An Examination of Recent Hypotheses about Institutional Inbreeding

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Institutional inbreeding has traditionally been viewed as a manifestation of academic particularism and parochialism. More recently, McGee and Berelson have hypothesized that, under certain circumstances, inbreeding may reflect universalistic patterns of recruitment and may aid a department's efforts to secure the services of noninbred scholars. This paper examines data for 1,165 U.S. academic scientists in an attempt to test the hypotheses of McGee and Berelson. Small but consistently negative relationships between being inbred and measures of scholarly productivity are found; inbred scientists at high-prestige departments appear to be no more productive than scientists at departments of lesser eminence. In addition, evidence consistent with McGee's claim that inbred scientists are discriminated against in the allocation of departmental rewards is presented. Some implications of these results for the question of the nature and future of institutional inbreeding are suggested.

In the early stages of the development of U.S. universities, educators frequently decried academic inbreeding that characterized the hiring of university faculties. Given the prominence of this mode of faculty recruitment during the late 19th and early 20th centuries, the educators' expressions of censure are of understandable origin. For example, in 1910 Harvard University, perhaps the most eminent university of that period, had obtained 64% of its faculty from among its own graduates.[1] Although his discussion was apparently not a consequence of this situation, it is notable that at the end of his long and distinguished career as president of Harvard University, Charles W. Eliot wrote that academic inbreeding "has grave dangers for a university" (1908, p. 90). Eliot did not outline just what these "grave dangers" might be, but apparently his omission would not have troubled his readers.

The practice of filling a department's faculty positions with its own graduates has traditionally been viewed as a straightforward example of

[1] This figure was obtained by finding the highest-academic-degree institutions for the faculty "appointed without limited time or for more than one year" at Harvard in 1910. A list of such faculty members is presented in the *Harvard University Catalogue* (Harvard University, 1910, pp. 10–22). Determination of whether these faculty members had obtained their highest academic degrees from Harvard was made on the basis of short biographical listings in the 1937 *Register* (Harvard University, pp. 96–478).

particularism which is at once the cause and consequence of institutional parochialism (Wilson 1942, pp. 54–56). This point of view received support from a series of empirical investigations into the nature of academic inbreeding which were carried out in the 1930s. In a report prepared for the U.S. Office of Education, McNeely (1932) presented evidence from a sample of 6,754 land-grant college faculty members that over one-third had taken their graduate training at the same institution where they were currently employed. In addition, he found that the inbred scholars in his sample tended to receive slightly lower salaries than the noninbred, and he concluded from this that those inbred "lack the broad outlook necessary to academic achievement" (1932, p. 1).

In an ambitious study of the concomitants of academic inbreeding, Eells and Cleveland (1935) matched inbred and noninbred faculty members from 219 colleges and universities with respect to their current departments, academic rank, length of service, and sex. After obtaining 2,036 matched pairs, they examined differences between the inbred and noninbred scholars in terms of such variables as publication rate, years taken for promotion in rank, and inclusion in directories such as *American Men of Science*. In almost all instances, Eells and Cleveland found that those inbred exhibited lower levels of academic achievement (as measured by these indicators) than their noninbred peers. Other empirical studies of the incidence and possible consequences of academic inbreeding at Chicago (Reeves 1933) and Indiana (Hollingshead 1938) reached similar conclusions.

Exceptions to the overwhelmingly opprobrious discussions of inbreeding were presented in the late 1950s. Although they were not based on the kinds of extensive empirical evidence presented by earlier studies, researches reported by McGee (1960) and Berelson (1960) suggested that there might be functional reasons for inbreeding's "prevalence in the face of odium" (McGee 1960, p. 483). In his study of inbreeding at the University of Texas, McGee claimed that universities which face financial and geographical handicaps in the national competition for faculty members may appoint large numbers of their own graduates to junior faculty positions in order to free resources for competition in the national academic labor market. Resources can be freed by this procedure insofar as inbred faculty members are subjected to discrimination in terms of academic rank, period required for promotion, salary, and working conditions. Thus, by discriminating against inbred faculty, universities can "rob Peter [the inbred faculty] to pay Paul [faculty attracted to the university through competitive efforts made possible by the discrimination]." A notable feature of McGee's argument was the claim that the inbred faculty's lower ranks, longer periods required for promotion, lower salaries, and poorer

working conditions were evidence of discrimination against the inbred faculty rather than evidence of its relatively lower level of scholarly performance, as had been claimed by earlier investigators. Both McGee and the earlier investigators relied on an examination of the zero-order associations between academic nativity and scholarly performance, and academic nativity and various measures of university rewards (such as rank, salary, etc.), in order to determine the nature of the latter set of variables. Both McGee and the earlier investigators found that inbred faculty members tended to have lower ranks, longer periods before promotion, etc. But whereas earlier investigators found that inbred faculty members had lower levels of scholarly performance, and then concluded that their lesser university rewards were additional evidence of these lower levels of performance, McGee found that at Texas the inbred faculty had higher levels of scholarly performance, and then concluded that their lesser rewards were evidence of the existence of discrimination.

Shortly after the publication of McGee's research, Lieberson and Gold (1961) pointed out that examination of such zero-order associations is not sufficient for determining the existence of discrimination, and that this question requires multivariate analysis to determine whether academic nativity is associated with university rewards after the effects of scholarly productivity are controlled. This objection, which is equally applicable to the researches that preceeded McGee's work, was not met in McGee's response (1961) to Lieberson and Gold's criticisms, and the question of discrimination against inbred faculty, as well as the functionalist argument about the nature of inbreeding at universities like the University of Texas, therefore remains an open question.

