



Cornell University
ILR School

Cornell University ILR School
DigitalCommons@ILR

Cornell Higher Education Research Institute
(CHERI)

Centers, Institutes, Programs

March 2004

The Changing Composition of American-Citizen PhDs

Jeffrey A. Groen
Bureau of Labor Statistics

Michael J. Rizzo
Centre College

Follow this and additional works at: <https://digitalcommons.ilr.cornell.edu/cheri>

Thank you for downloading an article from DigitalCommons@ILR.

Support this valuable resource today!

This Article is brought to you for free and open access by the Centers, Institutes, Programs at DigitalCommons@ILR. It has been accepted for inclusion in Cornell Higher Education Research Institute (CHERI) by an authorized administrator of DigitalCommons@ILR. For more information, please contact catherwood-dig@cornell.edu.

The Changing Composition of American-Citizen PhDs

Abstract

We describe patterns in the composition of American-citizen doctorate recipients from the early 1960s to 2000. The propensity of bachelor's degree recipients to earn PhDs varied widely during the 1960s and 1970s, especially for men, but has been relatively constant since the early 1980s. PhD propensity varies widely across students from different types of BA institutions, with higher propensities among those attending research universities and selective liberal-arts colleges. The share of PhDs awarded to women increased dramatically over the past 40 years and was driven largely by increases in the number of women earning BAs.

Keywords

PhDs, Bachelor degree, American citizens, gender

Comments

Suggested Citation

Groen, J. A. and Rizzo, M. J. (2004) *The changing composition of American-citizen PhDs* (CHERI Working Paper #48). Retrieved [insert date], from Cornell University, ILR School site: <http://digitalcommons.ilr.cornell.edu/cheri/19/>

Required Publisher Statement

Published by the Cornell Higher Education Research Institute, Cornell University.

The Changing Composition of American-Citizen PhDs*

Jeffrey A. Groen
Bureau of Labor Statistics
and
Cornell Higher Education Research Institute

Michael J. Rizzo
Centre College
and
Cornell Higher Education Research Institute

March 9, 2004

Abstract

We describe patterns in the composition of American-citizen doctorate recipients from the early 1960s to 2000. The propensity of bachelor's degree recipients to earn PhDs varied widely during the 1960s and 1970s, especially for men, but has been relatively constant since the early 1980s. PhD propensity varies widely across students from different types of BA institutions, with higher propensities among those attending research universities and selective liberal-arts colleges. The share of PhDs awarded to women increased dramatically over the past 40 years and was driven largely by increases in the number of women earning BAs.

* Addresses (as of Sept. 1, 2004): Groen: Bureau of Labor Statistics, 2 Massachusetts Ave. NE, Suite 4945, Washington, DC 20212 (e-mail: jg277@cornell.edu); Rizzo: Centre College, Department of Economics, Danville, KY 40422 (e-mail: mjr38@cornell.edu). This article is a condensed version of the paper we presented at the "Science and the University" conference in May 2003 at Cornell University. We are grateful to the Andrew W. Mellon Foundation and the Atlantic Philanthropies (Inc.) USA for funding through the Cornell Higher Education Research Institute. We thank Ronald Ehrenberg, Walter Cohen, and conference participants for helpful comments, and Andrew Nutting for research assistance.

1. Introduction

American research universities are admired at home and abroad. Doctoral programs at U.S. universities increasingly attract students from other countries, especially in science fields. As a consequence, the share of doctorates at U.S. universities awarded to U.S. citizens has fallen substantially over the previous four decades. In this paper, we describe changes in the composition of American-citizen doctorate recipients from the early 1960s to 2000. We examine composition in terms of fields of doctoral study, type of undergraduate institution, gender, and race/ethnicity.

Doctorate recipients represent the primary source of new talent in many occupations and professions. Doctorates in science and engineering are of particular interest to researchers and federal policymakers. The size and quality of the nation's scientific workforce are perceived to affect the pace of innovation and economic growth. Of particular interest for science and technology policy is how the number and composition of new PhDs responds to the wages of scientists and engineers.

The flow of new doctorates is also relevant for our nation's colleges and universities – in several ways. First, these institutions train future PhD recipients at the undergraduate level. Describing the undergraduate origins of doctorate recipients illustrates the role of different types of institutions in preparing and inspiring their students to enter PhD programs. Second, the demographic composition of new PhD recipients reflects in part the ability of graduate programs to attract increasing numbers of women and racial minorities. Third, since colleges and universities themselves employ a large share of new PhD recipients as professors, the composition of doctorates is relevant for understanding the composition and structure of academic labor markets.

The next section of the paper describes overall trends among U.S. citizens, including the number of doctorates and the proportion of those with bachelor's degrees going on to earn PhDs. The paper then turns to changes in composition along various dimensions: field of study, type of undergraduate institution, gender, and race/ethnicity. Throughout the paper, we pay particular attention to trends within science fields. Since we cover a lot of ground, our approach is primarily descriptive. However, we also point towards potential explanations for some of the trends. While we are not the first to discuss the composition of doctorate recipients, we do present a rather complete picture of changes along many dimensions of doctoral flows to U.S. citizens over the past 40 years.¹

2. Data and Overall Trends for U.S. Citizens

2.1 Data on Doctorate Recipients

Our data on the number and characteristics of individuals receiving doctorates are based on the Survey of Earned Doctorates. The survey, conducted since 1958, is an ongoing census of all individuals earning research doctorates at U.S. universities.² The surveys are completed by doctorate recipients once they have satisfied the requirements for their degrees. The survey collects information on demographics, including gender, citizenship, ethnicity, and racial group; education history, including field of degrees; sources of graduate student support; employment status during the year preceding receipt of the doctorate; post-graduation plans; and parents' education. Since almost all doctorate recipients complete and return the survey, it is the most reliable source of national data on doctorate recipients.³ In this paper, we examine trends in doctorate recipients since 1963.⁴

2.1 Trends by Citizenship

As a context for analyzing trends among U.S. citizens, we first present trends in the total number of doctorates conferred, including those awarded to U.S. citizens and non-U.S. citizens. The total number of PhDs conferred by U.S. universities has increased substantially over the past 40 years, rising from 12,720 in 1963 to 41,368 in 2000 (figure 1).⁵ The time trend can be broken into three parts. From 1963 to 1973, the number of PhDs conferred grew rapidly (at an average rate of 10 percent per year) and the growth was fueled by PhDs awarded to U.S. citizens. The number of PhDs conferred then declined slightly over the next period, 1973-1985. Since 1985, the number of PhDs conferred has grown gradually among both U.S. citizens and non-U.S. citizens.

<Insert Figure 1 about here>

The increasing presence of non-U.S. citizens in U.S. doctoral education is evident in these data. The share of PhDs awarded to U.S. citizens has fallen from 87 percent in 1963 to 71 percent in 2000 (figure 2). The decline was concentrated over the period from 1980 to the mid-1990s. The drop was particularly strong in science fields, where the U.S.-citizen share fell from 75 percent in the mid-1960s to 52 percent in 2000. (In this paper, we distinguish between “science” and “non-science” fields; “science” fields are defined as life sciences, physical sciences, and engineering. See Appendix A for details.) In contrast to the pattern over the previous 30 years, it is worth noting that the U.S.-citizen share increased slightly in the late 1990s. This recent trend appears to be driven by the life sciences, for which the U.S.-citizen share increased from 61 percent in 1996 to 70 percent in 2001. For the remainder of the paper, we limit our analysis to U.S. citizens.

<Insert Figure 2 about here>

2.2 *PhDs and BAs*

Given the general expansion of higher education in the U.S. since World War II, a useful way of understanding trends in the number of PhDs conferred to U.S. citizens is by comparison to the number of BA degrees awarded. The number of PhDs awarded in year t , G_t , can be decomposed into two terms using the following identity (Bowen, Turner, and Witte 1992):

$G_t = p \times B_{t-9}$. B_{t-9} is the number of BA degrees conferred 9 years earlier. Since having a BA is typically a prerequisite for entering a PhD program, B_{t-9} measures the pool of prospective PhD students and is therefore a natural reference group for PhD recipients in year t . The second part of the identity, p , is the ratio of G_t and B_{t-9} : the number of PhDs conferred in year t as a proportion of the number of BAs conferred 9 years earlier. We call p “PhD propensity” because it is a measure of the propensity for a given cohort of BA recipients to earn PhDs.

