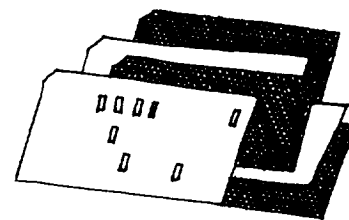


Research Summaries



Productivity, age, and labor composition changes in the U.S.

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It is well known that, since 1973, the United States has been experiencing a slowdown in the rate of growth of labor productivity. From 1948 to 1973, output per labor hour in the private nonfarm business sector grew at an average annual rate of 2.5 percent, while the 1973-86 rate of growth was 0.8 percent, or only one-third as large.

Throughout the period of the slowdown, the composition of the U.S. labor force has been changing. (See table 1.) Between 1970 and 1980, the average age of workers fell sharply, by 2.3 years, and from 1980 to 1986, it rose slightly, by 0.2 year. Besides changes in the age composition of the work force, there also have been changes in the composition of the labor force with regard to sex and educational attainment. The Bureau of Labor Statistics has been studying the relationship between changes in labor composition and productivity growth. Following a discussion of historical and recent Bureau estimates of the relationship between age of the worker and productivity, this report describes preliminary results now available from the new study.

Age and productivity

Several earlier studies conducted by the Bureau directly addressed the issue of age and job performance.¹ This research was part of a broad Department of Labor program of the 1950's and 1960's that examined problems faced by older workers. In each of the studies of comparative job performance by age, indexes of output per hour were constructed using data from employer records. These data were compiled for specific age groups.

The authors are economists in the Division of Productivity Research, Bureau of Labor Statistics. This report is drawn from a paper presented at the conference on "An Aging Workforce: Agenda for Action," sponsored by Wayne State University and the U.S. Department of Labor, in Detroit, MI, March 10-11, 1988. An extended version will appear in a volume of papers prepared for the conference.

Table 1. Average age of the civilian labor force age 16 and over by sex, selected years, 1948-86

Year	Average age		
	All persons	Women	Men
1948	39.0	36.6	40.0
1950	39.4	37.5	40.1
1955	40.4	39.0	41.1
1958	40.5	39.6	40.9
1960	40.4	39.8	40.7
1965	40.0	39.5	40.3
1970	39.2	38.4	39.7
1975	37.6	36.8	38.1
1980	36.9	36.3	37.4
1985	37.0	36.5	37.5
1986	37.1	36.6	37.5

The performance of factory workers in the footwear and furniture industries was the subject of the first study; two other studies involved clerical workers and mail sorters. Findings from all of the studies are displayed in table 2. The results of the footwear and furniture study showed that, for men and women in both industries, there was some decline in output per hour between the ages of 25 and 64. For men, the decline began after age 45, while for women, it started after age 35. There were more substantial declines in productivity among those age 65 and over in the footwear industry (although this was not the case in the furniture industry). For example, in comparison to the average output per hour of men ages 25 to 34, that of men ages 55 to 64 in the footwear industry was 8 percent lower, and that for men age 65 and over was 19 percent lower.

However, the footwear and furniture study also found that there was much variation in output rates within each age group, and that the degree of variability was not closely related to age. In fact, the degree of variation was such that many of the older workers performed better in terms of output per hour than the average for those in the 35-to-44 age group. For example, among men in the footwear industry, 44 percent of those ages 45 to 54 and 30 percent of those ages 55 to 64 exceeded the average output rate for the 35-to-44 group.

In the study of clerical workers, almost no decline in output per hour was seen between the ages of 25 and 64. The difference between the average productivity of those in the 25-to-34 group and those in the 55-to-64 group was less than 1 percent. Furthermore, the clerical workers

Table 2. Indexes of output per hour for workers in selected industries and occupations, by age, selected years

[Index=100 for 35-to-44 age group]

