# The U.S. Professional Sector: 1950 to 1988

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The United States economy, over the course of the twentieth century, has taken on a highly professional cast. Using Bureau of the Census occupational definitions, just 4 percent of all persons employed in 1900 were "professional, technical, and kindred" workers. But this "professional ratio" doubled to 9 percent by 1950; and it doubled again, to 18 percent, by 1988 (chart 1). Professional, technical, and kindred workers have also become prominent across a far broader range of industries in the years since 1950. Such workers then clustered in a small corner of the economy. But by 1988, they made up 20 percent or more of the labor force in industries ranging from health care and education, to high tech manufacturing and business services, to government and entertainment. In terms of international competitiveness, income per worker, and technical advance, this group of professionalized industries forms perhaps the most successful sector of the U.S. economy.

What distinguishes professionals from other workers is their vocational relationship to formal bodies of knowledge. While intellectuals live for ideas, Max Weber once quipped, professionals live off ideas. Industries employing large numbers of professionals thus depend on the productivity of knowledge workers, the evolution of formal knowledge systems, and the movement of ideas into practice. This close relationship to conceptual systems typically differentiates the management of work and the sources of change in professionalized industries from patterns observed elsewhere in the economy.

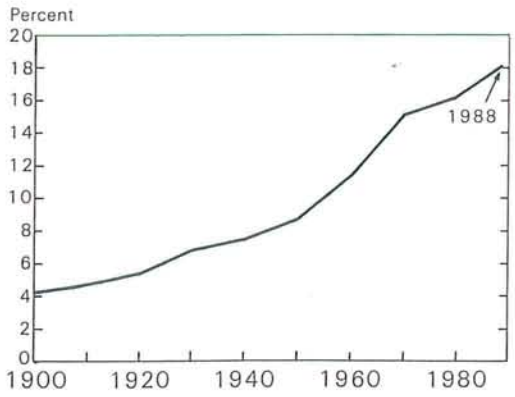
Professional work typically involves the custom application of expertise to discrete cases or projects. Because the expertise resides with the employee, and because the work is largely nonrepetitive, management must delegate a significant amount of authority to professional subordinates. Managers are thus largely removed from direct supervision of the work process.[1] And unless they can readily measure work outputs, which is often not the case, they find it difficult to monitor the

performance of professional workers. Professional organizations do develop explicit managerial structures where cases or projects involve the coordination of many professionals; where there are significant economies of scale or scope; or where market coordination fails. Large engineering and entertainment projects need close coordination; hospitals and universities can economize by operating on a larger scale; welfare organizations and consulting firms can often capture economies of scope; and health maintenance organizations have expanded because of breakdowns in the medical payment system. But where highly professional organizations do expand, the necessary delegation of authority to professional, technical, and kindred workers dilutes managerial authority. This renders management more difficult, narrows spans of control, and raises the cost of oversight.

The dynamic nature of professional conceptual systems further differentiates professional industries from the rest of the economy. In professions with strong research establishments, be they in universities, work establishments, government agencies, or elsewhere, technical change has been routinized through research seminars and laboratories, professional journals and associations, and public and private regulatory bodies. The direction of technical change, however, remains quite unpredictable. The shape of computers, the therapy for ulcers, and the interpretation of twentieth-century history will all be quite different within a decade. Such volatility renders more difficult long-term investment decisions, whether in physical or human capital. And enterprises must remain flexible to accommodate disruptions flowing as a matter of course from professional activities.

Chart 1

*Ratio of Professional, Technical, and Kindred Workers to Total Employed Persons, 1900-88*




*What distinguishes professionals from other workers is their vocational relationship to formal bodies of knowledge.*

This article is an introductory overview of professionalization of the U.S. economy in the years since 1950. After a look at professional concentrations by industry in section I, section II defines the industrial source of the rising U.S. professional ratio. Section III begins the process of identifying a sector of professional industries in the U.S. economy. Section IV looks at the pace and timing of the professionalization process, paying special attention to recent changes, and section V examines its demographic structure. The article concludes with some limited policy recommendations.

## *I. Out of Obscurity*

Discussions of recent economic change in the United States have largely overlooked the emergence of a sector of professional industries. Students of industrial structure seem more concerned with the dramatic fall in manufacturing's share of total U.S. employment than the rise of professionalized industries; most have directed their attention to the decline of the old, not the shape of the new. Various authors have nevertheless discussed topics touching on professionalization. They have written on the rise of an "information economy," the development of "high tech" manufacturing, and the growth of certain professional service industries. The "professional sector" concept focuses on knowledge and ideas, not information; and it groups high tech, professional service, and other industries on the basis of similarities in the

*Sources and Definitions*

It is a thankless task defining which occupation is and which is not "professional," or whether one occupation is more professional than another. Professional status is widely desired, while criteria for inclusion or comparison are vague: many workers claim to perform their duties in a professional manner, and most occupations aspire to the privileges and social standing of lawyers and physicians. Thus the U.S. Bureau of the Census's occupational definitions were eagerly adopted.

The measure of industry professionalization used in the study is the ratio of "professional, technical, and kindred workers," as defined by the Bureau of the Census, to the industry's total employed labor force. The measure does not distinguish different degrees of "professionalism" among occupations. In addition, the "professional, technical, and kindred" classification is more inclusive than that of "professional" alone. According to the 1970 Census enumeration, it includes accountants; computer specialists; engineers; librarians, archivists, and curators; life and physical scientists; physicians, dentists, and related practitioners; nurses, dietitians, and therapists; health technologists and technicians; social scientists; social and recreational workers; teachers, except college and university; engineering and science technicians; technicians, except health, engineering, and science; writers, artists, and entertainers; and other professional, technical, and kindred workers (including actuaries, architects, clergymen, lawyers, mathematicians, personnel and labor relations workers, statisticians, and college and university teachers).

The use of this Census definition has the virtue of simplicity and allows comparison with other work. And the figures needed to compute professional ratios are available in the decennial census publications and in the Bureau's Current Population Survey tapes. The study used the decennial censuses of 1950, 1960, and 1970, along with data from the Current Population Survey for 1980 and 1988 (U.S. Bureau of the Census, 1954, 1963, 1972, 1982, 1988).

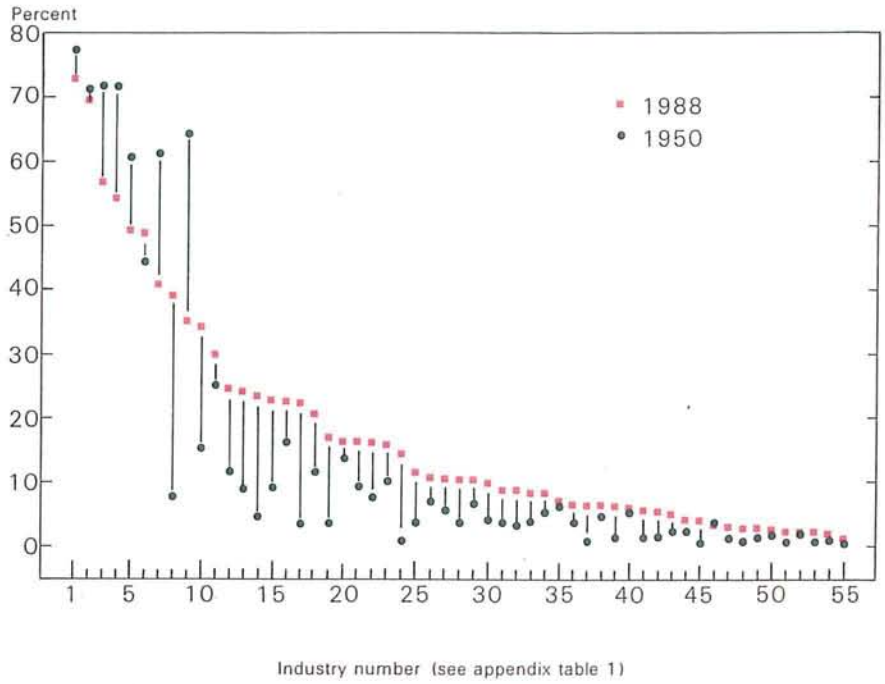
The Census Bureau, unfortunately, dramatically changed its occupational classification scheme in the early 1980s, making the 1980 decennial Census and the post-1982 Current Population Surveys not readily comparable to earlier years. This study crossed this divide, examining data for 1950, 1960, 1970, 1980, and 1988. So one classification scheme had to be chosen, and data converted from the other. For two reasons, the older scheme and its "professional, technical, and kindred worker" classification was selected. First, this decision involves the conversion of just one year of data: as the Current Population Survey for 1980 used the old classification scheme, only figures for 1988 need be converted. Second, the earlier classification seems more congruent with common usage. The new scheme, for example, excludes accountants from the "professional" rubric.

