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ABSTRACT

This document examines trends in employment, earnings, and education requirements among major sectors, industries, and four detailed industry groups (high tech, business services, health services, and eating and drinking establishments) in the United States. Trends show that the service sector, particularly in business and health services, are important sources of new jobs in the U.S. economy. Because the service sector tends to employ more college graduates, its expansion will tend to raise the educational requirements of jobs in the future economy. Yet the service sector pays lower average wages than the goods-producing sector, which could alter the distribution of earnings. The paper's first section contains a rationale for examining the industrial sector and includes a description of the industrial structure of the economy. The second section examines differences in employment and educational requirements among industrial sectors and detailed groups. Differences in earnings among industries are the subject of the third section. The final section discusses the implications of the material presented earlier. A 15-item bibliography and seven tables conclude the document. (CML)

The Changing Industrial Structure of the U.S. Economy: Its Impact on Employment, Earnings, and the Educational Requirements of Jobs

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Revised
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Abstract

Changes in the structure of the U.S. economy have important consequences on the number and kinds of jobs available and on the distribution of earnings. This paper examines trends in employment, earnings, and educational requirements among major sectors, industries, and four detailed industry groups. Employment trends show that the service sector in general and business and health services in particular are important sources of new jobs in the U.S. economy. The service sector tends to employ more college graduates, so its expansion will tend to raise the educational requirements of jobs in the future economy. Yet the service sector also pays lower average wages than the goods-producing sector, which could alter the distribution of earnings.

The industrial structure of the U.S. economy has undergone several major changes in the last one hundred years. A hundred years ago most workers were employed in the agricultural sector. With the growth of industrialization during the latter part of the last century, the bulk of the workforce became employed in the goods-producing sector of the economy, primarily in manufacturing industries. Finally, around 30 years ago, the service sector became the dominant sector of employment.

In addition to these major sectorial shifts, there have been shifts in employment among more detailed industries. One group of industries that has received considerable attention of late is that group that has been designated as "high-tech" industries. Although there is no precise definition of this industry group, it generally includes those industries involved in the design and production of new, technically sophisticated products, such as integrated circuits, computers, and advanced communication equipment. It is generally believed that high-tech industries not only provide important new products and innovations for other industries, but also provide an important source of new jobs in the economy.

One reason to examine changes in the industrial sector of the economy is that the kinds of jobs provided in different sectors and industries can be quite different. In some cases, occupations can be unique to particular industries. All farmers, for example, are employed in the agricultural sector, while almost all firefighters are employed by the government. But more

important than simply occupational differences, however, is that the distribution of jobs by skill or education level among industries can be quite different. Thus, shifts in employment among industries can alter the distribution jobs available in the economy that can, consequently, alter the education and training that workers will need to secure those jobs.

One recent concern is that the growth of high-tech industries and the continuing shift toward service employment will tend to increase the educational requirements of jobs. This would suggest that young people as well as adults increase their levels of schooling in order to be eligible for such jobs. This notion can be found in several of the recent commission reports on education that have spurred current reform efforts (e.g., National Commission on Excellence in Education 1983; Task Force on Education for Economic Growth 1983).

Another reason for examining changes in the industrial sector of the economy concerns earnings. Not only do industries differ in the kinds of jobs they provide, they also differ in the compensation they provide. In his classic study of the service economy, Fuchs noted that the earnings in the service sector are generally lower than in the manufacturing sector and lower than one might expect given the age, education, and demographic characteristics of the workers employed there (Fuchs 1968, Chapter 6). Even jobs of similar educational requirements can have quite different earnings levels. So again, shifts in employment among industries and sectors of the economy can have

important implications for the earnings opportunities of individuals as well as the earnings distribution of jobs in the economy overall.

Recently, there has been some concern that changes in the industrial structure is leading to a decrease in the number of middle-class or middle-income jobs, thereby creating a bi-polar distribution of earnings in the economy. This is said to be coming about from a decline in jobs in manufacturing industries, where wages of jobs are generally above average, and a growth in jobs in the service industries, where wages are generally below average (Bluestone, Harrison, and Gorhan 1984). While such employment shifts do appear to be taking place, other analyses show little change in the overall distribution of earnings in recent years (Lawrence 1984; Rosenthal 1985). Nonetheless, it remains unclear whether future employment shifts will alter the distribution of earnings in the economy.

The purpose of this paper is to examine the employment, education requirements, and earnings in the major sectors and industries of the U.S. economy as well as in a few, selected industry groups. The remainder of the paper is divided into four parts. The next section briefly describes the industrial structure of the economy. The following section examines differences in employment and educational requirements among industrial sectors and detailed groups. The third section examines earnirgs differences among industries. The final section discusses the implications of these findings.

