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LONG-TERM CAREERS OF ASTRONOMERS WITH DOCTORAL DEGREES FROM PRESTIGIOUS VS. NON-PRESTIGIOUS UNIVERSITIES‡

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A comparison has been made of the long-term careers of complete samples of astronomers who earned their PhD's at one prestigious (P) and one nonprestigious (NP) university. The sample sizes are 106 (degrees 1952-88) and 94 (degrees 1966-88) respectively. For both groups, the vast majority are still engaged in some aspect of astronomy or closely related sciences (90% and 74% respectively). But the fraction still engaged primarily in astronomical research and advanced teaching at PhD-granting universities and observatories is 65% for the prestigious and only 32% for the non-prestigious institution. The half-lives as members of the research publishing community are more than 30 yr vs. less than 20 yr for P vs. NP astronomers. Very little of the difference is attributable to the different distributions of dates of degrees in the two samples. A subsample of the P astronomers age-matched to the NP ones has 66% still engaged is astronomical research and advanced teaching; a large difference in publishing half-lives also persists in the subsamples with degrees since 1966.

Introduction

About 50 universities in the USA currently award doctoral degrees in astronomy. Yale has been doing so since before 1870, while many programs sprang up only in the wakes of World War II and Sputnik. Annual numbers of degree recipients range from half a dozen down to less than one, the national total having averaged 80 per year over the past decade, without any strong upward or downward trend (*Ellis* 1988).

In addition to differing in age and size, the doctoral programs differ considerably in the prestige accorded to them by the astronomical community. The three quantities are not strongly correlated (except that new, small programs generally rank rather low, if only because very few people have yet heard of them or their products). The periodically published rankings (e.g. Gourman 1987) reflect the opinions of people active in the field about the quality of both research and teaching

‡ Dedicated to the memory of Michael J. Moravcsik

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at the various institutions. There is considerable year-to-year stability in the universities ranked in the "top four," "second ten," "bottom quarter," and so forth.

The vast majority of incoming astronomy graduate students describe their long-term career goals as research or research and university teaching in the field. Graduate departments generally share this view of the primary purpose study in them. The situation in other physical sciences and engineering is undoubtedly somewhat different.

This investigations addresses long-term differences in the careers of astronomers who received their degrees from one "top four" institution (hereafter called P for prestigious) and one "second ten" institution (hereafter called NP for non-prestigious). Two points are considered: current primary professional activity and the length of time individuals continue to publish papers in the field.

The differences prove to be considerable, the P astronomers coming out ahead as you would expect. At least three causal factors might enter: (a) the higher standards for graduate admission at P may have enabled it to enroll students with greater aptitude for astronomical research; (b) students at P may have received a better education, enabling them to do more important and more interesting research, at least at the doctoral and early post-doctoral levels, and (c) the mere fact of having received a PhD from P may have resulted in the offer of better jobs, more opportunities to use first-rate research facilities and to collaborate with skilled colleagues, and more favorable refereeing of papers and research proposals, at least initially. The present data shed absolutely no light on which of these factors, or others, really matter; but the author is privately of the opinion that (c) is not negligible.

The data base

Institution P awarded 106 PhD's in astronomy between 1952 and 1988, and NP awarded 94 degrees between 1966 and 1988. Names of the recipients and current addresses of those who have chosen to maintain contact with their alma maters were provided by the departments (initially for other purposes). Current professional affiliations are those listed in *Boyce* (1988), *Havens* (1988), or on recent publications.

Publishing histories were extracted from *Esser* et al. (1988) and earlier volumes in the series dating back to the earliest PhD in the sample. This series of abstracts (*Astronomy and Astrophysics Abstracts* since 1969; *Jahrsbericht* before that) is exceedingly complete for articles, papers, and books on astronomy and astrophysics published in research journals with a significant physical sciences content in all the

world's major scientific languages. Such completeness is possible only because the field is a relatively small one, annual numbers of papers and authors being each currently between 20,000 and 25,000. Papers are assigned to numerical categories on the basis of subject matter within the Abstracts volumes and indexed by author, making it exceedingly easy to determine who has published and on roughly what subjects in each year.

The primary current professional activity of each of the 200 astronomers was determined from his place of employment, title, and whether or not he is currently publishing, supplemented in a few cases by personal knowledge. The nine categories of employment were: A – astronomical research and advanced teaching at observatory or PhD-granting university; AL – astronomical research at a government or industrial lab (e.g. Goddard Space Flight Center, Bell Labs); S – research and advanced teaching in another science; AS – support of astronomical research (generally data processing or development of hardware or software); G – government employment (usually science administration); I – industrial employment involving little or no published research (but technologically oriented in most cases); T – teaching at a non-PhD-granting institution; H – home address only listed in alumni records or society membership rosters and not currently publishing; X – lost to follow-up (has not maintained contact with alma mater, not current member of American Astronomical Society or American Physical Society, and not currently publishing). Astronomers who are retired or deceased (five from P, one from NP) are assigned to their most recent professional activity. Eight astronomers from P and four from NP employed outside the USA, most in the countries of their birth, are included in the samples. The number of female astronomers (6 from P, 11 from NP) is too small to permit separate analysis.