Unlike McGee's work, Berelson's discussion was focused on the question of inbreeding at the most eminent universities in the United States. These universities have always had greater proportions of their faculties inbred than other universities, but Berelson claimed that this is a "statistical consequence" of the dominant position of the most eminent universities as producers of new Ph.D.'s (Berelson 1960, p. 116). Unfortunately, Berelson did not specify what he meant by his term "statistical consequence"; but if he meant that the high inbreeding proportions shown by the most eminent universities would be expected on the basis of a random model for the apportionment of scholars to universities, he is clearly wrong, as has been shown by a reanalysis of his own data (Hargens 1969, p. 29). Berelson also noted that the greatest proportion of the most eminent universities' inbred faculty members were scholars who had originally obtained positions at other universities but who had been recalled to their alma maters. Since this "silver cord" phenomenon has traditionally been interpreted as an indication that the faculty members inbred in this manner have

demonstrated their superiority in open competition (Caplow and McGee 1958, p. 53), Berelson suggested that it does not constitute "real" inbreeding (Berelson 1960, p. 116).

In general, Berelson's discussion of inbreeding at the top of the U.S. academic hierarchy is notable for its lack of any evidence about the scholarly productivity of noninbred, inbred, and silver-corded faculty members. Indeed, Berelson does not explicitly speculate about the question of the relative productivity of scholars at the most eminent universities. On the one hand, inbred scholars may be more productive than their noninbred colleagues, and this circumstance would suggest that inbred scientists at eminent universities constitute an elite group of highly productive individuals who have been recruited by their doctoral departments in an effort to maintain departmental eminence. On the other hand, inbred scholars may be less productive. This does not, however, imply that the inbred scholars owe their positions to the operation of particularistic standards in the hiring of faculty. For example, even if inbred scholars at eminent universities are less productive than their colleagues, they may still be more productive than scholars at less eminent universities. In attempting to maintain their positions of eminence, distinguished departments may be forced to hire their own graduates because, though not as able and productive as the other members on the faculties, they are the next most productive scholars available. As long as inbred faculty at the most eminent universities are more productive than those less eminent universities, Berelson's claim that traditional negative evaluations of academic inbreeding are inappropriate for the most eminent U.S. universities is justifiable.

While their data are less adequate than the data presented by those who earlier viewed academic inbreeding as an indication of institutional particularism, the hypotheses and speculations of McGee and Berelson are not necessarily inconsistent with the results of those earlier investigators. The earlier investigators did not take into account institutional prestige, while Berelson and McGee argued for the benefits of academic inbreeding in terms of specific prestige strata. For example, although inbred scholars may be generally less productive than noninbred scholars, it is conceivable that the opposite relationship might exist among scholars in the top prestige universities. Similarly, the finding that inbred faculty are discriminated against in terms of such rewards as salary and promotion may not occur in universities with more or less prestige than the department studied by McGee.

In this paper, we present a more extensive examination of the possible concomitants and consequences of academic inbreeding. We attempt to determine whether the explanations of inbreeding suggested by McGee and Berelson are consistent with data from a large sample of scientists in U.S. universities. We employ measures of a scientist's scholarly productivity and

the eminence of a scientist's current department in multivariate analyses of the concomitants of holding a faculty position at one's doctoral university. In addition, since our samples of scientists include scholars from nearly every graduate institution in the United States, we are able to obtain an indication of whether conclusions presented in previous studies of single universities, such as McGee's study of the University of Texas, are generalizable to other similar universities.

THE DATA

The study reported here is based upon information about U.S. academic scientists originally collected by Warren O. Hagstrom in 1966.[2] Hagstrom drew systematic random samples of U.S. graduate faculty members in the fields of mathematics, experimental biology, physics, and chemistry. Data from such sources as *American Men of Science* were collected so that education and occupational histories could be constructed for the members of these samples. In addition, since scholars in these fields publish their research almost exclusively in the form of journal articles, information about the number of articles published by each of the members of these samples, and also about citations to their previous research work, was collected from the 1966 edition of *Science Citation Index*. Complete information on these topics was obtained for 1,514 scientists.

Because the sample sizes for each of the four fields are inadequate to support the kinds of multivariate analyses reported below, we have combined data from all four in our study. Our preliminary examination of the zero-order relationships between the variables discussed below within each of the four fields revealed few appreciable differences from field to field, and it is unlikely that statistically reliable interaction effects would be revealed by more intensive analysis within each of the fields. In combining data for such variables as the number of articles a scientist has published and the number of citations to a scientist's work, we have eliminated disciplinary differences in means and standard deviations by computing field-specific standard scores rather than simply analyzing raw score values. Other variables, such as prestige ratings for individual graduate departments, have not been standardized in this manner, since they were created in such a way as to yield fairly comparable distributions from field to field (Cartter 1966, pp. 15–16).

We present results separately for scholars currently (at the time of the survey) holding their first academic position and for those holding their

[2] A description of Hagstrom's sampling procedures and resulting sample will be found in Hagstrom (1967, pp. 98–109). We wish to thank Professor Hagstrom for his kindness in furnishing us with these data. Hagstrom's research was supported by a grant from the National Science Foundation (GS-1725).

second or subsequent positions. This is done in order to examine the possibility that the concomitants of academic inbreeding may be different for scientists who are presently at their first positions as opposed to those at later stages in their careers. Appointments to first positions are commonly made without reliable evidence about a scientist's abilities and energies. "Mistakes" made in the original allocation of scientists to positions may therefore be rectified by succeeding changes of positions. By "position" we refer to a job at a particular university at a particular rank. Scholars at their first positions are therefore those who have neither been promoted nor moved to another university since beginning their academic careers. In this study we have included only scholars at the rank of assistant professor and above. By doing this we attempt to include only those who have reached the first rung of the "tenure ladder" and to exclude those who hold positions which are often of a temporary nature, such as instructors and research associates (see National Research Council [1968, pp. 18–23] for evidence of the great decline in the significance of the instructorship in academic careers during recent decades). Inclusion of the latter in analyses of academic inbreeding increases the apparent prevalence of inbreeding and may obscure relationships between inbreeding and other characteristics which hold only for full-time, tenure-ladder positions.