The Industrial Structure of the U.S. Economy

The U.S. economy can be divided into three major sectors: agriculture, the industry or goods-producing sector, and the service sector. Each sector has been the dominant source of employment at some time in the nation's history. We are now in a period where the service sector is the dominant employer. In 1984, about two-thirds of the work force was employed in the service sector, while 30 percent was employed in the industrial sector and 3 percent employed in agriculture (Tables 1 and 2).

The industry and service sectors are actually aggregations of a large number of detailed industries that can also be grouped into several major categories. In general, the industry sector is concerned with the production of goods and the service sector with the production of services. But there is actually no clear lines of demarcation between the two sectors. A recent government analysis of sectorial employment aggregates major industry groups in one way (Kutscher and Personick 1986). In the present analysis I allocated major industry groups among the two sectors in a different manner, using the procedure employed by Fuchs (1968) in order to make comparisons between my analysis and his, which was performed on a similar set of data--the 1960 Decennial Census.

The only difference between the two procedures is that the government study puts agriculture into the goods-producing sector and allocates transportation, communication, and public utilities to the service sector. In contrast, Fuchs allocates agriculture

to a separate sector and includes transportation, communication, and public utilities to the industry sector. In the present study I included all government activities in the service sector, while Fuchs put government enterprises in the industry sector and other government activities (the majority) into the service sector.

Thus, in the present analysis, the industry sector is composed of the following major industries: mining, construction, manufacturing, and transportation, communications, and public utilities. Each of these major industries is itself composed of a large number of detailed industries, with manufacturing comoosed of the largest numoer. The service sector is also composed of several major industries: wholesale and retail trade, finance, insurance, and real estate, services, and government. Again each of these major industries is composed of a series of more detailed industries. Services, for example, can be further subdivided into business and repair services, personal services, entertainment services, health services, and other orofessional services.

The categories and groups are a way to identify those industries that provide a similar kind of good or service. In other words, they can be used to identify similar industries. Yet a similarity in goods or services does not necessarily mean that the industries within any category or group are similar in other ways, such as the kinds or jobs they provide or the educational attainments of the workers they employ. Thus there

is always a danger in making generalizations about the needs or requirements of particular types of industries, especially at rather high levels of aggregation. The service sector, in particular, represents a very large group of major industries and detailed industries whose characteristics and requirements are quite different.

In order to explore some those differences in more detail, I have identified four subgroups of industries to examine along with the major sectors and industries of the economy. The four detailed industry groups are high-tech manufacturing and three service-producing groups: eating and drinking places, business services, and health services. One reason for selecting these four groups is that together they have accounted for a major share of all new jobs added to the economy over the last two decades and they are expected to provide a similar share of new jobs in the next decade. These four groups also will help to illustrate differences in employment, educational requirements, and earnings between the goods-producing sector of the economy and the services-producing sector of the economy as well as differences within the services-producing sector itself.

It should be pointed out, however, that there are also significant differences in employment and earnings opportunities within these four groups. While the group identified as eating and drinking places actually represents a single, detailed industry, the other three groups are aggregations of detailed industries. High-tech manufacturing, for example, includes

drugs, petroleum refining, computer equipment, and aircraft. Business services includes advertising, commercial research and development, personnel supply, and protective services. The complete list of detailed industries within each of the three groups is shown in Appendix Table A.1.

In some cases, there are marked differences in the occupational structure and earnings among detailed industries within the same group. In business services, for example, the proportion of managerial and professional occupations among industries within the group ranges from 7 and 8 percent for building and protection services to 42 percent and 59 percent for advertising and business management and consulting. The proportion of professional and managerial occupations for each of the detailed industries within each group is shown in Appendix Table A.1. In the remainder of the paper we will ignore these intra-group differences and instead focus on inter-group differences and differences among major industries and sectors of the economy.

Employment and Educational Requirements

Employment growth over the last two decades, from 1959 to 1984, has helped to increase the employment base of the service sector. From 1959 to 1984, the share of employment within the service sector increased from 54 to 67 percent, while the share in the industry sector decreased from 38 to 30 percent (Table 2). Altogether, 85 percent of the employment growth took place in the

service sector.

Some major industries grew at particularly high rates over this period. The trades and services categories together accounted for more than 50 percent of all employment growth. The government accounted for another 18 percent of employment growth, more than the combined industry sector.

The four detailed groups combined accounted for one-third of all employment growth between 1959 and 1984. High-tech industries, contrary to what people might believe, employed the same proportion of the workforce in 1959 as they did in 1984. The other three groups, in contrast, increased their employment share substantially. Most notably, the share of employment in business services increased from 1 percent of the workforce in 1959 to 6 percent in 1984. Almost 3 out of every 10 new jobs added to the economy in this period found was in business services, health services, or eating and drinking establishments. What is particularly remarkable is that eating and drinking establishments represents a single, detailed industry, while the other groups are composed of as many as 20 detailed industries.

