathematics	1.817**	.22	1.613*	.19
Chemistry	.523	.08	.289	.04
Physics	.611	.09	.290	.04
Dest. prestige	—	—	−.001	−.03
Rated v. unrated	—	—	−1.308*	−.19
Intercept	3.467		9.024	
R^2	.30[d]		.34[d]	

[a] See Table 3, note a.
[b] The omitted category is assistant professors.
[c] The omitted category is biologists.
[d] Squared correlation between dependent variable and value predicted by the model.
* $p<.05$.
** $p<.01$.
*** $p<.001$.

model. Given the degree of collinearity between these two productivity measures (r = .62), there remains some doubt as to which of these indicators is more important in determining promotion.

Caplow and McGee (1958) suggested that academic job changers may trade downward prestige mobility for promotion in rank, but we find only equivocal evidence for that hypothesis. First, as already noted, there is no detectable effect of origin prestige on promotion. Second, in panel B of Table 5, we included both destination prestige and a dummy variable for rated versus unrated destination job.[8] With origin prestige held constant, those who move to an unrated department do have a significantly greater chance of being promoted. The odds of being promoted are about 3.5 times greater for those moving to an unrated department. On the other hand, the numerical prestige rating among those moving to rated departments has no impact on the chances of being promoted.

DISCUSSION

Previous research by Long, Allison, and McGinnis dealt a major blow to the hypothesis that academic jobs were allocated to scientists on the basis of their research productivity. Their longitudinal studies of biochemists found no evidence that productivity affected the prestige of first or subsequent jobs. Given previous emphasis on the role of universalism in science, their findings were highly problematic. Our results, however, offer very limited support for the productivity hypothesis. Specifically, for approximately 275 academic job changes in four disciplines in the 1960s and early 1970s, counts of previously published articles had statistically significant effects on gains or losses in job prestige. But, while the effect is significant, it is not substantively large. A change from having none to having 16 publications (from zero to four on the transformed metric) results in an expected increase in destination prestige of 40 points on a 500 point scale. Given that 80 percent of the sample have less than 16 publications, this is a major change in productivity. On the other hand, a change of 125 points in the prestige of the origin department will have the same effect on the destination prestige. A change of 140 points in the prestige of the Ph.D. department will have the same 40-point effect on the destination prestige. To obtain a prestigious job, it appears far more effective to obtain a degree from a top-rated graduate department than to be extremely productive.

Still, our results give more support for the effects of publications than Long et al. Several explanations can be considered for the disparity in results, although no definitive answer is possible. First, hiring practices in biochemistry may be less universalistic than those in the four fields studied here. This seems unlikely. Sec-

[8] For unrated destination jobs, the destination prestige variable was assigned the mean score for rated destination jobs. While this does not affect the coefficient of destination prestige, it has the desirable result that the coefficient for the rated-unrated dichotomy is the adjusted difference in average outcomes for rated and unrated destination jobs.

ond, the studies of biochemists dealt primarily with their first jobs. In contrast, the current study deals only with second or later jobs over a wide range of career ages. As noted earlier, it is quite plausible that hiring departments pay more attention to prior research productivity when the candidates are mature scholars with established track records. The only study that is directly comparable to that reported here is Long's (1978) analysis of 47 job changes. While he found no productivity effects, it is quite plausible that a larger sample might have yielded different conclusions. Indeed, if our sample had contained only 47 jobs changes, but had the same correlations among variables, the effect of articles on destination prestige would not have been significant.

Job Changes as a Market Outcome

Although our results support the notion that hiring departments seek productive scientists, the interpretation is far from straightforward. The ambiguity is that scientists are not allocated to jobs by some master decision maker, but rather by a complex market process in which both departments and job candidates are engaged in reciprocal actions. Two features of this process cloud any observed relationship between scientists' personal characteristics and the jobs they obtain. First, most moves are voluntary, and one would expect that scientists who do not perceive a net gain will not move voluntarily. Second, scientists are not constrained to accept the most prestigious job they are offered but may instead choose on the basis of other criteria.

