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ABSTRACT

The American university was shaped in a formative period from 1890 to 1940 long before the rise of federal funding, the G.I. Bill, and mass higher education. Both the scale and scope of institutions of higher education were greatly increased, the research university blossomed, states vastly increased their funding of higher education, and the public sector greatly expanded relative to the private sector. Independent professional institutions declined, as did theological institutes and denominational colleges in general. Increases in the scale and scope of institutions of higher education were generated by exogenous changes in the "structure of knowledge" and by others that affected the professions generally and that of the clergy in particular. The increase in the share of students in the public sector may also have been prompted by these exogenous changes for they gave advantages to institutions, such as those in the public sector, that had research facilities, reputation, and a long purse. The high school movement, which swept parts of the country from 1910 to 1940, brought students from less privileged backgrounds to college and thus also buoyed enrollments in the public sector. States differed widely in their funding of higher education per capita and we find that greater generosity in 1929 was positively associated with later statehood, lower private college enrollments in 1900, greater shares of employment in mining and manufacturing, higher income, and a proxy for greater and more equally distributed wealth.

Claudia Goldin
Department of Economics
Harvard University
Cambridge, MA 02138
and NBER
goldin@nber.org

Lawrence F. Katz
Department of Economics
Harvard University
Cambridge, MA 02138
and NBER
katz@nber.org

The industrial organization and political economy of higher education in the United States were shaped in the several decades after 1890. Although colleges had been founded much earlier in U.S. history — starting in the seventeenth century — they took their modern form in the several decades after 1890. The main changes involved scale and scope, and the role of the state. This paper describes the shifts in industrial organization and political economy during the formative years of higher education, some of the reasons for them, and a few of the consequences.

The shifts in the formative years profoundly altered the higher education industry. The decade around the turn of the twentieth century witnessed the flourishing of the American research university and the emergence of public-sector institutions as leaders in educational quality. In the subsequent two to three decades, institutions of higher education vastly increased in *scale*, particularly those in the public sector, and public-sector institutions, as a group, greatly expanded their enrollments relative to their private counterparts. Universities widened their *scope* of operations by adding a multitude of highly specialized departments (e.g., economics and other social sciences, business schools). Professional schools, which had been mainly independent entities, shifted to being embedded in universities. Denominational institutions, particularly schools of theology, went into absolute, and small liberal arts colleges into relative, decline. Something profoundly altered higher education around 1890 so that almost all of today's noteworthy U.S. universities and colleges were founded before 1900.

Whereas most states had largely neglected their institutions of higher education before 1890, many generously supported them after. By 1920 state commitment to public higher education was sufficiently formed that many differences across states in public support that are apparent today were manifest then. For example, states having high levels of public support per capita for higher

education in the 1920s continue to do so today.[1] Even though the fraction of Americans going to college would soar in the decades following World War II, the increase in the 1890 to 1940 period was substantial.

Our focus is on four-year higher education. We omit two-year colleges, as well as teacher-training institutions even if they granted the bachelor's degree.[2] Before the 1940s many professional schools had programs for which the bachelor's degree was not a prerequisite. Thus students in professional programs must be grouped with all pre-bachelor's. We end our study before World War II, thus in advance of substantial federal involvement in higher education and the period of the greatest increase in the fraction of youth continuing to college. We do so to emphasize that many of the distinctive features of today's four-year higher education were put in place long before the rise of federal funding, the G.I. Bill, and mass higher education.

Our paper addresses what accounted for the increased scale of higher education, its widened scope, the relative rise of public sector enrollments, and the commitment of particular states to higher education. The answers to these questions are interrelated. It was, in part, because of the increased scale and widened scope that public sector enrollments expanded relative to private sector enrollments. The commitment of certain states to higher education was, in turn, a function of the expanded scope of the institutions. States invested more when the perceived returns to the state were

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[1] The cross-state correlation between (log) state and local government spending per capita on higher education in 1929 and that in 1994 is 0.44. And the correlation between public college enrollments per capita in 1929 and that in 1994 is 0.61.

[2] The Office of Education separated teacher-training institutions from other institutions of higher education. The teacher-training institutions consisted of public and private colleges and normal schools. Although many of the teachers colleges offered a bachelor's degree, most students attended for just two years. In 1924 there were 88 state teachers colleges and 108 state normal schools (*Biennial 1922/24*). Much of the increase in state colleges and universities in the 1940s and 1950s came about from the conversion of these teacher-training institutions into parts of state university systems.

higher, and returns were higher in various applied subjects.

We begin, in section I, with various overarching changes in the higher education industry, starting with a discussion of the "technological shocks" that swept the "knowledge industry" in the late nineteenth and early twentieth centuries. These changes are crucial to understanding why the industry structure changed abruptly from the 1890s to the 1920s. We next present time series of enrollments and the founding dates of institutions to give a sense of the growth of the firms and clientele of the industry during the 1890 to 1940 period, which we term the "formative years." The major descriptive data on the industrial organization and political economy of the industry are given in section II. Both public and private-sector institutions greatly expanded their scale and scope of operations, but the publicly-controlled institutions grew far more. In section III we examine the political economy of higher education, in particular why the public sector grew relative to the private sector and what factors determined cross-state variation in funding higher education from 1890 to 1940. We turn, in section IV, to some of the consequences of publicly-funded higher education.

I. Higher Education before World War II

A. *Background: Changes in the Structure, Creation, and Diffusion of Knowledge*

Higher education is an integral, if not central, part of the "knowledge industry" for the business of colleges and universities is the creation and diffusion of knowledge. To understand the vast changes in the industrial organization and political economy of higher education in the 1890 to 1940 period, we must first describe shifts in the structure of knowledge.[3] The structure of knowledge

[3] By the structure of knowledge we mean what was known and how knowledge was packaged. Research in biology in the nineteenth century, for example, led to the discovery of microbes which, in turn, advanced knowledge of immunology. Several separate disciplines were thus formed as knowledge expanded.

radically changed in the late nineteenth and early twentieth centuries in a manner that was mainly exogenous to the higher education industry. These exogenous changes, in turn, expanded the optimal scale and scope of institutions of higher education and gave an advantage to certain institutions, particularly those in the public sector.

Across the latter part of the nineteenth century an increasing number of subjects taught in colleges and universities became subdivided and specialized. First in the sciences, a bit later in the social sciences and engineering, and then filtering into even the humanities and history, those who taught were in separate, specialized fields. The changes were brought about by somewhat different factors and at slightly different moments in time in each of the broad subjects we now classify as the physical sciences, the biological sciences, the social sciences, and the humanities. Yet several factors were common to most. They include the application of science to industry, the growth of the scientific and experimental methods, and an increased awareness of social problems brought about by an increasingly industrial and urban society.

In industry after industry, in the late nineteenth century, there emerged a growing importance of chemistry and physics, most notably in the manufacture of steel, rubber, chemicals, sugar, drugs, non-ferrous metals, petroleum, and goods directly involved in the use or production of electricity (Kevles 1979). Firms that had not previously hired trained chemists and physicists did so at an increasing rate, as did the federal and state governments.[4] Science replaced art in production; the professional replaced the tinkerer as producer. With greater demand for trained scientists, universities expanded their offerings. With new research findings, the classical scientific disciplines became

[4] The number of chemists employed in the U.S. economy increased by more than six-fold between 1900 and 1940 and by more than three-fold as a share of the labor force. The number of engineers increased by more than seven-fold over the same period. Source: Kaplan and Casey (1958, table 6).

increasingly fragmented and greater specialization resulted. Similar changes occurred in biology, although here the driving force was less industry and government, and more general changes in empiricism and experimentation borrowed from other fields and earlier stimulated by the appearance of Darwin's *Origin of Species* (Allen 1979). Not surprisingly analogous changes appeared in the agricultural sciences. But here part of the impetus was the expanding crop variety in the United States as the railroad spurred cultivation clear across the continent, resulting in the growth of highly specialized farming (Rossiter 1979). Even the social sciences expanded and splintered in the late nineteenth and early twentieth centuries. They were given a mission by the growing social problems of industry, cities, immigration, and a prolonged depression, first in the 1870s and later in the 1890s. They were shaped by Darwinian thought, Mendelian genetics, and later by the increased role of statistics, testing, and empiricism generally (Ross 1979).

To illustrate the increasing specialization in college disciplines we graph the numbers of learned societies founded by year.[5] As shown in Figure 1, the numbers increased greatly in the period from around 1890 to 1910.[6] The expansion is evident in the social sciences. Economists formed their

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[5] A learned society is "an organization composed of individuals devoted to a particular learned discipline or branch or group of disciplines in the humanities, social sciences, or natural sciences and primarily committed to the study and acquisition of knowledge in such discipline. [It] excludes professional societies in medicine, law, engineering, etc., where the *raison d'etre* and primary emphasis is upon the application of knowledge for professional and/or pecuniary purposes, and societies whose primary purpose has been the giving of recognition to individuals for achievements in the sciences or humanities" (Kiger 1963, p. 2)

[6] Our sample consists of all national learned societies existing in the United States in about 1960 (when Kiger wrote his book) and those that are current members of the American Council of Learned Societies. That sampling frame would appear to bias the group in favor of those founded late. But a careful reading of Kiger (1963), as well as Bates (1965) on scientific societies, reveals that very few national learned societies disappeared. An important one that did was the American Social Science Association (founded 1865), which was less a learned society than it was an advocacy group. It gave rise to a host of professional organizations on crime and social service, as well as to the American Historical Association and the American Economic Association. Having thus exhausted its membership, it disbanded in 1912 (Kiger 1963, p. 234-35).

society in 1885 and the rest quickly followed: psychologists in 1892, anthropologists in 1902, political scientists in 1903, and sociologists in 1905. The biological and chemical fields proliferated in the 1890 to 1910 period, and societies were formed for botanists, microbiologists, pathologists, electrochemists, and biological chemists, to mention a few.

These changes, or "technological shocks" in the structure of knowledge, had far reaching implications for "firms" in the knowledge industry. According to most historians, the higher education sector in the United States changed fundamentally and rapidly in the period and took on its modern features around 1910.[7]

During the early to mid-nineteenth century, institutions of higher education were often staffed by a mere handful of faculty, at least one of whom was proficient in ancient languages and religion whereas the rest were sufficiently informed to teach philosophy and history. A member of the group would be the college's president, and he would hand pick the other faculty whose abilities he knew intimately. All changed as the scientific method, practically-oriented courses, the "lecture" method of teaching, and specialization in a host of dimensions swept the world of knowledge.[8]

The era of the division of labor in higher education had arrived. No longer could one maintain a respectable college with a mere handful of faculty. No longer could the college president keep abreast of all his faculty's teaching interests (and morality). Most of the changes served to increase economies of scale in the production of higher education services and thus push out the minimum

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[7] See Veysey (1965) for a discussion of the various factors, such as the rise of the research university and increase in vocational subjects, that became accepted facts of higher education by 1910. According to Hofstadter and Hardy, "by 1910 the American university as an institution had taken shape" (1952, p. 31).

[8] See, for example, Handlin and Handlin (1970) on the changing role of the college in the socialization of youth and the introduction of the "lecture system." On the growth of the specialization of knowledge in the period between the 1860s and 1910s see, for example, Bates (1965), Kimball (1992), and the various essays in Oleson and Voss (1979), some of which we have already cited.

number of faculty and students required for a college to remain viable. Also important to the story at hand is that the diffusion of knowledge became closely bound up with the creation of knowledge. Those who diffused knowledge became its creators, increasingly so in the universities that swept the landscape of higher education beginning in the late nineteenth century. Research became the handmaiden of teaching, that we believe it is today.