To make the 1988 count of "professional, technical, and kindred" workers comparable to the numbers published in earlier years, first the current "professional specialty" and "technicians and related support" occupational categories were combined. Occupations reclassified out of or into the combined "professional, technical, and kindred worker" category were then added or subtracted. Where the new scheme moved parts of occupations across these category lines, specific Current Population Survey observations were reassigned at random, according to probabilities provided in Census publications. The major changes from current practice involved the inclusion of accountants, personnel and labor relations workers, sales engineers, and therapy assistants; and the exclusion of decorators and window dressers, health trainees, and practical nurses. For documentation of the classification changes, and the source of the probability weights, see Vines and Priebe (1989).

While changes in the classification of industries have not been as dramatic as those of occupations, they also presented problems. Some changes could be accommodated, such as shifting ordnance back to miscellaneous manufacturing and the U.S. postal service back to government in the 1988 count. Others, such as the 1970 movement of government welfare services from government to welfare and religion, could not. Unaccommodated industry changes were relatively rare, and do not influence the general conclusions. Among the industries included in the residual "Other Professional Industries" group are offices of actuaries, artists, authors, and psychologists, and government and nonprofit research organizations.

Chart 2

*Professional Ratios: Detailed Industries 1950 and 1988*




composition of their work forces and their relationship to formal knowledge systems. The usefulness of the professional sector concept depends on the significance of these characteristics.

The professional sector has escaped identification in part because the basic map of U.S. industrial structure—the 1-digit Standard Industrial Classification scheme—has been a poor guide to the professionalization process.[2] Of the broad industrial categories in the S.I.C., miscellaneous services employs the highest proportion of professional workers. But miscellaneous services is a residual grouping, not a coherent sector. Professional ratios moreover vary widely among the subsidiary industries of 1-digit divisions. As the incidence of big business cuts across the traditional S.I.C. lines, so it is with professionalization.

For a better view of the professionalization of U.S. industry, we require a finer industrial classification. Chart 2 and appendix table 1 array fifty-five industries according to their 1988 professional ratios, and give industry ratios for 1950 and 1988.[3] The 1950 and 1988 arrays in chart 2 are similarly shaped, albeit with some differences that will be explained below. In each array there is a small clump of highly professionalized industries with professional ratios above 40 percent. There follows a rapid drop-off to industries with professional ratios somewhat above the national average. Then begins a long array of industries whose ratios gradually descend to insignificant levels. In the end we come to industries wherein professionals clearly provide subordinate and peripheral services.

The clump of industries with exceptionally and consistently high professional ratios—the eight most professionalized in 1950 and eight of the top nine in 1988—are classified by the Bureau of the Census within its "Professional and Related Services" grouping. (This category, in turn, forms part of the "miscellaneous services" S.I.C. division.) These eight industries—accounting services, education, engineering and architectural services, hospitals, other health care, legal services, welfare and religious services, and "other" professional services—will be called the "Professional and Related Services*" industries, for the remainder of this article.[4] Each produces professional services as its primary output. Whether this group should be accepted as the pro-

fessional sector of the U.S. economy is discussed below.

As shown in chart 2 and appendix table 1, professional ratios at the high end of the array declined over time. In 1950, professional, technical, and kindred workers made up 63.4 percent of all persons employed in the Professional and Related Services* industries. But this ratio fell to 48.9 percent by 1988. Of the eight industries, only hospitals employed a greater proportion of professionals in 1988 than it had in 1950.[5] All other Professional and Related Services* industries grew more dependent on nonprofessional labor over this thirty-eight year period, most of them significantly more dependent.

Outside of the Professional and Related Services* industries, professional concentrations rose in forty-seven of the remaining forty-eight industries. (These ratios are given in appendix table 1.) In seven of these industries—aircraft, chemicals, communications, electrical machinery, mining, miscellaneous manufactures, office machinery, and professional equipment/instruments—professional ratios rose by more than 10 percentage points between 1950 and 1988. Only in construction did professionals become more scarce: there the ratio fell only from 3.7 to 3.2 percent. The process of professionalization clearly extended beyond the Professional and Related Services* group, and the rising professional concentrations in these industries contributed to the doubling of the U.S. ratio.

*The "professional sector" concept focuses on knowledge and ideas, not information; and it groups industries on the basis of similarities in the composition of their work forces and their relationship to formal knowledge systems.*

Given the contrasting changes in professional concentrations at the high and low ends of the spectrum, two questions arise. The first deals with the industrial origins of the increase in U.S. professionalization. It asks whether the rising professional ratios in the general economy explain the phenomenon, or whether expanding employment shares of highly professionalized industries, such as the Professional and Related Services* industries, led the upsurge. The second question deals with the identification of a professional sector. In 1950, a huge gap in professional ratios separated the Professional and Related Services* industries from the remainder of the economy. But in the intervening years, mainstream industries professionalized quite rapidly; and the occupational structure of Professional and Related Services* industries became more like the rest of the economy. Drawing a line around a professional sector thus becomes more difficult over time. These questions will be addressed in the following two sections.

## *II. The Industrial Sources of U.S. Professionalization*

A shift-share analysis, detailed in the appendix, decomposes the change in the overall professional ratio into the two above-mentioned effects. The procedure measures a ratio effect, or the influence of a change in each industry's professional ratio on the national rate; a share effect, or the impact on the national rate of a shift in each industry's share of total employment; and an interaction effect that cannot be allocated between the ratio and share effects. These effects are then totaled across industry groups.

Table 1 presents results of the shift-share analysis for the 1950–88 period. (Details for the fifty-five industries are provided in appendix table 1.) Looking at the national totals for the ratio and share effects, we see both were positive. Rising industry professional ratios and above-average employment growth in the highly professionalized industries both contributed to the increase in the U.S. ratio. The share effect, however, was far larger than the ratio effect. The professionalization of the U.S. work force between 1950 and 1988 was clearly driven by the expanding share of total U.S. employment held by highly professionalized industries.

The Professional and Related Services* industries were by far the most highly professionalized U.S. industries in 1950. And between 1950 and 1988, these eight industries expanded their share of the employed labor force from 8.2 to 21.0 percent. With their large initial professional concentrations, and this tremendous employment growth, the shift-share analysis attributes the bulk of all share effects to the Professional and Related Services* group. Of the 8.9

Table 1
*Contribution to Movements in the National Professional Ratio: Share and Ratio Effects*

| | 1950 Total Employment (thousands) | Employment Share (percent) | Professional Ratio (percent) | 1988 Total Employment (thousands) | Employment Share (percent) | Professional Ratio (percent) | Effects (percentage points) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Ratio | Share | Interaction | Total |
| All Industries | 55,805 | 100.0 | 8.7 | 112,569 | 100.0 | 18.0 | 2.4 | 8.9 | −2.0 | 9.3 |
| Professional & Related Services* Industries | 4,566 | 8.2 | 63.4 | 23,655 | 21.0 | 48.9 | −1.2 | 8.2 | −2.0 | 5.1 |
| All Other Industries | 51,239 | 91.8 | 3.8 | 88,914 | 79.0 | 9.7 | 3.5 | .7 | 0 | 4.2 |

Note: 780,000 employed persons not allocated by the Bureau of the Census in 1950 have been included in the all other industries group.
Source: U.S. Bureau of the Census (1954a, 1988), and author's calculations.

percentage point increase in the national professional ratio attributed to shifting employment shares, 8.2 points are assigned to these eight industries. Shifts among industries outside this group accounted for just the remaining 0.7 percentage point.

Changes in industry professional concentrations resulted in a much milder 2.4 percentage point increase in the national ratio. And as in the case of shifting employment shares, the pattern in the Professional and Related Services* industries differed quite sharply from that elsewhere in the economy. As noted earlier, professional ratios fell in all but one of the eight Professional and Related Services* industries while rising in all but one of the remaining forty-seven. Ratio changes in the former group reduced the national rate by 1.2 percentage points; in the latter they raised the national rate by 3.5 points. Outside of the Professional and Related Services* industries, rising professional concentrations were thus the major factor increasing the national ratio.[6]

Of the 9.3 percentage point gain in the U.S. professional ratio from 1950 to 1988, the shift-share analysis attributes the majority, 5.1 percentage points, to the Professional and Related Services* industries. Tremendous growth in the group's employment share overwhelmed its falling professional concentrations. Elsewhere in the economy, ratio and share effects were both positive and combined to raise the national rate by 4.2 percentage points. Here, however, rising industry professional concentrations had a far greater effect than shifting employment shares. The two industry groups thus contributed somewhat similarly to the increase in the national professional ratio. But in each, the pattern of growth was distinct.

## *III. Defining a Professional Sector*

The decline in professional ratios among the Professional and Related Services* industries and the increases elsewhere in the economy brought the professionalization of the two groups closer together. In 1950, 63.4 percent of all those who worked in the Professional and Related Services* group held professional, technical, or kindred occupations. The remainder of the economy made do with 3.8 professional, technical, or kindred workers per hundred persons employed. By 1988, professional ratios were 48.9 and 9.7 percent, respectively. The disparity between groups fell even more according to other indicators. In 1950, a 19.0 percentage point gap separated the lowest professional ratio in the Professional and Related Services* group from the highest elsewhere in the economy. But the two groups actually overlapped in 1988. The lowest concentration of professionals in a Professional and Related Services* industry (other health services) was below that of one outside the group (office machinery, which includes computers). Distinguishing between professionalized and nonprofessionalized industries thus becomes more difficult.