This identity is useful for interpreting trends in PhDs conferred (overall and within sub-groups) because it separates changes in the number of PhDs conferred into those due to changes in the pool of prospective PhD students (the size of the BA cohort) and those due to changes in the propensity of successive cohorts to pursue and complete PhDs. In particular, patterns in PhD propensity should reflect changes in the incentives to pursue graduate study, such as funding available for graduate study and job prospects in academic labor markets. Our data on BA degrees awarded are taken from the Earned Degrees Conferred Survey, an annual survey of colleges and universities conducted by the U.S. Department of Education.⁶ We use a 9-year lag based on the typical number of years between BA receipt and PhD receipt. The median total time span between the baccalaureate and doctorate has risen from 8.0 years for 1966 doctoral recipients to 10.3 years for 2000 doctoral recipients. Given that students who earn their BA in a

given year take different amounts of time to earn a PhD, our matching of BA and PhD cohorts is not exact. However, it does provide a useful metric for understanding large changes.⁷

The pool of prospective PhD recipients, as indicated by the number of BAs conferred 9 years earlier, has increased substantially over the postwar period (figure 3). However, the increase from 265,000 BAs in 1954 (9 years earlier than the 1963 PhD cohort) to 1.1 million BAs in 1991 (2000 PhD cohort) has not been uniform. The size of the prospective-PhD pool grew steadily over the first part of the period (1963-1973 PhD cohorts), increased rapidly through 1985, and increased slightly through recent PhD cohorts. Dividing the number of PhDs conferred by the number of BAs conferred 9 years earlier produces an interesting pattern (figure 4). The number of PhDs conferred to U.S. citizens in 1963 represented 4.2 percent of BAs conferred in 1954. Throughout the 1960s, PhD propensity increased rapidly, rising to 7 percent for the 1971 PhD cohort. However, PhD propensity plummeted over the next decade, falling to 2.6 percent for the 1982 PhD cohort. Since then it has been relatively stable at 2.5-2.8 percent.

<Insert Figure 3 about here>

<Insert Figure 4 about here>

PhD propensity is greater among students in science fields. In 2000, PhDs in science represented 5 percent of BAs in science 9 years earlier, while PhD propensity overall was 2.5 percent. Despite this difference, since 1975 the trend in PhD propensity in the sciences is quite similar to the overall trend (figure 4). Throughout the period, PhD propensity is roughly 2.5 percent higher among students in science. The late 1990s represent a notable exception to the common trends, however. While PhD propensity was stable overall, it increased among students in science. The increase from 4.2 percent in 1995 to 5 percent in 1998 reflected a decrease in the number of science BAs (see figure 3) and an increase in the number of science PhDs.

The trends in PhD propensity and BA degrees conferred over all fields can shed some light on trends in PhDs awarded to U.S. citizens (see figure 1). For each of the three measures, there are three distinct periods of change, as noted above, and these periods roughly coincide across the measures. Over the first period, 1963 to 1971, the rapid increase in PhD propensity and steady growth in the number of BAs conferred fueled rapid growth in the number of PhDs conferred. From 1971 to 1983, the number of PhDs declined because of the steep decline in PhD propensity, in spite of the strong growth in the number of BAs. Since 1983, the number of PhDs has increased slightly due to modest growth in the number of BAs, while PhD propensity has been stable.

3. Field of Study

We now turn from trends in the overall number of PhDs conferred to U.S. citizens to trends in the composition of new doctorate recipients along a variety of dimensions. We first consider changes in the composition of new PhDs across broad fields of study. In 2000, about 40 percent of PhDs awarded to U.S. citizens were in the three science fields: 20 percent in life sciences, 12 percent in physical sciences, and 8 percent in engineering (table 1). Among the non-science fields, about 20 percent of PhDs were awarded in both social sciences and education, and 11 percent were awarded in humanities.

<Insert Table 1 about here>

Given that the total number of PhDs awarded to U.S. citizens across all fields has nearly doubled since 1966, it is perhaps not surprising that the number of PhDs awarded in each of the six broad fields has increased over the 1966-2000 period. However, some fields grew faster than others. Among the science fields, life sciences grew the fastest, increasing as a share of all PhDs from 15 percent in 1966 to 20 percent in 2000. In contrast, the share of all PhDs in engineering

and physical sciences fell over the period. As a whole, the share of PhDs awarded in the science fields fell from 47 percent in 1966 to 39 percent in 2000. Among the non-science fields, social sciences increased the fastest, from 15 percent in 1966 to 20 percent in 2000, with education and humanities each having the same share of PhDs in 1966 and 2000.

4. Type of Undergraduate Institution

Next, we explore the composition of doctorate recipients by the type of institution they attended as undergraduates. The undergraduate origins of PhD recipients are relevant for understanding the role that different types of institutions play in preparing and motivating undergraduate students to pursue graduate study. The number of PhD recipients who attended a certain type of college or university as undergraduates reflects a variety of factors. First, institutions that train large numbers of undergraduates (e.g., public universities) will produce a lot of PhD recipients merely because of their scale, even if a relatively small share of their undergraduates pursues a PhD. Second, institutions may differ in the share of their undergraduates who pursue PhD study merely because of the sorting (by academic ability and interests) created by the college-admissions process. Third, institutions and their faculty may directly encourage their undergraduate students to pursue PhD study. Of course, this could happen through strong preparation in a particular discipline. In addition, it might also be important to expose undergraduates to research, such as writing a senior thesis or assisting a professor with a research project.

Looking first at the control of the institution, the number of PhD recipients who attended public institutions as undergraduates far exceeds the number who attended private institutions. For instance, 59 percent of PhD recipients in 2000 attended public institutions. However, PhD propensity is greater among students who attended private institutions: 2.8 percent in 2000

compared to 2.1 percent among students who attend public institutions. The share of PhD recipients who attended public institutions as undergraduates has grown over time from 51 percent in 1963 to 59 percent in 2000. This growth reflects the differential growth in the size of public and private undergraduate sectors. In particular, the public BA sector grew much more rapidly from 1963 to 1974 (see Groen and Rizzo 2003). The trends in PhD propensity, on the other hand, are remarkably similar for students from both sectors and follow the overall pattern in figure 4.

The majority of PhD recipients attended research universities as undergraduates. In 1963 and 2000, 61 percent of PhD recipients attended research universities. In addition, 21 percent of PhD recipients in 2000 attended Master's-level institutions and 18 percent attended liberal-arts colleges. Liberal-arts colleges have played a slightly increasing role in preparing students for PhD study, increasing their share by 5 percentage points over the 1963-2000 period. While liberal-arts colleges produce the fewest PhD recipients of the three groups, the propensity of their students to earn PhDs is comparable to that of research universities. In 2000, PhD propensity was about 3 percent for students from both types of institutions, compared to 1.5 percent among students from Master's institutions. The time pattern of PhD propensity for each group is similar to the overall pattern among U.S. citizens (figure 5).

<Insert Figure 5 about here>

The relatively high PhD propensity for students who attended private institutions and liberal-arts colleges presumably reflects the tendency for these institutions to attract students who are academically talented. To get at the notion of the "quality" of an undergraduate institution, we use U.S. News and World Report (2002) rankings to identify the top 10 liberal-arts colleges and the top 10 research universities. Not surprisingly, PhD propensity is much higher among

students at top-10 institutions. PhD propensity in 2000 was 13 percent among students at top-10 liberal-arts colleges and 10.6 percent at top-10 research universities, compared to about 3 percent among all institutions in each category.