B. Enrollments and institutional founding dates

The formative period of higher education in the United States, while not one of enormous growth in the enrollment rate, nonetheless contains an impressive increase. We graph in Figure 2 the number of individuals enrolled (either as undergraduate or graduate students) in institutions of higher education in the United States as a fraction of those 18 to 21 years old. We include all institutions — college, university, professional, teacher training, and junior college — for consistency across the full period. The resulting figures overstate the fraction who ever attended a two or four-year institution of higher education because some in professional or graduate school had already earned their first degree, and they, or others, may have attended for more than four years.[9]

The upper panel of Figure 2 graphs the time series from 1890 to 1970 and reveals the expansion in higher education in the post-World War II period, as well as the particularly rapid growth after 1960. But the more than doubling of the rate from 1940 to 1970 hides important changes in the previous fifty years. The lower panel gives the data for the shorter period from 1890 to 1940. Although growth was moderate from 1890 to 1910, college enrollment expanded greatly

[9] Other data problems include the fact that prior to 1955 enrollment was cumulated over the year but after that date it is given as "opening fall enrollment." The difference, according to the Department of Education, is about 10 percent. The duplication of students within a university (e.g., registered in two divisions) was accounted for in the original collection of the data by the U.S. Office of Education.

in the next two decades, until the temporary lull brought on by the Great Depression. Enrollment increased by five-fold from 1890 to 1940 and by about three-fold from 1910 to 1940.[10]

Whereas enrollment greatly expanded from 1910 to the 1930s, institutional founding flourished before 1900. Figure 3 graphs the "opening dates" of institutions of higher education in existence in 1934, toward the end of the period under study. The upper panel includes all institutions whereas the lower panel contains just the public sector.[11] For the total, there is a steady increase in numbers to around the early 1890s, and then a rather sharp falling off, with one upturn in 1908. The public opening dates, not surprisingly, contain a somewhat earlier peak — just after the first Morrill Act, although they, too, have a peak in the early 1890s, coinciding with the second Morrill Act.[12] Not only were there relatively few institutions founded after the turn of the twentieth century, but there is only one private university of note that was founded in the twentieth century, whereas several were established in the 1890s (e.g., Stanford, Chicago, California Institute of Technology).[13]

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[10] It should be noted that the data in Figure 2 should not be interpreted as the percentage of the relevant cohort who attended college because there is, as just noted, an implicit over counting. Compared with the high school graduation rates for the period, the college rates appear too high. The computed college enrollment rate for 1910 is about 0.05. The U.S. (public and private) high school graduation rate in 1910 was about 0.10 and the fraction continuing to some form of higher education was between 0.35 and 0.49, where the 0.49 figure includes "other institutions"such as normal schools and business institutes (Goldin 1998). Thus the fraction of youths who went to college was somewhere between 0.035 and 0.049.

[11] Because there were five times the number of private than public institutions, a graph of the private ones looks almost identical to that of the total.

[12] The relationship between the large increase in state institutions in the 1890s and the second Morrill Act (1890) does not appear to be direct. The act increased funds available to all land-grant colleges and universities and gave additional funds for the establishment of black institutions of higher education, of which five were formed in the 1890s. Of the 22 non-black-only public institutions founded in the 1890s, eight were through the first Morrill Act's 1866 amendment extending the land grants to new states.

[13] Only three private institutions in the *U.S. News and World Report* top 50 universities began college-level instruction in the twentieth century. They are the Carnegie Institute of Technology (later Carnegie Melon University), established in 1900 with instruction beginning in 1905; Rice Institute (later Rice University), founded in 1891 with college-level instruction beginning 1912); and Brandeis University, founded in 1948. Thus,

Something fundamental appears to have changed around the turn of the twentieth century to make the founding of new institutions of higher education, particularly private ones, more difficult. That change, we will contend, had much to do with barriers to entry stemming from the larger scale and widened scope needed to be competitive with many of the state universities and some of the private institutions. Not only were financial resources of increasing importance, but institutional reputation also began to matter more.

II. Changes in the Industrial Organization and Political Economy of Higher Education

A. Changes in Scale

Major alterations occurred in the size distribution of educational institutions in both the public and the private sectors in the half century before 1940. The data we use to illustrate these points come from three cross sections constructed for 1897, 1924, and 1934 at the institutional level and a linked sample for 1924 and 1934.[14] The dates were chosen to span the period of interest.[15] Several

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only one private university of national prominence was founded after 1900. That institution was established, in large measure, because Jewish academics (and students) had long been discriminated against, large numbers of Jewish scholars took refuge in the United States during the war, and the Jewish community had amassed funds to found a great university. Three institutions in the *U.S. News and World Report* top 40 liberal arts colleges were founded in the twentieth century. They are Claremont McKenna College (1928), Connecticut College (1915), and Scripps College (1927), although Claremont and Scripps are part of the Claremont college system that includes Pomona College founded in 1888. For the rankings see HTTP://WWW.USNEWS.COM and the Data Appendix for the establishment date sources.

[14] The 1897 data set probably undercounts small private colleges, many of which did not survive into the twentieth century. The Office of Education, in recognition of the undercounting, made substantial adjustments to secondary and higher education enrollment data in the 1930s, although the method was not described nor was there mention that modifications had been made. See Goldin (1994).

[15] The *Biennial 1938/40* is the last to present data for separate institutions. Summaries by state exist for most years but include junior colleges before 1934 and after 1942. We exclude all independent teacher-training institutions and two-year colleges. In the discussion of this section we also exclude students who were in the preparatory departments of higher educational institutions. In 1897 about 35 percent of all students in liberal arts colleges and universities were not yet admitted to undergraduate rank but were, rather, preparatory students; the figure declined to 13 percent in 1924. Not surprisingly, the highest percentages in 1897 were in parts of the country where colleges had the most difficulty obtaining well-trained youths. The Mountain states

distributional measures are offered in Table 1 because the surveys we use probably undercount small private institutions in 1897 and 1924, whereas virtually all public institutions, meeting the conditions we have mentioned, were included.[16] We have also included recent data, averaged from 1990 to 1994, as a comparison.

In 1897 the median private institution had 128 students and the median private student was in an institution with 505 students (rows 2 and 5). In the public sector these two measures were 242 and 787. Thus publicly-controlled institutions were, on average, larger than those in the private sector, but they were not very much larger. By 1924 the average institution in both sectors had grown substantially, but public-sector institutions had grown far more. The median private institution had 359 students in 1924 and the median student in the private sector was in an institution with 1,630 students. The public-sector numbers were 1,225 and 3,950. For both statistics, the public sector grew by about 1.8 times that of the private-sector. (The relative growth of institutional revenue, given in rows 3 and 4, is about the same order of magnitude.) And public-sector institutions grew, relatively, even though private liberal arts colleges declined with the increasing role of scale and despite the addition of specialized public-sector institutions not of university rank. From 1924 to 1934, the scale of both public and private institutions increased, but their relative magnitudes remained about the same. Similar increases in the growth of public to private sector enrollments can be found for that decade using either rows (1) and (2) or (11) and (12), which employ a matched

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led, followed by those in the central portion of the nation, excluding the Midwest. Whereas 45 percent of all college students in the Mountain states were preparatory, just 3 percent were in New England. Privately-controlled institutions had a greater fraction who were preparatory than did the publicly-controlled, and universities and technical institutions had lower fractions than did liberal arts colleges.

[16] See the Data Appendix for more information on these data sets.

sample. The various enrollment summary statistics are displayed in Figure 4.

The ratio of the public to private median number of students per institution was 1.89 in 1897, but was 3.43 in 1924 and 4.02 in 1934. The ratio for the size of the institution of the median student was 1.56 in 1897, but 2.34 in 1924 and 2.41 in 1934. The relative magnitudes in recent data are not much above the 1920s to 1930s levels, although the absolute levels are far greater for both. In 1990-94 the median number of students per institution was 1,579 in the private sector and 8,181 in the public sector, producing a ratio of 5.18. The data for the size of the institution of the median student was 7,766 in the private sector and 19,379 in the public sector, a ratio of 2.50. The ratios are graphed in Figure 5, which demonstrates the rapid change in the formative period.

A major change in relative magnitudes, therefore, occurred sometime between 1897 and the 1920s. By 1924 public-sector institutions of higher education already included many large, research-oriented universities.[17] Four-year public-sector institutions have since that time grown at a somewhat greater rate than those in the private sector, but not by much. Scale effects, however, have continued to advance for institutions in both sectors.

We also give measures (rows 6 to 9) disproportionately affected by the largest schools. In 1897 almost 5 percent of private institutions had more than 1000 students and about 10 percent of the public institutions did. They contained about 35 percent of all students in the private sector and 41 percent of those in the public sector. In 1924, 15 percent of private institutions had more than

[17] Although we do not have good measures of total research funds at either the institutional or state levels, we do have expenditures for "organized research separately budgeted" for public and private institutions (not including teachers colleges, normal schools, and junior colleges). We find that, in 1934, 2.4 percent of all educational and general expenditures for privately-controlled colleges went for "research," defined in this manner, and that 9.3 percent did in the publicly-controlled sector. The highest private percentage by state was New Jersey, because of a state-supported, privately-controlled institution — Rutgers University.

1000 students but about 60 percent of the public ones did. About 60 percent of private-sector students were in these large schools, but more than 90 percent of public-sector students were. Whereas six publicly-controlled institutions were in the top twenty by student population in 1897, ten were in 1924 and twelve were in 1934. Changes from 1934 to 1990-94 in these measures show the continued increase in the scale of both the private and public-sector institutions. Although today only 5 percent of all private-sector institutions have more than 10,000 students, 42 percent of public-sector institutions do. All of today's top twenty institutions by enrollment are in the public sector.

B. Changes in Scope

1. Emergence of the research university

Of enormous importance to the overall changes in higher education in the formative period was the rise of the modern research university. Universities had long existed in Europe, particularly in Germany, where they emphasized graduate studies and research to the virtual absence of undergraduate training. In the United States the founding of the Johns Hopkins University (1876), followed by Clark University (1889) and the University of Chicago (1892), dates an important transition to an emphasis on research and graduate training.[18] But the modern research university in the New World was a different creature than its European counterpart for it became a melding of all the components of higher education, serving a multitude of functions simultaneously.

Long before it gained its modern and current meaning, the word "university" was used to

[18] See, for example, Veysey (1965) on the origins of the American research university. The Johns Hopkins University was the first in the United States to be established as a dedicated graduate and research center, followed by Clark University and the University of Chicago.

connote institutions of higher education of various types.[19] The modern definition is almost as ambiguous. At the center of a "university," using the current meaning, sits a liberal arts college.[20] Surrounding the college are graduate programs in various fields and several professional, but non-technical, schools. The professional schools can include those of law, medicine, dentistry, pharmacy, theology, and even business.[21] A "university," then, would appear to be a department store of higher education, combining the specialized disciplines with the broader ones of the past and adding the various non-classical professional subjects.

But the modern university is far more than a mere collection of higher education services brought together under one roof for the benefit of its student-clients. It is, more importantly, a production center in which the research of one part enhances the teaching and research of the other parts. The "university" form was an organizational innovation enabling the exploitation of technical complementarities among its various components. While the public sector did not have a corner on universities, it did, from the beginning of the period we are studying, have a disproportionate share of them.[22] And its universities grew faster than did those in the private sector in the period before

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[19] Many of institutions incorporated as "universities" were actually liberal arts colleges (e.g., Taylor University), and some "colleges" have been true universities for some time (e.g., Boston College).

[20] According to the, then, U.S. Office of Education universities are "institutions in which there is considerable stress on graduate instruction, which confer advanced degrees in a variety of liberal arts fields, and which have at least two professional schools that are not exclusively technological" (American Council on Education 1960, p. 11).

[21] In our discussion of professional schools, however, we include only law, dentistry, pharmacy, and the various types of medicine.

[22] In 1897 the publicly-controlled sector had 43 percent of all universities but only 13 percent of all institutions of higher education.

World War II.[23] The fact that the publicly-controlled sector was disproportionately established in the university, research-oriented form gave it a substantial edge on the private sector in the period to 1940. Certain universities had, as well, the capacity to bestow reputation on new divisions in untried areas, such as business schools, and in areas plagued by claims of quackery, as were medical schools in the wake of the 1910 Flexner Report.[24] Thus, the university came to have all three sets of features — those of the "department store," the "integrated factory," and the "brand name."

2. Demise of independent professional institutions

Also occurring in the formative years of higher education was the demise of independent professional institutions and concomitant rise of professional schools in universities.[25] At the turn of the twentieth century, 48 percent of students training to be lawyers, dentists, pharmacists, and doctors (of both humans and animals) attended professional schools that were independent of any other institution of higher education (see Table 2).[26] The students, moreover, were generally not required to have had a college degree, and many had not previously attended college at all. But in

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[23] Among all (non-preparatory) students in universities in 1897, 41.2 percent were in publicly-controlled institutions; in 1934 the figure was 45.8 percent. In 1897 77 percent of all public-sector students attended universities, but only 30 percent of those in the private sector did. By 1934 the difference narrowed to 77 percent for the public sector but 48 percent for the private sector. (We exclude New York because the New York City municipal higher-education institutions expanded rapidly in the period and are categorized as colleges. The figures with New York are for 1897, 75 versus 32, and for 1934, 64 versus 54.) The point is that the university form expanded relative to all others as the overall share of (non-preparatory) students in universities (including New York) increased from 41.6 percent in 1897 to 59 percent in 1934.