Contributing to this convergence was the fact that, in the general economy, the largest absolute increases in professional concentrations occurred in those industries that had the highest initial ratios. Ten industries outside the Professional and Related Services* group had professional ratios above 20 percent in 1988: aircraft and parts; business services; chemicals and allied products; communications; electrical machinery, equipment, and supplies; entertainment and recreational services; mining; office

Table 2

*Occupational Distribution: Professional and Related Services* Industries, 1950 and 1988.*

Percent

| Industry | Profes-sional | Managers | Clerical Workers | Sales Workers | Craft Workers | Laborers & Operatives | Service Workers |
|---|---|---|---|---|---|---|---|
| 1950 Occupational Distribution | | | | | | | |
| Other Prof. Inds. | 77.3 | 3.3 | 10.2 | .5 | 3.3 | 2.2 | 2.5 |
| Accounting Services | 71.8 | 3.0 | 23.9 | .4 | .3 | .3 | .1 |
| Education | 71.7 | 1.5 | 7.9 | .2 | 2.7 | 2.4 | 13.3 |
| Engin./Architech. | 71.1 | 4.7 | 15.0 | .7 | 4.9 | 4.0 | .6 |
| Other Health Services | 64.3 | 2.1 | 20.1 | .2 | 1.6 | 1.8 | 9.9 |
| Welfare & Religion | 61.3 | 2.2 | 12.4 | .3 | 1.9 | 3.9 | 17.7 |
| Legal Services | 60.6 | .7 | 36.7 | .1 | .6 | .4 | .8 |
| Hospitals | 44.5 | 1.6 | 9.1 | .1 | 3.2 | 5.0 | 36.3 |
| Prof. & Related Serv.* Total | 63.4 | 1.7 | 12.2 | .2 | 2.5 | 2.9 | 16.9 |
| 1988 Occupational Distribution | | | | | | | |
| Other Prof. Inds. | 72.7 | 9.3 | 11.1 | .8 | .8 | 2.5 | 2.0 |
| Accounting Servs. | 56.4 | 11.7 | 29.9 | .4 | 1.1 | .3 | .3 |
| Education | 53.9 | 8.1 | 17.0 | .8 | 1.6 | 3.6 | 14.3 |
| Engin./Architech. | 69.2 | 10.6 | 13.1 | .8 | 2.4 | 2.8 | .3 |
| Other Health Servs. | 34.8 | 8.0 | 18.4 | .4 | 1.8 | 2.3 | 33.9 |
| Welfare & Religion | 40.5 | 8.4 | 19.9 | .6 | 1.1 | 4.3 | 25.1 |
| Legal Services | 49.0 | 4.0 | 46.2 | 0 | 0 | .2 | .6 |
| Hospitals | 48.5 | 5.7 | 17.5 | .4 | 2.2 | 1.9 | 23.0 |
| Prof. & Related Serv.* Total | 48.9 | 7.7 | 19.2 | .6 | 1.6 | 2.8 | 18.7 |
| Percentage Point Change in Occupational Distribution, 1950–88 | | | | | | | |
| Other Prof. Inds. | −4.6 | 6.0 | .9 | .2 | 2.5 | .3 | −.5 |
| Accounting Servs. | −15.3 | 8.7 | 6.0 | 0 | .8 | 0 | .1 |
| Education | −17.8 | 6.5 | 9.1 | .6 | −1.1 | 1.2 | 1.0 |
| Engin./Architech. | −1.8 | 5.9 | −1.9 | 0 | −2.4 | −1.2 | −.4 |
| Other Health Servs. | −29.5 | 5.9 | −1.7 | .2 | .2 | .5 | 24.0 |
| Welfare & Religion | −20.7 | 6.2 | 7.5 | .3 | −.7 | .4 | 7.4 |
| Legal Services | −11.6 | 3.3 | 9.6 | −.1 | −.6 | −.2 | −.2 |
| Hospitals | 4.0 | 4.1 | 8.4 | .3 | −1.0 | −3.1 | −13.2 |
| Prof.& Related Serv.* Total | −14.5 | 5.9 | 7.0 | .4 | −.8 | −.1 | 1.8 |

Source: U.S. Bureau of the Census 1954a, 1988.

machinery (including computer equipment); professional and photographic equipment and watches/instruments; and public administration.[7]

While most American industries were professionalizing, the occupational structure of the Professional and Related Services* industries grew closer to that found elsewhere in the economy. The declining concentration of professional, technical, and kindred workers was nearly matched by increasing proportions of clerical and managerial personnel (see table 2). Clerical workers showed the greatest proportional gain of any occupational group among the eight Professional and Related Services* industries. Changes in clerical concentrations nevertheless varied substantially, and in two cases actually declined.[8] The employment of managers meanwhile increased in all eight Professional and Related Services* industries, rising from a minuscule 1.7 percent to a more

Table 3
*The Professional Sector Defined Two Ways, 1950 through 1988*
Professional Ratio

| | 1950 | | 1960 | |
|---|---|---|---|---|
| Professional Ratio above 20% | Other Prof. Inds* | 77.3 | Engin/Architech* | 71.4 |
| | Accounting Services* | 71.8 | Education* | 67.3 |
| | Education* | 71.7 | Other Prof. Inds* | 66.0 |
| | Engin/Architech* | 71.1 | Accounting Services* | 65.8 |
| | Other Health* | 64.3 | Legal Services* | 58.2 |
| | Welfare & Religion* | 61.3 | Other Health * | 54.4 |
| | Legal Services* | 60.6 | Welfare & Religion* | 53.0 |
| | Hospitals* | 44.5 | Hospitals* | 40.2 |
| | Entertainment | 25.2 | Aircraft | 22.3 |
| Professional Ratio above National Average | Business Services | 16.4 | Entertainment | 19.5 |
| | Aircraft | 15.4 | Business Services | 17.6 |
| | Petro/Coal Products | 14.0 | Office Machinery | 17.4 |
| | Chemicals | 11.8 | Prof. Equip/Instruments | 16.2 |
| | Public Administration | 11.7 | Chemicals | 15.6 |
| | Non-Profit Orgs. | 10.2 | Elec. Machinery | 15.2 |
| | Printing | 9.5 | Petro/Coal Products | 15.1 |
| | Prof. Equip/Instruments | 9.3 | Public Administration | 13.7 |
| | Elec. Machinery | 9.2 | Non-Profit Orgs. | 12.9 |
| | National Ratio: | 8.7 | | 11.3 |
| Professional Sector: Defined as industries with professional ratios above 20 percent | | | | |
| | Professional Ratio: | 59.3 | | 55.1 |
| | Employment Share: | 9.2 | | 12.5 |
| Professional Sector: Defined as industries with professional ratios above the national average. | | | | |
| | Professional Ratio: | 33.4 | | 35.3 |
| | Employment Share: | 20.0 | | 24.8 |

Note: All industries listed have professional ratios above the national average.
Industries above the dotted line have professional ratios above 20 percent.
* Professional and Related Services* Industry
Source: U.S. Bureau of the Census 1954a, 1963a, 1972a, 1980, and 1988.

significant 7.7 percent of total employment in the group. Some of these new managers probably directed the activities of the expanded clerical corps; and this 7.7 percent managerial share was lower than the 10.9 percent share found elsewhere in the economy. But the size of this increase in share, and its consistency across all eight professional service industries, suggests that professionals were working in larger groups and deriving greater benefit from managerial coordination.[9]

The falling professional ratios observed in the Professional and Related Services* industries may reflect general trends in the delivery of professional services. The increased use of substitute, support, and supervisory personnel in the Professional and Related Services* industries may characterize work processes in professional offices throughout the economy. If so, then the professional ratio may be a biased indicator of the amount of labor committed to the output of professional work. The doubling of the U.S. professional ratio between 1950 and 1988, and the rise among the non-Professional and Related Services* industries from 3.8 to 9.7 percent, would then understate growth in the number of workers involved in the production of professional output.