Industry and age group	Men		Women		All workers	
	Index	Coefficient of variation	Index	Coefficient of variation	Index	Coefficient of variation
Footwear (1956-57)						
Under 25	93.8	17.9	94.4	17.1	—	—
25-34	100.3	16.3	102.8	17.5	—	—
35-44	100.0	13.8	100.0	15.2	—	—
45-54	97.7	14.1	98.8	15.6	—	—
55-64	92.5	14.5	94.1	13.1	—	—
65 and over ...	81.1	16.6	88.0	20.7	—	—
Household furniture (1956-57)						
Under 25	98.5	16.3	101.4	18.8	—	—
25-34	101.5	15.1	107.4	19.4	—	—
35-44	100.0	11.8	100.0	17.8	—	—
45-54	96.1	11.0	98.7	18.0	—	—
55-64	94.5	11.8	85.6	18.6	—	—
65 and over ...	93.6	11.6	—	—	—	—
Clerical workers (1958-59)						
Under 25	—	—	—	—	92.4	22.3
25-34	—	—	—	—	99.4	20.1
35-44	—	—	—	—	100.0	18.1
45-54	—	—	—	—	100.1	19.4
55-64	—	—	—	—	98.6	19.4
65 and over ...	—	—	—	—	101.2	20.5
Mail sorters (1961)						
Under 25	—	—	—	—	101.2	13.7
25-29	—	—	—	—	100.1	13.2
30-34	—	—	—	—	101.3	13.0
35-39	—	—	—	—	100.1	12.2
39-44	—	—	—	—	99.8	12.8
45-49	—	—	—	—	99.5	12.6
50-54	—	—	—	—	100.9	12.9
55-59	—	—	—	—	99.1	15.0
60 and over ...	—	—	—	—	96.2	13.7

SOURCE: See text footnote 1.

who were 65 and over had the highest average output per hour of all the age groups. As in the footwear and furniture study, however, a substantial amount of variation in productivity within each age group was found.

Mail sorters were the third group of workers studied. As with the other studies, the output per hour of workers ages 35 to 44 was indexed to 100. The results of this study indicated that there was not a significant amount of variation in average output per hour among age groups below 60. Among those 60 and over, a small decline was observed. Once again, however, there was considerable within-group variation in output per hour among individuals. In each group, the majority of workers had indexes below 95 or above 105.

Together, these studies suggest that there is not a large decline in average productivity between the ages of 25 and 64. The most noteworthy decreases tended to be seen

among those in the oldest group, but in each study, there was much variation in output per hour within age groups.

In all of these studies of comparative job performance, measures of output per hour were constructed with data on the output of individual workers available from employer records. For the majority of workers, such data are not available, thereby precluding the direct measurement of productivity. However, there are ample data on wages, from which more can be learned about productivity. If firms maximize profits in a competitive economy, then the wage of a group of workers is equal to the value of their marginal product. The marginal product is the increase in output resulting from an additional hour of labor. So, the connection between age and an individual's wage can be examined to gain additional insights regarding the connection between age and productivity.

Age and earnings are linked together by work experience, on-the-job training, skills, and productivity. Older workers, on average, have more work experience than younger workers, and because of this they tend to have had more on-the-job training. When workers undergo training, they learn new skills and these new skills make them more productive. A worker who has become more productive tends to earn a higher wage. Hence, as workers become older, their earnings tend to rise. However, during the later years of their working lives, workers may see their hourly earnings level off or possibly drop. This can occur because workers may stop acquiring training towards the end of their working lives. If skills are no longer being acquired, hourly earnings may stabilize. Furthermore, if skills lose value over time, then an individual may find that earnings fall as retirement nears due to this depreciation. So, in general, one would expect a worker's wage to rise for many years and then to level off or perhaps start to decline.