[24] See, for example, Starr (1982).

[25] An independent professional institution is not connected with a major university. It can, however, be part of a group of professional schools (e.g., University of Omaha). In categorizing the institutions we used information in the Office of Education reports (see Data Appendix), as well as histories of the institutions in American Council on Education (1960). The 1897 data listed all professional schools separately and we excluded from the "independents" any schools also included in the university and college group.

[26] "Professional" students are at both the undergraduate and graduate levels. See Abbott (1988, pp. 206) on the founding of preprofessional programs and the teaching of professional courses to undergraduates.

1934 only 19 percent of professional students were attending independent schools. Professional training underwent a transformation and, in the process, furthered the rise of the university. The change occurred in several steps and the timing differed by profession.

In the professions, increased specialization and the greater need for rigorous scientific training, enhanced the returns to formal schooling. Thus the first step in the transition was the shift from informal apprenticeships to formal education in specialized schools, although in the case of law (and engineering) apprenticeships continued well into the twentieth century. The schools providing the credentials were increasingly required to have state approval, research facilities, and unassailable reputation. The education was eventually deemed to require an undergraduate education.[27] Medicine was transformed, as well, by the increased strength of the American Medical Association in the 1910s, its campaign to rid the nation of "sub-standard" medical schools, and the regulatory response of the various states. In 1897 the U.S. Office of Education surveyed 185 independent professional schools which were 22.5 percent of all institutions of higher education responding that year and contained 15.5 percent of all (non-preparatory) students. In 1934 only 58 independent professional schools were listed or 6.8 percent of the total surveyed (just 1.9 percent of all students).[28]

Thus the clinical, informal, and apprenticeship programs of the past gave way, in almost all the professions, to scientific, formal, and school-based training. Moreover, the schools in which the training was delivered increasingly became parts of universities rather than existing as separate

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[27] But even as late as 1934 only 10.7 percent of the 122 law schools listed in *The College Blue Book* (1934), a contemporary guide to colleges, required four years of college; 67.2 percent required one semester to two years of college, and 9.0 percent required just a high school diploma.

[28] Of the 185 in 1897, 103 were medical schools, 22 were law schools, 32 were schools of dentistry, and 28 taught pharmacy. Of the 58 in 1934, 27 were law schools.

independent institutions. Even though some professional schools, for example in law, increased their numbers with the decline of apprenticeship training, most independent institutions did not survive. The research university had enormous advantages in terms of its productivity enhancing aspects and because it lent its reputation to recently-sullied, as well as new, professions.

3. Decline of independent schools of theology and denominational institutions

Secularization was crucial to the emergence of universities as major research centers for they could not be so when bound to the dictates of a church. In 1897, 13 percent of all surveyed institutions of higher education were independent theological schools (having 4.3 percent of all students), but by 1934 10 percent were (with 1.5 percent of students). The difference is far greater (17 percent versus 11 percent) if the independent professional schools are omitted, for they too declined precipitously.[29] The change took place in a variety of ways. Many transformed themselves into non-sectarian, liberal arts colleges. Still others merged with universities to become non-denominational divinity schools, and many simply vanished. Part of the demise in denominational institutions that trained ministers was caused by the decreased relative demand for their services; the earnings of the clergy relative to workers in manufacturing declined by about 30 percent between 1890 and the 1920s. But another portion was related to the triumph of the scientific method, as well as a need for college and university presidents to be shrewd administrators.[30]

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[29] There were 109 unaffiliated theological seminaries listed in the Office of Education survey in 1897, but only 89 in 1934. See Data Appendix for sources.

[30] The ratio of the average salary of Methodist and Congregational ministers to that of all wage earners in manufacturing fell from 1.81 in 1890, to 1.68 in 1900, 1.44 in 1910, and 1.38 in 1925 (*Historical Statistics* 1975, series D 781, 793). On secularization in general see Hofstadter and Hardy (1952, chap. II).

C. Political Economy of Higher Education

1. Changes in Public and Private Enrollment

Even though the college enrollment rate, as conventionally measured, increased far less pre-1940 than post-war, the change in the fraction of students in publicly-controlled institutions was more rapid in the half-century before the war than in the half-century after. In Figure 6 (see also Table 3) two of the lines (those with circles) give the fraction of students in the publicly-controlled sector (excluding independent teacher-training institutes) from 1897 to 1960. One is for all four-year institutions whereas the other includes two-year colleges (the two lines coincide from 1897 to 1918). A third line (with triangles), for 1934 to 1990, uses a more current distinction: students in four-year institutions including those in independent teacher-training institutes.

From 1897 to 1940 the fraction of students in publicly-controlled institutions increased from 0.22 to about 0.5 including junior colleges, and 0.45 excluding them.[31] From 1934 to 1990 the series, which includes teacher-training institutions but excludes junior colleges, increased from around 0.5, just before World War II, to 0.67 in 1990.[32] The full century would then appear to involve an increase from around 0.22 to 0.67, although the group of included schools changes in large measure because the functions of the schools did.[33]

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[31] It is interesting to note the impact of World War I, which disproportionately reduced the numbers in private institutions, compared with World War II, which did the opposite. The data reinforce the notion that World War I was the more democratic of the two wars. See also Levine (1986, chapter 2), on how private institutions sought to maintain enrollments by accepting federal funds for military training.

[32] See also Hight (1976) who computes, for 1927 to 1972, a statistic apparently similar to that in Table 3, col. (3), but which also includes two-year institutions. Because Hight's data do not contain the previous thirty years, the conclusion reached is somewhat different from ours. Hight emphasizes the relative increase of the public sector after 1947 rather than seeing a greater increase before.

[33] The share of total enrollments accounted for by publicly-controlled institutions in 1994 was 78 percent when two-year institutions are also included (U.S. Department of Education 1996).

2. *State Support of Higher Education*

Even before the Morrill Act passed in 1862, the vast majority (80 percent) of existing states outside the northeast had at least one state-controlled institution of higher education.[34] The early state institutions were often established to produce educated personnel needed to staff teaching at the lower grades.[35] Most were set up using federal land grants, similar to those of the subsequent Morrill Act. The demand for publicly-funded and publicly-controlled education varied by state. In many of the sparsely settled areas, the state took the initiative to provide higher education that would be geographically accessible to their citizens. Although many state institutions contained a liberal arts college indistinguishable from those in the private sector, almost all eventually produced services of value to the state apart from teaching undergraduates and training school teachers.

A primary reason for state support to higher education was to provide "public goods."[36] State institutions in the nineteenth century were more practically and, often, more scientifically oriented than were their private counterparts, in large measure because of the commitment to provide goods

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[34] There were 33 states in 1860. Of these, five of the six states of New England did not have a state institution (VT is the only one that did), and two of the three in the Middle Atlantic did not (PA is the exception). The other states without established state higher education institutions in 1860 were: AR, IL, KY, OR, and TX. Dates used in this paper are generally those at which time the institution offered instruction at least at the undergraduate level, although we use, here, the establishment date. Thus, the Universities of California and Minnesota were established before 1860 yet neither had an operating undergraduate program until 1869. See also Brubacher and Rudy (1958).

[35] The role of the public sector in higher education is complicated for the "state" has regulated and funded higher education ever since 1636. We concentrate here on the funding of higher education and on institutions under the direct control of the "state," rather than on the broader issues of state regulation.

[36] Increased access to higher education for youth facing capital market constraints is a further rationale for public subsidies. But a key unresolved question is why public financial support for higher education is bundled with its provision. States rarely subsidized private-sector universities to do research and training in this formative period. In only two, New Jersey and New York, did the state grant substantial funds to privately-controlled institutions (Rutgers and Cornell) for agricultural and other research and training. One potential reason for the lack of public support to private research endeavors concerns that given by Hart, Shleifer, and Vishny (1997) regarding the roles of cost versus quality when contracts are incomplete.

and services of value to citizens and local industrial interests. Even though many state institutions were founded before the 1862 Morrill Act and another large group were established with that legislation, state funding on a per capita or per student basis was measly until the late nineteenth century when scientific findings became important in agriculture, mining, oil exploration, and a vast array of manufacturing industries, such as chemicals, metals, rubber, and foods.

Anecdotal evidence, bolstered by quantitative results we present below, suggest that in states having a concentration of economic activity by industry or by farm product, or in which there were important mining or oil interests, the public sector invested heavily in both training and research.[37] These services often took the form of research in the dominant industries of the state. Wisconsin subsidized work on dairy products, Iowa on corn, Colorado and other western states on mining, North Carolina on tobacco, and Oklahoma and Texas on oil exploration and refining.[38] State institutions of higher education often contained professional training institutes, such as in engineering, and graduate programs in various sciences, including those pertaining to agriculture. For these reasons, the state institutions of higher education attained the status of "university" to a greater extent than did those in the private sector. They had all the component parts of the university — the liberal arts college, the graduate programs, and the professional schools — and they also had the research funds of the state at a time when such funds were less available elsewhere.

Among the most striking differences between the curricula of public and private institutions

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[37] Rosenberg and Nelson (1993) discuss the role of both state and private universities in producing "local public goods" before the 1940s but shifting to defense and health-related work later. See also the classic volume by Nevins (1962) on the Morrill Act.

[38] Another reason offered for state funding of university research is that it has localized positive spillovers that increase economic growth and industrial development in the state, even if the research does not directly relate to the current industries. See Jaffe (1989) for evidence on positive spillover effects of university research on state patenting rates and industrial research and development.

in the formative period concerns engineering. In 1908 almost 30 percent of all students in the public sector were in engineering programs, although by 1929 the figure dropped to around 15 percent (see Table 4). The private sector percentage was about one-third that in the public sector. Not only were students in the public sector disproportionately in engineering programs, but engineering students were primarily in the public sector. In 1929, at a time when 37 percent of all students were in publicly-controlled institutions, 66 percent of all engineering students were.[39] Furthermore, in 1929 just three states (Massachusetts, New York, and Pennsylvania) enrolled 26 percent of all private-sector engineering students and these states had almost no engineers enrolled in public-sector institutions. Thus the geographic dispersion of virtually all other engineers came from those enrolled in the public sector. Even though the percentage of all public sector students who were engineers declined from 1908 to 1929, the fraction of all engineers enrolled in the public sector rose.

Many institutions of higher education were of a highly specialized nature, and these burgeoned after the 1880s. New Mexico, Colorado, South Dakota, and Montana, in that order, founded separate mining schools from 1859 to 1921. The majority of the state schools established in the early part of the twentieth century were for blacks or women, or were teaching, technical, and industrial institutes, such as the Lowell Textile Institute in Massachusetts. States were still founding institutions that had broad local support, but they were no longer the universities of the earlier period.

III. Explaining Political Economy Changes of the Formative Period

A. Accounting for the Relative Growth of Public Higher-Education Institutions

We have set forth a long list of changes in higher education during its formative period. Among those that we have grouped in the industrial organization heading are the increased scale and

[39] The 37 percent figure comes from Table 3.

scope of institutions, the demise of the independent professional school , the secularization of higher education, and the rise of the research university. These were prompted by a host of changes in the economy and in the structure of knowledge that led to greater specialization in subject matter and to a larger role for the applied and scientific disciplines. But what accounts for the relative growth of the public sector?

We will offer two, complementary interpretations. The more novel explanation is that the application of the scientific method and the increased division of labor and specialization in higher education disproportionately benefited certain types of institutions. Those that had access to research funds, were initially large and diverse, were non-sectarian, and had reputation and a long-purse were in the best position to prosper from the changes. Most public-sector institutions, and some in the private sector, were so situated and thus flourished and expanded in the wake of the changes to the structure of knowledge that shook higher education from around 1880 to 1910.

The reason the changes to the structure and diffusion of knowledge favored public-sector institutions was, in part, because they created complementarities between research and teaching. Institutions of higher education that engaged in research activities were suddenly able to provide teaching services at lower cost. Small liberal arts colleges, independent professional schools, and sectarian institutions were at a competitive disadvantage. But state institutions of higher education could spread their research base to benefit their teaching.