If the only scientists who moved were those who perceived a gain, the distribution of destination would be truncated from below. This sample selection process would tend to produce biases in coefficients relative to what would be observed if a random sample were forced to move (Heckman 1979). While there is tendency for such bias to be toward zero, it is also possible for coefficients to be inflated. Including a sample of nonmovers, together with recently developed sample selection models (Heckman 1979), might correct such biases, but we have grave doubts about the utility of such procedures (Little 1985).

More problematic is the fact that job candidates may choose among several offers, and their bases for choice might reflect quite different rewards than those studied here. Suppose, for example, that male candidates always choose the job with the highest prestige gain, while female candidates always choose the job in the largest urban environment. Then, even if hiring departments are sex-blind, we would expect to find that mobile males, on the average, make larger prestige gains than mobile females. In general, then, the observed determinants of prestige outcomes or rank outcomes may indicate the tastes and preferences of both hiring departments and the candidates they recruit.

With these principles in minds, we turn to a detailed consideration of the estimated effects of each of the major independent variables.

Origin Prestige

For those moving to rated departments, the prestige of the origin department had by far the strongest effect on destination prestige. It also had a moderate effect on whether the move was to a rated or unrated department. On the other hand, there was no effect at all on promotion in academic rank. Although it may be tempting to interpret the effect of origin prestige as an indication that hiring departments prefer candidates who are currently at high prestige departments, it is more likely that this effect is a consequence of the "frictional" preferences of the candidates themselves. No one likes to move downward on any desirable dimension; instead, scientists may simply stay put until they get an offer at a university department that is at least as prestigious as their current one. Such a process could easily produce a high correlation between origin and destination.

The fact that origin prestige does *not* affect the probability of a promotion is additional evidence for this interpretation. If hiring departments really want to recruit scientists from high-prestige departments, they should offer any available inducements to attract such people. Unlike departmental prestige, academic rank is under the control of the hiring institution and is an obvious means of attracting better candidates. Yet, those leaving prestigious departments seem to have no advantage in getting this reward.

Doctoral Prestige

The effect of doctoral prestige on prestige of later jobs is surely the most persistent finding in the literature on stratification in science, and it has usually been interpreted as evidence for a particularistic strain in academic hiring. We find a strong effect in this study, too. However, for reasons we do not understand, we find no effect of doctoral prestige on whether or not the destination job had a numerical prestige rating. Since both impressionistic and empirical evidence suggest that the unrated departments are mostly at low-prestige institutions, one would expect a positive effect of doctoral prestige on the rated versus unrated dichotomy. We also found no effect of doctoral prestige on the probability of a promotion in rank.

One obvious interpretation of the effect of doctoral prestige on destination prestige is that hiring departments actively recruit candidates with prestigious educational backgrounds. This could be either because they think this will add luster to their own institutions, or because they (rightly or wrongly) interpret such backgrounds as an indicator of scientific talent or superior training. If they really want such people, however, why don't they offer them promotions in rank in order to persuade them to come?

An alternative interpretation is one that might be described as passively particularistic. It could be that departments do not strongly prefer candidates from prestigious doctoral departments, but that these candidates are more likely to come to their attention as a result of social ties that are stratified by prestige. Such a process might produce a strong correlation between prestige ratings of doctoral and destination departments, without having any bearing on promotion in rank. Promotions, after all, are likely to occur *after* a candidate has been chosen, as an inducement to accept the offer, and thus should not necessarily be affected by social ties.