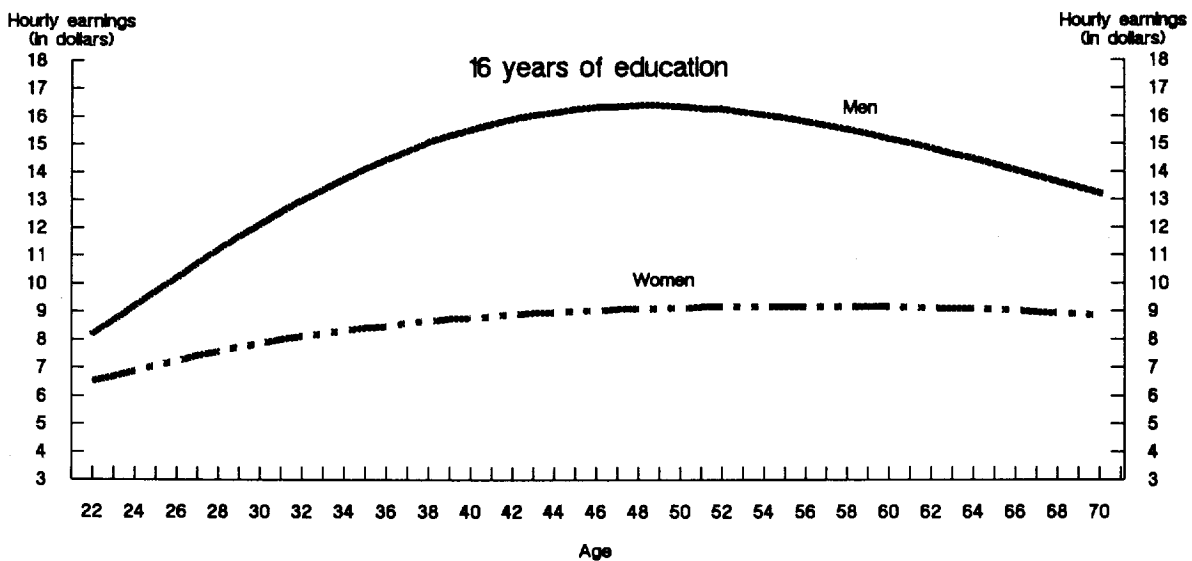
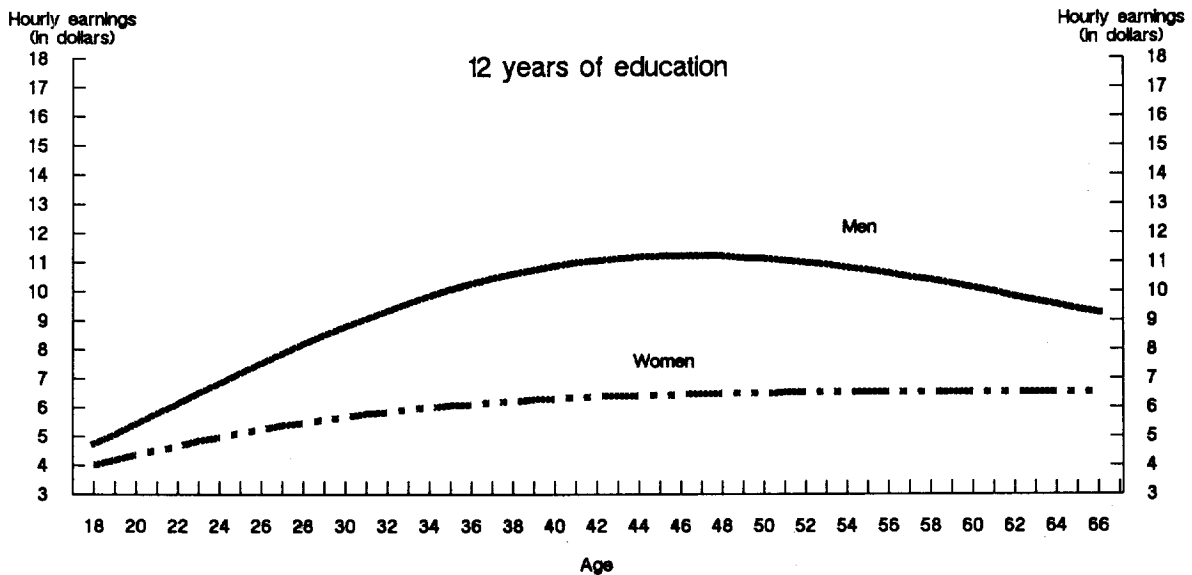
To learn more about the relationship between age and productivity, the Bureau constructed age-earnings profiles, which are presented in chart 1. Each profile is a curve showing the estimated relationship between age and hourly earnings for a particular group of workers, such as male high school graduates. These profiles are based on experience and earnings equations, estimated separately for men and women. Experience equations were estimated because our major data sources do not include a measure of actual work experience. The empirical results are used to estimate the accumulated work experience of individuals, based on certain worker characteristics: age, educational attainment, and in addition, for women, marital status and number of children. (Note that accumulated work experience includes experience acquired while in school.) The estimation was performed with data from the 1973 Exact Match Study, which linked data from the Current Population Survey, Social Security Administration records, and Internal Revenue Service tax returns. Based on the empirical results, a male college graduate has 15

years of estimated experience at age 35. A 35-year-old female college graduate has 14 years of estimated experience if she is single, and 9 years if she is married and has two children.

Earnings equations were constructed with estimated work experience as an explanatory variable. Schooling variables also were included because education, like on-the-job training, raises productivity and wages. The remaining explanatory variables are control variables, such as for region of residence. The equations were estimated with data from the Current Population Survey.