Certain private institutions also gained from the technological changes that affected higher education at the start of the formative period. Some were research and graduate institutions prior to the changes of the turn of the century (e.g., Johns Hopkins, Chicago). Still others were well established, with large endowments and long lists of prosperous alumni. Even though they may not

all have been research institutions, they had something else to sell their prospective students. Some of the professions, particularly new ones, like business, and those under suspicion, like medicine, needed the reputational quality of the older private institutions. Certain professions benefited more from a good name, a long-purse, and an extensive history, and therefore, some private institutions also expanded relatively after the technological shock. The importance of pre-existing reputation and the immense scale required to be a first-rate university after this technological shock is highlighted by the trivial number of leading universities founded in the twentieth century.

An alternative, and far simpler, explanation for the rise in the public share of higher education enrollment concerns the high school movement that swept much of the nation between 1910 and 1940 (Goldin 1994, 1998). In 1910, less than 10 percent of young Americans graduated from public and private secondary schools, but by the mid-1930s about half did in most states outside the South. The fraction with high school diplomas grew even more rapidly on the West Coast and in the mid-section of the country during the 1920s. Not only did the supply of high school graduates increase, but the increase was greater in states that earlier had well-functioning public higher education institutions (Goldin and Katz 1997).

In 1910, at the beginning of the increase in secondary schooling in the United States, a large fraction of graduates, perhaps 50 percent, continued with their education (Goldin 1998, table 2).[40] As secondary school enrollments soared, a smaller fraction of high school graduates went on to

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[40] Even though more of the new high school graduates did not continue to college, the returns to college remained high in the period. We find, using a unique data set from the 1915 Iowa State Census, that the estimated "return" to a year of college from a standard log earnings regression was over 12 percent a year for young workers, similar to estimates for the 1990s. That is, there was a substantial inducement to continue with college, particularly if the youth was in a state with a high quality, inexpensive public system. See Goldin and Katz (1998).

college but a larger fraction of all youths did. The new group of high school graduates differed from the old by background, aspirations, and geography, and more of the newer graduates were less able to afford the tuition of private institutions.[41] Thus, the relative shift toward public institutions is postulated to have been brought about by both an increased relative demand on the part of high school graduates for a more practically-oriented curriculum and by the lower income levels of a large fraction of the new high school graduates.

The explanation concerning the expansion of public secondary school may be compelling, but the cross-state correlation between the high school graduation rate in 1928 and the public share of higher education students (among state residents) in 1931 is weak ($\rho = 0.17$). About one-half of the total change in the public share of higher education enrollment from 1897 to 1940 can be explained by the cross-section relationship, leaving substantial room for the alternative hypothesis.

B. The Political Economy of State Spending on Higher Education

State support for public higher education increased greatly from the late 1890s to 1940, measured either by state spending on higher education or by the growth of enrollments in publicly-controlled institutions relative to all enrollments, or to the college-aged population.[42] But public funding for higher education and access to public colleges and universities varied substantially among states throughout the period. The greatest levels of support were found in the West (the Pacific,

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[41] Differences in the cost of college attendance between public and private-sector institutions of higher education were already substantial in this period. The average (list) in-state tuition plus fees for undergraduates at public-sector institutions in 1933 was $61 as compared with $265 in the private sector. The overall difference in the costs attending public versus private institutions was further enlarged by the higher average room and board costs in private schools. Source: The College Blue Book (1933).

[42] The total expenditures of state higher-education institutions increased from 5.1 percent to 11.0 percent of state and local government spending from 1902 to 1940, or from 0.06 percent to 0.29 percent of GNP (*Historical Statistics* 1975, series Y 684-85, F 1).

Mountain, and West North Central divisions) and the lowest were found in the northeast (New England and the Middle Atlantic). Because many of these differences still persist we ask what the determinants of state support for higher education were in 1929.[43]

State and local government subsidies to higher education, which averaged $1,089 per 1000 persons across the 48 states in 1929, were 6 percent of total state and local government spending.[44] Almost 95 percent of state and local support for higher education went to publicly-controlled institutions; only in New York and New Jersey was state support of privately-controlled institutions of significance.[45] State and local spending on higher education per 1000 inhabitants ranged from a low of $458 in New England to a high of $2,057 in the Mountain states. Enrollments in publicly-controlled institutions averaged 3.19 per 1000 inhabitants: from 0.82 in New England to 6.04 in the Mountain states and 6.09 in the Pacific states. What explains these substantial differences across regions and the even larger differences among individual states?

The first three columns of Table 5 explore the determinants of differences across states in the log of state and local spending per capita on higher education in 1929.[46] The public choice decision to provide support for higher education is likely to be affected by the level and distribution of wealth

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[43] We analyze 1929 to examine state differences just prior to substantial effects on state and local budgets of the Great Depression and expansions of federal support. Analyses of cross-state differences in 1924 and 1934 lead to similar conclusions as to those presented here for 1929.

[44] Total expenditures of publicly-controlled institutions of higher education were 10 percent of state and local expenditures. The difference is accounted for by other sources of funds, such as student fees and federal government funding.

[45] Rutgers University and Cornell University, both privately-controlled institutions at the time, received substantial funding from New Jersey and New York respectively.

[46] The results in cols. (1) to (3) are similar when the share of the population of college age (15 to 24-years old) is added as a covariate. This variable is insignificant in each of these specifications.

or income in a state, community stability and homogeneity, and the importance of industries that capture localized benefits of research at state institutions. Col. (1) indicates a strong positive relationship of automobile registrations per capita on state support for higher education. A one standard deviation increase (or 0.32) is associated with a 0.4 log point (49 percent) increase in state spending per capita on higher education. Automobile registrations per capita in this period is a measure of both the level and distribution of wealth since it is, essentially, a count of the fraction of individuals wealthy enough to own a car.[47] Thus it proxies for the share of voters sufficiently wealthy to believe their children were likely to attend college. The shares of employment in mining, manufacturing, and agriculture are also positively related to state support for higher education. The relationship might emanate from the ability of these sectors to lobby for research, extension, or experiment station support at state institutions. It might, as well, come from the belief of state legislators that the social return on public expenditures was high and that it would accrue to residents of states that had highly concentrated agriculture, unique manufacturing outputs, and idiosyncratic engineering and mining needs. The states of the northeast (the base group) have substantially and significantly lower public support for higher education than do other regions even after including controls for wealth, industrial structure, and social structure (fraction Catholic).[48]

The regression in col. (2) of Table 5 adds enrollments in privately-controlled institutions in 1900 as a proxy for the historical importance of private colleges and universities in each state. A

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[47]Automobile registrations per capita is a stronger predictor of state spending on higher education than either per capita property wealth or income per capita. Goldin and Katz (1997) similarly find that automobile registrations per capita is the best predictor of state high school graduation rates during this period.

[48] The observed differences in public support for higher education in 1929 do *not* appear to simply reflect differences across states in overall tastes for government spending. The addition of (log) total state and local government spending in 1932 as a covariate to the specifications in col. (1) and (2) of Table 5 does not materially affect the magnitude or statistical significance of any of the effects of other included variables.

substantial presence of private universities in a state in 1900 had a significant depressing effect on public support of higher education in the state in 1929, but the inclusion of the variable does not markedly change the impact of the others. The difference between private college enrollments per 1000 residents in Massachusetts and Iowa in 1900 (3.35 - 0.99) implies a decrease in per capita spending on higher education of 61 log points (84 percent). Figure 7 illustrates the strong negative relationship between state spending on higher education in 1929 and the importance of private universities in the state at the start of the twentieth century (the raw correlation coefficient is -0.69).

The regression in col. (3) more fully explores how state "initial" conditions, circa 1900, affected public support for higher education in 1929. States with high agricultural income per worker at the turn of the century, a low share of Catholics, more recent statehood, and without initially strong private universities provided more public support for higher education in 1929. Col. (4) shows the negative effect that access to private colleges in 1900 had on public college enrollments, as a share of state population in 1929, controlling for the eligible pool of state residents proxied by the high school graduation rate and the population share 15 to 24-years old.

Thus newer states, with a high share of well-to-do families, and scant presence of private universities in 1900 became the leaders in public higher education by 1930. They remain so today. The tradition of stronger private universities and lower support for publicly-controlled universities in the northeast also continues to the present.

IV. Consequences of the Increased Public Higher Education Enrollments in the Formative Period

One reason for interest in the growth of public higher education is to understand its impact on college-going rates in general. We therefore explore the factors that affected college-going at the state level from 1897 to 1931. Because college students attend school both in and out of their state

of residence, we use data on the college attendance of individuals by their state of residence. Such data have been collected by the federal government at various intervals since the 1870s.[49] The percentage of students attending college in their state of residence was 76.4 percent in 1897, 75.6 percent in 1923, and 80.3 percent in 1931.

The dependent variable is the number of college students by state of residence as a fraction of those 18 to 21-year olds in the state. In cols. (1) to (4) of Table 6 we present levels regressions for 1897, 1923, and 1931, and in col. (5) we show a change regression across the entire period as a function of various initial conditions. We have included, in Table 6, many of the variables that we have found of importance in explaining cross-state variation in secondary school graduation rates during a similar period. The variables included are motivated by a model of individual income maximization and by a public choice framework (Goldin and Katz 1997).

Cols. (1), (2), and (3) are parsimonious specifications that include only a per capita income or wealth measure, measures of community stability (fraction elderly) and homogeneity (fraction Catholic). A higher percentage elderly in a state could indicate that they are more connected to their community either because the area was not recently settled or because the elderly have not migrated from it.[50] We find that the effect is not much altered by adding the fraction under five years old in the population nor by the proportion foreign born, but is, rather, is a separate influence. The

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[49] See Hoxby (1997a, 1997b) for an interesting use of these data to track the evolution of a national market in education.

[50] In 1910 the states with the highest percentage elderly were in New England, where out-migration produced the result. But there is considerable variation among the other states and our results on secondary schooling are robust to including a dummy variable for New England. Poterba (1997) finds a contrasting result using recent data: a more rapid growth in the percentage elderly is associated with lower growth in K-12 spending per child. Hoxby (1998) finds that per pupil spending at the school district level is positively related to the elderly share of the population in 1900 and 1910, but negatively related in 1990.

percentage Catholic is highly correlated with the fraction foreign born and the fraction urban in a state. All these variables provide measures of the degree of heterogeneity in the area and thus the potential for conflict in voting on public expenditures. The col. (4) regression for 1931 adds the high school graduation rate and a measure of state college tuition and fees.

We find, for all years, that per capita income, per capita wealth, or agricultural productivity (proxied by agricultural income per farm worker) were important and strong stimulants to college enrollment, as is our measure of community stability, although less so for 1931. The West becomes a more impressive, positive outlier toward the end of the period, and the South emerges as a negative outlier. In 1931 even controlling for per capita wealth and the high school graduation rate, we find that the direct cost of tuition in the publicly-controlled sector is an important factor. A decrease in public-sector tuition and fees of one standard deviation in 1931 ($84) would increase the college enrollment rate of state residents by 1.2 percentage points (or 9 percent of the mean level), conditional on the secondary school graduation rate.

The change regression in col. (5) indicates that states with later dates of statehood had more rapid growth in college enrollments rates from 1897 to 1931; Figure 8 shows the positive relationship between the year of statehood and the college enrollment rate that existed by 1931.[51] With the exception of three outliers, all of which were sparsely-settled and contiguous states of the southwest, nearly all states fall into just two quadrants.[52] Those that were early entrants had low levels of college enrollment. Among them are many of the states of New England and the Middle West known for

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[51] See also Quigley and Rubinfeld (1993) for a discussion of the relationship between state higher education more recently and the year of statehood.

[52] West Virginia is another outlier, but its year of statehood is debatable since it was broken off from a preexisting state at the close of the Civil War.

their early and strong commitment to primary education. The late entrants had high levels of college enrollment and these include states in the Great Plains and Far West. Many of those states emerged as leaders in the high school movement after 1910, but the differences in the case of college enrollment are more extreme. Not only did the late-entering states have a large proportion of their young population eligible to attend college, but they also funded higher education so well that they achieved a college-going rate about double that of the group in the other quadrant. Many of the states in the early-statehood quadrant also had a substantial proportion of their youth prepared to enter higher education (e.g., Indiana, Maine, Massachusetts, New Hampshire, Ohio), but their state support of higher education was more meager.