Recent employment projections for the period from 1984 to 1995 suggest patterns of employment growth similar to those of the recent past. About 82 percent of future employment growth is expected to occur in the service sector. The biggest change is for government employment, which is expected to account for only 7 percent of new jobs, compared to 18 percent in the earlier period.

The four detailed industries are expected to account for almost the same proportion of new jobs in the future as they did in the past, about one in three. Business services is expected to account for a larger share and eating and drinking establishments a somewhat smaller share. High-tech industries are expected to provide a somewhat larger share of new jobs, but their total employment share is not expected to increase. In fact, more new jobs are expected in eating and drinking establishments over this period than in high-tech industries. This finding, too, probably runs counter to a common perception that high-tech industries will be an important source of new jobs in the future U.S. economy.

Besides differences in the number of jobs provided by different sectors and industries in the economy, there are differences in the kinds of jobs provided. Two types of occupational categories can be used to illustrate these differences. Professional and managerial jobs represents one category. As in the case of industrial categories, this category is composed of a large number and wide range of detailed occupations, ranging from doctors and lawyers to low-level managers. The category is based on the classification scheme used in the 1980 Decennial Census (U.S. Bureau of the Census 1983). In general, however, this category contains the most prestigious and highest paying jobs in the economy. Jobs in this category also employ about 2 out of every 3 recent college graduates (Rumberger 1984, Table 4).

Another occupational category is composed of high-tech occupations, defined by the U.S. Bureau of Labor Statistics as those occupations requiring a an in-depth knowledge of science, mathematics, and engineering (Richie, Hecker, and Burgan 1983, p. 54). For the most part, these are professional level occupations in science, mathematics, and engineering requiring at least 4-year college degrees, although they also include computer programmers, and engineering and science technicians who require no more than a high school diploma or a 2-year college degree.

The proportion of jobs in these two occupation groups varies widely across sectors, major industries, and the four detailed industry groups. For the economy as a whole, 23 percent of all occupations fall into the professional and managerial category (Table 3). In the industry sector the proportion is only 14 percent, while in the service sector the proportion is 29 percent. The highest proportion in any major industry group is found in government, where 2 out of every 5 workers are employed in professional and managerial occupations. Among the four detailed groups, business and health services have a much higher proportion of professional and managerial jobs--about one in three--than either high-tech or eating and drinking establishments.

High-tech occupations represent only about 4 percent of all jobs in the economy as a whole. The industry sector overall has about twice the proportion of high-tech occupations than the service sector. High-tech manufacturing has the greatest

concentration of high-tech occupations, but even there only 15 percent of the jobs are in this group. Many of the remainder are in relatively low-paying production occupations (Rumberger and Levin 1985, p. 411). The next highest concentrations of high-tech occupations are found in mining (13 percent) and business services (10 percent).

Another way to compare industries is by the educational attainments of the workers they employ. Higher education levels are generally associated with higher quality workers and higher quality jobs. Thus the educational attainments of workers in current jobs can suggest the educational requirements of future jobs.

In 1980 more than half of American workers had completed a high school degree or less, 20 percent had completed some college (1 to 3 years), and another 19 percent had completed 4 or more years of college. As a whole, workers in the service sector have higher levels of education than workers in the industry sector. Therefore the continued grow of the service sector will have a tendency to raise the educational requirements of work in the U.S. economy independently of any upgrading of requirements that might take place within occupations.

However, the educational requirements of future jobs due such compositional shifts may be less than expected based on these gross differences because educational attainments vary widely among industries within the service sector. For example, in government, 37 percent of the workers have completed 4 or more

years of college, while in wholesale and retail trade, only 10 percent have completed 4 or more years of college. Since the government is expected to contribute only 7 percent of all new jobs over the next decade, while the trade industries are expected to provide 24 percent (Table 2), these shifts by themselves will have a tendency to reduce not raise educational requirements of jobs in the economy.

Of course the growth of the service industries, which are expected to provide 44 percent of the new jobs between 1984 and 1995, will help to raise the educational requirements of work since these industries have a high concentration of jobs for college graduates. For the economy as a whole, however, a recent analysis suggests that the educational requirements of future jobs over the next decade be will about the same as the educational attainments of current jobs (Levin and Rumberger 1986, Table 1).

There is also a good deal of variation in the educational attainments of workers among the four detailed industry groups. The proportion of college graduates ranges from 5 percent in eating and drinking establishments to 27 percent in business services. In high-tech manufacturing, 18 percent of the workers have 4 or more years of college, which is lower than for the service sector as a whole. Thus not only will high-tech industries provide a relatively small proportion of new jobs in the economy over the next decade (6 percent), they also tend to employ less-educated workers than the service sector generally.