To create age-earnings profiles for high school and college graduates, estimated work experience was calculated with coefficients of the estimated experience equations for each combination of age, sex, and educational level. For the women's profiles, marital status and number of children had to be specified because these factors enter into the women's experience equation; "married with two or three children" was the family status that was specified. Estimated hourly earnings were derived with the intercept and the experience and schooling coefficients of the estimated earnings equations for 1986.²

Chart 1. Estimated hourly earnings by age, sex, and educational attainment, 1986



NOTE: Estimates for women pertain to married women with two or three children.

The age-earnings profile for male high school graduates reveals that their hourly earnings climb until age 46, and then begin to drop slowly. For male college graduates, the peak occurs a couple of years later, at age 48, after which hourly earnings gradually fall. The profiles for women are much flatter than those for men. The estimated hourly earnings of female high school graduates reach the maximum level for women in their late forties and then remain there. For female college graduates, the peak level is attained around age 50, and the wage stays there until it gradually begins to decline for women in their sixties. So, for all of these workers, estimated hourly earnings peak between the ages of 45 and 50; men's earnings start to fall after the peak, while women's earnings stay level for years after the peak is reached. Notice that these age-earnings profiles are based on cross-sectional data, rather than data for specific cohorts of workers over time. Because of this, the shapes of the actual age-earnings profiles of particular cohorts may differ somewhat from those of the profiles depicted in the chart. However, the profiles that the Bureau has constructed do provide a general idea as to the relationship between age and productivity.

Composition of the labor force

Turning to the labor composition study itself, the Bureau has, as mentioned earlier, developed preliminary results. These results may be revised when the study is complete. The growth rate of the labor composition index measures the contribution to labor input of changes in the composition of the work force with regard to work experience, education, and sex. Experience is used rather than age because experience is more closely tied to on-the-job training and job skills. The labor composition index is formed with information on hours of work that have been classified by estimated work experience, education, and sex and information on the price of labor. The price for each type of labor is calculated using the estimated earnings equations described earlier.³

The Bureau study has found that, in the private nonfarm business sector, the index of labor composition grew at an average annual rate of 0.24 percent from 1948 to 1973. During the first part of the productivity slowdown, 1973-79, the growth rate of labor composition was only 0.06 percent. Then, from 1979 to 1986, the rate was 0.51 percent, which is about twice as large as the pre-slowdown rate of growth.

As might be expected, experience accounts for the low growth rate of the labor composition index over the period 1973-79. The main effect of experience on labor composition was -0.42 percent per year during that time. In contrast, prior to the productivity slowdown, the main effect of experience was much smaller in magnitude, -0.10 percent. Then, from 1979 to 1986, the main effect

Table 3. Annual rates of growth of output per hour of all persons and its components in private nonfarm business, 1948-86 and selected subperiods

Measures	1948-86	1948-73	1973-79	1979-86	Percentage-point change in growth rate between —	
					1948-73 and 1973-79	1973-79 and 1979-86
					[In percent]	
Output per hour of all persons ..	1.9	2.5	0.5	1.2	-2.0	0.7
Contribution of capital intensity ²8	.8	.6	.9	-.2	.3
Contribution of labor composition ³	.2	.2	.0	.3	-.2	.3
Multifactor productivity ⁴	.9	1.5	-.1	.0	-1.6	.1

¹ Excludes government enterprises.
² Changes in capital services per hour multiplied by capital's share of current-dollar output.
³ Changes in labor composition effects multiplied by labor's share of current-dollar output.
⁴ Output per unit of combined labor and capital inputs, adjusted for labor composition.

of experience was no longer negative; instead, it was slightly above zero, at 0.04 percent per year.

The growth rate of output per hour in private nonfarm business was 2.5 percent from 1948 to 1973. (See table 3.) The growth rate dropped, by 2 percentage points, to 0.5 percent for the period 1973-79. The corresponding drop in the contribution of labor composition to productivity growth was 0.2 percentage point, which means that changes in labor composition account for 10 percent of the initial slowdown in labor productivity. Between 1979 and 1986, the contribution of labor composition to labor productivity was 0.3 percentage point higher than in 1973-79, while labor productivity growth was 0.7 percentage point higher. Hence, changes in labor composition account for about half of the increase in the productivity growth rate that was seen over the 1979-86 period.