From 1975 to the mid-1980s, PhD propensity at these institutions dropped dramatically, following the overall trend. Since the mid-1980s, PhD propensity overall and within the broad categories defining institution types has been relatively stable. At top-10 institutions, by contrast, PhD propensity rose over the period: from 1986 to 2000, it rose from 8.5 percent to 13 percent among liberal-arts colleges and from 9.1 percent to 10.6 percent among research universities (figure 6). The differential trend at top-10 institutions might reflect the increasing concentration of top students at elite institutions over this period (Cook and Frank 1993, Hoxby 1997).⁸

<Insert Figure 6 about here>

5. Demographic Characteristics

5.1 Gender

The presence of women among doctorate recipients has increased markedly since the 1960s. In 1966, men earned 88 percent of all PhDs awarded to U.S. citizens. By 2000, the gender gap in overall PhDs awarded had nearly vanished, with men and women each earning roughly half of all PhDs. The share of PhDs awarded to women has increased continuously over the period in each of five broad fields (table 2). In science fields, the share of PhDs awarded to women increased from 6 percent in 1966 to 37 percent in 2000. While the gender gap has disappeared in the aggregate, women are still relatively more represented in social sciences and education, and less represented in the sciences.

<Insert Table 2 about here>

While the share of PhDs awarded to women has increased continuously since the 1960s, the gender gap as measured by the raw difference in PhDs awarded has not. It widened substantially in the late 1960s and early 1970s, reaching a peak in 1971 (figure 7). This was due to differences between men and women in the time pattern of PhDs awarded. Since 1963, the number of PhDs awarded to women has increased steadily. On the other hand, the number of PhDs awarded to men increased rapidly in the late 1960s, decreased from the early 1970s to the mid-1980s, and has been relatively stable since then. The time pattern for science fields is similar to that for all fields.

<Insert Figure 7 about here>

The rise and fall in PhDs awarded to men was driven in large part by variation in PhD propensity across cohorts. In particular, in the late 1960s PhD propensity for men increased modestly, from 6 percent in 1963 to 10 percent in 1971. However, it reversed course at this point and fell dramatically over the 1970s. Between the 1971 and 1981 PhD cohorts, PhD propensity for men fell from 10 percent to 3.2 percent (figure 8). The abrupt reversal in PhD propensity for men in 1971 appears to have been the result of the end of Vietnam-war draft deferments for graduate students in 1967-68 (Bowen, Turner, and Witte 1992). Women were not subject to the draft and the pattern of PhD propensity over the early 1970s is different for them. From 1971 to 1975, PhD propensity for women rose, continuing the trend from the early 1960s.

<Insert Figure 8 about here>

Over the late 1970s, however, PhD propensity fell for women as well, albeit less rapidly than it was falling for men. This suggests a general weakening in PhD prospects. Since 1980, PhD propensity has been relatively stable for both groups, at about 3 percent for men and 2.5 percent for women. Despite the lower PhD propensity for women, the tremendous growth in the

number of BAs awarded to women allowed the number of PhDs awarded to women to continue to rise. For men, on the other hand, the number of PhDs has been relatively stable since the early 1980s because both PhD propensity and the number of BAs awarded have been stable. Within science fields, PhD propensity is higher for both men and women, but the time trends are similar to those over all fields.

Examining trends in PhD propensity raises questions about the propensity of men and women in different cohorts to pursue post-BA training generally, not just PhDs. In particular, to what extent do changes in PhD propensity over time reflect shifts between PhDs and other graduate degrees, versus attainment of graduate degrees altogether? We address this question with data on degrees awarded to men and women since 1971 in three professional fields: medicine, law, and business (i.e., MD, JD, and MBA degrees). Professional degrees in these fields are the principal alternatives to the PhD for most students. Compared to PhD programs, professional-degree programs typically offer higher completion rates and shorter times-to-degree.

For each of the three fields, we examine trends in both the number of degrees conferred and the propensity of men and women with BAs to earn the degree (figure 9). We measure propensity following the method for PhDs, except that we use a 5-year lag to reflect the shorter length of these programs relative to PhD programs. The trends reveal several interesting facts. (1) The falling PhD propensity for men in the 1970s is not explained by shifts from PhDs to professional degrees. On the contrary, the propensity of men to earn professional degrees fell in medicine and law and was relatively stable in business. This is consistent with the explanation that their PhD propensity fell because of the end of draft deferments. (2) While PhD propensity has been stable for men and women since the early 1980s, MBA propensity has increased for

both men and women, JD propensity has been stable for both men and women, and MD propensity has decreased for men and increased for women. (3) Considering together PhDs and the professional degrees, the share of men with BAs going on to earn one of them decreased in the 1970s and increased in the 1980s and 1990s. For women, on the other hand, the corresponding share increased in all three decades.

<Insert Figure 9 about here>

5.2 Race/Ethnicity

It is well-known that certain racial/ethnic minorities are underrepresented among doctorate recipients relative to their presence among BA recipients or among the general population. Indeed, this is the basis for special assistance at the undergraduate level to encourage minorities to pursue PhD programs, especially in the sciences. Among PhDs awarded to U.S. citizens in 2000, 5.8 percent were awarded to blacks, 4.9 percent to Asians, and 4.2 percent to Hispanics. Since 1975, the share of PhDs awarded to each minority group has increased (figure 10). In particular, the share of PhDs awarded to Asians and Hispanics increased steadily from around 1 percent in 1975 to 4-5 percent in 2000. The share awarded to blacks, on the other hand, fluctuated between 3 and 4 percent from 1974 to the late 1980s before increasing in the 1990s.

<Insert Figure 10 about here>

Given the increasing presence of minority groups among PhDs awarded in the 1990s, it is relevant to ask whether the trends are different by field of study. To be sure, the presence of minority groups varies greatly across fields at a point in time. In 2000, for instance, blacks represented 12 percent of PhDs awarded in the field of education but only 3 percent of PhDs awarded in the sciences (table 3). On the flip side, Asians represented 2 percent of PhDs in

education and 8 percent of PhDs in the sciences. The presence of Hispanics is the least variable of the three groups across fields.

<Insert Table 3 about here>

Within science fields, the time pattern for the share of PhDs awarded to minority groups has followed the trend over all fields. Notably, in the 1990s each group experienced an increase in its share of science PhDs. In fact, this happened not only in science but also in education, humanities, and social sciences (table 3). Blacks and Asians experienced the largest gains in their share of PhDs in the fields in which they had the strongest presence in 1990: blacks in education and Asians in the sciences. Hispanics made the largest gains in education.

Increasing shares of PhDs awarded to minority groups could reflect demographic trends and/or an increasing propensity of BA recipients to earn PhDs. For doctorate recipients in 2000, PhD propensity was 3.4 percent for Asians, 2.5 percent for blacks, 2.3 percent for Hispanics, and 2.5 percent for whites. (In the sciences, PhD propensity was 4.8 percent for Asians, 2.3 percent for blacks, 3.2 percent for Hispanics, and 5.2 percent for whites.) Trends in PhD propensity by race from 1986 to 2000 reveal some interesting facts (figure 11). Over this period, PhD propensity increased modestly for blacks, increased slightly for Hispanics, and decreased slightly for Asians. As a consequence of these patterns (and the relatively stable propensity for whites), racial differences in PhD propensity narrowed from 1986 to 2000. (Trends within the sciences are similar.)

<Insert Figure 11 about here>

Since PhD propensity decreased for Asians, their increasing share of PhDs must be due to increases in the number BAs awarded. For blacks and Hispanics, on the other hand, PhD

propensity increased. Therefore, the increasing share of PhDs awarded to blacks and Hispanics is due to increases in both PhD propensity and in the number of BAs awarded.

6. Conclusion

We have identified several key trends in the composition of doctorates awarded to U.S. citizens since the early 1960s. First, the propensity of bachelor's degree recipients to earn PhDs varied widely during the 1960s and 1970s, especially for men. In particular, PhD propensity for men declined rapidly in the early 1970s. This change appears to have been driven in large part by the end of Vietnam-war draft deferments for graduate students. More generally, we would like to better understand the factors behind the trends in PhD propensity over the entire period. For instance, how does PhD propensity depend on factors reflecting the cost of graduate study, such as tuition, the availability of scholarships and research grants, and the foregone earnings while in graduate school? How does it depend on the structure of PhD programs and the wages and employment opportunities in occupations requiring a PhD and those in alternative careers? Evidence on these questions would appear to be important in evaluating the effectiveness of various governmental and institutional policies.