Given these considerations and restrictions, the distribution of sample cases upon which the following analysis is based is as presented in table 1.[3]

TABLE 1

DISTRIBUTION OF THE SAMPLE AMONG SUBCATEGORIES OF THE ANALYSIS

ACADEMIC NATIVITY	PRESTIGE OF DEPARTMENTAL AFFILIATION				TOTAL
	Not Rated "Insufficient–Adequate"	"Adequate Plus–Good"	"Strong"	"Distinguished"	
	Scientists at Their First Positions				
Inbred	12	5	10	13	40
Not inbred	253	101	106	40	500
Total	265	106	116	53	540
	Scientists at Their Second and Subsequent Positions				
Inbred throughout	25	24	54	25	128
Silver-corded ...	5	2	12	9	28
Not inbred	461	206	231	111	1,009
Total	491	232	297	145	1,165

[3] Respondents with positions in graduate departments not rated by Cartter were included with those in departments rated as being of "insufficient" and of "marginal to adequate" quality in the lowest prestige category shown in table 1.

It is evident from table 1 that within general prestige strata the numbers of scholars who are inbred, or have returned to their doctorate institutions after spending a period at another university, are quite small. Thus, extensive subgroup analyses and searches for the possible existence of interaction effects among the variables to be examined below cannot be supported by these data. However, it will be possible to examine the independent associations of academic inbreeding with other variables such as the quality and quantity of a scholar's publications using departmental prestige scores as a quantitative variable rather than as a basis for dividing the sample into subgroups.[4] In addition, it will be possible to examine relationships between the variables under analysis within prestige strata of particular interest because of their importance in the formulations of McGee and Berelson noted above, and to compare the results for these strata with those shown by the sample as a whole.

RESULTS

In the following analysis we examine two questions. First, we examine the relationships between academic inbreeding and measures of scholarly performance after controlling for other variables such as the prestige of a scientist's present departmental affiliation. Second, we examine the independent relationship between academic inbreeding and a measure of institutional reward, the number of years which elapsed between a scientist's appointment to his first position and his first subsequent promotion. This latter analysis obviously can only be carried out for the subgroup of our sample who have had more than one position during their careers and who were promoted at the university where they received their first position.

Inbreeding and Scholarly Performance

We turn first to the relationship between inbreeding and scientific productivity among scientists currently at their first academic positions. Table 2 presents the results of the multiple regression analyses carried out for this

[4] The prestige scores here are those reported by Cartter for the "rated quality of graduate faculty" (Cartter 1966, p. 12). Since Cartter does not present prestige scores for departments below the "strong" level, we used the midpoints of the intervals corresponding to each of the lower levels to represent the prestige of departments in those levels (Cartter 1966, p. 16). Departments not included in Cartter's survey were assigned a prestige score of 1.0 because we found their members to be less productive in terms of publications and citations received than members of departments which obtained ratings of "adequate" to "insufficient" in Cartter's survey, and which were assigned a score of 1.5 in accordance with the midpoint convention described above. Hagstrom (1971, pp. 379–80) has shown that measures of the publications and citations received by the members of a department have high loadings on a departmental prestige factor obtained from a factor analysis of departmental characteristics.

TABLE 2

RESULTS OF REGRESSIONS OF MEASURES OF QUANTITY AND QUALITY OF SCHOLARLY PUBLICATIONS ON PRESTIGE OF CURRENT DEPARTMENT, YEAR OF PH.D. DEGREE, AND ACADEMIC NATIVITY, FOR SCIENTISTS CURRENTLY AT THEIR FIRST ACADEMIC POSITIONS ($N = 540$)

Independent Variable	Dependent Variable: No. of Articles Published			Dependent Variable: No. of Citations to Previously Published Works		
	b	b^*	F	b	b^*	F
Prestige of current dept.	.156	.29	49.40**	.132	.29	50.74**
Year of Ph.D. degree	—.031	—.34	77.25**	—.018	—.25	38.75**
Inbreeding	—.187	—.08	3.64	—.153	—.08	3.48
(Constant)	1.138	...	...	.581	...	...
R^2	.192		42.33**	.143		29.88**

** F-value significant at $\alpha = .05$.

subgroup, and since the form of presentation employed in this table will be repeated through the rest of this paper, it is appropriate to comment upon its general design and purpose.

Table 2 presents the results of two separate regression analyses, one in which the number of articles published by a scientist is the dependent variable, and the other in which the number of citations made to a scientist's previously published work is the dependent variable. These two indicators are commonly used to measure the quantity and the quality of a scientist's research output, and, as mentioned above, we have converted the raw scores for these indicators into field-specific standard scores before combining scientists in the various disciplines in our analysis. We have regressed both of these dependent variables on three independent variables: the prestige of a scientist's current department, the year in which the scientist received his Ph.D., and the scientist's inbreeding status or "academic nativity." It is well known that the quantity and quality of scientists' publications vary positively with the prestige of their departments (Zuckerman 1970, pp. 245–47) and that scientists just launching their careers after having obtained their first position are less productive and therefore less frequently cited than their slightly more experienced colleagues who have established research programs. These two variables are therefore included in the analysis so that a more accurate estimation of the independent relation between inbreeding and the quantity and quality of a scientist's publications can be obtained. The third independent variable, academic nativity, is a dummy variable which takes on a value of one when a scientist holds a position in the department where he took his Ph.D., and a value of zero when this is not the case.