By 1988, professionals had become critically important to many industries not involved in the production of professional work per se. In terms of their

Table 3 *continued*

*The Professional Sector Defined Two Ways, 1950 through 1988*

Professional Ratio

| 1970 | | 1980 | | 1988 | |
|---|---|---|---|---|---|
| Engin/Architech* | 72.4 | Other Prof. Inds* | 75.0 | Other Prof. Inds* | 72.5 |
| Education* | 59.7 | Engin/Architech* | 74.3 | Engin/Architech* | 69.2 |
| Accounting Services* | 58.5 | Accounting Services* | 57.4 | Accounting Services* | 56.4 |
| Legal Services* | 53.4 | Legal Services* | 54.9 | Education* | 53.9 |
| Welfare & Religion | 53.1 | Education* | 54.3 | Legal Services* | 49.0 |
| Other Prof. Inds.* | 47.1 | Welfare & Religion* | 50.7 | Hospitals* | 48.5 |
| Other Health | 39.3 | Hospitals* | 42.9 | Welfare & Religion* | 40.5 |
| Hospitals | 36.8 | Other Health* | 35.2 | Office Machinery | 38.8 |
| Office Machinery | 29.6 | Office Machinery | 31.3 | Other Health* | 34.8 |
| Aircraft | 26.2 | Aircraft | 29.8 | Aircraft | 33.9 |
| Entertainment | 23.6 | Entertainment | 28.7 | Entertainment | 29.6 |
| Business Services | 22.1 | Petro/Coal Products | 21.0 | Chemicals | 24.4 |
| Petro/Coal Products | 21.1 | Business Services | 20.8 | Elec. Machinery | 23.9 |
| ---------- | ---------- | ---------- | ---------- | Communications | |
| Machinery | 19.0 | | | Prof. Equip/Instruments | 22.6 |
| Chemicals | 18.5 | Communications | 19.1 | Business Services | 22.4 |
| Elect. Machinery | 18.4 | Public Administration | 19.0 | Mining | 22.1 |
| Prof. Equip/Instruments | 16.9 | Elec. Machinery | 19.0 | Public Administration | 20.4 |
| Public Administration | 16.5 | Chemicals | 18.7 | | |
| | 15.1 | | 16.2 | | 18.0 |
| | 46.0 | | 44.4 | | 37.2 |
| | 21.4 | | 24.3 | | 39.5 |
| | 35.9 | | 36.7 | | 37.2 |
| | 33.4 | | 34.9 | | 39.5 |

labor inputs, the office machinery, aircraft, and entertainment industries (where professional workers accounted for 38.8, 33.9, and 29.6 percent of employees, respectively) are no longer so different from the lower half of the Professional and Related Services* group, consisting of legal services, hospitals, welfare and religion, and other health services (with professional ratios ranging from 49.0 to 34.8). As the professional ratios of certain Professional and Related Services* industries and industries outside of this group converge, their constituent enterprises can be expected to adopt more similar strategies, structures, and productive processes.

At this stage in the discussion, identifying a professional sector that displays such similarities is largely an arbitrary exercise. Using the professional ratio measure, one could adopt an absolute cutoff, say 20 percent, as a boundary line. Another approach would use a time-contextual cutoff, say 100 percent of the national ratio. The absolute boundary appeals because an industry seems to need some minimum concentration of professional, technical, and kindred workers before attaining a "professional" character. The relative approach, on the other hand, is sensitive to historical conditions and avoids anachronistic judgments.

Table 3 provides data on professional sectors, defined in two different ways, from 1950 to 1988. The first uses a 20 percent professional ratio filter; the second uses the national professional ratio for the year in question as the cutoff. For 1988, the two measures define identical professional sectors: the national ratio that year was 18.0 percent, and no industry then had a ratio between 18.0 and 20 percent. Thus the "1988 professional sector," defined in either of these two ways, included all eight members

of the Professional and Related Services* group and the ten other aforementioned industries with professional ratios above 20 percent. The sector employed nearly 40 percent of the work force in 1988; and three in eight of this 40 percent had professional, technical, or kindred occupations. The professional sector defined by the absolute 20 percent cutoff grows shorter as we look back through time: in 1950 it included just the Professional and Related Services* and the entertainment industries. The list of industries with above average ratios, however, turns out to be remarkably stable over the 1950–88 period. The group's professional ratio also remained remarkably stable, while its share of total employment essentially doubled over this thirty-eight-year period.

## *IV. Pace and Timing*

Table 3 suggests that the pace of professionalization varied across decades as it has across industries. The number of industries with professional ratios above 20 percent increased sharply in the 1960s and 1980s, but not at all in the 1950s and 1970s. Chart 1 also shows variation in the timing of U.S. professionalization. While the chart shows the U.S. professional ratio rising continuously over the post–World War II period, the ratio jumped sharply upward in the 1950s and even more so in the 1960s; the smallest increase came in the 1970s; thus far in the 1980s, professionalization has again advanced at a rapid rate. In this chart it is the deceleration of the 1970s that stands out prominently.

Performing a shift-share analysis for each of the four decades (1950–60; 1960–70; 1970–80; 1980–88) sharpens the picture of how the U.S. professional ratio increased. The results, presented in table 4, show significant shifts in the source of professionalization. Share effects dominated the first three decades of the period under review. Between 1950 and 1980, expansion in the U.S. professional ratio came almost exclusively from the growth of highly professionalized industries. Then ratio effects predominated in the 1980s, as the initiative in expanding the U.S. professional ratio moved outside the traditional Professional and Related Services* industries.

Two factors appear to explain the shift in the 1980s in the sources of U.S. professionalization. Among the Professional and Related Services* industries, the share of total employment of the huge education industry stopped expanding. Professional ratios elsewhere in the economy meanwhile resumed their secular expansion. As these changes appear durable, industries outside the Professional and Related Services* core may continue to provide the majority of new professional employment opportunities.

Among the Professional and Related Services* industries in the 1980s, the fall-off in education is striking. The industry's professional ratio fell, which is not surprising among members of the group. But education's share of total employment also declined, which is quite unusual. Education had accounted for about half of professional and total employment in the Professional and Related Services* industries in both 1950 and 1980; between 1950 and 1980, the industry had grown at about the same rate as the group. Had education in the 1980s matched the performance of the seven remaining industries, the group would again have raised the national professional ratio by more than all other industries. But by the 1980s the baby boom generation had largely passed through its school-going years, and the demand for educational services fell. And according to U.S. Bureau of Labor Statistics projections, employment in the education industry will continue to grow more slowly than the U.S. total through the year 2000.[10]

*The general economy is likely to remain the primary source of professional employment gains through the 1990s.*

The professionalization of industries outside the Professional and Related Services* core meanwhile continued apace. This produced, in the decade, a doubling in the number of non-core industries with professional ratios greater than 20 percent (from five to ten). As can be seen in the professional sector listings of table 3, the commercialization of science-based technologies and the emergence of electronic data processing were the key factors pushing new industries through this 20 percent filter. In 1950, the only industry outside Professional and Related Services* with a professional ratio above 20 percent had little to do with science or computers: the professional, technical, and kindred workers employed in the entertainment industry were writers, performers, designers, and the like. But all industries thereafter added to the list, with the probable exception of government, em-

Table 4

*Contribution of Share and Ratio Effects to Movements in the National Professional Ratio, 1950 through 1980*

| | Data for Year | | Effects for Decade (Percentage points) | | | | |
|---|---|---|---|---|---|---|---|
| Year | Total Employment (000) | Professional Ratio | Ratio | Share | Interaction | Total | Decade |
| All Industries | | | | | | | |
| 1950 | 55,805 | 8.7 | | | | | |
| 1960 | 63,747 | 11.3 | .3 | 2.4 | −0 | 2.7 | 1950s |
| 1970 | 76,754 | 15.1 | .7 | 3.6 | −.6 | 3.8 | 1960s |
| 1980 | 99,807 | 16.2 | .1 | 1.0 | −0 | 1.1 | 1970s |
| 1988 | 112,569 | 18.0 | .8 | 0.7 | .3 | 1.8 | 1980s |
| Professional and Related Services* Industries | | | | | | | |
| 1950 | 4,566 | 63.4 | | | | | |
| 1960 | 7,332 | 58.0 | −.4 | 2.1 | −.2 | 1.5 | 1950s |
| 1970 | 13,228 | 51.4 | −.8 | 3.5 | −.6 | 2.2 | 1960s |
| 1980 | 19,291 | 49.5 | 0 | 1.0 | −.3 | .7 | 1970s |
| 1988 | 23,655 | 48.9 | 0 | .8 | −.1 | .7 | 1980s |
| All Other Industries | | | | | | | |
| 1950 | 51,239 | 3.8 | | | | | |
| 1960 | 56,415 | 5.3 | .7 | .3 | .1 | 1.2 | 1950s |
| 1970 | 63,526 | 7.5 | 1.5 | .1 | −0 | 1.6 | 1960s |
| 1980 | 80,516 | 8.2 | .1 | 0 | .3 | .4 | 1970s |
| 1988 | 88,914 | 9.7 | .8 | −.1 | .4 | 1.1 | 1980s |

Source: U.S. Bureau of the Census (1954a,1963a,1972a,1980,1988), and author's calculations.

ployed professional, technical, and kindred workers for expertise based primarily in science or computer skills. These industries include those commonly classified as "high tech"—the five manufacturing industries and the "high tech" portions of business services (computer and data processing services and research and development services). The list also includes mining and communications, which now are not commonly classified as high tech.[11]