Regarding the undergraduate origins of doctorate recipients, the number of PhD recipients who attended particular types of institutions depends on both the relative size of the sectors and the propensity of students from each sector to earn PhDs. The time trends in PhD propensity are remarkably similar across different sectors. What stands out, instead, are differences in PhD propensity across sectors at a point in time. For instance, students who attended private institutions and research universities as undergraduates are more likely to earn PhDs. An open question is the extent to which these differences reflect the academic

qualifications of students upon entering undergraduate training versus the ability of institutions to create interest and aptitude for graduate study.

In terms of demographics, the most significant change over the past 40 years has been the dramatic increase in the presence of women among doctorate recipients. Overall, PhDs awarded to women as a share of the total increased from 11 percent in 1963 to 49 percent in 2000. This increase was driven largely by increases in the number of women earning BAs and by decreases in PhD propensity for men. Over the 1980s and 1990s, professional degrees (especially in business) have become increasingly common for both men and women, while PhD propensities have remained stable. Separately, racial and ethnic minorities have increased their presence among doctorate recipients within several fields, especially since 1990. Differences in PhD propensity across racial/ethnic groups have narrowed since the mid-1980s.

¹ Recent studies using similar data sources include Bowen and Rudenstine (1992), Ehrenberg (1992), and Lomperis (1992).

² For convenience, we use the terms “PhD” and “doctorate” interchangeably, since most research doctorates are PhDs. Among doctorates that are not PhDs, the large majority are in the field of education (EdD).

³ The overall response rate for the 2000 survey was 92 percent. Annual response rates have varied over the 1967-2000 period from 91 percent to 98 percent (Hoffer et al. 2001).

⁴ Our data from the Survey of Earned Doctorates for 1966-2000 are taken from WebCASPAR, a web-based database system maintained by the National Science Foundation containing information from a variety of surveys. Data for 1963-1965 are taken from a published report (National Academy of Sciences 1967).

⁵ Throughout the paper, year t refers to the academic year ending on June 30 of calendar year t . For example, “year 2000” refers to the period from July 1, 1999, to June 30, 2000.

⁶ Data for BA degrees awarded 1966-1991 are taken from WebCASPAR (see note 4). For 1954-1965, our BA data are based on published reports (U.S. Department of Health, Education, and Welfare, various years).

⁷ An alternative would be to organize the Survey of Earned Doctorates data by BA cohort rather than PhD cohort, as in Bowen, Turner, and Witte (1992). However, the underlying micro data are not publicly available and the public-use tabulations are organized by PhD cohort. As a consequence, researchers typically organize the data by PhD cohort.

⁸ Cook and Frank (1993) present evidence that the concentration of top students increased slightly between the 1960s and 1970s but increased substantially between the 1970s and 1980s. The increase in concentration in the 1980s roughly corresponds to the timing of the increase in PhD propensity among students at top-10 BA institutions.

Appendix A. Field Classification

Science

Physical Sciences

- Chemistry
- Physics and Astronomy
- Earth, Atmospheric, and Marine Sciences
- Mathematics and Statistics
- Computer Sciences

Life Sciences

- Biological Sciences
- Agricultural Sciences
- Health and Medical Sciences
- Other Life Sciences

Engineering

Non-Sciences

Humanities

- History
- English and Literature
- Foreign Languages
- Other Humanities

Social Sciences

- Psychology
- Economics
- Political Science and Public Administration
- Sociology
- Anthropology
- Linguistics
- Other Social Sciences

Other

- Business and Management
- Arts and Music
- Religion and Theology
- Communication and Librarianship
- Social Service Professions
- Other Professional Fields
- Other Fields

References

- Bowen, William G. and Neil L. Rudenstine. 1992. *In pursuit of the PhD*. Princeton, NJ: Princeton Univ. Press.
- Bowen, William G., Sarah E. Turner, and Marcia L. Witte. 1992. The B.A.-Ph.D. nexus. *Journal of Higher Education* 63 (1): 65-86.
- Carnegie Foundation for the Advancement of Teaching. 1994. *A classification of institutions of higher education*. Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.
- Cook, Philip J. and Robert H. Frank. 1993. The growing concentration of top students at elite schools. In *Studies of supply and demand in higher education*, ed. Charles T. Clotfelter and Michael Rothschild, 121-140. Chicago: Univ. of Chicago Press.
- Ehrenberg, Ronald G. 1992. The flow of new doctorates. *Journal of Economic Literature* 30 (2): 830-875.
- Groen, Jeffrey A. and Michael J. Rizzo. 2003. The changing composition of American-citizen PhDs.” Paper presented at *Science and the University* conference, Cornell Higher Education Research Institute, Ithaca, NY, May 20-21, 2003, <http://www.ilr.cornell.edu/cheri/>.
- Hoffer, Thomas B., Bernard L. Dugoni, Allen R. Sanderson, Scott Sederstrom, Rashna Ghadialy, and Peter Rocque. 2001. *Doctorate recipients from United States universities: Summary report 2000*. Chicago: National Opinion Research Center.
- Hoxby, Caroline M. 1997. How the changing market structure of U.S. higher education explains college tuition. Working Paper 6323, National Bureau of Economic Research, Cambridge, MA.

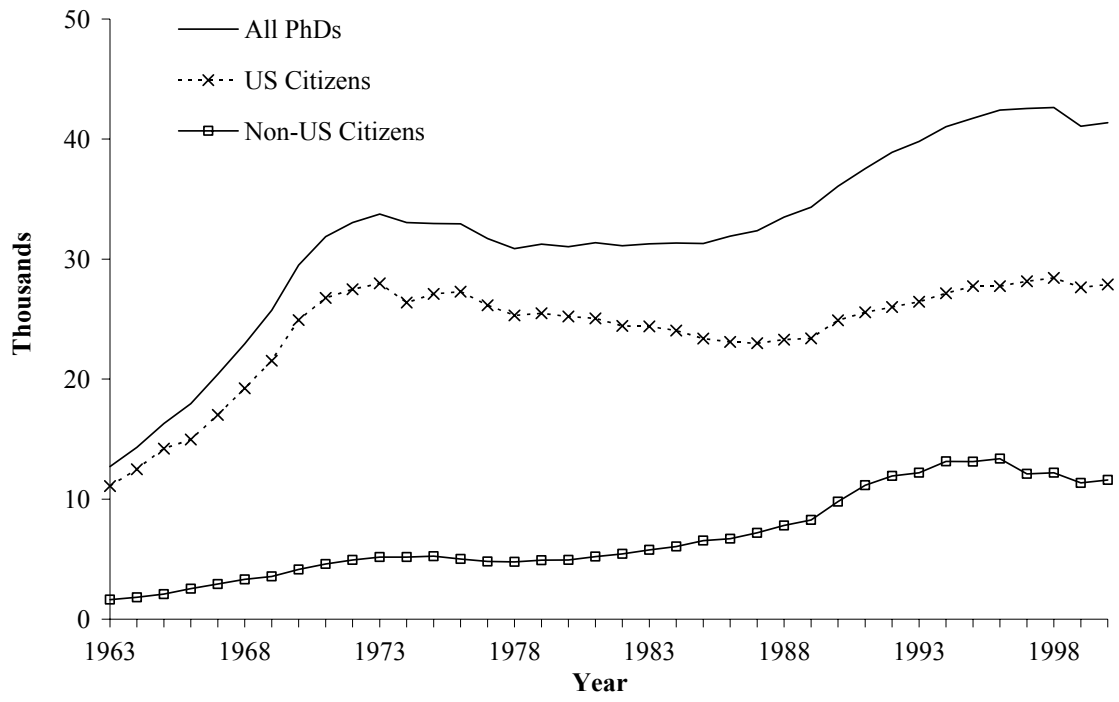
Lomperis, Ana Maria Turner. 1992. The demographic transformation of American doctoral education. *Research in Labor Economics* 13:131-213.

National Academy of Sciences. 1967. *Doctorate recipients from United States universities: 1958-1966*. Publication 1489. Washington, DC.