Each astronomer was deemed to have been part of the publishing community from the date of this PhD to the date of the last technical (research, review, etc.) paper or book on which his name appeared as author or co-author. Seven people (2 from P, 5 from NP) never published at all. Nearly all the rest produced at least one paper a year up either to the present or to an abrupt cutoff, immediately suggesting an analogue of medical survival statistics as the proper way of presenting the data. For various reasons, all of the retired and deceased astronomers remain members of the publishing community for several years after their nominal departures.

Results

Table 1 shows current professional activities of astronomy doctoral recipients from the prestigious (P) and non-prestigious (NP) universities, grouped into the nine categories described in the previous section. The categories are ordered from most to least like the research and teaching jobs envisioned by most beginning students and their departments. About twice as many P astronomers (65%) as NP ones (32%) are in the "most desirable" category, A, of research and advanced teaching at observatories and PhD-granting universities.

Table 1

Current professional activities of astronomers who received their PhD's from a prestigious (P) and a non-prestigious (NP) university. Categories of employment are defined in Sect. II. Fractions of each sample in each category are given in parentheses under the absolute numbers. P' is an artificial sample of P astronomers age-matched to the NP ones and normalized to a total of 100

	A	AL	S	AS	I	G	T	H	X	Total
P	69	7	8	6	8	2	3	1	2	106
	(0.69)	(0.07)	(0.08)	(0.06)	(0.08)	(0.02)	(0.03)	(0.01)	(0.02)	(1.0)
NP	30	11	10	15	9	3	5	8	3	94
	(0.32)	(0.12)	(0.11)	(0.16)	(0.10)	(0.03)	(0.05)	(0.08)	(0.03)	(1.0)
P'	66.7	5.6	7.6	4.8	10.0	0.0	2.7	0.7	1.9	100

Because the P doctoral program is older than the NP one, some of the difference might be due to its products having joined the astronomical community when good jobs were easier to get (if you are too young to remember this period, let me assure that, in addition, the towers were made of real ivory and all our students were above average). This hypothesis is tested in the last line of the Table, which represents an artificial sample, P', of the P astronomers age-matched to the NP ones. It was constructed by considering the two real samples divided into chronological cohorts (1966-70, 71-75, 76-80, and 81-88) and choosing for the artificial sample a fraction of each P cohort corresponding to the fraction of NP astronomers who received their degrees during that time period. For instance, 0.266 of the NP degrees were awarded between 1976 and 1980. Nineteen P astronomers received their degrees during the same period and are currently in categories A(14), AL(1), S(1), AS(1), and I(2). Hence that cohort contributes 0.266 X (14/19) to category A of the artificial sample, 0.266 X (1/19) to category AL, and so forth. Each of the nine categories was summed across the six cohorts and the final numbers normalized to a total of 100 astronomers in the artificial sample P'. Since 66% of the members of this artificial sample are in category A, the difference in age distribution between the P and NP

astronomers is clearly not the main reason for the differences in their present professional activities.

Figure 1 presents the publishing histories of the P and NP astronomers. It shows the fraction of all astronomers who could have been publishing N years past the PhD (in the sense of having had their degrees for N years, even if retired or deceased) who were, in fact, still publishing. The P points remain above the NP one for all values of N (years). Both start off from less than unity because a few PhD recipients never published anything, not even meeting abstracts of their thesis work.

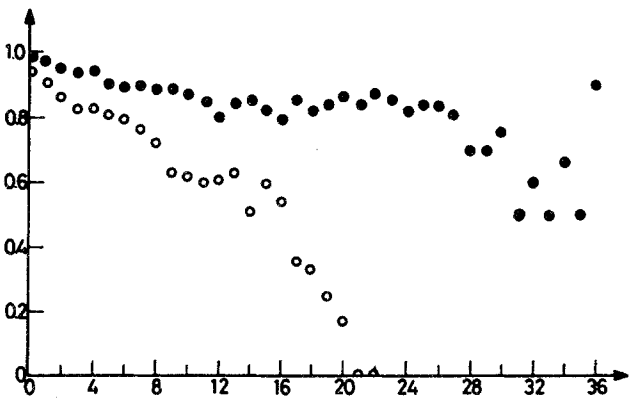

Fig. 1. Fraction of PhD astronomers still publishing papers abstracted in *Esser* et al. (1988) and preceeding volumes of *Astronomy and Astrophysics Abstracts* as a function of N, the number of years past the PhD. Upper points pertain to 106 astronomers with degrees from a prestigious university, P, and lower points to 94 astronomers with degrees from a non-prestiqious university, NP. Numbers in the samples fall below 10 at 18 years for NP and 28 years for P. Neither set of points starts off from unity at N = 0 because a few astronomers from each institution never published anything