Earnings

The various sectors and industries in the U.S. economy differ in the earnings opportunities they provide as well as the number and kinds of jobs. Some of these differences in earnings are due to differences in occupations, which vary widely in the remuneration they provide. But there are also other factors that contribute to earnings differences. For instance, it is well-known that unionized industries tend to pay higher salaries than industries that are not unionized (Freeman and Medoff 1985). And of course the educational attainments of workers and other, individual characteristics also contribute to observed earnings differences.

In order to compar earnings across industries and the role that education and other individual factors play in determining earnings, a simple model was used to estimate earnings:

$$\ln w = a + B_1 S + B_2 A + B_3 R + b_4 f, \qquad (1)$$

where w represents hourly earnings, S represents a vector of dummy variables for schooling categories, A represents a vector of dummy variables for age categories, R represents a vector of dummy variables for racial and ethnic categories, and f represents a dummy variable for female.

The model was estimated on a random 10 percent sample of persons from the 1980 1/1000 Public Use Sample. The sample was restricted to persons who were in the labor force in 1980 and reported positive values for annual earnings, weeks worked, and usual hours worked in 1979. This yielded a sample size of 9,784

persons. Hourly earnings were estimated by dividing annual earnings in 1979 by total annual hours (weeks worked times usual hours worked).

In order to reveal differences in the payoff to schooling, the model was estimated separately for workers within each of the three sectors, the eight major industries, and the four detailed industry groups. The estimated coefficients for the schooling variables appear in Table 4. Since schooling was divided into a series of dummy variables, each schooling coefficient shows the payoff to that level of schooling relative to other workers with 12 years of schooling within the same sector or industry.

For the overall sample, the model reveals the usual relationship between years of schooling and hourly earnings. Workers with more schooling receive significantly higher hourly earnings than workers with less schooling. Workers with four years of college, for example, receive about 30 percent higher earnings than high school graduates. Workers with only a grade school education have hourly earnings that are almost 25 percent less than high school graduates.

The results also reveal substantial differences in the relative returns to schooling across sectors and industries. While the relative payoff to four years of college is similar between the industry and service sectors (around 30 percent), the relative payoff to graduate education is much higher in the service sector than in the industry sector (49 percent versus 31 percent). Larger variations in the relative returns to

schooling, however, are found among major industries and detailed industry groups.

In some industries, workers with higher levels of schooling do not earn significantly higher wages than persons with less schooling. This is largely the case in mining, construction, eating and drinking establishments, and business services. The lack of any payoff to additional schooling could result from the kinds of jobs found in those industries, jobs where additional schooling is not needed and therefore not rewarded. Business services, for example, is composed of a wide variety of detailed industries that provide a wide range of jobs, from janitors and private service workers to computer specialists and managers. In some of these jobs, there may be a payoff to additional schooling, while in others there may not.

Even in industries where there is a significant payoff to additional schooling, the relative payoff varies widely. The relative payoff to four years of college varies from 25 percent in the services industries to 40 percent in wholesale and retail trade. In the four detailed industries, the relative payoff to four years of college is around 30 percent in high-tech manufacturing and health services and insignificant in eating and drinking establishments and business services.

Additional comparisons of earnings differences across sectors and industries can also be made using expected earnings. Expected earnings were computed for each sector and industry by multiplying the estimated coefficient for each variable from the

entire sample by the mean value of that variable for workers employed within each industry. More specifically, expected earnings was estimated by the equation:

$$\ln \hat{w}_i = \hat{a} + \hat{B}_1 S_i + \hat{B}_2 A_i + \hat{B}_3 R_i + \hat{b}_4 f_i, \qquad (2)$$

where S_i, A_i, R_i, and f_i represent the mean values for these variables for industry i.

Several ratios were then constructed using actual and expected earnings for each sector and industry group. The first ratio compared actual hourly earnings in each category with mean hourly earnings for all industries. This comparison reveals relative differences in actual hourly earnings <u>across</u> sectors and industries. A second ratio compared expected hourly earnings in each category with expected hourly earnings for all industries. This comparison reveals earnings differences <u>across</u> sectors and industries due to differences in educational attainments and other individual characteristics, assuming that these characteristics were rewarded similarly in all industries and sectors. The third ratio compared actual earnings with expected earnings <u>within</u> each category. This comparison reveals differences due to the differential returns to individual characteristics as well as other factors not accounted for in the model, such as the extent of unionization.

This technique was used by Fuchs (1968) in his classic study of the service economy to identify differences between the service and industry sectors of the economy. His estimates were based on the 1960 1/1000 Public Use Sample, whereas the present

estimates were based on the 1980 1/1000 Public Use Sample. Thus it is instructive to compare the estimates from the two studies to see what changes have taken place over the last 20 years. One problem in making these comparisons, however, is that I put all government workers in a separate category, while Fuch's only separated government workers in public administration and the postal service, but left the remainder in other industries. Therefore the categories are not strictly comparable.