Both the unstandardized (b) and the standardized (b^*) regression co-

efficients are presented for each analysis. The only unstandardized coefficient of direct interest here is that for the inbreeding dummy variable. This coefficient indicates the difference in means on the dependent variable between inbred and noninbred scientists after controlling for the relationships between that dependent variable and the other independent variables in the equation (Cohen 1968, p. 431). For example, a value of —1.0 for this coefficient when the dependent variable is "number of articles published" would indicate that after controlling for the respective relations of departmental prestige and year of Ph.D. degree, inbred scientists have a mean number of articles which is 1.0 standard deviations below the mean for scientists who are not inbred. The standardized regression coefficients for each analysis are included in order to provide the reader with a measure of the relative sizes of the independent relations between the independent variables and the dependent variables. Finally, the coefficient of determination (R^2) and the values of the F-ratio for this coefficient and the regression coefficients for each independent variable are also presented for the two regressions in table 2.

The results shown in table 2 indicate that, as expected, prestige of current department and year of Ph.D. degree have fairly sizable and statistically significant relationships with the two dependent variables. These relationships are also in the directions predicted above. On the other hand, although academic nativity shows negative independent relations with the two dependent variables, the coefficients for these relations are not large enough to bring about the rejection of the null hypothesis that there is actually no relationship between academic nativity and the quantity and quality of a scientist's publications. Thus, we conclude there is no evidence here to suggest that academic inbreeding has any particular independent relationship with scientific productivity when departmental prestige and year of Ph.D. are included in the analysis.

The results presented in table 2 are all scientists in our sample currently at their first positions, and the inclusion of departmental prestige as a continuous variable in our regressions precludes the discovery of differences in the relationships of academic inbreeding and quantity and quality of publications within different prestige levels conceived as discrete strata. Since Berelson has suggested that among the most prestigious universities inbred scholars may be more productive than their colleagues, we have disaggregated the sample into prestige strata by grouping departments included in a single descriptive rating category used by Cartter (1966, pp. 12–16). For example, Cartter labeled those departments with average ratings of 4.0 and above as being of "distinguished" quality, and in fact his raters used a five-point rating scale in which this adjective corresponded to the highest possible rating. Because we are interested in the possibility that inbreeding has a different relationship to scholarly output among the most

prestigious departments, we have therefore rerun our regressions on only those scientists who have positions in departments labeled as distinguished by Cartter. The results of these regressions are presented in table 3.

TABLE 3

RESULTS OF REGRESSIONS OF MEASURES OF QUANTITY AND QUALITY OF SCHOLARLY PUBLICATIONS ON YEAR OF PH.D. DEGREE AND ACADEMIC NATIVITY, FOR SCIENTISTS CURRENTLY AT THEIR FIRST POSITIONS IN "DISTINGUISHED" DEPARTMENTS ($N = 53$)

INDEPENDENT VARIABLE	DEPENDENT VARIABLE: No. of Articles Published			No. of Citations to Previously Published Works		
	b	b^*	F	b	b^*	F
Year of Ph.D. degree ..	—.050	—.45	11.68**	—.048	—.31	5.02**
Inbreeding	—.278	—.16	1.45	—.330	—.14	.96
(Constant)	2.994	...	...	3.088	...	...
R^2	.19		5.90**	.09		2.60

** F-value significant at $\alpha = .05$.

Although the regression coefficients for academic inbreeding are once again both negative, and although they are of larger magnitudes than their counterparts in table 2, the number of cases upon which table 3 is based is so small that the inbreeding coefficients once again fail to be statistically significant. Although we do not present the results here, we have also rerun the above regressions for the other prestige strata distinguished by Cartter and have found results quite similar to those in table 3. There is no evidence that the relationship between academic inbreeding and scholarly output varies across departmental prestige strata, and the results presented in table 2 appear to represent relationships which exist within general prestige strata as well as across them. In addition, neither the idea that inbred scientists are less able and productive than their colleagues, nor the idea that they are more able and productive, finds much support in tables 2 and 3.

Thus far we have presented results only for scientists at their first academic positions. Since a scientist's first position is almost always a non-tenured position and since many scientists are denied tenure by their first departments, it may be possible that the relationships shown above are not present among scientists who are at their second and succeeding positions.[5]

[5] For those scientists who were at their second positions at the time of the survey reported here, the transition from first to second position was overwhelmingly a promotion in rank regardless of whether it also involved a change in universities. An examination of the scientists in our sample who were assistant professors in 1961 indicates that of those who changed positions before 1966, 90% were promoted in rank. Thus, of the 1,165 scientists included in table 4, only 1.3% are at the rank of assistant professor. Although it is true that the rank of associate professor does not

TABLE 4

RESULTS OF REGRESSIONS OF MEASURES OF QUANTITY AND QUALITY OF SCHOLARLY PUBLICATIONS ON PRESTIGE OF CURRENT DEPARTMENT, YEAR OF PH.D. DEGREE, AND ACADEMIC NATIVITY