U.S. Department of Health, Education, and Welfare. Office of Education. Various years. *Earned degrees conferred*. Washington, DC: Government Printing Office.

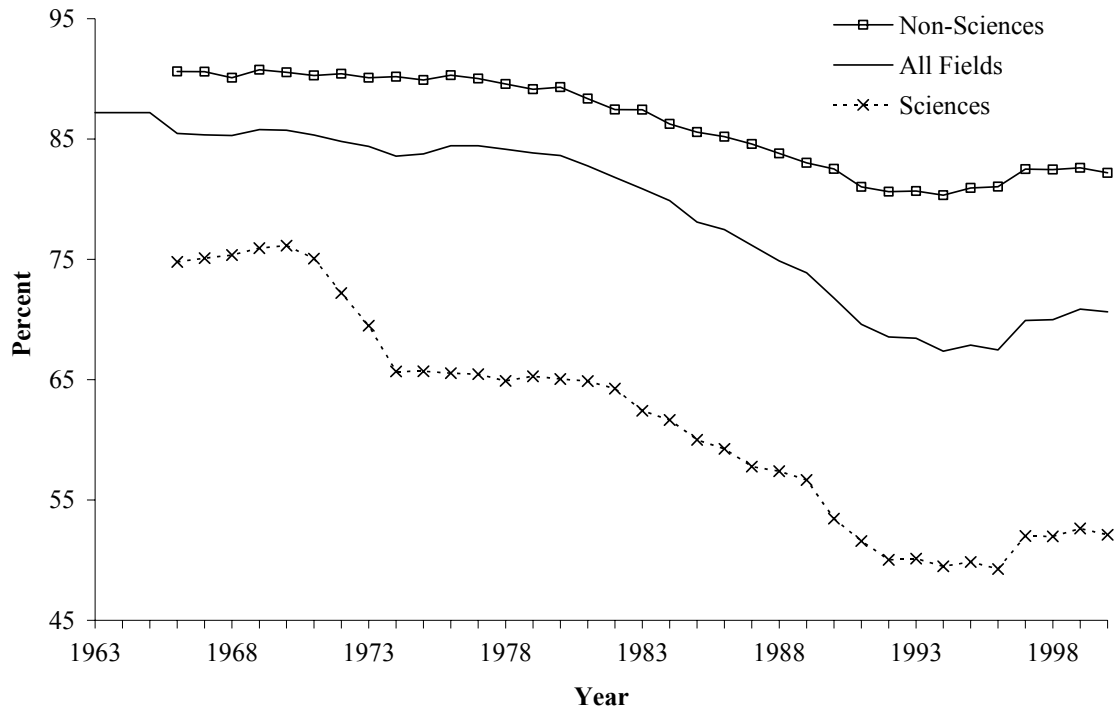
U.S. News and World Report. 2002. *America's best colleges*. 2003 ed. Washington, DC: U.S. News and World Report.

Figure 1. PhDs conferred by citizenship, 1963-2000



Source: Survey of Earned Doctorates

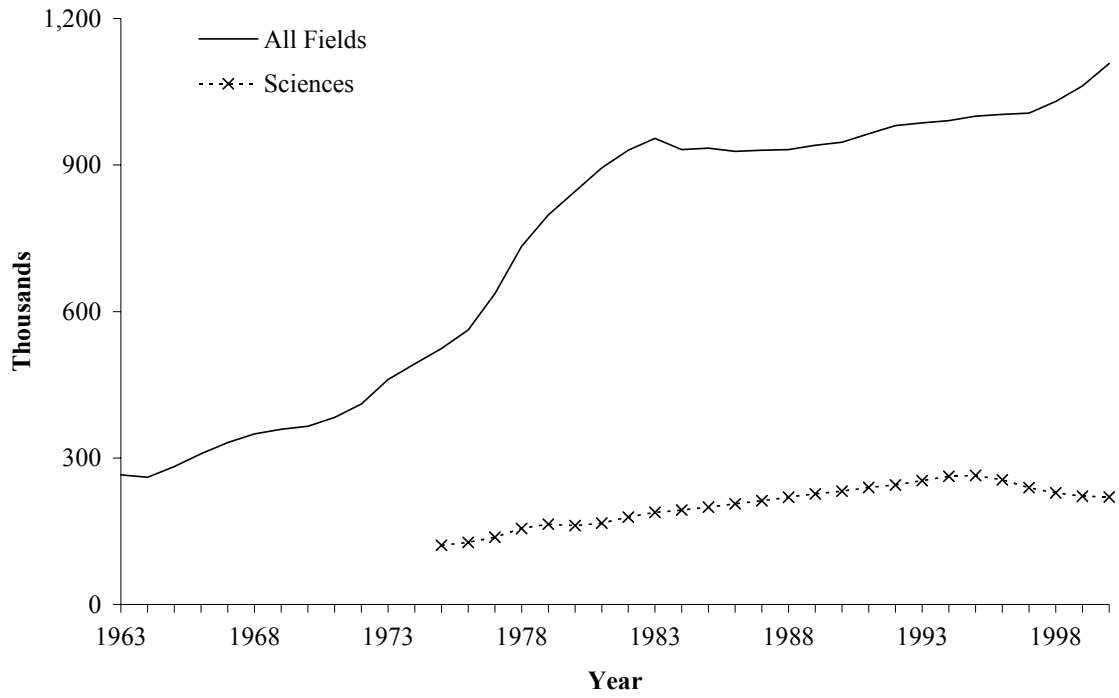
Figure 2. PhDs conferred to U.S. citizens as share of total, 1963-2000



Source: Survey of Earned Doctorates

Note: For definitions of “sciences” and “non-sciences,” see Appendix A.

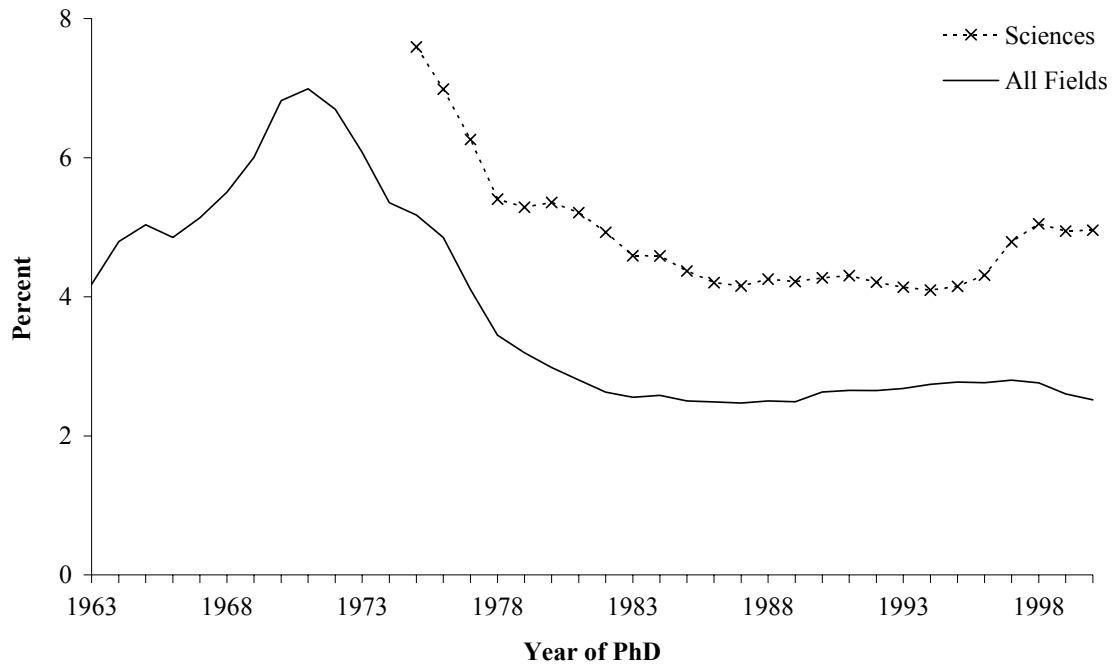
Figure 3. BAs conferred 9 years earlier, 1963-2000



Source: Earned Degrees Conferred Survey

Note: For definition of “sciences,” see Appendix A.