Actual and expected earnings for the economy as a whole as well as for sectors, major industries, and the four detailed industry groups are shown in Table 5. Comparisons of actual and expected earnings across industries reveal a number of differences between the industry and service sectors. First, actual hourly earnings in the industry sector were about 12 percent higher than in the service sector in 1979. Relative differences in expected earnings are 6 percent, which suggests that education and other individual characteristics account for half of the observed difference in earnings between the two sectors. Yet actual earnings in the industry sector were still 5 percent higher than expected in 1979 given the age, education levels, race, and sex of the workers in that sector, whereas actual earnings in the service sector were 1 percent less than expected.

In contrast, Fuchs found about the same relative differential (13-14 percent) in actual hourly earnings for 1959 between the two sectors, but could not account for any of the

difference due to differences in education and other individual characteristics (Fuchs 1968, Table 46). Thus Fuchs found that actual earnings in the industry sector were about 8 percent higher than expected earnings, while actual earnings in the service sector were about 8 percent lower than expected earnings (Fuchs 1968, Table 46). Comparisons between these two sets of findings suggest, therefore, that the relative advantage of working in the industry sector compared to the service sector has been reduced over the last 20 years by more than half, although some advantage still remains.

Relative comparisons of expected earnings across sectors and industry groups suggests that some of the observed differences in actual earnings are expected due to differences in the education, age, race, and sex of the workers in each category. That is, some of the observed disparities in hourly earnings across industries are expected given the differences in the characteristics of the workers employed. Yet even accounting for these differences, some sectors of the economy pay higher wages than other sectors. The agricultural sector and government pay the lowest wages relative to other sectors and industry groups given the characteristics of workers employed there, whereas construction, eating and drinking establishments, and health services pay the most.

In contrast, Fuchs found that the ratios of actual to expected hourly earnings were lowest in retail trade, personal services, and government (postal service and public

administration). The highest ratios were in mining, construction, and finance, insurance, and real estate (Fuchs 1968, Table 46). Comparisons between these two sets of estimates suggest that, in some cases, the relative advantages of workers in some industries have not changed over time (e.g., government), whereas the relative advantages of other workers have changed (e.g., mining).

A final analysis estimated actual and expected earnings separately for males and females. The results appear in Table 6. These estimates reveal that both men and women receive different hourly earnings in different sectors and industries of the U.S. economy, even controlling for differences in education, age, and race/ethnicity. Yet the relative advantages for men and women across industries differ.

Both men and women earn more than expected in the industry sector compared to the service sector, although the difference between the two sectors is higher for men (7 percent) than for women (2 percent). Yet women do much better than expected in the agricultural sector (29) percent, while men do significantly worse than expected (11 percent).

Comparative advantages for males and females also differ across industry groups. Males have their highest ratios of actual to expected earnings in construction, eating and drinking establishments, and health services. They have the lowest ratios in agriculture and government. Females have their highest ratios of actual to expected earnings in transportation, communications,

and public utilities, and in business services. Their lowest ratios are in wholesale and retail trade, and in eating and drinking establishments. The biggest contrasts between men and women in relative earnings are found in agriculture, eating and drinking establishments, health services, and government.

Fuchs also found large disparities in relative earnings between men and women in government and business and repair services (Fuchs 1968, Table 46). These findings suggest that the industry sector as a whole is more uniform in the wages paid to men and women (perhaps because of unionization), but that the service sector is not. In particular, the government has remained a relatively attractive place to work for women (in terms of wages) over last 20 years and a relatively unattractive place for men (Freeman 1985). It has been suggested that one function of the government sector, in fact, has been to provide the employment and earnings opportunities for women (and minorities) that they have not been able to find in the private sector (Carnoy, Shearer, and Rumberger 1983, Chapter 6).

Summary and Conclusions

The purpose of this paper was to illustrate that there are substantial differences in employment opportunities, educational requirements, and earnings among different industrial segments of the U.S. economy. These differences were examined across sectors, major industries, and four detailed industry groups. The fact that such differences exist suggests that shifts in

employment opportunities across sectors and industries can have profound impacts on the overall composition of jobs, future educational requirements, and income distribution.

For example, the service sector has generated a major share of new jobs over the last two decades and is expected to generate the major share of new jobs in the next decade. Moreover, the educational attainments of workers in the service sector are generally higher than in the industry and agricultural sectors. Yet there is also substantial variation in the educational requirements of jobs within the service sector. So to some extent the growth of those industries with the highest educational requirements, such as health services, will be buttressed by the growth of industries with lower educational requirements, such as eating and drinking establishments.

Earnings are generally lower in the service sector than in the industry sector. So the continued expansion of the service sector will probably act to reduce the average earnings of workers. Both males and females receive a relative advantage working in the industry sector in that their earnings are higher than expected given their level of schooling, age, and racial composition. However, at a more detailed level, males have a comparative advantage working in eating and drinking establishments and in health services, while females have a comparative advantage working in agriculture, in transportation, communications, and public utilities, and in business services.

