May 7, 2004

Changes in the Composition of Labor
for BLS Multifactor Productivity Measures, 2002

Characteristics of workers evolve over time and in response to changing labor market conditions. Each succeeding generation has completed more years of schooling than the one before. Women have entered the work force in increasing numbers since the late 1950s, continuing a trend seen throughout the last century. The large baby boom cohort entered middle age during the 1980s and 1990s, and is now a dominant force in the labor market. Consequently, middle-aged workers have come to account for an ever-larger share of total hours worked, and the average age of workers has risen. Furthermore, the longest economic expansion in U.S. history ended in the first quarter of 2001. The recession that followed had different impacts on young and old, men and women, and highly and less educated workers.

As a result of these changes, the work force in 2002 was very different from the work force in 1948. And the skill composition of hours worked today, as measured by a worker's education and work experience, is very different from the distribution of hours worked by level of skill in 1948.

The BLS labor composition index estimates the effect of shifts in the experience, education, and gender composition of the work force on the efficiency of labor and multifactor productivity growth. The Office of Productivity and Technology assembles data on workers' hours classified by their educational attainment, age and gender. Measures of labor input for private business and private nonfarm business are then calculated by summing the annual percent changes in each group's hours of work, each weighted by that group's share of total labor compensation. These BLS labor composition indexes are reported annually in the Multifactor Productivity Trends news release. A complete description of these measures and methods can be found in Bulletin 2426, Labor Composition and U.S. Productivity Growth, 1948-90.

Recent Changes in Labor Composition

Based on data from the March 2003 Current Population Survey (CPS) of households, the labor composition index for 2002 increased at the following rates:

Sector	2001-2002
Private business	1.19%
Private nonfarm business	1.12%

Charts 1 and 2 show annual changes in the index of labor composition and hours for the private business sector and the private nonfarm business sector since 1979. The rates of growth for the private business and private nonfarm business sectors are very similar because the two sectors cover approximately the same portions of the economy. Private nonfarm business excludes hours in the farm sector from private business, and the farm sector comprises 2 percent of the hours in the total economy. Therefore, changes in the composition of hours are virtually identical in the two sectors. For this reason, the private nonfarm business sector is not discussed further.

The 1.19 percent increase in the labor composition index for the private business sector was the largest increase since 1992 when labor composition rose 1.23 percent. Since 1979, labor composition in private business has accounted for more than 25 percent of the increase in labor input. Within a growth accounting framework, a 1-percent change in the labor composition index indicates that increases in workers' skill levels have had the same effect on output and productivity growth as a 1-percent change in hours worked.

Table 3 (at the end of this document) divides the sources of labor input growth for the private business sector. While annual changes in labor input as measured by the Current Population Survey are usually dominated by changes in hours, labor composition growth generally provides a small but steady positive contribution to labor input. In addition, labor composition generally grows more rapidly in weak labor markets. Labor composition has contributed about 20 percent of labor input growth.

Chart 1. Changes in the labor composition index and hours in private business, 1979-2002
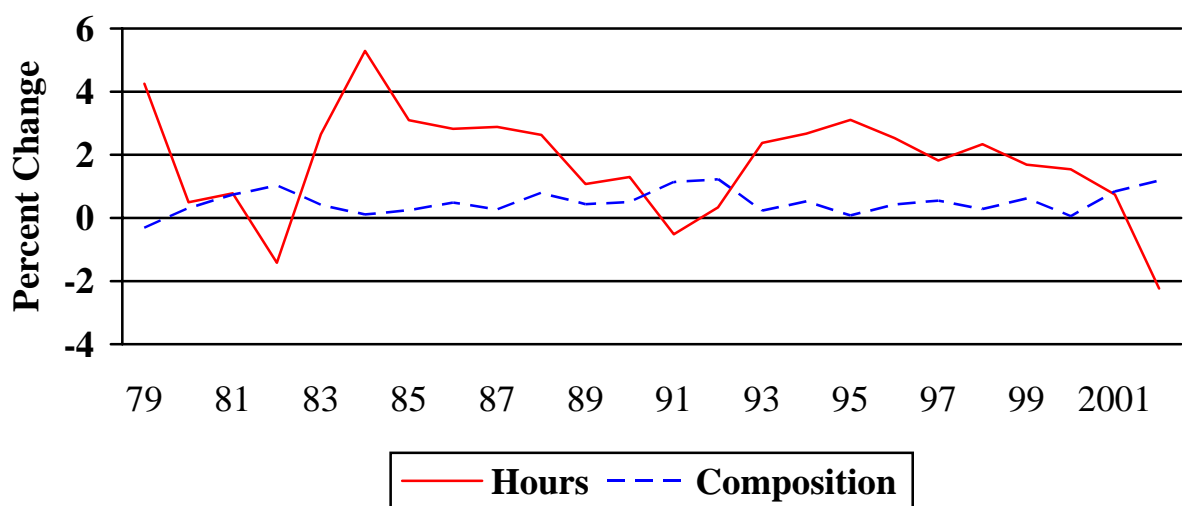
Hours and labor composition are based on the March annual demographic file of the Current Population Survey.