A third possible interpretation is that the effect of doctoral prestige reflects the preferences of the candidates themselves. It is well known that the movement from graduate department to first job is typically one of downward prestige mobility. If we assume that scientists experience this as a loss, it is reasonable to expect that they would be highly motivated to regain a prestige level comparable to that of their graduate experience. If they then seek out and accept offers from institutions similar to those in which they were educated, this alone would produce a correlation between doctoral and destination prestige. It would *not*, however, produce a correlation between doctoral prestige and rank promotion. In fact, if the prestige motivation is strong enough, we might expect that scientists educated at prestigious departments would tolerate downward mobility in rank in exchange for upward prestige mobility.

Research Productivity

The most noteworthy result of this study is that prestige mobility is determined, in part, by the number of articles that a scientist has recently published, but not by the number of citations to those articles or to earlier articles. This supports those who believe that science is a meritocratic institution, but it is troubling that the quantity rather than the "quality" of the work seems to affect mobility outcomes and that the effect is smaller than that of either Ph.D. origin or current departmental prestige. The work by Cole and Cole (1973) provided convincing evidence that citation counts, for all their defects, are a strong indicator of the visibility of a scientist and the impact of his or her research on the research of others. The measure easily surpasses what has been achieved in most other efforts to measure occupational productivity. Yet, we find no evidence that a high citation count (whatever it may measure) is an advantage in getting a prestigious job.

However, we find that scientists with many citations are more likely to be promoted in rank when they change jobs, suggesting that departments (and their parent institutions) do pay some attention to this dimension of scientists' publication records. Furthermore, controlling for the citation measure, the number of articles published does not seem to play a role in the decision to promote. It is not obvious why departments should seek *quantity* of research in deciding which scientists to recruit, but reward *quality* of research in deciding what inducements to offer their leading candidates.

We must again caution that these results may also indicate the preferences of job seekers. It is possible that highly productive scientists are more motivated to seek prestigious jobs and the rewards that accompany those jobs.

Suggestions for Further Research

Long, Allison, and McGinnis claimed that research productivity does not affect a scientist's job placement, but that job placement does affect subsequent research productivity. We have looked at the first claim and found that it needs to be moderated when applied to job changes after the first job. Using the same sample of job changes, we are now re-examining the second claim. Results are still incomplete.

While most previous studies have concentrated on the prestige outcome of scientists' mobility, we believe that the study of rank changes provides an important complement. In fact, the determinants of promotion may give a less ambiguous indication of what hiring departments look for in their new recruits. The picture is incomplete, however, because we do not know much about the process by which academic promotions are awarded to those who do not change institutions. While some preliminary work has been done on this topic (Long 1977; Cole 1979), there is a real need for research that uses event-history methods (Allison 1984; Tuma and Hannan 1984) to study this reward.

Event-history methods should also be used to determine why some scientists change jobs and some do not. While this will not directly address the process of reward allocation, it can shed considerable light on what rewards are important to scientists in their job searches (Allison [1976] 1980). Such knowledge can help greatly in interpreting the kinds of results we have reported here.

Finally, there is the question of the generalizability of our results. Our sample of job changes occurred mostly in the 1960s, with a few in the early 70s. This period was predominantly one of rapid expansion, but it ended with a downturn in academic employment opportunities. It was also a period in which equal opportunity and affirmative action requirements were beginning to be implemented and institutionalized. Would the same results be obtained today? It is possible that the more formalized recruitment practices that are now the norm would produce a more universalistic pattern of hiring. On the other hand, the generally dismal conditions that characterized the academic labor market in the late 70s and early 80s may have induced pressures to rely on social ties to an even greater extent. Only additional research can settle this question.

There is also the question of whether similar results would obtain for the social sciences. Hargens and Hagstrom (1982) reported that status attainment processes differ somewhat in political science compared with those in the natural sciences, and they interpreted those results to be a consequence of differing levels of codification and consensus. The same may be true for institutional mobility.

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[Footnotes]

[1] **Entrance into the Academic Career**
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[2] **Sample Selection Bias as a Specification Error**
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[2] **A Note About Models for Selectivity Bias**
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[4] **A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity**
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