These differences illustrate that the industrial structure

of the U.S. economy has and will continue to have an important impact on employment opportunities and earnings of workers. These differences will contribute to the overall welfare of workers in the future economy as well as the relative welfare among different social groups.

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Table 1

Actual and Projected Employment by Sector and Industry Group, 1959, 1984, 1995

(thousands of persons)

	Employment			Employment Growth	
	1959	1984	1995	1959-84	1984-95
All industries	67,784	106,841	122,760	39,057	15,919
I. Agriculture	5,583	3,293	3,059	-2,290	-234
II. Industry	25,797	31,850	34,695	6,053	2,845
Mining	614	651	631	-37	-20
Construction	3,910	5,920	6,636	2,010	716
Manufacturing	17,018	19,779	21,124	2,761	1,345
(1) High-tech[1]	3,712	5,434	6,417	1,722	983
Transportation, communications, and public utilities	4,255	5,500	6,304	1,245	804
III. Service	36,405	71,698	85,006	35,293	13,308
Wholesale and retail trade	13,492	24,290	28,272	10,798	3,982
(2) Eating and drinking establishments	2,002	5,733	6,936	3,731	1,203
Finance, insurance, and real estate	2,959	6,296	7,397	3,337	1,101
Services	11,871	25,128	32,193	13,257	7,065
(3) Business services	953	4,825	7,512	3,872	2,687
(4) Health services	1,930	6,472	8,232	4,542	1,760
Government	8,083	14,499	15,582	7,390	1,083

[1]High-tech industries defined as those industries with a ratio of R&D expenditures to net sales at least twice the average for all industries, as determined by the BLS. BLS designations of SIC industries translated to BLS industries. See Richie, Richard W.; Daniel E. Hecker; and John U. Burgan, "High Technology Today and Tomorrow: A Small Slice of the Employment Pie." Monthly Labor Review, Vol. 106, (November 1983), pp. 50-58.

Source: Valerie A. Dersonick, "A Second Look at Industry Outpout and Employment Trends Through 1995." Monthly Labor Review, Vol. 108, (November 1985), Tables 1 and 7.

Table 2

Actual and Projected Employment by Sector and Industry Group, 1959, 1984, 1995

(percent distribution)

	Employment			Employment Growth	
	1959	1984	1995	1959-84	1984-95
All industries	100	100	100	100	100
I. Agriculture	8	3	3	--	--
II. Industry	38	30	28	15	18
Mining	1	1	1	--	--
Construction	6	6	5	5	4
Manufacturing	25	18	17	7	8
(1) High-tech[1]	5	5	5	4	6
Transportation, communications, and public utilities	6	5	5	3	5
III. Service	54	67	69	85	82
Wholesale and retail trade	20	23	23	26	24
(2) Eating and drinking establishments	3	5	6	9	7
Finance, insurance, and real estate	4	6	6	8	7
Services	18	24	27	32	44
(3) Business services	1	6	6	9	17
(4) Health services	3	6	7	11	11
Government	12	14	13	18	7

[1]High-tech industries defined as those industries with a ratio of R&D expenditures to net sales at least twice the average for all industries, as determined by the BLS. BLS designations of SIC industries translated to BLS industries. See Richie, Richard W.; Daniel E. Hecker; and John U. Burgan, "High Technology Today and Tomorrow: A Small Slice of the Employment Pie." Monthly Labor Review, Vol. 106, (November 1983), pp. 50-58.

Source: Valerie A. Dersonick, "A Second LooK at Industry Outpout and Employment Trends Through 1995." Monthly Labor Review, Vol. 108, (November 1985), Tables 1 and 7.

Table 3

Occupational Employment and Educational Attainments of Workers by Sector and Industry Group, 1980

	Percent in Professional/ Managerial Occupations	Percent in High-Tech[1] Occupations	Educational Attainments (years of schooling) (percent distribution) 0-11	12	13-15	16+
All industries	23	4	24	37	20	19
I. Agriculture	6	1	43	34	11	12
II. Industry	14	6	30	42	17	11
Mining	14	13	31	37	18	14
Construction	9	3	33	40	18	9
Manufacturing	15	6	31	42	16	11
(1) High-tech[1]	21	15	22	41	19	18
Transportation, communications, and public utilities	16	4	20	46	23	11
III. Service	29	3	20	35	21	24
Wholesale and retail trade	14	1	31	40	19	10
(2) Eating and drinking establishments	17	--	36	33	16	5
Finance, insurance, and real estate	22	1	8	39	26	27
Services	36	4	19	31	23	27
(3) Business services	33	10	16	33	24	27
(4) Health services	35	1	16	31	28	25
Government	41	4	14	31	18	37

[1]High-tech industries defined as those industries with a ratio of R&D expenditures to net sales at least twice the average for all industries, as determined by the BLS. BLS designations of SIC industries translated to BLS industries. High-tech occupations defined as those that require an in-depth knowledge of science, mathematics, and engineering, such as engineers and computer specialists. See Richie, Richard W.; Daniel E. Hecker; and John U. Burgan, "High Technology Today and Tomorrow: A Small Slice of the Employment Pie." Monthly Labor Review, Vol. 106, (November 1983), pp. 50-58.