Chart 2. Changes in the labor composition index and hours in private nonfarm business, 1979-2002
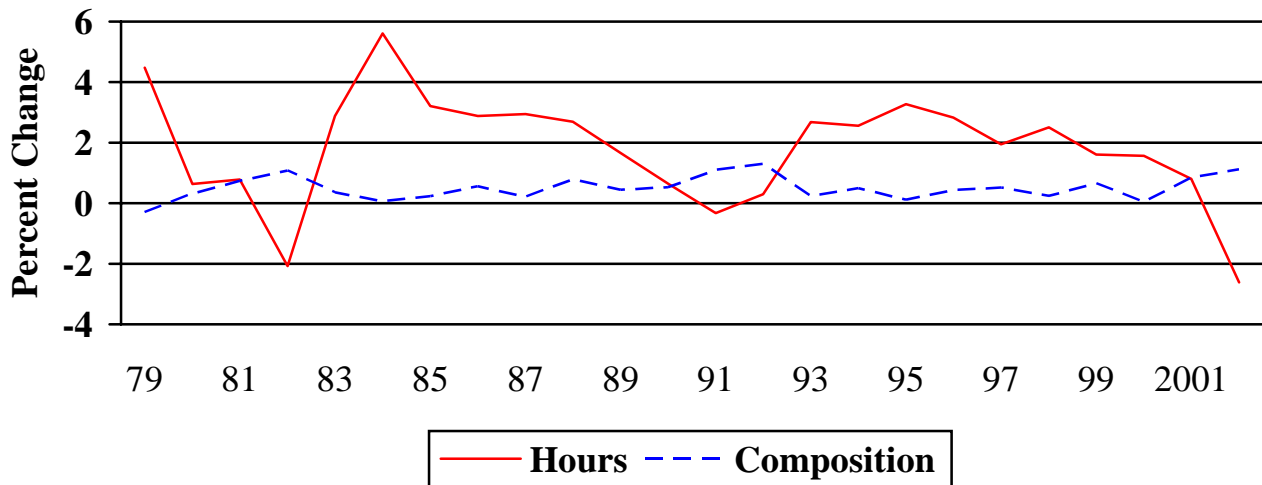
Hours and labor composition are based on the March annual demographic file of the Current Population Survey.

To better understand why these changes are occurring, it is useful to examine changes in educational attainment and work experience within the employed work force. Hours-weighted average levels of educational attainment increased at a fairly steady pace until 1994. In 1995 and 1996, educational attainment failed to advance. Since then it has resumed its upward trend, although at a slower pace than previously. Typical of weak labor markets, less educated workers were more adversely affected than well educated workers. In 2002, average schooling increased for men, and advanced strongly for women. Work experience levels increased rapidly and steadily for men throughout the 1998-2000 period, due largely to the aging of the baby boom cohort. In 2001 and 2002, the weak labor market added to this trend and the level of work experience accelerated even more rapidly as both the aging of the work force and the declining employment prospects for younger workers reduced the share of employment for inexperienced workers. For women, the effects are even more pronounced as the average level of work experience for women rose nearly a year between 2000 and 2002.

The role of experienced and highly educated workers within the current composition of the work force also can be seen in tables on employment, hours, and median weekly earnings that are published by broad age intervals in the Bureau of Labor Statistics publication Employment and Earnings. Employment fell in 2002. Younger workers and less educated workers were more adversely affected. Employment continued to rise for workers age 45 years and older. Those with at least some college education also posted increases in employment.

As can be seen in the charts above, weak labor markets affect labor composition growth. For example, growth rates for labor composition greater than 1 percent occur only in 1982, 1991 and 2002. Hours, as measured by the Current Population Survey,

declined in each of these years. As labor markets weaken, firms generally lay off workers with the least seniority ("last-hired first-fired"). Blue-collar workers usually experience more layoffs than well-educated white-collar workers do. Conversely, expanding labor markets are often initially characterized by the re-employment of many blue-collar workers. As the expansion continues, firms often hire workers with lesser qualifications and workers who were not previously in the labor force. It is typical for labor composition to increase relatively rapidly when hours decline and for labor composition to grow relatively slowly when unemployment is relatively low. Consistent with this pattern, labor composition in 2002 grew faster than any year since 1991-92.