INDEPENDENT VARIABLE	DEPENDENT VARIABLE: No. of Articles Published			No. of Citations to Previously Published Works		
	b	*b**	*F*	*b*	*b**	*F*
	All Scientists Currently at Their Second and Succeeding Academic Positions ($N = 1,165$)					
Prestige of current dept.	.377	.40	202.24**	.332	.35	147.74**
Year of Ph.D. degree	—.008	—.07	7.20**	—.006	—.06	3.91**
Always inbred	—.305	—.09	9.47**	—.249	—.07	5.92**
Silver-corded	—.393	—.05	3.90**	—.313	—.04	2.33
(Constant)	—.476	...	...	—.411	...	...
R^2	.163		56.28**	.122		40.52**
	Scientists Currently at Their Second and Succeeding Academic Positions in "Distinguished" Departments ($N = 145$)					
Year of Ph.D. degree	—.058	—.28	11.23**	—.049	—.23	7.85**
Always inbred	—.361	—.07	.69	—.097	—.02	.05
Silver-corded	—.534	—.06	.58	—.666	—.08	.88
(Constant)	3.662	...	...	3.144	...	...
R^2	.088		4.56**	.068		3.46**

** F-value significant at $\alpha = .05$.

Results from regression analyses carried out on this latter group of scientists are presented in table 4. In this table there are two dummy variables for the representation of academic nativity. The first, "always inbred," takes on a value of one if a scientist has spent his entire career at his doctoral department, while the second, "silver-corded," takes on a value of one if a scientist originally obtained a position at another department but was later brought back by his doctoral department. The regression coefficients for each of these two dummy variables are to be interpreted as indicating the difference between the mean (on a given dependent variable) for the group of cases receiving a one for that dummy variable and the group of cases receiving zeros for *both* of the dummy variables (scientists who are not currently inbred). Once again, these differences in means are differences which result when variation in the continuous variables in the regression equation is controlled. For example, a regression coefficient equal to 1.0 for the "silver-corded" dummy variable in table 4 would indicate that after controlling for variation in prestige of current department and year

always carry the privilege of tenure, this latter circumstance is also rare; and the results presented in table 4 are probably representative of tenured scientists at U.S. graduate departments.

of Ph.D., scholars who are silver-corded have a mean on the dependent variable under examination which is one standard deviation above the mean of scholars who are presently not inbred.

The actual results in the upper panel of table 4 indicate that both those who have been inbred throughout their careers and those who have returned to their doctoral departments after spending part of their careers elsewhere tend to be less productive (in terms of quantity and quality of publications) than those who are not inbred. However, being inbred or silver-corded accounts for only a small proportion of the variance in either dependent variable (as represented by the standardized regression coefficients), and one of the coefficients for the "silver-corded" category is too small to merit rejection of the hypothesis that it differs from zero because of sampling error. In general, the results in the upper panel of table 4 furnish support for the hypothesis that holding a position in one's doctoral department is negatively associated with scholarly output, and, like the results in tables 2 and 3, no support for the contrary hypothesis of a positive association between these variables. As was the case in previous tables, the prestige of one's current department has positive independent relations with the measures of scholarly output, and the year of one's Ph.D. degree has negative independent relations with these measures.

A comparison of the relative magnitudes of the unstandardized regression coefficients for these two independent variables and their corresponding coefficients in table 2 indicates that whereas prestige of current department has larger coefficients in table 4 than in table 2, year of Ph.D. exhibits the opposite pattern. These results are in accord with expectations that there is a smaller correlation between scientific productivity and prestige of department among young scientists than among older scientists (Hargens and Hagstrom 1967, pp. 34–35), and that the negative relationship between length of career and scholarly performance is greater among young scientists just beginning their careers than among older scientists.[6]

In the lower panel of table 4 we turn once again to the question of whether scientists at the most prestigious graduate departments show different relationships between academic nativity and measures of scholarly output than the more general population of scientists in all graduate departments. The results presented are consistent with those in previous tables: once again the regression coefficients for the categories of academic na-

[6] Any curvilinearity in the relationship between age and scientific productivity appears to be due to relatively lower productivity rates for scientists just starting their careers and for scientists at and beyond the age of retirement (Dennis 1956, 1966; Van Zelst and Kerr 1951; Peter 1957, p. 129). Thus, within the categories of "scientists at their first positions" and "scientists at their second and succeeding positions" the relationships between year of Ph.D. and our measures of scientific productivity are probably linear. Since our data are not longitudinal in nature, we are unable to provide a test of this hypothesis.

tivity have negative signs. Although the unstandardized coefficients for these categories are somewhat larger than those presented in previous tables (the standardized coefficients are of similar magnitude to those in previous tables), the small sample size precludes the rejection of the hypothesis that these coefficients differ from zero only because of sampling error. Our replication of this analysis within the other prestige strata distinguished by Cartter yielded results similar to those in table 5, and we therefore conclude that the results shown in table 4 for all graduate universities appear to represent adequately the results within the various prestige strata.

The results in each of the four tables presented thus far indicate that when we control for professional experience, scientists with positions at their doctoral departments tend to be slightly less productive, in terms of quantity and quality of publications, than their noninbred colleagues. Although these differences are fairly small and most often statistically insignificant, it is notable that every one of the 12 regression coefficients indicating a comparison of inbred with noninbred scientists shows a negative sign. On the basis of this evidence it is not unreasonable to suggest that a slight negative relationship between inbreeding and professional output does exist, but that the relationship, independent of other variables, is so small that in a given instance only very large samples enable us to reject the null hypothesis that its manifestation in that instance is attributable to sampling error.

These results certainly allow us to reject the argument that inbred scholars, relative to their noninbred colleagues, are highly productive individuals whose services could not ordinarily be obtained by their doctoral departments except for the affective ties to region, community, and/or alma mater which can be invoked by these departments. On the basis of the evidence presented above, this argument can be rejected as a description of inbred scholars generally, and of particular groups of inbred scholars (silver-corded scholars, inbred scholars at high-prestige departments) who are often cited as being unexpectedly able and productive given their institutional locations. On the other hand, the evidence presented above fails to speak directly to the question of whether inbred scholars in a given prestige stratum of departments are more productive than noninbred scholars in the next lower prestige stratum. Although inbred scholars appear to be slightly less productive than their noninbred colleagues, this does not mean that they may not simultaneously be much more productive than other scholars in a lower prestige stratum. In order to assess the likelihood of this latter possibility, it is necessary to have recourse to information about the productivity levels of the specific groups involved in such a comparison.