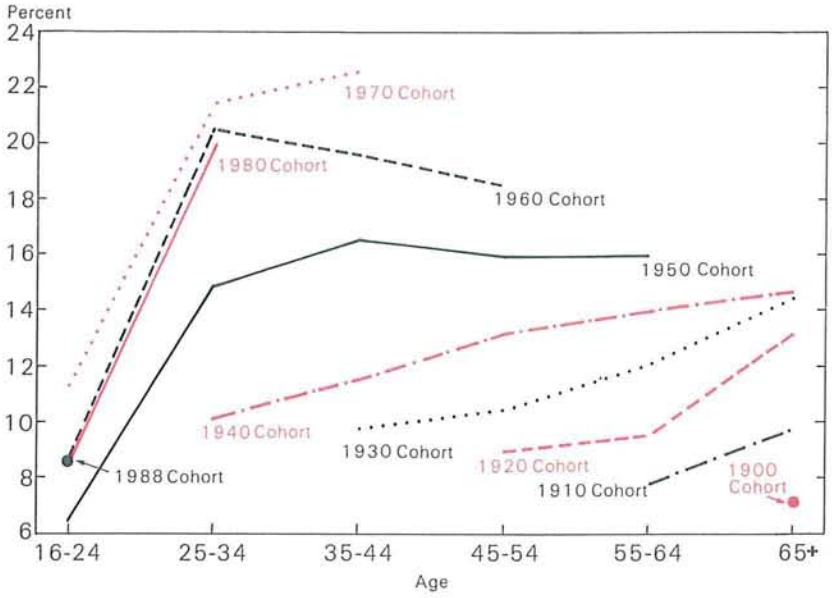
Increased employment of workers with science- and computer-based skills is also apparent in industries with professional ratios below 20 percent. The banking/credit and brokerage industries, for example, introduced sophisticated new financial engineering tools and computer applications in the 1980s. This pushed professional ratios in these two financial industries up by 4.8 and 6.1 percentage points, to 10.3 and 10.6 percent, respectively. With technical sophistication and the demand for professional labor spreading so widely, the potential seems great for continued movement of professionals beyond the traditional Professional and Related Services* core.

Evidence from the international trade arena further underlines the new significance of the highly professionalized industries not in the traditional Professional and Related Services* group. Robert Reich (1989) sees a new international division of labor developing in the 1980s, with highly developed areas like the United States providing professional goods and services and developing areas specializing in production. In a recent article, Jane Little compiled a list of U.S. exporting industries and U.S. import-competitive industries, and her results corroborate such a proposition. The manufacturing industries Little identified as most vulnerable to import competition all have low professional ratios while all five manufacturing industries in the 1988 "professional sector" are on her list of six exporters. Among the nonmanufacturing industries on the 1988 professional sector list, education, entertainment, and business services are also significant exporters.[12] To the degree that there is a new international division of labor, such as Reich described, the upward shift in the demand for professional labor outside the Professional and Related Services* industries is durable.

The general economy is therefore likely to re-

Chart 3

*Professional Ratios for Generational Cohorts, by Age*




Source: Table 5.

main the primary source of professional employment gains through the 1990s. The expansion of sophisticated science- and computer-based technologies into new areas, and the development of a new international division of labor, can be expected to extend further the demand for professionals beyond the traditional Professional and Related Services* industries. Meanwhile, the demand for education appears likely to remain sluggish through the decade.

## *V. The Constraint of Demography*

The discussion above showed professional employment expanding across the industrial landscape in the 1980s, while slowing in the Professional and Related Services* core. This pattern also appeared likely to continue into the future. A review of the demographics of professionalization, however, suggests possible constraints on significant further increases in U.S. professionalization.

The professionalization process has had a distinct demographic structure, with differences within and between 10-year generational cohorts.[13] (Cohorts, for convenience, are identified by the year in which their members were 16 to 24 years of age.) Among all cohorts entering the labor force before 1950, professional ratios consistently increased with age. As illustrated in table 5 and chart 3, the concentration of professional, technical, and kindred workers in the 1940 cohort rose steadily over time, from 10.2 percent at ages 25 to 34 (in 1950) to 14.8 percent at ages 65 and over (in 1988). This pattern then changed abruptly, as the cohorts of 1950 and 1960 reached their peak professional concentrations between the ages of 25 and 44. Peaks for the 1970 and later cohorts will remain unknown until more observations become available.[14]

This shift in the pattern of cohort professionalization is closely associated with movements in the national professional ratio noted above: the tremendous increases between 1950 and 1970, and then the deceleration between 1970 and 1988. In the 1950s and 1960s as the older cohorts continued increasing their professional ratios, the younger cohorts moved quickly to their peak concentrations. Professional ratios for the 25 to 34 and 35 to 44 age groups thus showed tremendous leaps in these two decades. In the 1970s and 1980s, there were no such increases among any age group.

A second difference among cohorts has been a general increase over time in their professional ratios.

Cohorts entering the labor force would thus reach significantly higher levels of professionalization than the retiring cohorts; for any age group, professional ratios thus were generally higher than they had been a decade earlier. This upward march in cohort professionalization has consistently pushed up the national ratio. But now the end of this trend may be in sight. The 1980 and 1988 cohorts have thus far had lower age-specific professional ratios than either the 1970 or 1960 cohorts. These are the only instances in table 5 of declining professional concentrations for a given age group. The data are thin, and certainly inadequate to declare a fall in cohort professional concentrations. But it seems reasonable to sense some limit to cohort professional ratios at current levels, and thus to expect little further increase in the overall national rate.

Reinforcing this sense of limited future increases in U.S. professionalization is the maturation of the baby boom generation. The giant generation, born between 1946 and 1964, entered the work force as the cohorts of 1970 and 1980. If they repeat the pattern established by the cohorts of 1950 and 1960, they are now in their peak professional years. If baby boom ratios do decline as their members age, as was the case for the preceding two cohorts, then the unusually large size of the baby boom generation will further retard any increases in the national rate.

The cohorts following the baby boom generation are relatively small. And their peak professional concentrations may be no higher. If so, then the current economywide professional concentration of 18.0 percent is very close to its long-run equilibrium level.[15] The expanding employment opportunities beyond the Professional and Related Services* industries may thus collide with a demographic constraint.

## *VI. Conclusions*

The years since 1950 have seen huge changes in the employment of professional, technical, and kindred workers in the United States. These occupations more than doubled their share of the work force, and their dispersion among the nation's industries widened enormously. In 1950, professionals were largely concentrated in the eight Professional and Related Services* industries, and there they dominated the work force. One could then reasonably speak of professional occupations and professional industries as one and the same. Since 1950, employment in the Professional and Related Services* industries expanded tremendously and these industries came to employ a far higher proportion of clerical and managerial workers. Professional, technical, and kindred workers also became much more common elsewhere

Table 5
*Professional Ratios by Generational Cohort and Age Group*

| | Cohort Age | | | | | |
|---|---|---|---|---|---|---|
| Cohort[a] | 16–24 | 25–34 | 35–44 | 45–54 | 55–64 | 65+ |
| 1988 | 8.7 | | | | | |
| 1980[b] | 8.7 | 20.0 | | | | |
| 1970[b] | 11.5 | 21.5 | 22.7 | | | |
| 1960 | 8.8 | 20.5 | 19.6 | 18.5 | | |
| 1950 | 6.5 | 14.9 | 16.6 | 16.0 | 16.0 | |
| 1940 | | 10.2 | 11.6 | 13.3 | 14.1 | 14.8 |
| 1930 | | | 9.7 | 10.4 | 12.1 | 14.5 |
| 1920 | | | | 9.0 | 9.6 | 13.2 |
| 1910 | | | | | 7.8 | 9.7 |
| 1900 | | | | | | 7.2 |

[a]Cohorts defined by year in which their members were aged 16–24.
[b]Baby boom generation
Source: U.S. Bureau of the Census: 1954b. Table 11, "Major Occupation Group: [Employed] Persons 14 Years Old and Over, by Years of School Completed, Age, Color, and Sex, for the United States, by Regions: 1950"; 1963a. Table 6, "Age of Employed Persons, by Detailed Occupation and Sex, for the United States: 1960"; 1972a. Table 40, "Age of Employed Persons, by Detailed Occupation and Sex: 1970"; and 1980, 1988.

in the economy. Thus in the years since 1950, the core professional industries normalized their occupational structure as the rest of the economy professionalized. A new professional sector—composed of industries dependent on professional labor but employing significant proportions of supervisory, support, or substitute workers—can now be said to exist. Using a 20 percent professional ratio cutoff, the 1988 professional sector would include eighteen industries that produce a wide array of goods and services and employ nearly 40 percent of the U.S. work force.