V. Concluding Remarks: Persistence of Change in Higher Education

Our interest in the history of higher education, like that of others (see, e.g., Quigley and Rubinfeld 1993), is motivated by its relevance for today. States in which private institutions had a substantial presence in the more distant past, and in which higher education received scant public support, continue to exhibit similar patterns today. Those that entered the union earliest had, in the early twentieth century and continue to have today, lower public college enrollment rates and lower state subsidies for higher education. The cross-state correlation of public college enrollments per capita, in 1994, with year of statehood is 0.70. The 1994 level of in-state tuition at four-year public universities has a correlation of -0.59 with year of statehood. Similarly, states with high private university enrollments around1900 continue to provide less support per capita for public institutions of higher education and have lower public college enrollment rates.[53] History appears to matter today

[53] The correlation of public college enrollments per capita in 1994 with private college enrollments per capita in 1900 is -0.56. Data on public-college enrollments and in-state tuition levels for 1994 are from U.S. Department of Education (1996).

in state-level indicators regarding higher education.

Many of the most obvious features of (four-year) higher education in the United States today — the large average size (and variance) of its institutions, the distinction between liberal arts colleges and research universities, the wide teaching and research scope, the substantial share of enrollment in the public sector, and the per capita resources provided by the various states — were shaped during a formative period from 1890 to 1940. We have suggested that the increases in the scale and scope of institutions of higher education were brought about by exogenous changes in the "structure of knowledge" and by others that affected the professions generally and that of the clergy in particular. The increase in the share of students in the public sector may also have been prompted by these exogenous changes for they gave advantages to institutions, such as those in the public sector, that had research facilities, reputation, and a long purse. The high school movement, which swept parts of the country from 1910 to 1940, brought students from less privileged backgrounds to college and thus also buoyed enrollments in the public sector.

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DATA APPENDIX

Sources of data sets at the institutional level for 1897, 1924, and 1934:

Department of the Interior, Commissioner of Education. 1898. *Annual Reports of the Department of the Interior for the Fiscal Year Ended June 30, 1897*, vol. 2. Washington, D.C., GPO.

U.S. Office of Education. 1927. *Biennial Survey of Education, 1922-24.* Bulletin 1926, No. 23. Washington, D.C.: GPO.

U.S. Office of Education. 1937. *Biennial Survey of Education, 1932-34.* Bulletin 1935, No. 2. Washington, D.C.: GPO.

Variables and institutional linkages:

Each of the three sources contains relatively similar information on the number of students in various groups (e.g., by sex; by level such as preparatory, undergraduate, and graduate; by type such as collegiate and professional) and revenue sources (e.g., student fees, government grants, private gifts). Total revenues do not include additions to endowment, which are listed separately. Students do not include those in summer school, correspondence courses, extension, or military drill.

Data similar to those we have used are available for most of the years after 1890 to 1938. The Office of Education switched in 1934 to a compact tabular presentation. We coded 1934 for that reason and also because it is a Depression year. The 1934 data set includes 853 institutions, 711 privately-controlled and 142 publicly-controlled. That for 1924 has 790, with 677 in the private sector and 113 in the public sector. For the 1897 data the Commissioner of Education listed 534 universities and colleges separately from professional and theological schools, and technical institutes. We added the last three groups, but only for those institutions not already on the original list. (The added institutions only have information on students and faculty.) It is our understanding that the professional schools separately listed duplicate the student data in the original list. This can be demonstrated for many universities having medical and law schools. The final 1897 sample contains 821 institutions (including the independent professional and theological schools), of which 717 were private and 104 public. We did not code institutions that were junior or two-year colleges in the given year. Independent teaching colleges and normal schools, in both the public and private sectors, were separately listed by the Commissioner of Education or the Office of Education, and we did not code them.

The 1924 listing contains the "date at first opening," which can be different from the date of founding, and also the denomination of the institution. We coded that information and checked it against the year given for first instruction in American Council on Education (1960). We linked the 1924 schools to those in 1934 and used several other guides, such as The College Blue Book (1934), for the histories of various schools that changed city or name, or merged with or split off from others. Of the 790 schools in 1924, 695 were linked to institutions on the 1934 list. Among those that were not theological seminaries and independent professional schools in 1924, the linkage rate is 91.5 percent.

Linkages from 1897 forward in time were more difficult. We had information in the 1897 listing for the date at first opening and the denominational affiliation. Of the 534 universities and colleges listed in 1897, we linked 412 to the 1924/34 list. Some did not survive to 1924/34; others were altered in ways that prevented us from linking them back to preexisting institutions. We relied on the historical information in American Council on Education (1960) for the original names of various institutions (e.g., California Institute of Technology was, in 1897, the Throop Polytechnic Institute).

In both 1897 and 1924 many of the publicly controlled, historically-black institutions of today were not listed, although some were. We have carefully traced the histories of these institutions and believe that their absence from the lists for colleges and universities is because the Commissioner of Education categorized them as teaching colleges or industrial institutes, which were listed separately. We believe this categorization is correct in most cases.

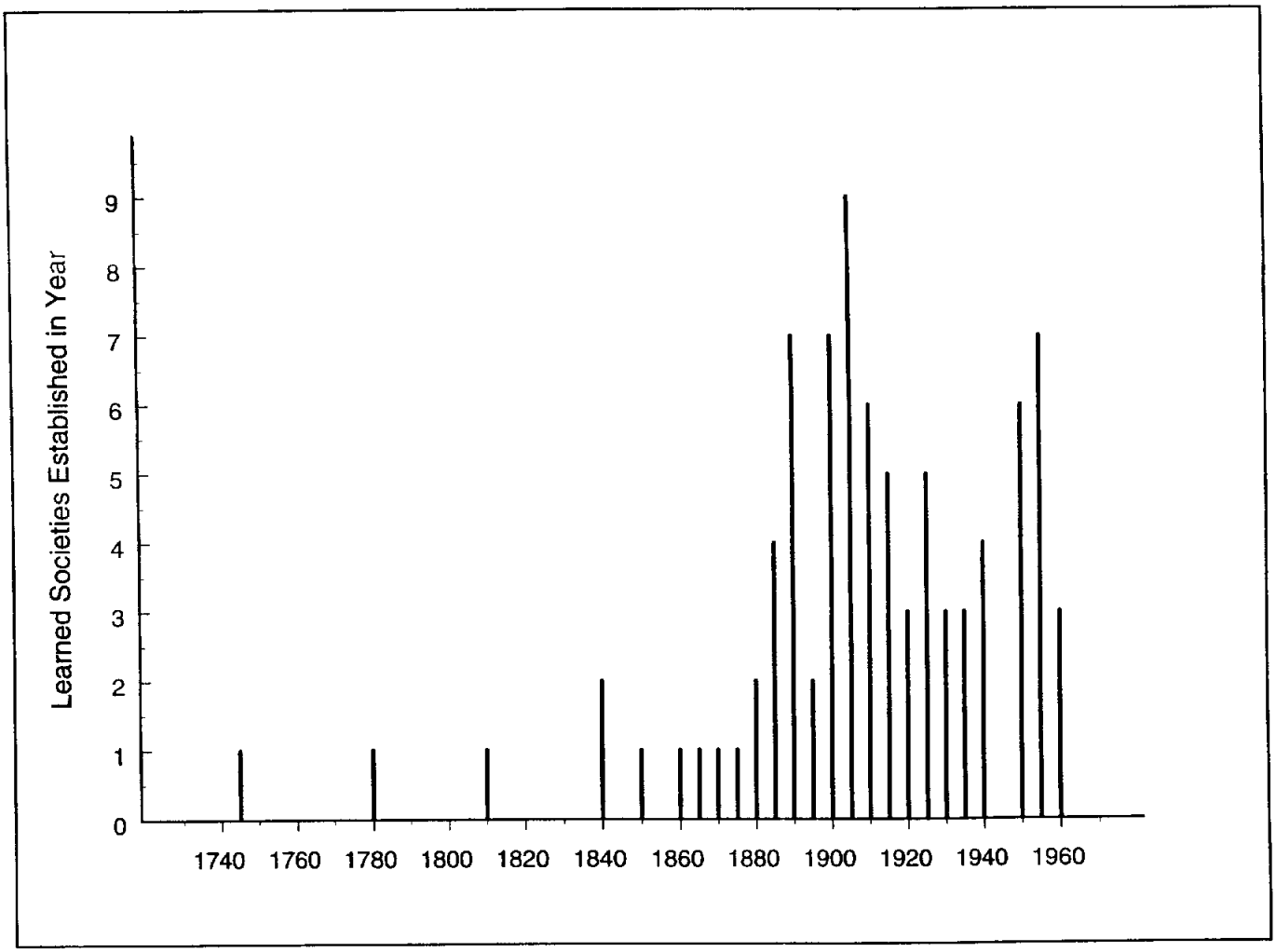
Except in the case of the historically-black institutions, we were able to find virtually all -- if not all — publicly-controlled institutions known to have existed in each of the three years: 1897, 1924, and 1934. Thus we are reasonably certain that, given the caveat in the above paragraph, the publicly-controlled sample is complete.

Categorization of the institutions:

We categorized the institutions, primarily as of 1934, as liberal arts colleges, universities, technical institutes, agriculture and/or mechanical schools, land grant colleges, independent schools of theology, and independent professional schools. Institutions could be in more than one group, although universities could not be in any of the others except land grant. Thus, the university title "trumps" the rest, as per the definition offered in the text. All were also categorized as coed, male, or female, and each was either privately or publicly controlled.

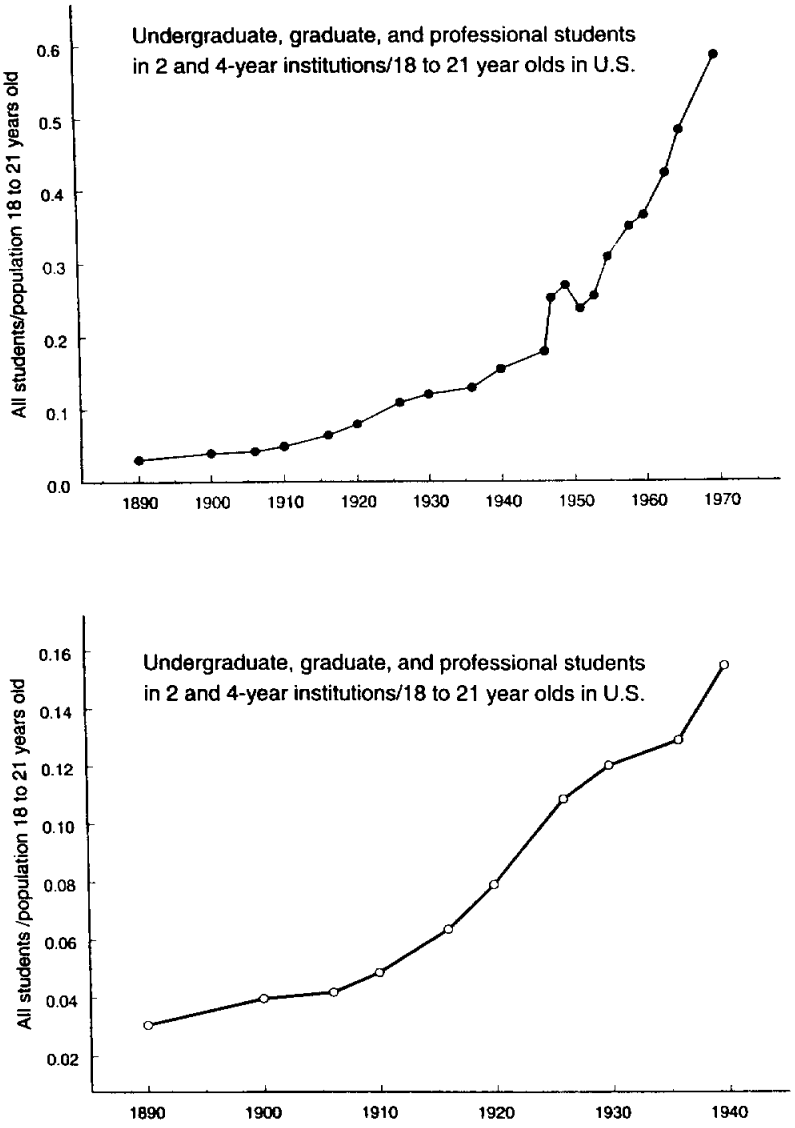
We used the historical information in American Council on Education (1960) for our coding and were helped by the contemporaneous information in The College Blue Book (1934).