Source: Calculated from the 1980 1/1000 Public Use Sample, U.S. Bureau of the Census (N=9642).

Table 4

Estimated Effects of Schooling on Log Hourly Earnings
by Sector and Industry Group, 1969

Industry (N)	Years of Schooling						R^2
	0-8	9-11	12	13-15	16	17+	
All industries (9784)	-.23*	-.12*	--	.09*	.29*	.41*	.20
I. Agriculture (246)	-.11	-.06	--	.19	.41	.51*	.07
II. Industry (3485)	-.24*	-.11*	--	.04	.30*	.31*	.21
Mining (107)	-.07	-.05	--	.05	.07	.51	.16
Construction (562)	-.04	-.08	--	.05	.36*	.28	.10
Manufacturing (2197)	-.28*	-.11*	--	.04	.30*	.28	.24
(1) High-tech[1] (538)	-.15	-.18*	--	.06	.31*	.39*	.30
Transportation, communications, & pub. util. (619)	-.26*	-.08	--	.03	.26*	.46*	.19
III. Service (6053)	-.26*	-.16*	--	.14*	.34*	.49*	.20
Wholesale and retail trade (1952)	-.29*	-.13*	--	.10*	.40*	.45*	.18
(2) Eating & drinking establishments (389)	-.28	-.03	--	.28*	.43	.58	.13
Finance, insurance, & real estate (566)	-.01	.06	--	.16*	.32*	.44*	.22
Services (1899)	-.24*	-.23*	--	.14*	.25*	.43*	.15
(3) Bus. ser. (266)	-.37	-.27	--	.13	.28	.29	.22
(4) Health ser. (583)	-.22	-.22*	--	.22*	.30*	.65*	.21
Government (1636)	-.17*	-.12*	--	.14*	.33*	.32*	.26

*Significant at the .05 level.

[1]High-tech industries defined at those industries with a ratio of R&D expenditures to net sales at least twice the average for all industries, as determined by the BLS. BLS designations of SIC industries translated to BLS industries. See Richie, Richard W.; Daniel E. Hecker; and John U. Burgan, "High Technology Today and Tomorrow: A Small Slice of the Employment Pie." Monthly Labor Review, Vol. 106, (November 1983), pp. 50-58.

Note: Regression equations contain control variables for age group, gender, and race/ethnicity group. See text for a detailed explanation.

Source: Calculated from the 1980 1/1000 Public Use Sample, U.S. Bureau of the Census (N=9642).

Table 5

Actual and Expected Hourly Earnings
by Sector and Industry Group, 1979

	Actual	Actual/ Actual (All)	Expected/ Expected (All)	Actual/ Expected
All industries	7.46	1.00	1.00	1.00
I. Agriculture	6.39	.86	.97	.88
II. Industry	8.07	1.08	1.03	1.05
Mining	8.60	1.15	1.12	1.03
Construction	9.02	1.21	1.07	1.13
Manufacturing	7.52	1.01	1.00	1.01
(1) High-tech[1]	8.18	1.10	1.07	1.03
Transportation, communications, and public utilities	9.04	1.21	1.09	1.11
III. Service	7.15	.96	.97	.99
Wholesale and retail trade	5.83	.89	.87	1.03
(2) Eating and drinking estaolishments	6.40	.86	.75	1.15
Finance, insurance, and real estate	9.03	1.08	1.02	1.06
Services	6.94	.93	.95	.98
(3) Business services	8.32	1.12	1.03	1.09
(4) Health services	7.33	.98	.88	1.11
Government	7.72	1.03	1.07	.96

[1]High-tech industries defined at those industries with a ratio of R&D expenditures to net sales at least twice the average for all industries, as determined by the BLS. BLS designations of SIC industries translated to BLS industries. See Richie, Richard W.; Daniel E. Hecker; and John U. Burgan, "High Technology Today and Tomorrow: A Small Slice of the Employment Pie." Monthly Labor Review, Vol. 106, (November 1983), pp. 50-58.

Note: Expected earnings calculated by multiplying the estimated regression coefficient for every independent variable calculated from the entire sample times the mean value for that variable in each industry category.

Source: Calculated from the 1980 1/1000 Public Use Sample, U.S. Bureau of the Census (N=9784).