In the 1980s, professional employment for the first time expanded more in the general economy than in the eight Professional and Related Services* industries. This pattern appears likely to continue at least through the 1990s. But demographic constraints will probably slow this expansion of professionals into new areas of employment. The large number of professionals who entered the work force in the years since 1950 facilitated the significant shifts discussed in this article. The tremendous growth of professional employment in the 1950s and 1960s—in the Professional and Related Services* industries and elsewhere in the economy—owed much to the step-up and speed-up in cohort professionalization. In the 1980s, professional employment expanded rapidly into new industries in part because then the baby boom generation was reaching its years of peak professional concentration. But the forces that raised the professional ratio in the past now appear spent. Cohorts are no longer increasing the speed at which they professionalize. The size of cohorts passing through their peak professional years will be relatively small in the future. And the peak cohort professional ratio appears stalled between 20 and 25 percent.

If opportunities for professional employment continue to emerge in nontraditional areas, as they have in the 1980s, the U.S. economy will probably not be able to exploit them as easily at it has in the past. Professionals choose their specialties at the beginning of their working careers, and thereafter find it difficult to change their skills. When large numbers of professionals are entering the labor force, those just starting out can exploit the available opportunities. But when fewer new professionals are coming onstream, as will soon be the case, we can expect the misalignments between opportunity and expertise to become more common and persistent. To adjust to changing circumstance in the future, we must either expand the supply of new professionals or shift experienced professionals between industries and professions. Both are difficult and costly operations. But if the nation forgoes the expenditure, it may miss new opportunities for professional work and remain trapped in sectors of declining demand.

The education industry played a key role in the professionalization of the U.S. labor force since 1950, and it may again play such a role in the future. The industry, higher education in particular, trains most professionals. It also provides critical services in the creation, certification, and dissemination of new professional techniques. Education thereby functions as a basic capital goods industry to professional occupations and industries. The industry had to grow dramatically first to raise and quicken cohort professionalization, and then to train the huge baby boom generation. The impending decline in the supply of new professionals could create new demands on the education industry. One response would draw the children of the nation's underprivileged groups into professional occupations. Another would facilitate professional career and industry shifts. The structure of educational initiatives to meet these requirements may well differ from models currently in place. But for the economy to adapt to changing professional opportunities, serious programs need to be developed.[16]

## Appendix

The shift/share analysis begins with the identity that the number of professionals in an industry (P) equals total U.S. employment ($N_{us}$); multiplied by that industry's share of total U.S. employment (s); multiplied by the industry's professional ratio (PR). Thus for industry i in year t,

$$(1) \qquad P_{i,t} = N_{us,t} * s_{i,t} * PR_{i,t}.$$

As the number of professionals in the economy ($P_{us,t}$) is equal to the sum of professionals across all industries, the U.S. professional ratio ($PR_{us,t}$) can be expressed as

$$(2) \qquad PR_{us,t} = P_{us,t}/N_{us,t} = \sum_i P_{i,t}/N_{us,t}.$$

Substituting (1),

$$(3) \qquad PR_{us,t} = \sum (N_{us,t} * s_{i,t} * PR_{i,t})/N_{us,t}.$$

$$(4) \qquad = \sum (s_{i,t} * PR_{i,t}).$$

The national professional ratio, in other words, is equal to the sum of industry professional ratios, weighted by their share of the total employed labor force.

A change in the national professional ratio ($PR_{us,1} - PR_{us,0}$) can be expressed

$$(5) \qquad \sum (s_{i,1} * PR_{i,1}) - \sum (s_{i,0} * PR_{i,0}) =$$

$$(6) \qquad \sum [(s_{i,1} * PR_{i,1}) - (s_{i,0} * PR_{i,0})] =$$

$$(7) \qquad \sum [(s_{i,0} + \Delta s_i) * (PR_{i,0} + \Delta PR_i) - (s_{i,0} * PR_{i,0})] =$$

$$(8) \qquad \sum [(s_{i,0} * PR_{i,0}) + (s_{i,0} * \Delta PR_i) + (PR_{i,0} * \Delta s_i) +$$

$$(\Delta s_i * \Delta PR_i) - (s_{i,0} * PR_{i,0})] =$$

$$(9) \qquad \sum [(s_{i,0} * \Delta PR_i) + (PR_{i,0} * \Delta s_i) + (\Delta s_i * \Delta PR_i)].$$

with $\Delta s_i = s_{i,1} - s_{i,0}$; $\Delta PR_i = PR_{i,1} - PR_{i,0}$.

A change in the national professional ratio can thus be expressed as the sum, across all industries, of three industry-specific terms. The first, ($s_{i,0} * \Delta PR_i$), multiplies the change in the industry professional ratio by the initial industry employment share. It measures the effect of a change in the industry professional ratio on the national ratio and will be called the ratio effect. The second, ($PR_{i,0} * \Delta s_i$), multiplies the change in the industry employment share by the industry's initial professional ratio. It measures the consequence of a shift in the industry employment share on the national professional ratio and will be called the share effect. Finally, ($\Delta s_i * \Delta PR_i$) multiplies the incremental industry professional ratio by the incremental industry employment share. It will be called the industry interaction effect, and cannot be allocated between share and ratio effects.

Appendix Table 1

## *Contribution to Movements in the National Professional Ratio: Share and Ratio Effects*

Industries ranked according to 1988 professional ratios.