Figure 1
National Learned Societies Formed by Year: 1743 to 1963



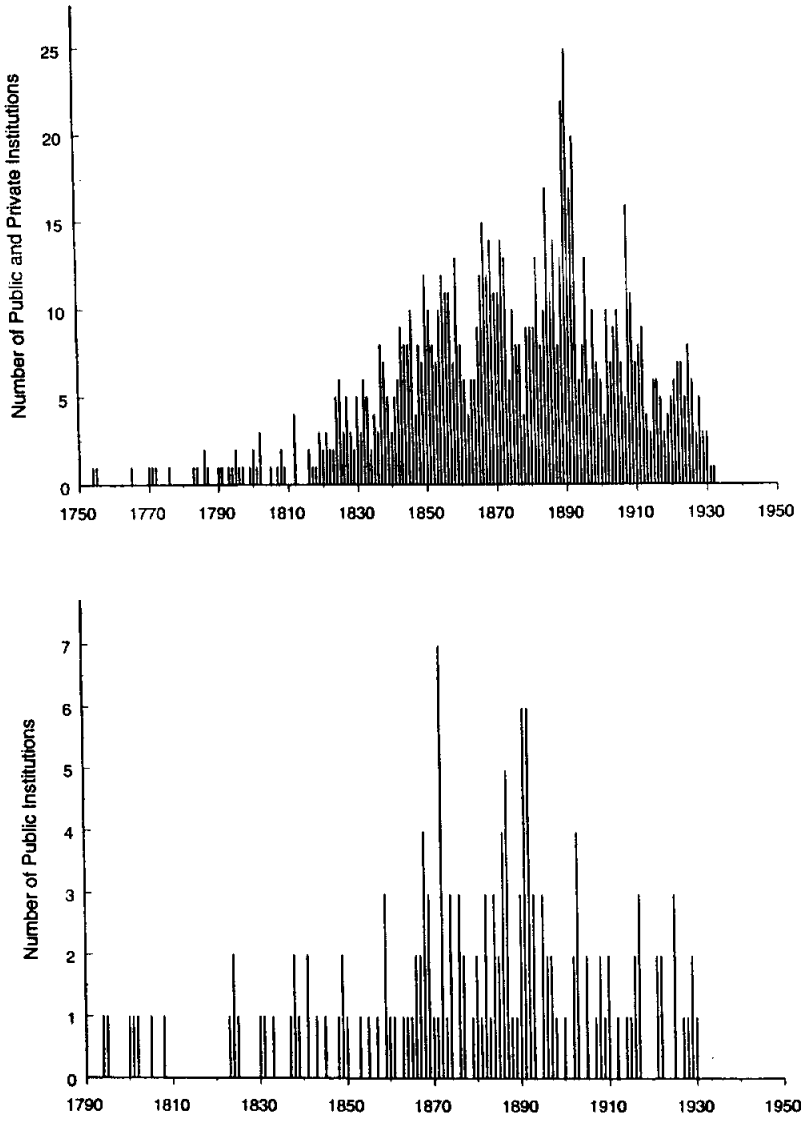
Sources: Kiger (1963, pp. 265); American Council of Learned Societies (1996).
Notes: The year given is the date of founding. Date are grouped in 5-year intervals, and the year given in the graph is the mid-point. The data set includes all current members of the ACLS and all those listed in Kiger (1963).

Figure 2
Students in Two and Four-Year Institutions in the United States
a Fraction of the Number of 18 to 21-Year Olds: 1890 to 1970



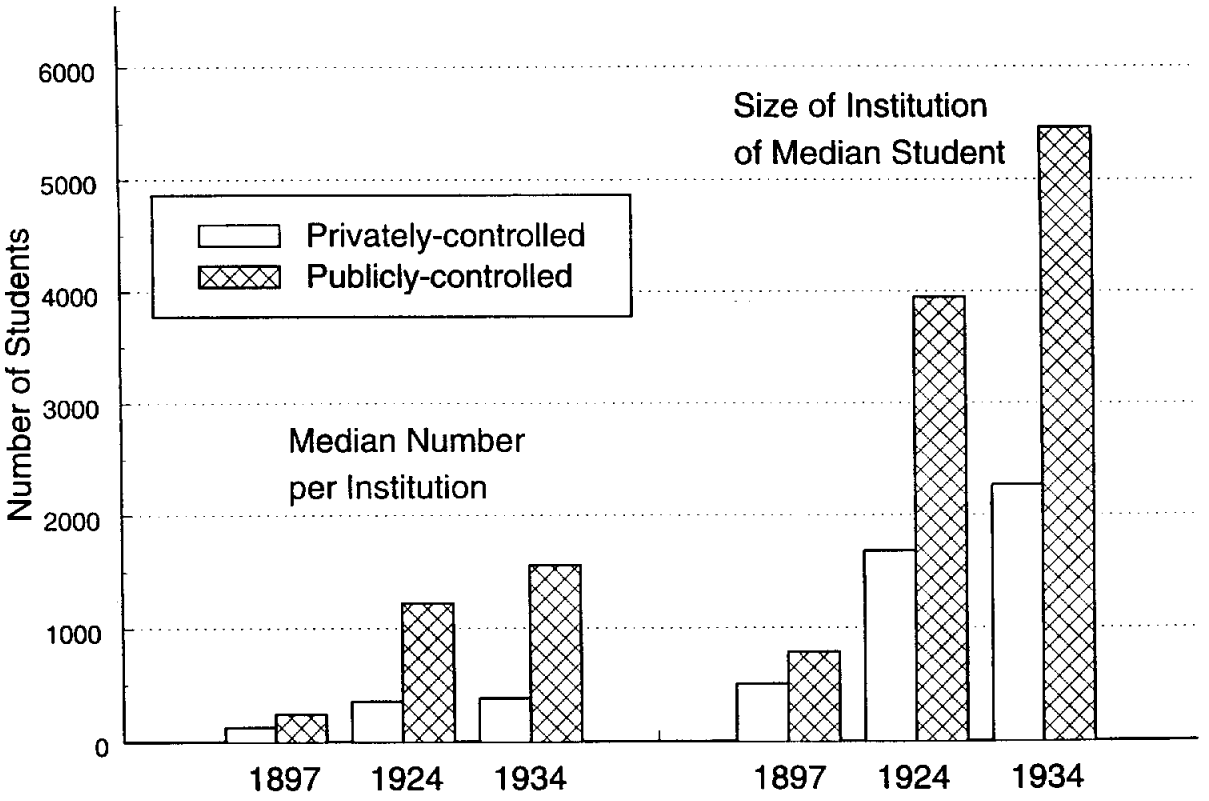
Notes and Sources: *Historical Statistics* (1975, series A 123, A 124, H 700). See notes to Table 3 for adjustments to series H 700. Data exclude students in preparatory departments of colleges and include all in collegiate, graduate, and professional divisions, without duplication, as well as those in teaching programs and 2-year colleges. The number of 18 to 21-year olds was estimated as 0.4 × number of 15 to 24 year olds.

Figure 3
Opening Dates for Four-Year Institutions of Higher Education
(Excluding Independent Teacher-Training Institutions) Existing in 1934: 1750 to 1934



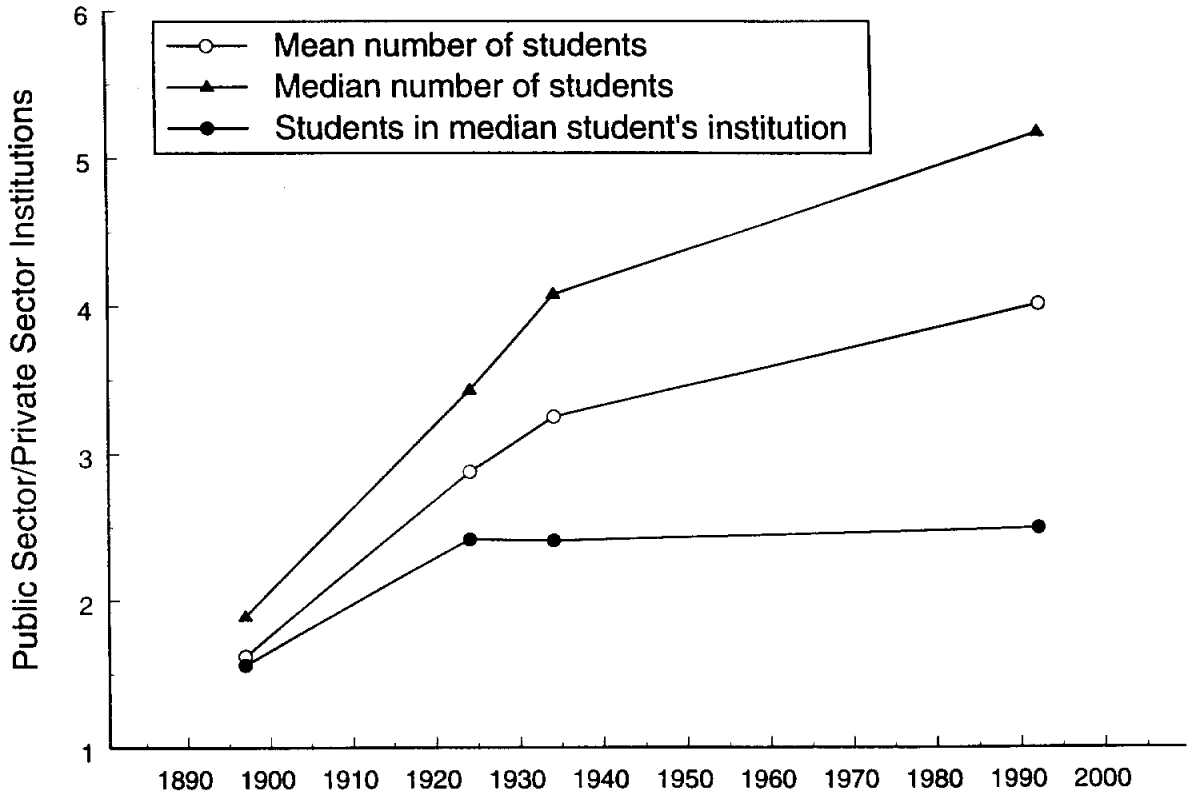
Notes and Sources: "Opening date" means, at least, as a four-year liberal arts college or professional school and is occasionally not the same as the date of establishment or the date of first instruction. The dates come from various *Biennials*, especially that for 1922/24, and have been checked against the detailed information on institutional histories in American Council on Education (1960). The timeline for all institutions excludes, for graphical presentation reasons, all those founded before 1750.

Figure 4
Scale of Public and Private Institutions of Higher Education: 1897, 1924, and 1934