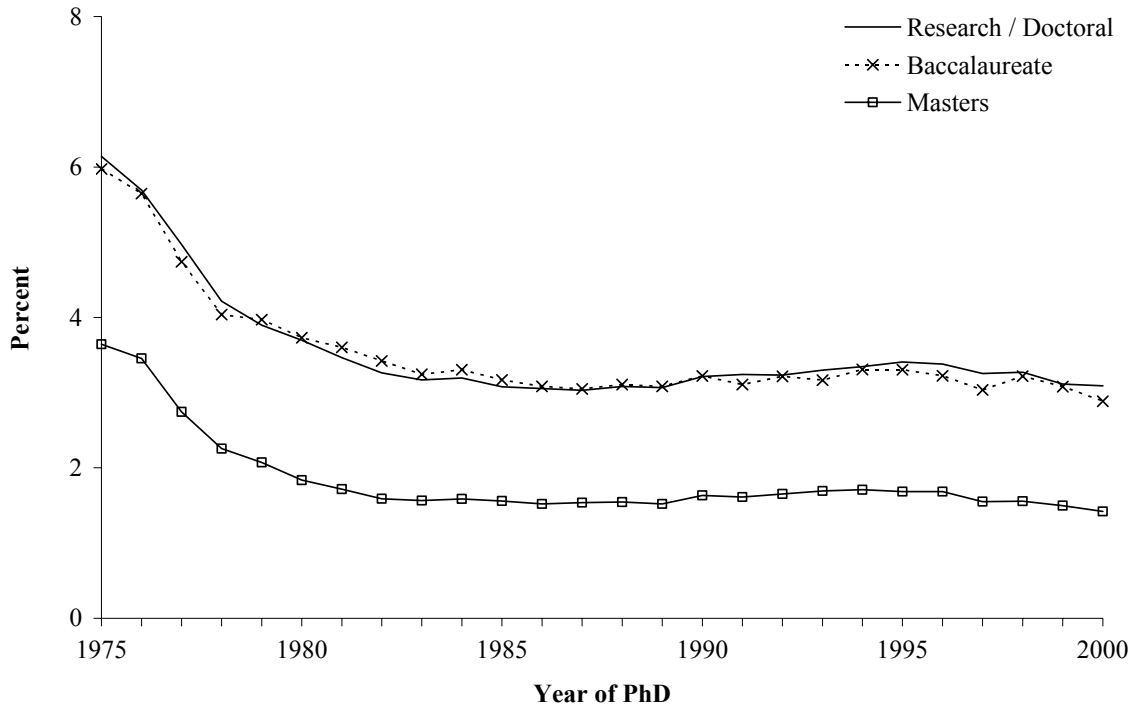
Figure 4. PhD propensity, 1963-2000



Source: PhD data are from the Survey of Earned Doctorates. BA data are from the Earned Degrees Conferred Survey.

Notes: PhD propensity is the number of PhDs conferred in a year divided by the number of BA degrees conferred 9 years earlier. For definition of “sciences,” see Appendix A.

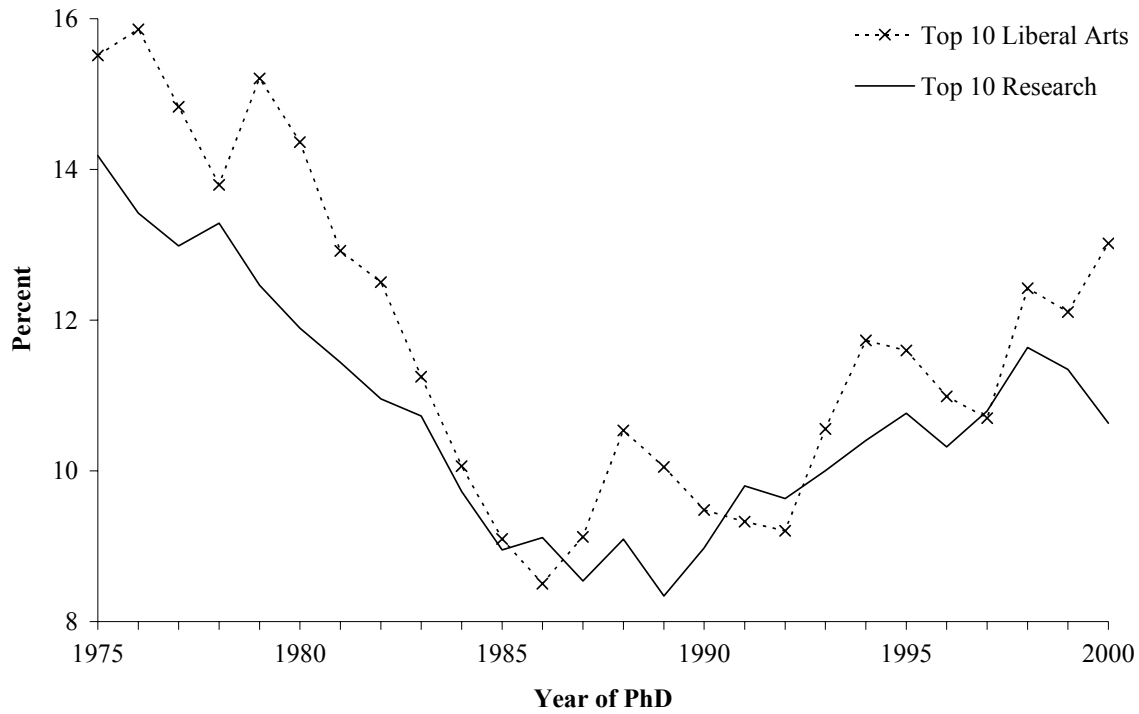
Figure 5. PhD propensity by type of BA institution, 1975-2000



Source: PhD data are from the Survey of Earned Doctorates. BA data are from the Earned Degrees Conferred Survey.

Notes: Institution categories are defined using the 1994 Carnegie Classifications (Carnegie Foundation for the Advancement of Teaching 1994). PhD propensity is the number of PhDs conferred in a year divided by the number of BA degrees conferred 9 years earlier.

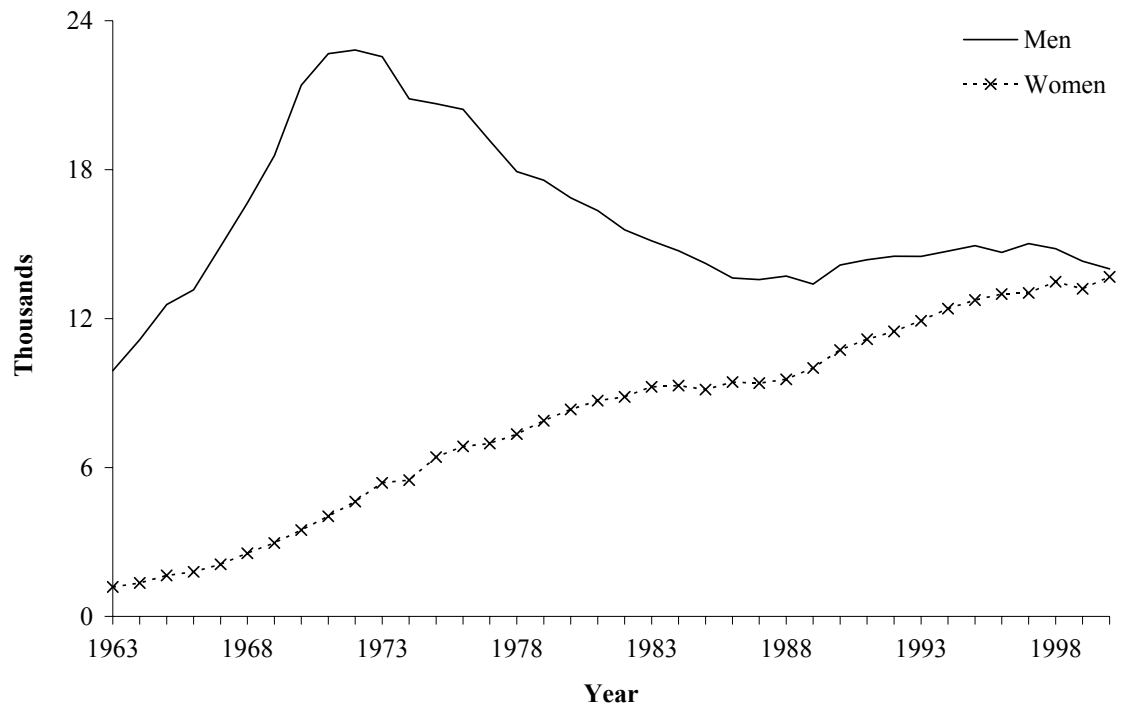
Figure 6. PhD propensity for top-10 BA institutions, 1975-2000



Source: PhD data are from the Survey of Earned Doctorates. BA data are from the Earned Degrees Conferred Survey.