Since it is impossible to obtain reliable productivity estimates for de-

tailed breakdowns of our sample by prestige of department, professional experience, and academic nativity, we will rely upon the results of the multiple regression analyses presented in table 2 and 4 to provide us with estimates of the productivity levels of the groups in question. Although the regression coefficients for the categories of academic nativity were usually statistically insignificant, in view of the consistently negative signs shown for these coefficients we will treat them as estimates of the true independent associations between the categories of academic nativity and our measures of scholarly output (thus attributing their lack of statistical significance to inadequate sample sizes).

By arbitrarily assuming a certain Ph.D. year and contrasting inbred scholars at departments in one prestige stratum with noninbred scholars at departments in the next lower stratum, we may obtain estimates of their respective productivity levels from the regression equations presented in tables 2 and 4. For example, an estimate of the number of articles published by silver-corded scholars at departments labeled by Cartter as "distinguished" can be obtained from the formula:

$$\text{Number of Articles} = -.476 + .377\ (\text{Cartter Score}) - .008\ (\text{Year of Ph.D.}) - .305\ (\text{Always Inbred}) - .393\ (\text{Silver-corded})$$

By entering a value of 4.50 for the Cartter score variable in this equation, 47 for the year of Ph.D., 0.0 for the "always inbred" variable, and 1.0 for the "silver-corded" variable,[7] one obtains an estimate of 0.45 for the number of articles. Remembering that our productivity measures are standard scores, this operation gives us the estimate that silver-corded scientists at distinguished departments who obtained their Ph.D.'s in 1955 have a rate of publishing articles which is 0.45 standard deviations above the mean of all scientists. Employing a value of 3.50 to represent the average prestige score among Cartter's "strong" departments and a value of 58 for the mean year of Ph.D. for scientists at their first positions, one obtains the estimates reported in table 5. These results suggest that inbred scholars at "distinguished" departments and noninbred scholars at "strong" departments are indistinguishable, as far as professional productivity is concerned, when degree of professional experience is controlled. Although the latter group tends to show higher productivity levels than the former group, all comparisons are within 0.1 standard deviation. Differences of such small magnitudes are unlikely to be perceived by practicing scientists who lack information about their actual sizes. Given that there are no apparent dif-

[7] The value of 4.50 is the midpoint of the scores of departments in Cartter's "distinguished" category (Cartter 1966, p. 16). The year 1947 is actually the mean year of Ph.D. for scholars at their second and succeeding positions in our sample, but since this value is entered in all regression equations involved, it has no effect on differences between the estimated productivity levels of the groups shown in table 5.

TABLE 5

ESTIMATED VALUES FOR NUMBER OF ARTICLES PUBLISHED AND NUMBER OF CITATIONS TO PREVIOUS PUBLICATIONS FOR INBRED SCIENTISTS AT "DISTINGUISHED" DEPARTMENTS AS OPPOSED TO NONINBRED SCIENTISTS AT "STRONG" DEPARTMENTS

	ESTIMATED VALUE FOR	
	No. of Articles	No. of Citations
Scientists at first positions:		
Inbred at distinguished depts.	—.14	—.02
Noninbred at strong departments	—.11	.00
Scientists at second and succeeding positions:		
Silver-corded at distinguished depts.	.45	.49
Always inbred at distinguished depts.	.54	.55
Noninbred at strong departments	.47	.47

ferences between the productivity levels of the inbred and noninbred groups in table 6, it would appear that the speculation that inbred scholars constitute a highly able and productive group is very questionable, even when inbred scholars are compared with scholars in a lower prestige stratum. An obvious alternative hypothesis is that inbred scholars, who are no more productive than scholars in a lower prestige stratum, have obtained positions in a higher prestige stratum than they would ordinarily merit because of particularistic ties with their Ph.D. departments.

Inbreeding and Time Taken for Promotion

We turn now to an examination of the relationship between academic nativity and one form of institutional reward which a scholar may enjoy: rapid promotion. McGee argued (on the basis of insufficient evidence) that inbred scholars at the University of Texas were discriminated against in terms of promotion and other rewards, and that Texas was able to employ the resources freed in this manner for competition for scholars on the national labor market. Although we cannot evaluate the adequacy of both elements of McGee's argument, we can evaluate the adequacy of the first element by examining the association between academic nativity and the amount of time scholars spend before promotion in rank. In addition, since our sample covers all U.S. graduate institutions, we can assess the extent to which McGee's argument about the University of Texas is also applicable to other universities.

In our analysis we attempt to meet criticisms of McGee's failure to carry out a multivariate analysis of the relationships among academic nativity, scholarly productivity, and time taken for promotion. However, since our productivity measures were gathered for the time that the survey was carried out rather than for the entire professional careers of the sample

members, we can interpret these measures only as indicators of the actual productivity of scholars during earlier periods, before their promotions. The adequacy of this procedure is clearly dependent upon the correlations of the measures across time periods, and although there is fragmentary evidence that these correlations are fairly high over periods of five or ten years,[8] the larger question of stability of scientists' relative productivity levels over the course of their careers remains an important unexamined question in the sociology of science. In the following analysis we use the number of citations to a scientist's previous work, rather than the number of articles published by a scientist, to measure scientists' productivity levels. The use of the former measure has two advantages over the use of the latter: first, "quality" of research productivity has been shown to be of greater consequence for institutional rewards than mere "quantity" (Cole and Cole 1967, pp. 384–88), and, second, citations to scientists' previously published research probably have larger correlations across given time periods than the number of articles published by scientists.