Table 6

Actual and Expected Hourly Earnings
for Males and Females by Sector and Industry Group,
1979

	Males				Females			
	Act.	Act./ Act. (All)	Act./ Exp.	Exp./ Exp. (All)	Act.	Act./ Act. (All)	Act./ Exp.	Exp./ Exp. (All)
All industries	8.47	1.00	1 00	1.00	5.20	1.00	1.00	1.00
I. Agriculture	6.36	.75	.84	.89	6.55	1.26	.98	1.29
II. Industry	9.07	1.07	.98	1.09	5.33	1.03	.95	1.08
Mining	8.83	1.04	.95	1.09	6.34	1.22	1.15	1.06
Construction	9.29	1.10	.92	1.20	6.08	1.17	1.02	1.15
Manufacturing	8.75	1.03	.95	1.08	5.03	.97	.93	1.04
(1) High-tech[1]	9.75	1.15	1.07	1.07	5.32	1.02	.97	1.05
Transportation, communications, and public utilities	9.86	1.16	1.04	1.12	6.49	1.25	1.01	1.24
III. Service	8.85	1.04	1.02	1.02	5.57	1.07	1.01	1.06
Wholesale and retail trade	8.24	.97	.89	1.09	4.70	.90	.91	.99
(2) Eating and drinking establishments	9.22	1.09	.73	1.49	4.35	.83	.85	.98
Finance, insurance, and real estate	11.16	1.32	1.17	1.13	5.55	1.07	1.02	1.05
Services	9.01	1.06	1.05	1.01	5.48	1.05	1.02	1.03
(3) Business services	9.61	1.13	1.04	1.09	6.66	1.28	1.02	1.25
(4) Health services	12.83	1.51	1.14	1.32	5.91	1.14	1.03	1.11
Government	8.78	1.04	1.11	.94	6.65	1.28	1.12	1.14

[1]High-tech industries defined at those industries with a ratio of R&D expenditures to net sales at least twice the average for all industries, as determined by the BLS. BLS designations of SIC industries translated to BLS industries. See Richie, Richard W.; Daniel E. Hecker; and John U. Burgan, "High Technology Today and Tomorrow: A Small Slice of the Employment Pie." Monthly Labor Review, Vol. 106, (November 1983), pp. 50-58.

Note: Expected earnings calculated by multiplying the estimated regression coefficient for every independent variable calculated from the entire sample times the mean value for that variable in each industry category.
Source: Calculated from the 1980 1/1000 Public Use Sample, U.S. Bureau of the Census (N=9784).

Appendix Table A.1

Total Employment and Percent Professional & Managerial Occupations by Detailed Industries within High-Tech and Selected Service Industries, 1980

	Employment (thousands)	Percent in Professional/ Managerial Occupations
(1) High-tech manufacturing[1]	5,512	23
Plastics	234	15
Drug	204	25
Soaps & cosmetics	135	21
Paints, varnishes, and related prods.	76	20
Agricultural chemicals	68	21
Industrial and mis. chemicals	555	22
Petroleum refining	183	22
Ordinance	85	16
Engines & turbines	137	15
Office & accounting machines	100	24
Electronic computing equipment	429	34
Radio, TV, camera equipment	591	13
Electronic machinery	1,257	18
Aircraft & parts	625	24
Guided missles	201	46
Scientific & controlling instruments	235	23
Optical & health service supplies	255	18
Photography equipment & supplies	142	23

Appendix Table A.1 (Continued)

Total Employment and Percent Professional & Managerial Occupations by Detailed Industries within High-Tech and Selected Service Industries, 1980

		Employment (thousands)	Percent in Professional/ Managerial Occupations
(2)	Eating & drinking places	4,181	14
(3)	Business services	2,725	31
	Advertising	208	42
	Building services	336	7
	Commercial R&D	237	41
	Personnel supply	249	39
	Business man. & consulting services	337	59
	Computer & data processing	361	33
	Detective & protective	241	8
	Business services, n.e.c.	756	28
(4)	Health services	7,250	35
	Offices of physicians	736	47
	Offices of dentists	397	34
	Chiropractors	36	56
	Optometrists	48	48
	Health practitioners, n.e.c.	54	63
	Hospitals	4,425	36
	Nursing facilities	1,084	19
	Health services, n.e.c.	471	38

[1]High-tech industries defined at those industries with a ratio of R&D expenditures to net sales at least twice the average for all industries, as determined by the BLS. BLS designations of SSCCindustriestranslatedtoBLS industries. See Richie, Richard W.; Daniel E. Hecker; and John U. Burgan, "High Technology Today and Tomorrow: A Small Slice of the Employment Pie." Monthly Labor Review, Vol. 106, (November 1983), pp. 50-58.

Source: U.S. Bureau of the Census, 1980 Census of the Population, Vol. 2: Occupation by Industry (Washington, DC: Government Printing Office, 1984), Table 4.