| Rank No. | Industry | 1950 Total Employment (000) | 1950 Employment Share (percent) | 1950 Profes-sional Ratio | 1988 Total Employment (000) | 1988 Employment Share (percent) | 1988 Profes-sional Ratio | Effects | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Ratio | Share | Inter-action | Total |
| 1 | Other Prof. Inds.* | 69 | .12 | 77.3 | 397 | .35 | 72.5 | 0 | .2 | 0 | .2 |
| 2 | Engin./Architech* | 83 | .15 | 71.1 | 777 | .69 | 69.2 | 0 | .4 | 0 | .4 |
| 3 | Accounting Services* | 102 | .18 | 71.8 | 753 | .67 | 56.4 | 0 | .3 | −.1 | .2 |
| 4 | Education* | 2,077 | 3.72 | 71.7 | 9,849 | 8.75 | 53.9 | −.7 | 3.6 | −.9 | 2.1 |
| 5 | Legal Services* | 226 | .40 | 60.6 | 1,127 | 1.00 | 49.0 | 0 | .4 | −.1 | .2 |
| 6 | Hospitals* | 984 | 1.76 | 44.5 | 4,429 | 3.93 | 48.5 | .1 | 1.0 | .1 | 1.1 |
| 7 | Welfare & Religion* | 400 | .72 | 61.3 | 1,963 | 1.74 | 40.5 | −.1 | .6 | −.2 | .3 |
| 8 | Office Machinery | 106 | .19 | 7.6 | 851 | .76 | 38.8 | .1 | 0 | .2 | .3 |
| 9 | Other Health* | 625 | 1.12 | 64.3 | 4,360 | 3.87 | 34.8 | −.3 | 1.8 | −.8 | .6 |
| 10 | Aircraft | 257 | .46 | 15.4 | 884 | .79 | 33.9 | .1 | .1 | .1 | .2 |
| 11 | Entertainment | 557 | 1.00 | 25.2 | 1,326 | 1.18 | 29.6 | 0 | 0 | 0 | .1 |
| 12 | Chem. & Allied Prods. | 655 | 1.17 | 11.8 | 1,214 | 1.08 | 24.4 | .1 | 0 | 0 | .1 |
| 13 | Electrical Machinery | 771 | 1.38 | 9.2 | 2,244 | 1.99 | 23.9 | .2 | .1 | .1 | .3 |
| 14 | Communications | 641 | 1.15 | 4.8 | 1,652 | 1.47 | 23.2 | .2 | 0 | .1 | .3 |
| 15 | Prof. Equip./Instrs. | 197 | .35 | 9.3 | 588 | .52 | 22.6 | 0 | 0 | 0 | .1 |
| 16 | Business Services | 353 | .63 | 16.4 | 4,877 | 4.33 | 22.4 | 0 | .6 | .2 | .9 |
| 17 | Mining | 928 | 1.66 | 3.5 | 778 | .69 | 22.1 | .3 | 0 | −.2 | .1 |
| 18 | Public Admini. | 2,491 | 4.46 | 11.7 | 6,379 | 5.67 | 20.4 | .4 | .1 | .1 | .6 |
| 19 | Misc. Manufacturing | 577 | 1.03 | 3.7 | 823 | .73 | 16.8 | .1 | 0 | 0 | .1 |
| 20 | Petrol. & Coal Prods. | 284 | .51 | 14.0 | 167 | .15 | 16.2 | 0 | −.1 | 0 | 0 |
| 21 | Printing & Publishing | 868 | 1.56 | 9.5 | 1,898 | 1.69 | 16.1 | .1 | 0 | 0 | .1 |
| 22 | Util. & Sanitation | 779 | 1.40 | 7.7 | 1,498 | 1.33 | 16.0 | .1 | 0 | 0 | .1 |
| 23 | Non-Profit Org. | 185 | .33 | 10.2 | 471 | .42 | 15.7 | 0 | 0 | 0 | 0 |
| 24 | Tobacco | 92 | .17 | 1.1 | 56 | .05 | 14.3 | 0 | 0 | 0 | 0 |
| 25 | Other Transp. Serv. | 850 | 1.52 | 3.8 | 1,741 | 1.55 | 11.4 | .1 | 0 | 0 | .1 |
| 26 | Brokerage | 87 | .16 | 7.2 | 668 | .59 | 10.6 | 0 | 0 | 0 | .1 |
| 27 | Other Trans. Manuf. | 216 | .39 | 5.7 | 449 | .40 | 10.5 | 0 | 0 | 0 | 0 |
| 28 | Banking & Credit | 516 | .93 | 3.7 | 2,778 | 2.47 | 10.3 | .1 | .1 | .1 | .2 |
| 29 | Machinery | 1,178 | 2.11 | 6.7 | 1,640 | 1.46 | 10.3 | .1 | 0 | 0 | 0 |
| 30 | Motors | 863 | 1.55 | 4.2 | 1,115 | .99 | 9.8 | .1 | 0 | 0 | 0 |
| 31 | Insurance | 751 | 1.35 | 3.7 | 2,256 | 2.00 | 8.7 | .1 | 0 | 0 | .1 |
| 32 | Paper | 464 | .83 | 3.4 | 733 | .65 | 8.7 | 0 | 0 | 0 | 0 |
| 33 | Stone/Clay/Glass | 459 | .82 | 4.0 | 618 | .55 | 8.3 | 0 | 0 | 0 | 0 |
| 34 | Rubber & Plastics | 236 | .42 | 5.4 | 754 | .67 | 8.2 | 0 | 0 | 0 | 0 |
| 35 | Other Personal Servs. | 1,324 | 2.37 | 6.3 | 1,883 | 1.67 | 7.0 | 0 | 0 | 0 | 0 |
| 36 | Ferrous Metals | 947 | 1.70 | 3.8 | 486 | .43 | 6.4 | 0 | 0 | 0 | 0 |
| 37 | Leather | 378 | .68 | 1.0 | 142 | .13 | 6.3 | 0 | 0 | 0 | 0 |
| 38 | Fabricated Metals | 831 | 1.49 | 4.8 | 1,231 | 1.09 | 6.3 | 0 | 0 | 0 | 0 |
| 39 | Textiles | 1,233 | 2.21 | 1.4 | 720 | .64 | 6.1 | .1 | 0 | −.1 | 0 |
| 40 | Non-Ferrous Metals | 216 | .39 | 5.3 | 284 | .25 | 6.0 | 0 | 0 | 0 | 0 |
| 41 | Railroads | 1,382 | 2.48 | 1.6 | 345 | .31 | 5.5 | .1 | 0 | −.1 | 0 |
| 42 | Furniture | 323 | .58 | 1.6 | 640 | .57 | 5.3 | 0 | 0 | 0 | 0 |
| 43 | Food | 1,380 | 2.47 | 2.6 | 1,714 | 1.52 | 5.0 | .1 | 0 | 0 | 0 |
| 44 | Wholesale Trade | 1,947 | 3.49 | 2.5 | 4,181 | 3.71 | 4.0 | .1 | 0 | 0 | .1 |
| 45 | Agric./Forestry/Fish. | 7,017 | 12.57 | .6 | 3,016 | 2.68 | 3.9 | .4 | −.1 | −.3 | 0 |
| 46 | Construction | 3,398 | 6.09 | 3.7 | 6,856 | 6.09 | 3.2 | 0 | 0 | 0 | 0 |
| 47 | Other Repair | 285 | .51 | 1.3 | 611 | .54 | 2.9 | 0 | 0 | 0 | 0 |
| 48 | Lumber | 851 | 1.53 | .9 | 717 | .64 | 2.8 | 0 | 0 | 0 | 0 |
| 49 | Real Estate | 529 | .95 | 1.5 | 2,080 | 1.85 | 2.8 | 0 | 0 | 0 | 0 |
| 50 | Retail Trade | 8,442 | 15.13 | 1.9 | 18,960 | 16.84 | 2.6 | .1 | 0 | 0 | .1 |
| 51 | Priv. Hsehld. Servs. | 1,662 | 2.98 | .7 | 1,106 | .98 | 2.3 | 0 | 0 | 0 | 0 |
| 52 | Hotel | 531 | .95 | 2.0 | 1,509 | 1.34 | 2.3 | 0 | 0 | 0 | 0 |
| 53 | Trucking | 696 | 1.25 | .7 | 1,783 | 1.58 | 2.2 | 0 | 0 | 0 | 0 |
| 54 | Apparel | 1,072 | 1.92 | 1.0 | 1,200 | 1.07 | 1.9 | 0 | 0 | 0 | 0 |
| 55 | Auto Service | 657 | 1.18 | .5 | 992 | .88 | 1.3 | 0 | 0 | 0 | 0 |
| All Industries | | 55,805 | | 8.7 | 112,569 | 100.0 | 18.0 | 2.4 | 8.9 | −2.0 | 9.3 |
| Prof. & Relatd. Serv.* Inds. | | 4,566 | 8.18 | 63.4 | 23,655 | 21.0 | 48.9 | −1.2 | 8.2 | −2.0 | 5.1 |
| All Other Industries: | | 51,239 | 91.82 | 3.8 | 88,914 | 79.0 | 9.7 | 3.5 | .7 | 0 | 4.2 |

Notes: 780,000 employed persons not allocated by Bureau of the Census in 1950 are assigned to the all other industries group.

*Professional and Related Services* Industry

Source: U.S. Bureau of the Census 1954a and 1988.

Appendix Table 2

## *Professional Ratios by Industry, 1950 through 1988*

Percent, in descending order according to 1988 professional ratio

| no. | industry | 1950 | 1960 | 1970 | 1980 | 1988 |
|---|---|---|---|---|---|---|
| 1 | Other Professional Industries* | 77.3 | 66.0 | 47.1 | 75.0 | 72.5 |
| 2 | Engineering/Architecture* | 71.1 | 71.4 | 72.4 | 74.3 | 69.2 |
| 3 | Accounting Services* | 71.8 | 65.8 | 58.5 | 57.4 | 56.4 |
| 4 | Education* | 71.7 | 67.3 | 59.7 | 54.3 | 53.9 |
| 5 | Legal Services* | 60.6 | 58.2 | 53.4 | 54.9 | 49.0 |
| 6 | Hospitals* | 44.5 | 40.2 | 36.8 | 42.9 | 48.5 |
| 7 | Welfare & Religion* | 61.3 | 53.0 | 53.1 | 50.7 | 40.5 |
| 8 | Office Machinery | 7.6 | 17.4 | 29.6 | 31.3 | 38.8 |
| 9 | Other Health* | 64.3 | 54.4 | 39.3 | 35.2 | 34.8 |
| 10 | Aircraft | 15.4 | 22.3 | 26.2 | 29.8 | 33.9 |
| 11 | Entertainment | 25.2 | 19.5 | 23.6 | 28.7 | 29.6 |
| 12 | Chemicals & Allied Products | 11.8 | 15.6 | 18.5 | 18.7 | 24.4 |
| 13 | Electrical Machinery | 9.2 | 15.2 | 18.4 | 19.0 | 23.9 |
| 14 | Communications | 4.8 | 10.7 | 14.7 | 19.1 | 23.2 |
| 15 | Prof. Equipment/Instruments | 9.3 | 16.2 | 16.9 | 12.8 | 22.6 |
| 16 | Business Services | 16.4 | 17.6 | 22.1 | 20.8 | 22.4 |
| 17 | Mining | 3.5 | 7.4 | 11.0 | 12.6 | 22.1 |
| 18 | Public Administration | 11.7 | 13.7 | 16.5 | 19.0 | 20.4 |
| 19 | Misc. Manufacturing | 3.7 | 3.3 | 6.3 | 16.3 | 16.8 |
| 20 | Petroleum & Coal Products | 14.0 | 15.1 | 21.1 | 21.0 | 16.2 |
| 21 | Printing & Publishing | 9.5 | 9.2 | 12.6 | 13.7 | 16.1 |
| 22 | Utilities & Sanitation | 7.7 | 8.1 | 10.6 | 14.0 | 16.0 |
| 23 | Non-Profit Organizations | 10.2 | 12.9 | 14.5 | 9.6 | 15.7 |
| 24 | Tobacco | 1.1 | 2.2 | 5.1 | 8.8 | 14.3 |
| 25 | Other Transport. Services | 3.8 | 4.8 | 8.3 | 8.4 | 11.4 |
| 26 | Brokerage | 7.2 | 7.8 | 6.5 | 4.6 | 10.6 |
| 27 | Other Transport. Manufacturing | 5.7 | 6.1 | 8.7 | 5.6 | 10.5 |
| 28 | Banking & Credit | 3.7 | 3.3 | 5.5 | 5.5 | 10.3 |
| 29 | Machinery | 6.7 | 9.4 | 10.6 | 10.8 | 10.3 |
| 30 | Motors | 4.2 | 6.8 | 8.1 | 11.0 | 9.8 |
| 31 | Insurance | 3.7 | 3.9 | 6.0 | 7.5 | 8.7 |
| 32 | Paper | 3.4 | 5.1 | 6.8 | 8.7 | 8.7 |
| 33 | Stone/Clay/Glass | 4.0 | 3.5 | 6.7 | 6.7 | 8.3 |
| 34 | Rubber & Plastics | 5.4 | 5.8 | 7.3 | 9.6 | 8.2 |
| 35 | Other Personal Services | 6.3 | 5.6 | 3.0 | 6.0 | 7.0 |
| 36 | Ferrous Metals | 3.8 | 5.0 | 6.3 | 5.9 | 6.4 |
| 37 | Leather | 1.0 | .9 | 1.9 | 1.1 | 6.3 |
| 38 | Fabricated Metals | 4.8 | 9.5 | 10.9 | 7.1 | 6.3 |
| 39 | Textiles | 1.4 | 1.9 | 3.3 | 4.4 | 6.1 |
| 40 | Non-Ferrous Metals | 5.3 | 7.4 | 8.3 | 10.1 | 6.0 |
| 41 | Railroads | 1.6 | 1.9 | 2.8 | 3.5 | 5.5 |
| 42 | Furniture | 1.6 | 2.0 | 2.9 | 4.0 | 5.3 |
| 43 | Food | 2.6 | 2.5 | 4.5 | 4.9 | 5.0 |
| 44 | Wholesale Trade | 2.5 | 3.0 | 4.3 | 3.8 | 4.0 |
| 45 | Agriculture/Forestry/Fishing | .6 | 1.3 | 2.9 | 3.6 | 5.3 |
| 46 | Construction | 3.7 | 4.7 | 4.5 | 3.4 | 3.2 |
| 47 | Other Repair | 1.3 | 1.3 | 4.2 | 2.6 | 2.9 |
| 48 | Lumber | .9 | 1.3 | 2.2 | 2.5 | 2.8 |
| 49 | Real Estate | 1.5 | 1.2 | 3.8 | 1.8 | 2.8 |
| 50 | Retail Trade | 1.9 | 1.7 | 2.2 | 1.6 | 2.6 |
| 51 | Private Household Services | .7 | .3 | 1.5 | .9 | 2.3 |
| 52 | Hotel | 2.0 | 2.1 | 3.0 | 3.1 | 2.3 |
| 53 | Trucking | .7 | .7 | 1.1 | 1.6 | 2.2 |
| 54 | Apparel | 1.0 | 1.1 | 1.9 | 1.7 | 1.9 |
| 55 | Auto Service | .5 | .6 | 1.2 | .3 | 1.3 |
| National Professional Ratio: | | 8.7 | 11.3 | 15.1 | 16.2 | 18.0 |