The extreme right hand ends of both curves pertain to very few people, NP dropping below 10 at 18 years and P at 28 years. Thus statistics of small numbers introduce a good deal of noise. But the P curve clearly has an assymptote near 0.5 (in that, of the first six PhD recipients, two are dead, one retired, and the other three still hard at work), while the NP curve drops much lower (with only one of the first six degree recipients still active in research). The half-lives for the samples seem to be about 35 and 17 years respectively.

Again one might attribute much of the difference to the P program having produced its PhD's earlier. The median degree dates for the two groups are 1974 for P and 1976 for NP, but P of course has a much longer tail. Figure 2 tests this hypothesis by comparing the publishing history of the complete NP sample with that

of P astronomers who received degrees in 1966-88. The right-hand four point for each involve 10 or fewer people. Some of the difference has disappeared. Only about 70% of the younger P astronomers are still publishing after 18 years, while about 90% of the complete P sample were, but this is still twice the participation of the NP astronomers, only a third of whom continued as long.

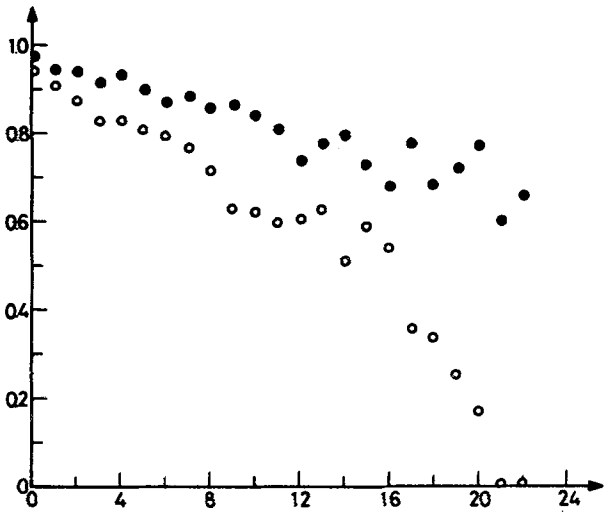

Fig. 2. Fraction of PhD astronomers still publishing papers abstracted in *Esser* et al. (1988) and preceeding volumes as a function of number of year, N, past the PhD earned between 1966 and 1988. Upper points pertain to 85 astronomers with degrees earned during that period from a prestigious university, P, and lower points to 94 astronomers with degrees from a non-prestigious university, NP. Numbers in the samples fall below 10 past 18 years for both samples. Neither set of points starts off from unity at N = 0 because a few astronomers from each institution never published at all. The two sets of point are clearly different, but not so much so as those in Fig. 1, suggesting that younger astronomers, from any institution, are having greater difficulty staying within the community than did older ones at the same stages in their careers

Conclusions and implications

Receiving an astronomy PhD from a prestigious rather than a non-prestigious university is clearly predictive of a high probability of achieving a long-term career in research and advanced teaching (the avowed goals of most graduate students and departments of the subjects). The data have nothing to say about the reasons for the correlation. These might include creditable (the prestigious institutions have their reputations because they really provide a better education), neutral (institutions like

P skim the cream off the available entering graduate student pool), and slightly discreditable (honors and dollars are bosons) items.

But, whatever the causes of the greater success of the P astronomers, the moral is that, from the point of view of long-range career goals, we should advise our promising undergraduates to go to the highest-ranked graduate school they can get into, even if it means accepting less desirable teaching assistantships or other personal disadvantages.

A slightly subtle implication of line P' of Table 1 and Fig. 2 is that good jobs really are harder to find than they used to be, even for astronomers from the prestigious P institution. The fraction in category A is currently the same for both older and younger cohorts from P. But people continue to diffuse out of the research and publishing communities throughout their lives, and they generally do not come back (though there is constant diffusion into astronomy from physics and other disciplines) – no member of the current sample resumed publication in astronomy after a hiatus as long as five years. Thus, a decade or two in the future, the fraction of the younger cohorts still publishing and still holding category A jobs is likely to be less than the present values of 65-70% and so smaller than the values that now pertain to the older cohorts.

I do not know where Michael Moravcsik did his graduate work, but I am sure he would have been a productive scholar no matter what sort of institution he had attended!

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