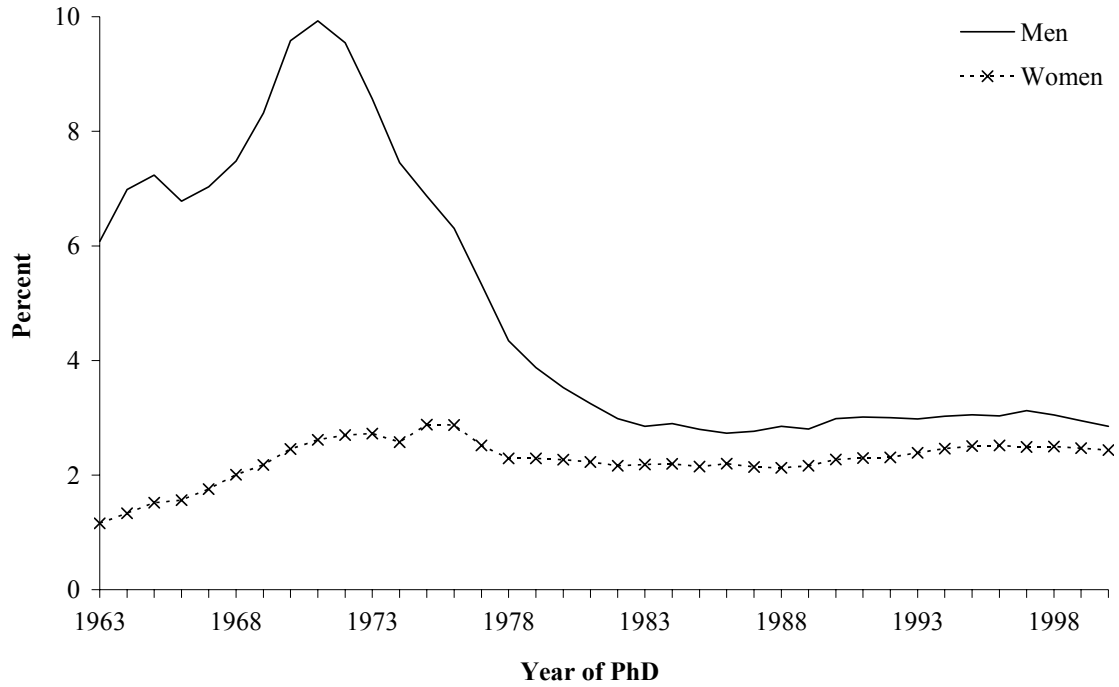
Notes: Institution categories are based on U.S. News and World Report (2002) rankings. PhD propensity is the number of PhDs conferred in a year divided by the number of BA degrees conferred 9 years earlier.

Figure 7. PhDs conferred by gender, 1963-2000



Source: Survey of Earned Doctorates

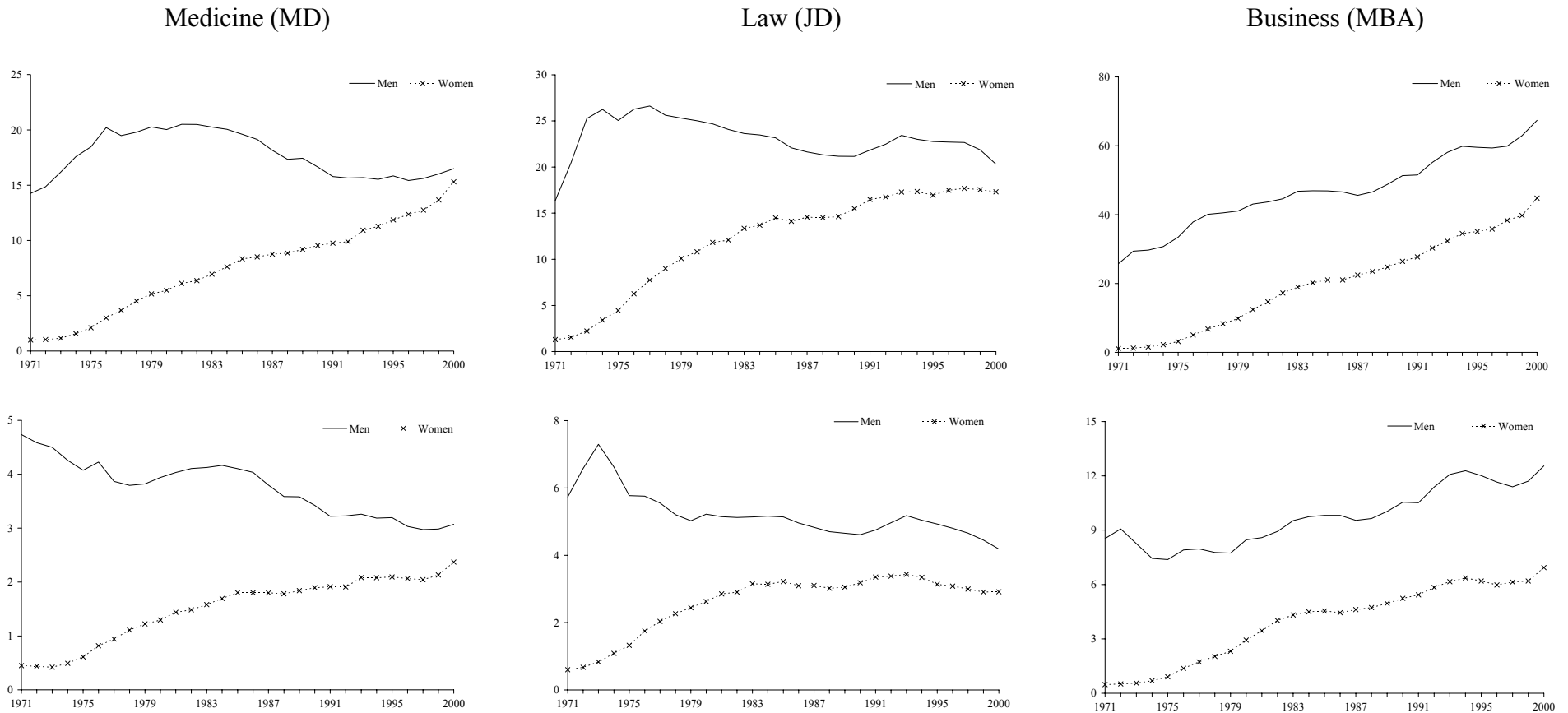
Figure 8. PhD propensity by gender, 1963-2000



Source: PhD data are from the Survey of Earned Doctorates. BA data are from the Earned Degrees Conferred Survey.

Note: PhD propensity is the number of PhDs conferred in a year divided by the number of BA degrees conferred 9 years earlier.