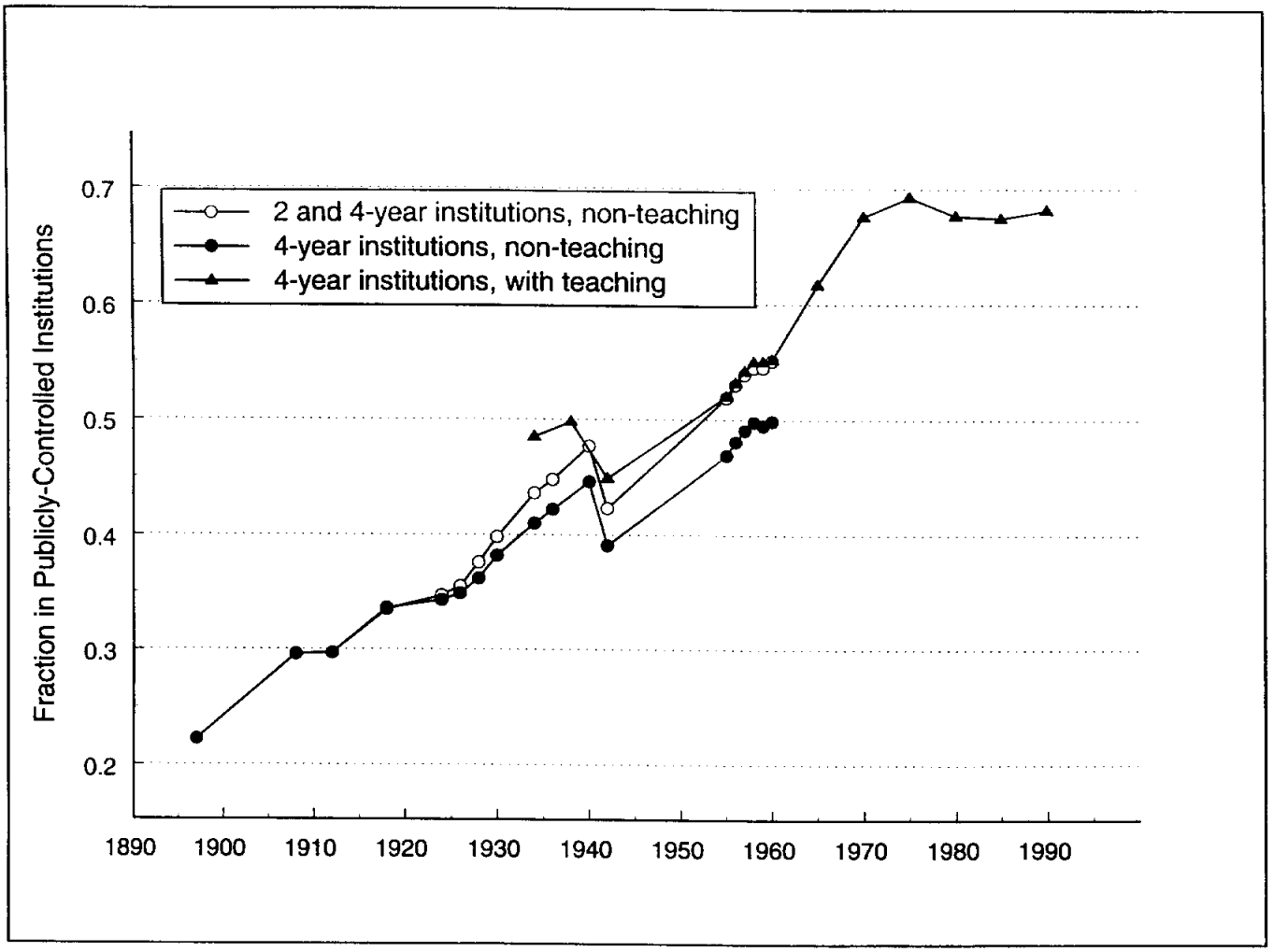
Source: Table 1.
Notes: Institutions of higher education include only four-year colleges and universities and exclude junior colleges, normal schools, independent teaching colleges, independent professional schools, and independent theological institutes.

Figure 5
Relative Scale of Public and Private Institutions of Higher Education: 1897 to 1990-94



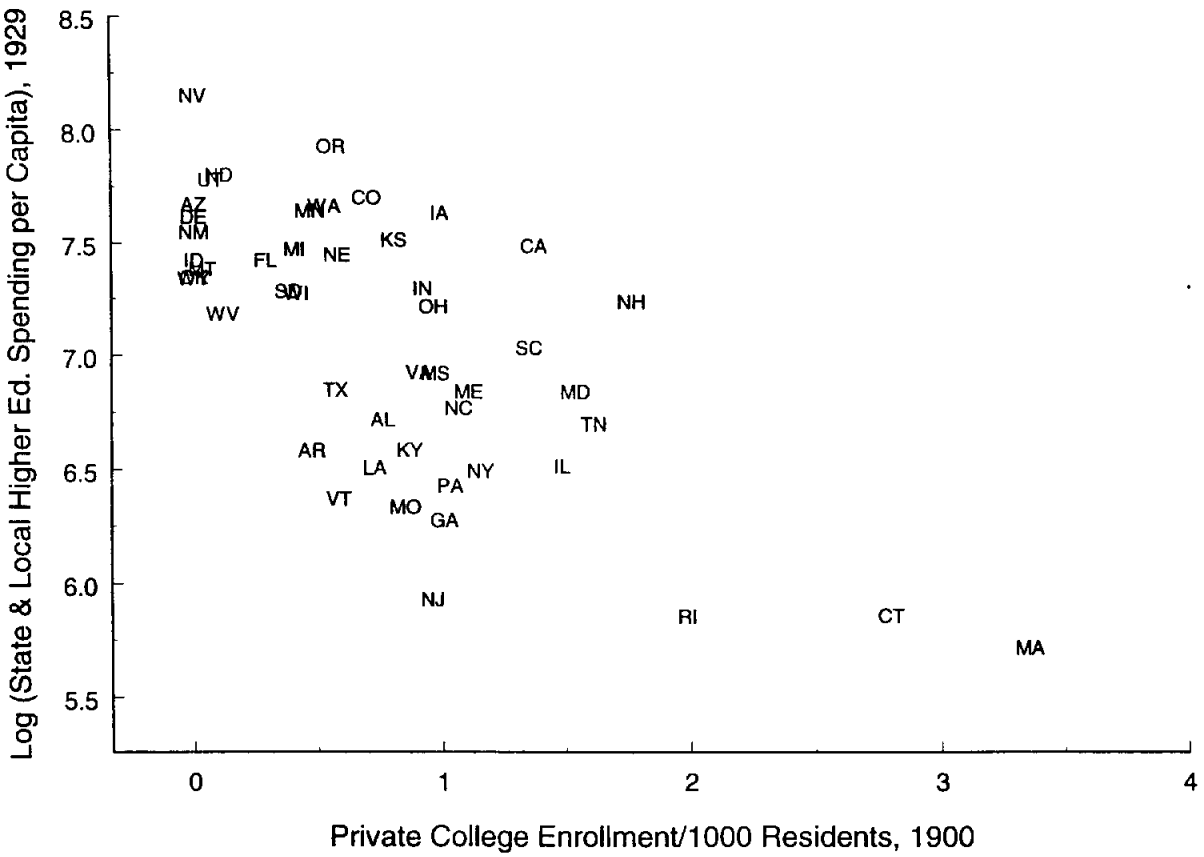
Source: Table 1.
Notes: Institutions of higher education include only four-year colleges and universities and exclude junior colleges, normal schools, independent teaching colleges, independent professional schools, and independent theological institutes.

Figure 6
Fraction of Students in the Publicly-Controlled Higher Education Sector: 1897 to 1990



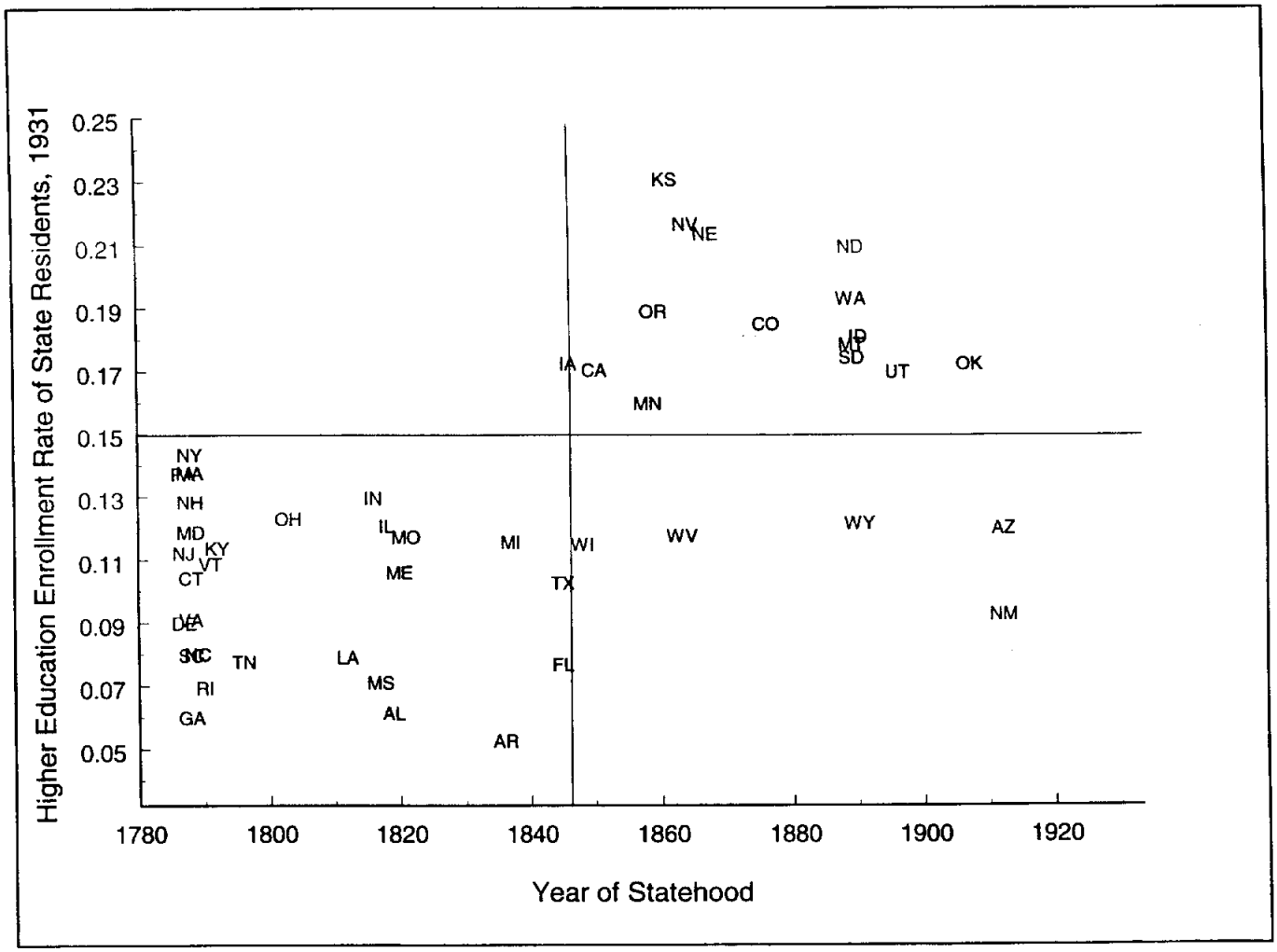
Notes and Sources: See Table 3. The two lines with circles are cols. (1) and (2); the line with triangles is col. (3).

Figure 7
Relationship between State and Local Spending on Higher Education in 1929 and Private College Enrollments per 1000 Residents in 1900



Notes and Sources: See notes to Table 5.

Figure 8
Relationship between the College Enrollment Rate in 1931 and the Year of Statehood



Notes and Sources: See Table 6. The enrollment rate is the ratio of state residents in an institution of higher education anywhere in the United States to the estimated number of 18 to 21 year olds in the state (the number of 15 to 24 year olds × 0.4).

Table 1
Scale of U.S. Private and Public Higher Education: 1897, 1924, 1934, and 1990-94

	1897		*1924*		*1934*		*1990-94*	
	Private	*Public*	*Private*	*Public*	*Private*	*Public*	*Private*	*Public*
(1) Mean number students	256	415	755	2165	859	2790	2800	11244
(2) Median number students	128	242	359	1225	383	1561	1579	8181
(3) Mean institutional revenue, 1992 dollars (000)	$826	$1511	$2885	$11625	$3718	$12147	$54955	$141520
(4) Median institutional revenue, 1992 dollars (000)	$282	$1008	$1196	$7239	$1195	$7139	$17530	$62047
(5) Number of students in median student's institution	505	787	1630	3950	2271	5465	7766	19379
(6) % institutions having > 1,000 students	4.9	9.9	15.0	59.6	14.2	70.5	73.4	98.3
(7) % students in institutions having > 1,000 students	34.9	41.1	60.1	90.3	62.5	94.2	94.0	99.9
(8) % institutions having > 10,000 students	0	0	0.60	2.75	0.56	5.74	4.98	41.6
(9) Number institutions in top 20 institutions	14	6	10	10	8	12	0	20
(10) Number of institutions for rows (1) to (9)	305	81	498	109	536	122	904	515
(11) Mean number students in matched 1924-34 sample	—	—	814	2338	955	3150	—	—
(12) Median number students in matched 1924-34 sample	—	—	391	1424	413	1734	—	—

Table 1 continued

(13) Number of institutions for rows (11) and (12)	—	—	450	99	450	99	—	—

Notes and Sources: See Data Appendix for 1897, 1924, and 1934 sources. The 1990-94 data (a five-year average) are from the CASPAR database from which were excluded junior colleges, normal schools, independent teaching colleges, independent professional schools, and independent theological institutes. Students in preparatory departments are excluded from the calculations in this table for 1897 and 1924. Black-only schools are excluded in both the public and private numbers because of ambiguities regarding the appropriateness of including many black public institutions before the 1930s when most of their students were in normal and industrial training. Total revenue excludes additions to endowment. Lines (4) and (5) use the BLS CPI in *Historical Statistics* (1975, series E 135) for which 1967 = 1: 1897 0.250, 1924 0.512, and 1934 0.401, and the CPI-U from the *Economic Report of the President* (1997) for which 1982-84 = 1 and 1992 = 1.403. Thus the multiplicative factor to produce 1992 dollars from 1967 dollars is 4.201.