In order to eliminate differences in time taken for promotion which may be due to the particular kind of promotion involved (e.g., assistant professor to associate professor vs. associate professor to full professor), we have restricted our analysis to the promotion from assistant to associate professor. Although there is somewhat less variation in time taken for promotion to associate professor than in time taken for promotion to full professor, sample sizes are much larger for analyses of the former variable. In addition, the former variable is often thought to be more crucial in that it is almost always connected to the attainment of a tenured status. Since we are interested in the differential treatment of inbred and noninbred scholars by departments which have originally hired and then promoted these scholars, it is also necessary to restrict our analysis to the members of our sample who have been promoted at the department where they obtained their first position. These restrictions yield a subsample of those scientists who are presently at their second and succeeding positions and which is composed of 788 members.

Table 6*A* presents results of the regression of years taken for promotion to associate professor on prestige of department, year of Ph.D., number of citations to work, and academic nativity for the entire subsample described above. Once again, in order to remove differences between fields in the means and standard deviations of time taken for promotion, we have calculated field-specific standard scores for this variable before combining cases from the different fields covered by our sample.

The results in table 6*A* indicate that, net of its associations with the

[8] For example, a study presently being carried out by Barbara F. Reskin at the University of California at Davis shows that the correlation between the number of citations a scientist receives in the first and last years of a six-year period is 0.88.

TABLE 6

RESULTS OF REGRESSION OF YEARS TAKEN FOR PROMOTION ON CITATIONS TO PREVIOUS WORK, PRESTIGE OF DEPARTMENT, YEAR OF PH.D. DEGREE, AND ACADEMIC NATIVITY

A. ALL SCIENTISTS WHO WERE PROMOTED AT THEIR FIRST JOB INSTITUTIONS ($N = 788$)

INDEPENDENT VARIABLE	DEPENDENT VARIABLE: NO. OF YEARS TAKEN FOR PROMOTION		
	b	b^*	F
Prestige of department	—.001	—.03	0.54
Year of Ph.D. degree	—.027	—.27	62.61**
No. of citations to work	—.128	—.15	17.18**
Inbreeding	.292	.12	10.83**
(Constant)	1.259	...	...
R^2	.107		23.41**

B. ALL SCIENTISTS WHO WERE PROMOTED AT THEIR FIRST JOB INSTITUTIONS WITHIN PRESTIGE CATEGORIES OF DEPARTMENTS

INDEPENDENT VARIABLES	PRESTIGE CATEGORIES					
	Not Rated; "Insufficient"–"Adequate" ($N = 308$)			"Adequate Plus"–"Good" ($N = 173$)		
	b	b^*	F	b	b^*	F
Year of Ph.D. degree	—.030	—.28	26.69**	—.022	—.23	9.36**
No. of citations to work	—.096	—.06	1.14	—.220	—.15	3.92**
Inbreeding	.754	.20	13.83**	.139	.05	0.54
(Constant)	1.362	...	...	.979	...	...
R^2	.117		13.45**	.079		4.87**
	"Strong" ($N = 206$)			"Distinguished" ($N = 101$)		
Year of Ph.D. degree	—.030	—.31	22.20**	—.020	—.27	7.80**
No. of citations to work	—.231	—.25	15.40**	—.065	—.16	2.61
Inbreeding	.193	.09	1.96	—.012	—.01	0.01
(Constant)	1.387	...	...	.882	...	...
R^2	.175		14.32**	.090		3.20**

** F-value significant at $\alpha = .05$.

other variables in the equation, time taken for promotion does have an association with academic nativity; the association is in the same direction as argued by McGee. Inbred scientists take longer to be promoted than noninbred scientists *even* when we take into account the slightly lower productivity levels of the former shown above, and this difference is statistically significant. It is also notable that prestige of department appears to have no independent association with years taken for promotion, while

both year of Ph.D. and number of citations to previous work have more substantial independent associations. The association between citations to previous work and promotion time indicates that, as expected, those with more numerous citations to their work tend to be promoted more quickly than those with fewer citations. The association between year of Ph.D. and promotion time indicates that younger scientists have been promoted more quickly than older scientists, and this is consistent with the belief that the academic labor market was a seller's market in the late 1950s and early 1960s relative to earlier periods.[9]

Although the results presented in table 6 might appear to suggest that the phenomenon of discrimination against inbred scientists is more general than McGee perceived, two important caveats are in order. First, it is always dangerous to infer the existence of discrimination on the basis of a residual association between an independent variable like academic nativity and a dependent variable like time taken for promotion. This kind of residual association may be due to many factors, the most plausible of which are the failure to include all relevant independent variables in the analyses and systematic measurement error. For example, to the extent that inbred scientists fall below noninbred scientists on other factors relevant for promotion in rank besides those included in an analysis, the analysis may yield the appearance of discrimination even where none exists. Given that only one factor (citations to previous work) commonly thought to be relevant to promotion in rank is included in the above analysis, it is certainly possible that this kind of circumstance might be present. Thus, the results presented in table 6*A* can at most be interpreted as presumptive evidence for the existence of discrimination against inbred scientists.

Second, the existence of a relation between two variables in a general population does not necessarily imply the existence of that relation in each of the various subgroups of the population. The question of the generality of the relations shown in table 6*A* over various prestige strata has therefore not yet been determined. In table 6*B* we therefore present the results of analyses for each of four general prestige strata distinguished by Cartter.