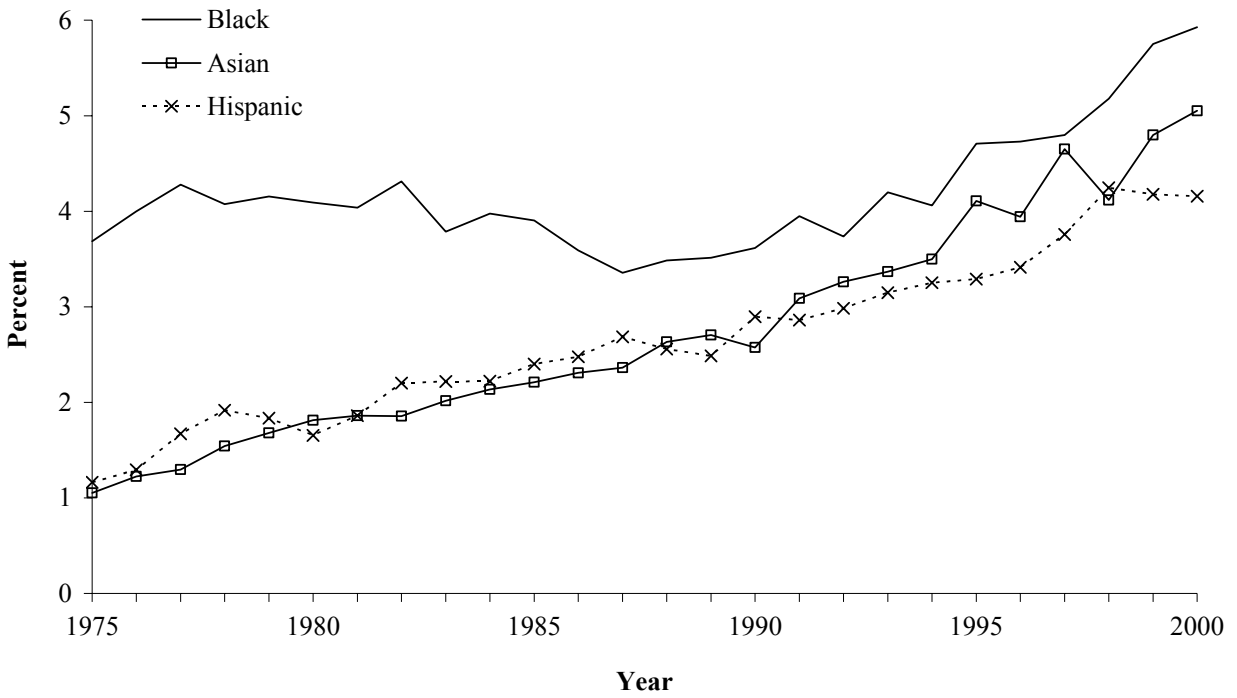
Figure 9. Attainment of professional degrees, by gender, 1971-2000. Top panel: degrees conferred (in thousands); bottom panel: propensity (in percent).



Source: Earned Degrees Conferred Survey

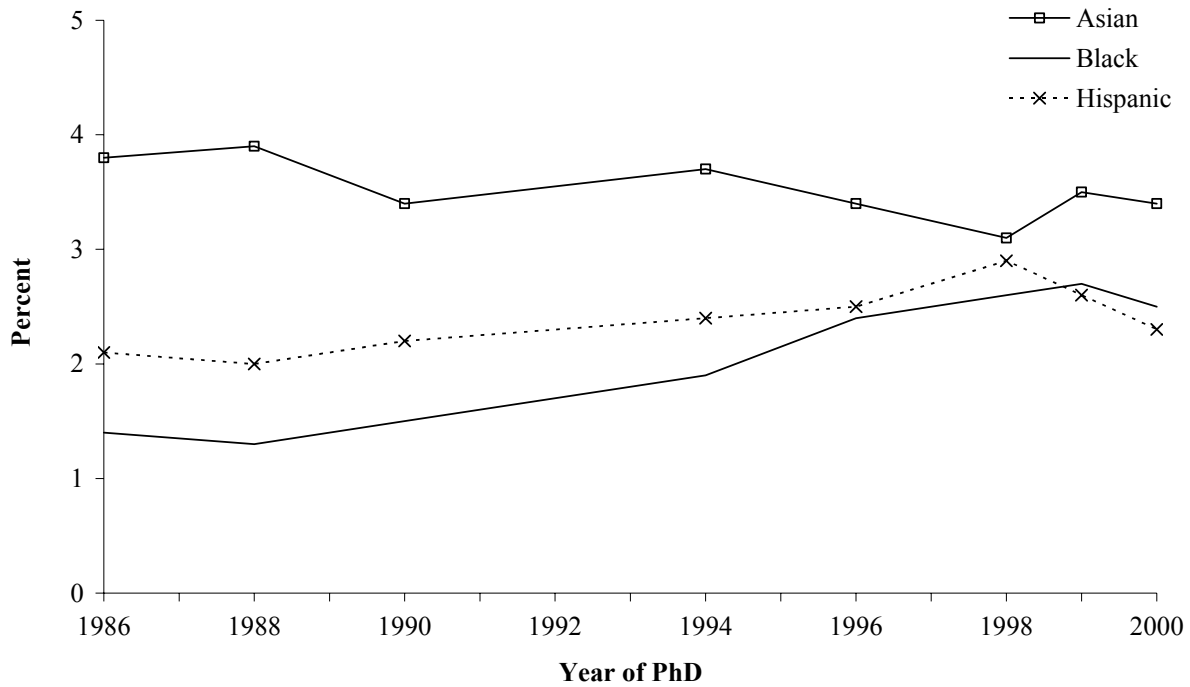
Note: "Propensity" is the number of professional degrees conferred in a year divided by the number of BA degrees conferred 5 years earlier.

Figure 10. PhDs conferred to racial/ethnic minorities as share of total, 1975-2000



Source: Survey of Earned Doctorates

Figure 11. PhD propensity by racial/ethnic group, 1986-2000 (selected years)



Source: PhD data are from the Survey of Earned Doctorates. BA data are from the Earned Degrees Conferred Survey.

Notes: Due to limitations in the BA data, measures of PhD propensity can be constructed for selected years only (even-numbered years [except 1992] and 1999). PhD propensity for whites is similar to PhD propensity over all races (see figure 4). PhD propensity is the number of PhDs conferred in a year divided by the number of BA degrees conferred 9 years earlier.

Table 1. PhDs conferred by field (number and share of total)

Field	1966		2000	
	Number	Share	Number	Share
Sciences				
Engineering	1,690	11.3	2,206	7.9
Physical sciences	3,138	21.0	3,260	11.7
Life sciences	2,229	14.9	5,454	19.6
<i>Total</i>	7,057	47.1	10,290	39.2
Non-sciences				
Social sciences	2,268	15.1	5,848	21.0
Education	2,875	19.2	5,532	19.8
Humanities	1,987	13.3	3,096	11.1
Other	787	5.3	2,492	8.9
<i>Total</i>	7,917	52.9	16,968	60.8

Source: Survey of Earned Doctorates

Note: For field classifications and definition of “sciences,” see Appendix A.

Table 2. PhDs conferred to women as share of total

Field	1966	1980	2000
Sciences	5.7	18.9	36.8
Social sciences	16.0	36.4	57.9
Education	18.7	46.1	66.1
Humanities	19.4	41.9	49.7
Other	13.7	31.2	47.1
<i>Total</i>	12.0	33.1	49.4

Source: Survey of Earned Doctorates

Note: For field classifications and definition of “sciences,” see Appendix A.

Table 3. PhDs conferred to racial/ethnic minorities as share of total

Field	Black			Hispanic			Asian		
	1990	2000	Diff.	1990	2000	Diff.	1990	2000	Diff.
Sciences	1.3	3.1	1.8	2.3	3.5	1.2	4.2	7.5	3.3
Social sciences	3.8	6.3	2.5	3.6	5.0	1.4	1.9	3.8	1.9
Education	8.1	12.2	4.1	3.2	4.9	1.7	1.2	2.2	1.0
Humanities	2.6	3.6	1.0	4.3	4.8	0.5	1.0	2.9	1.9
Other	3.2	5.1	1.9	2.0	3.0	1.0	1.7	4.1	2.4
<i>Total</i>	3.6	5.8	2.2	2.9	4.2	1.3	2.6	4.9	2.3

Source: Survey of Earned Doctorates

Note: For field classifications and definition of “sciences,” see Appendix A.