*Professional and Related Services* Industry

Sources: U.S. Bureau of the Census 1954a, 1963a, 1972a, 1980, and 1988.

[1] Managers of professionals focus on housekeeping, intermediation, and career and organizational strategy rather than direct supervision.

[2] As this study uses Bureau of the Census data, it also uses its industrial classification scheme. The major difference between the Census approach and the Standard Industrial Classification is the treatment of government, with the Census listing various public activities within the appropriate nongovernment category. The Census, for example, classifies public education under services; public welfare agencies under services (beginning in 1960); and the U.S. post office under transportation and public utilities (after 1980). See the box on sources and definitions for the treatment of such changes.

[3] Chart 2 and the two appendix tables provide industry detail below the 1-digit level where two conditions apply. First, industries are broken out where greater definition reveals significant variation in professionalization. Second, an industry is included only if data are available for all five years used in this study—1950, 1960, 1970, 1980, and 1988.

[4] Accounting services joined the Professional and Related Services group in the 1960 Census. For some reason the Census Bureau also classified nonprofit and membership organizations within Professional and Related Services. This industry, however, never registered more than a moderate level of professionalization according to our measure—the professional ratio. For the remainder of this paper, references to the "Professional and Related Services" industries will thus exclude the nonprofit and membership organization industry. All such references will be marked with an asterisk—"Professional and Related Services*"—to signal our difference from Bureau of the Census usage.

[5] Since 1950, hospitals have focused increasingly on the provision of professional-intensive acute care services. They have transferred convalescent and chronic care services to other facilities, which the Census Bureau classified under the "other health" rubric. Specialization on the part of hospitals thus resulted in an increased professional ratio for that industry and a sharp drop for other health services. Taking both industries together, however, health care as a whole showed a typical 10.5 point drop in its professional ratio, from 52.2 percent to 41.7 percent.

[6] Interactions between ratio and industry effects were large and on balance accounted for a 2.0 percentage point drop in the national professional ratio. The entire interaction effect originated among the Professional and Related Services* industries, whose professional ratios sharply fell while their shares of total employment rose significantly. (The interaction effect, for each industry, is the product of the change in its professional ratio multiplied by the change in its employment share.)

Interactions between ratio and industry effects outside the Professional and Related Services* industries were quite small, accounting for just a 0.01 gain in the national professional ratio. This indicates a lack of association, elsewhere in the economy, between changes in industry professional ratios (which were all positive, with the exception of construction), and changes in industry employment shares. The positive share effect, on the other hand, indicates an association between initial professional ratios and subsequent growth in employment shares.

[7] Commercial research, development, and testing labs; computer and data processing services; and business and management consulting, components of the large and heterogeneous business services "industry," are in effect providers of professional services and had even higher 1988 professional concentrations than office machinery. The analysis does not break out business services because the published Census volumes did not provide such detail prior to the Census of 1980.

[8] Successful efforts to leverage professional skills or a general increase in paperwork may underlie this rise in clerical personnel. Among the factors that may account for the substantial variation in clerical worker employment among the eight Professional and Related Services* industries are different patterns of office automation, the rise of alternate payment systems in medical care, and the shift of certain medical services out of hospitals.

[9] The shares of managers reported in the text are lower than those given in the Current Population Survey due to our reclassification of accountants, personnel and labor relations specialists, and certain other "management-related" occupations from "executive, administrative, and managerial" to "professional, technical, and kindred" occupations.

The only occupational shift of any significance, other than among managers and clericals, was the dramatic drop in service worker employment in hospitals, and the concomitantly large jump in this group in other health services. This reflects the transfer of service-intensive services out of the former and into the latter "industry," as discussed in note 4. For health care as a whole, the fraction of employees in service worker occupations rose slightly, from 26.0 percent to 28.4 percent.

[10] Personick (1987), p. 43, table 6, "Employment by Selected Industry, 1972, 1979, 1986, and Projected to 2000."

[11] The Massachusetts Department of Employment and Training, for example, classifies as "high tech" S.I.C. industries 281, 282, 283, (from chemicals and allied products); 351, (from non-electrical machinery); 357, (office machinery, also from non-electrical machinery); 361, 362, 366, 367, (from electronic and electrical equipment); 372, 376, (aircraft and space vehicles); 381, 382, 383, 384, 386, (from instruments); 737, 739, (from business services); 891 (engineering and architectural services); and 892 (noncommercial educational and scientific research).

[12] Little (1989) lists as "import-vulnerable" manufacturing industries: apparel, lumber, paper, leather, primary metals, and miscellaneous manufacturing. Her "export-oriented" manufacturers are: chemicals (PS), rubber and plastics, non-electrical machinery (office equipment-PS); electric and electronic equipment (PS), transportation equipment (aircraft-PS); and instruments (PS). For the trade balances of nonmanufacturing industries, see U.S. Bureau of Economic Analysis 1989, Table F, "Other Private Services, Unaffiliated," p. 57.

[13] In each cohort, the 16-to-24-year-old age group displayed the smallest professional concentrations, as those who would later hold professional, technical, or kindred positions were either in school, in casual employment, or just in other lines of work when younger. Cohort professional ratios rose after they reached age 65 perhaps because professionals tend to live longer, because their efforts were more rewarding and less taxing than other employments, or because Social Security replacement ratios were less generous for the generally better-paid professional workers.

[14] The 1950 cohort reached its peak professional concentration between the ages of 35 and 44 and thereafter stabilized at a slightly lower level; the professional ratio for the 1960 cohort peaked between the ages of 25 and 34, and thereafter fell for two decades; the 1970 cohort reached its highest professional concentration between the ages of 35 and 44, slightly above its level at ages 25 to 34, and this is the most recent reading for this generational cohort.

[15] Given the large underprivileged populations in the United States, the potential supply of professional labor is clearly greater than levels currently achieved. Tapping this resource may require substantial institutional change and income redistribution. Barring such actions, the nation may simply be unable to increase its supply of professional labor much further. As underprivileged populations will comprise an increasing proportion of the nation's work force, the national professional ratio may indeed decline in the absence of such institutional change and income redistribution.

[16] For some ideas emerging from a somewhat different context, see Spring (1989).

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