It is evident that there is substantial variation in the independent association between academic nativity and time taken for promotion across prestige strata. Only among scientists in the lowest prestige category does this association attain statistical significance, and the unstandardized regression coefficients for this association tend to be smaller in successively higher prestige strata. Thus, unlike the results obtained in our analysis of the association of academic nativity with scholarly productivity, there does appear to be an interaction effect across prestige strata in the relation

[9] In addition however, this result may be partly artifactual in that the younger scholars included in this table had to be rapidly promoted in order to qualify for inclusion. Younger scholars not promoted are not in the subsample considered here.

between academic nativity and time taken for promotion. What is more, the interaction effect appears to be quite consistent with McGee's argument about the relative prominence of discrimination against inbred scholars in low-prestige, as opposed to high-prestige, universities. McGee made his argument in terms of the University of Texas, a university he identified as facing financial and regional handicaps in competition in the national academic labor market. Although Texas may be handicapped in these respects as far as competition with the 10 or 12 most eminent U.S. universities is concerned, it certainly cannot be considered to face such handicaps relative to all U.S. universities. Thus, it is notable that Texas usually ranks in the "good" and "strong" categories for most disciplines in the American Council on Education prestige ratings, and that these strata show much smaller independent relationships between inbreeding and time taken for promotion than the relationship shown for the lowest prestige stratum.

In view of these circumstances, the findings of Lieberson and Gold which suggested no discrimination against inbred scholars at Texas are consistent with those presented above. But, although it would appear that McGee's argument about discrimination against inbred faculty members at Texas is highly questionable, his general argument about that kind of discrimination at universities which face the handicaps he attributes to Texas may be correct. These handicaps, especially the financial ones, are present in their most extreme form in the lowest prestige stratum of universities (Cartter 1966, pp. 107–17), and it is in this stratum that the results in table 6*B* are consistent with McGee's argument about the existence of discrimination against inbred scholars. Once again, however, it is necessary to caution that the results in table 6*B* can only offer presumptive evidence for the existence of the hypothesized discrimination, and that this evidence has no bearing whatsoever on McGee's broader functional argument about the manner in which resources made available by the discrimination are utilized by the universities in which it takes place.

CONCLUSIONS

Although the results presented above certainly do not conclusively resolve the questions about academic inbreeding at U.S. universities, they tend to be generally more consistent with early interpretations which identified inbreeding as a manifestation of particularism and parochialism rather than with the more recent objections to these traditional interpretations. This is especially true with respect to Berelson's claim that inbreeding at the most eminent universities is a natural outcome of the dominance of these universities as producers of the most able scholars. Our evidence suggests that not only are inbred scholars at the most eminent universities less productive than their noninbred colleagues, but also they are no more pro-

ductive than noninbred scholars in the next lower prestige stratum of universities. This kind of circumstance is entirely consistent with the traditional hypothesis that the chief difference between inbred scholars in high-prestige departments and scholars in departments of lesser eminence lies not in any difference in their levels of scholarly productivity, but instead in differences in their particularistic ties to the high-prestige departments. Our results also suggest that the relation between academic inbreeding and scholarly productivity found among the most eminent universities also holds throughout the prestige hierarchy of universities. Thus, the enhancement of career opportunities through particularistic ties with doctoral institutions appears to occur in lower prestige strata as well as the highest ones.

The results presented above are also consistent with McGee's hypothesis that inbred scholars are discriminated against in the allocation of institutional rewards at universities which face great financial and regional handicaps in competition in the national labor market for scholars. Although it is doubtful that the University of Texas can be adequately described as this kind of institution, universities in the lowest prestige stratum can, and it is among these latter universities that we find evidence consistent with McGee's hypothesis. It should be noted that since we have no information about the scholarly productivity levels of scientists outside U.S. graduate universities, we cannot determine whether this possible discrimination against inbred scientists exists simultaneously with discrimination for inbred scholars in terms of particularistic hiring practices. It may be, for example, that these scientists are less productive than many scientists at colleges and in industry who would choose a job in a graduate department if given the opportunity. Thus, discrimination in hiring in favor of a department's former students is not necessarily inconsistent with the discrimination against these students in the allocation of institutional rewards such as promotion in rank.

Finally, we conclude by emphasizing two points. First, our examination of the relationships among academic inbreeding, scholarly performance, and career progress obviously does not provide information about the specific mechanisms and effects of the particularistic ties which academic inbreeding may reflect. Although the results presented above are inconsistent with the claim that inbred scholars are more talented and productive than their noninbred peers, they do not imply any particular causal ordering between academic nativity and scholarly productivity. It may be, for example, that inbred scholars lack the degree of exposure to new ideas and techniques which makes for a higher level of scientific productivity and creativity (Pelz and Andrews 1966, pp. 140–53), or that their old ties to their professors inhibit the development of a sense of independence and personal innovation. Such arguments are entirely consistent with the results pre-

sented above. Second, the relationships shown above are specific to one period in the history of U.S. academic science, and although these relationships are consistent with past speculations, it may be dangerous to extrapolate them very far into the past or future. Academic inbreeding may be viewed as one manifestation of "sponsored mobility" in science, and the general levels of inbreeding in U.S. universities may be responsive to the same features of academic life previously suggested as possible determinants of sponsored mobility (Hargens and Hagstrom 1967, pp. 37–38). On the other hand, insofar as academic inbreeding varies across prestige strata of universities, the general level of inbreeding in U.S. universities as a whole may consist of very different components. For example, if inbreeding at the more eminent U.S. universities is only a residual of past intellectual parochialisms, there may be in the future the extension of an apparent trend toward less inbreeding at these universities. To the extent that inbreeding is a response to financial pressures among less eminent universities however, one may expect to observe higher rates of inbreeding at these institutions if the present financial difficulties they face are not resolved.

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