TO SUM UP, the growth rate of labor composition fluctuated between 1948 and 1986, and an important source of these fluctuations was changes in the amount of work experience that U.S. workers possessed. This, in turn, was strongly affected by changes in the age distribution of the labor force that occurred during the period. These relationships are especially evident in the data for the 1970's. Between 1973 and 1979, the average age of the work force fell by one full year and the index of work experience fell four times as fast as it did prior to the slowdown. The growth rate of labor composition was only one-quarter as large as it was before the slowdown.

Since 1979, labor composition growth has been much higher than it was during the first part of the slowdown. This has been due in large part to an increase in the effect

of work experience on labor composition. An important reason for this increase is that the average age of the work force has been slowly moving upward in the 1980's, after rapidly declining in the 1970's. The rise in the average age toward the years of peak productivity is expected to continue until at least the year 2000, and it is likely to have a positive effect on the growth of labor composition and labor productivity.⁴ □

—FOOTNOTES—

¹The methodology and results of these studies are described in the following: *Job Performance and Age: A Study in Measurement*, Bulletin 1203 (Bureau of Labor Statistics, September 1956); *Comparative Job Performance by Age: Large Plants in the Men's Footwear and Household Furniture Industries*, Bulletin 1223 (Bureau of Labor Statistics, November 1957); Ronald E. Kutscher and James F. Walker, "Comparative Job Performance of Office Workers by Age," *Monthly Labor Review*, January 1960, pp. 39-43; and James F. Walker, "The Job Performance of Federal Mail Sorters by Age," *Monthly Labor Review*, March 1964, pp. 296-300.

²Because the construction of the profiles involves earnings data for just one year, 1986, inflation is not an issue here. The shapes of the profiles give an indication of what happens (on average) to the real hourly earnings of individuals over the course of their working lives.

³A complete discussion of the methodology and results of the labor composition study will be available in a future Bureau of Labor Statistics publication.

⁴See Ronald E. Kutscher, "Overview and implications of the projections to 2000," *Monthly Labor Review*, September 1987, pp. 3-9; and Howard N. Fullerton, Jr., "Labor force projections: 1986 to 2000," *Monthly Labor Review*, September 1987, pp. 19-29.

Employers and child care: what roles do they play?

HOWARD V. HAYGHE

As more and more mothers are joining the ranks of the employed, child care has become one of today's most widely debated social and political issues. Awareness of the problem has spread dramatically, as demonstrated by the recent report by the Secretary of Labor and by child-care initiatives presently in the Congress.¹ Employers, too, are beginning to be involved in the search for solutions.

As in the past, American employers on the whole still do not play an active role in the care of their workers' children. However, with mothers becoming a more im-

portant part of the work force, some employers are coming to realize that the difficulties that their employees face in arranging care for their children may result in absenteeism, tardiness, low morale, and productivity problems. This may be exacerbated in some areas by worker shortages. Consequently, there is some evidence that employers are looking at steps they can take to help their employees who are parents.²

To determine what employers were doing, the Bureau of Labor Statistics conducted a special nationwide survey of approximately 10,000 business establishments and government agencies in the summer of 1987.³ Results from this survey show that direct aid to working parents is still very limited. Only about 2 percent, or 25,000, of the Nation's 1.2 million nonagricultural establishments with 10 or more employees actually sponsored day-care centers for their workers' children while an additional 3 percent provided financial assistance towards child-care expenses.⁴ But, as this report will show, employers are doing a number of other things to aid employees with growing children.

Scope of the issue

The potential demand for child care is immense. As of March 1987, there were 10.5 million children under the age of 6 whose mothers were in the labor force—more than half of all children these ages.⁵ In addition, there were 15.7 million youngsters ages 6 to 13 whose mothers were in the labor force and who required some sort of care or supervision before and after school or on school holidays. A total of 26.1 million children under age 14 lived in homes where both parents or the lone parent was in the labor force.

How are these children being cared for? The following tabulation, which is based on data collected by the Bureau of the Census in the winter of 1984-85, shows a percentage distribution of children under age 15 in terms of the institution or person *primarily* responsible for their supervision while their mothers worked:⁶

	Percent
Total	100.0
In own home	17.8
In others' home	14.4
Day-care facility	9.1
School	52.2
Child cares for self	1.8
Parent	4.7

The survey also showed that there were more than a million children ages 5 to 14 who cared for themselves after school—the so-called "latch-key" children.⁷ These data simplify the actual complexity of today's child-care arrangements: parents working different shifts; transporting the children to and from the day-care providers; and coping with breakdowns in the arrangements or other emergencies. However, child-care arrangements are not

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