Table 2
Professional Students and Independent Professional Schools, 1897 to 1934

	Percentage of Professional Students in Independent Professional Schools, Public and Private	Number of Independent Professional Schools, Public and Private
1897	47.8	185
1924	24.5	64
1934	18.6	58

Notes: The 1897 statistic is the ratio of all students in independent professional schools divided by the total number of professional students (in medicine, law, dentistry, and so on) in all colleges and universities, including all those in the independent professional schools. Both the 1924 and 1934 statistics divide the number of students in independent professional schools, derived from our estimates, by the total number of professional students (in the same disciplines as in 1897) from the compilations by type of professional school in the *Biennials 1922/24, 1932/34*. We use the compilations because the category "professional" in 1922/24 and 1932/34 also includes those in engineering and theology, among others.

Sources: See Data Appendix.

Table 3
Percentage of Higher Education Students in Publicly-Controlled Institutions

Year	*(1) All 2 and 4-year (without teacher-training) institutions*	*(2) Only 4-year (without teacher-training) institutions*	*(3) Only 4-year (including teacher-training) institutions*
1897	0.222	0.222	—
1908	0.296	0.296	—
1912	0.297	0.297	—
1918	0.335	0.336	—
1924	0.347	0.343	—
1926	0.355	0.349	—
1928	0.376	0.362	—
1930	0.398	0.382	—
1934	0.436	0.410	0.485
1936	0.448	0.422	—
1938	—	—	0.498
1940	0.477	0.446	—
1942	0.423	0.391	0.449 [a]
1955	0.519	0.469	0.520
1956	0.530	0.481	0.532
1957	0.539	0.491	0.542
1958	0.545	0.498	0.550
1959	0.545	0.495	0.550
1960	0.551	0.499	0.552
1965	—	—	0.617
1970	—	—	0.676
1975	—	—	0.693
1980	—	—	0.677
1985	—	—	0.675

1990	—	—	0.682

[a] The 1942 figure is extrapolated on the basis of col. (2).

Notes and Sources:

General Note: In all cases an attempt was made (by us and by the government) to include the total number of students at the college level without duplication. That is, all collegiate, graduate, and professional students, but not preparatory students, should be in both the numerator and the denominator. The U.S. Office of Education revised its totals sometime in the early 1930s because of a suspicion that many small private colleges were not included in the surveys or did not respond to them. The totals that appear in *Historical Statistics* (1975, series H 706) are those corrected figures. The contemporaneous enrollment numbers for the publicly-controlled institutions appear to be correct. The implied data for the privately-controlled institutions (obtained by subtraction) are considerably less stable over time than they probably were and we have therefore adjusted them by interpolation. These adjustments slightly affect some of the totals for 1897 to 1912. Publicly-controlled institutions include all those at the state, city, and national levels.

Students in all 2 and 4 year (including professional and graduate) institutions: 1897-1942: *Historical Statistics* (1975, series H 706) with amendments given in the *General Note*. 1955-1960: *Opening Fall Enrollment* (1960, table 22). 1965-1990: *Digest of Education Statistics* (1996, table 169).

Students in all independent teachers' and normal schools: 1897-1942: We generally accept the totals in the various *Biennials*, but extrapolate between 1890 and 1910. 1955-1960: U.S. Department of Health, Education, and Welfare (1961, table 22).

Students in all junior and 2-year colleges: 1897-1942: *Biennial 1944/46* (p.5, table III). 1955-1960: *Opening Fall Enrollment* (1960, table 22).

Students in publicly-controlled 2 and 4 year (including professional and graduate) institutions: 1897: *Report of the Commissioner of Education 1897*, constructed from data on separate institutions. 1908, 1912: U.S. Bureau of Education (1909, 1913), constructed from data on separate institutions; municipals and nationals are added from *Report of the Commissioner of Education [year] or Annuals, [year]* and state-supported but not state-controlled are subtracted. 1918-1942: *Biennials*.

Students in publicly-controlled independent teachers' and normal schools: These data were not added to the public numbers by the U.S. Office of Education. 1934, 1938: *Biennials*.

Students in publicly-controlled junior and 2-year colleges: 1897-1942: *Biennial 1944/46* (p.5, table III).

Table 4
Engineers in the Public and Private Sectors

	Percentage Engineers among Students in Four-Year Institutions: 1908 to 1930		Percentage of engineering students in public sector
	Public	Private	
1908	28.6 [a]	n.a.	n.a.
1910	n.a.	n.a.	60
1923	17.3 [a]	n.a.	n.a.
1924	15.2	5.4	59
1930	14.8	4.6	66

[a] Municipal universities and colleges are not included.

Notes:
All students, both undergraduate and graduate, are included. Engineering students were mainly undergraduates. Because not all colleges and universities reported their students by courses of study, we cannot report the percentage engineers among students but can compute the percentage in the public sector. The difference between the 1923 and 1924 numbers is the inclusion of the municipal universities and colleges, in particular the extremely large enrollment in the New York City municipal colleges which were did not train many engineers at that time.

Sources:
1908: U.S. Bureau of Education (1909); 1910: *Report of the Commissioner of Education 1910*; 1923: U.S. Department of the Interior (1924); 1924: *Biennial 1922/24*; 1930: *Biennial 1928/30*.

Table 5
Determinants of State Support for Higher Education: 1929

	log (state and local spending on higher education per capita)			*public college enrollments per 1000 residents*
	(1)	(2)	(3)	(4)
Log (automobile registrations per capita), 1930	1.31 (0.278)	1.06 (0.274)		
Log (agricultural income per agricultural worker), 1900			0.339 (0.153)	
Fraction Catholic, 1910, 1926 [a]	-0.631 (0.584)	-0.628 (0.542)	-1.09 (0.515)	
Fraction of labor force in mining, 1930	4.14 (1.59)	2.38 (1.62)		
Fraction of labor force in manufacturing, 1930	2.47 (1.57)	3.05 (1.47)		
Fraction of labor force in agriculture, 1930	1.73 (0.848)	1.45 (0.793)		
West	0.803 (0.261)	0.782 (0.243)		
South	0.753 (0.244)	0.667 (0.229)		
East North Central	0.493 (0.206)	0.386 (0.195)		
Public and private high school graduation rate, 1928				12.5 (2.53)
Fraction of population 15 to 24-years old, 1930				19.8 (19.1)
Private college enrollments per 1000 residents, 1900		-0.258 (0.0952)	-0.294 (0.115)	-1.73 (0.309)
Year of statehood $\times 10^{-2}$			0.500 (0.207)	
Constant	-1.68 (1.79)	-0.115 (1.76)	-3.88 (3.43)	-2.11 (4.16)
R^2	0.759	0.798	0.645	0.645

Mean squared error	0.322	0.298	0.371	1.43
Number of observations	48	48	48	48

[a] The 1926 figure is used for cols. (1) and (2); the 1910 figure is used for col. (3).

Notes and Sources:

State and local spending on higher education per capita, 1929: Biennial 1928/30. The numerator is total receipts from state and city governments to publicly and privately-controlled institutions, 1929/30. The denominator is total population/1000 in 1930.

Public college enrollments per thousand residents, 1929: *Biennial 1928/30.* The numerator is total enrollments (excluding duplicates) of publicly-controlled universities, colleges, and professional schools, 1929/30. The denominator is total population/1000 in 1930.

Automobile registrations per capita, 1930: *Statistical Abstract* (1940).

Agricultural income per agricultural worker, 1900: Kuznets, et al. (1960). The variable is agricultural service income per agricultural worker.

Fraction Catholic, 1910, 1926: U.S. Department of Commerce (1930, vol. I, table 29).

Fraction of labor force in mining, manufacturing, agriculture, 1930: Statistical Abstract (1934).

West: includes West North Central, Mountain, and Pacific census divisions.

South: includes South Atlantic, East South Central, and West South Central census divisions.

Public and private high school graduation rate, 1928: Goldin (1994). The numerator includes all students in public high schools, private secondary schools, and the preparatory departments of the nation's colleges and universities. The denominator is the number of 17-year olds in the state.

Fraction of population 15 to 24-years old, 1930: *Historical Statistics* (1975, series A 195-209).

Private college enrollments per 1000 residents, 1900: Report of the Commissioner of Education (1900/01). Numerator is the total number of undergraduate and graduate students in private universities, colleges, and schools of technology in 1900/01. The denominator is total state population in 1901, imputed.

Table 6
Determinants of College Enrollment Rates by State: 1897, 1923, and 1931

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
	1897	*1923*	*1931*	*1931*	*Δ(1931-1897)*
Log (agricultural income per agricultural worker), 1900	0.0289 (0.00743)				0.0492 (0.0105)
Log (per capita wealth), 1922		0.0305 (0.0143)	0.0571 (0.0170)	0.0472 (0.0159)	
Fraction > 65 years old , 1900, 1920, 1930[a]	0.993 (0.173)	0.793 (0.304)	0.418 (0.329)		
Fraction Catholic, 1910, 1926[b]	-0.00560 (0.0188)	-0.102 (0.0344)	-0.111 (0.0413)	-0.0697 (0.329)	-0.0939 (0.0343)
Per student fees in public institutions (000), 1930				-0.139 (0.046)	
Public and private high school graduation rate, 1930				0.187 (0.0481)	
Year of statehood × 10^{-3}					0.411 (0.103)
West	0.0138 (0.00618)	0.0282 (0.0103)	0.0321 (0.0118)		
South	0.0159 (0.00833)	-0.0306 (0.0143)	-0.119 (0.0166)		
Constant	-0.188 (0.489)	-0.163 (0.117)	-0.337 (0.136)	-0.273 (0.115)	-0.956 (0.170)
Mean of dependent variable	0.0396	0.100	0.130	0.130	0.0902
Mean of dependent variable weighted by population 15 to 24-years old	0.0369	0.0949	0.124	0.124	0.0871
R^2	0.671	0.747	0.727	0.756	0.627
Root mean squared error	0.0121	0.0218	0.0257	0.0240	0.0260
Number of observations	48	48	48	48	48

[a] The 1900, 1920, and 1930 figures are used for cols. (1), (2), and (3) respectively.

[b] The 1910 figure is used for cols. (1), (2), and (5); the 1926 figure is used for cols. (3) and (4).

Notes:

Standard errors are in parentheses. The dependent variable is the number of college students by state of residence as a fraction of 18 to 21-year olds in the state.

Sources:

College enrollment rate of state residents. 1897: Report of the Commissioner of Education 1897; 1923: Biennial 1922/24; *1931*: *Biennial 1928/30.* The numerator is the total number of state residents attending college anywhere in the United States. The totals for each state from these residence and migration surveys are adjusted upward, by the same proportion in each year, so that the national totals agree with those in *Historical Statistics* (1975), as adjusted by us (see notes to Table 2). The denominator is the approximate number of 18 to 21-year olds in the state (15 to 24-year olds × 0.4) from *Historical Statistics* (1975). It should be noted that the means overstate the actual college enrollment rates at the national level for the reasons given in the text.

Agricultural income per agricultural worker, 1900: Kuznets, et al. (1960). The variable is agricultural service income per agricultural worker.

Per capita wealth, 1922: *Statistical Abstract* (1925). The variable used is state taxable wealth/state population.

Fraction > 65 years old, 1900, 1920, 1930: *Historical Statistics* (1975, series A 195-209).

Fraction Catholic, 1910, 1926: U.S. Department of Commerce (1930, vol. I, table 29)

Per student fees in public institutions, 1930: *Biennial 1928/30*, tables 3b and 6b. The numerator is total receipts from all student fees (tuition, room and board, and other fees) of publicly-controlled institutions. The denominator is total enrollments (excluding duplicates) of publicly-controlled institutions.

Public and private high school graduation rate, 1930: Goldin (1994). The numerator includes all students in public high schools, private secondary schools, and the preparatory departments of the nation's colleges and universities. The denominator is the number of 17-year olds in the state.

West: includes West North Central, Mountain, and Pacific census divisions.

South: includes South Atlantic, East South Central, and West South Central census divisions.