Changes in the Distribution of Hours

Table 1 below shows the distribution of hours in the private business sector by educational attainment. The general pattern of an increasing share of hours worked by more educated workers is again apparent for men in 2002. The share of hours continued to increase sharply for those with at least 16 years of schooling. Offsetting this shift, men in each category of schooling with no more than 12 years of school experienced a declining share. The share of hours worked by men with 12 years of schooling has been generally declining and the decline was quite pronounced in 2002. The hours-weighted average level of educational attainment for men rose to 13.5 in 2002.

Table 1. Distribution of hours by years of school completed
Men and women in private business 1998-2002
(Percent)

Years	Men					Women				
	1998	1999	2000	2001	2002	1998	1999	2000	2001	2002
0-4	0.82	0.89	0.92	1.06	1.03	0.51	0.54	0.57	0.59	0.49
5-8	3.34	3.40	3.35	3.63	3.51	2.04	2.09	2.18	2.15	1.97
9-11	7.76	7.45	7.20	7.35	7.34	6.62	6.37	6.37	6.03	5.52
12	34.50	33.86	33.98	33.31	32.70	35.33	34.51	33.79	33.68	33.45
13-15	25.89	26.25	26.41	25.84	25.94	31.65	32.19	31.96	31.77	31.84
16	18.96	18.90	19.16	19.26	19.64	17.84	18.15	18.78	18.91	19.49
17+	8.74	9.26	8.98	9.59	9.83	6.01	6.16	6.34	6.87	7.25
Mean	13.38	13.42	13.42	13.41	13.46	13.41	13.45	13.47	13.51	13.59

Sum over all schooling levels in each year equals 100 for men and for women.

Among women, the consistent trend has been for college educated women to increase their share of hours, and this trend was especially pronounced in 2002. The share of hours for women with 13-15 years of education has fluctuated without trend since 1998. The erosion of hours worked by women with 12 years of school or less continued in 2002 as each group posted a lower share. The net result was that hours-weighted average schooling levels for working women increased substantially to 13.6 years in 2002.

Table 2 shows the distribution of hours by level of potential work experience, defined as age minus years of completed schooling minus 6. The mean years of potential experience rose for men in 2002 while the average jumped nearly a half year for women. In large part, this reflects increases in employment for workers age 45 and older while employment fell among workers less than 45 years of age.

These changes reflect long term demographic changes as well as the changing job prospects of younger less skilled workers. The share of hours worked by the original baby boom generation continues to rise in large part because the population of this cohort (aged 38-56) increased considerably more rapidly than the remainder of the population. This age group most closely corresponds to workers with 20-29 years of potential experience as seen in table 2. Men in 2002 with 20-29 years of potential experience increased their share of hours. The gain was larger for women and the trend since 1998 has been one of more consistent increases.

The largest gains were made among even older workers, however. The employment of those age 55-64 jumped more than 7 percent in 2002 even while overall employment fell. The gain for workers over 65 years was very modest. For workers with 30 or more years of potential experience, their share of hours worked rose nearly 1 percentage point, a notably large increase.

**Table 2. Distribution of hours by years of potential experience
Men and women in private business, 1998-2002**

(percent)

Years	Men					Women				
	1998	1999	2000	2001	2002	1998	1999	2000	2001	2002
0-4	11.72	11.70	11.69	11.29	10.63	14.85	14.81	15.33	14.45	13.50
5- 9	12.32	12.01	12.07	11.97	11.80	12.68	12.17	11.95	11.79	11.46
10-14	13.48	13.25	12.85	12.97	12.65	12.38	12.19	11.66	11.54	11.75
15-19	14.63	14.54	14.04	13.64	13.78	13.72	13.42	13.43	12.91	12.43
20-29	26.75	27.17	27.54	26.97	27.25	25.26	26.04	26.38	26.47	26.84
30-39	14.68	14.61	15.22	16.18	17.08	15.19	15.21	15.23	16.27	17.25
40+	6.43	6.72	6.59	6.98	6.81	5.92	6.16	6.02	6.56	6.78
Mean	19.53	19.72	19.83	20.13	20.38	18.84	19.06	19.06	19.58	20.02

The sum over all experience levels in each year equals 100 for men and for women. Potential experience represents the number of years since leaving school (age-schooling-6).

Inexperienced workers now include some of the children of the baby boom cohort, sometimes designated the "baby boom echo." However, growth in the population of 16-19 year olds was slower than for other groups and declining labor force participation and rising unemployment rates resulted in a declining employment share for teens. As a result, the share of hours worked for both men and women with less than 5 years of potential experience fell sharply again in 2002.

Wage Equation Estimates

The labor composition index is affected by both shifts in the distribution of hours employed and changes in the relative wage rates received by different groups of workers. Labor composition rises when the average marginal product of labor increases. This can occur from a shift in the work force to workers with higher marginal products or from an increase in the marginal products (as measured by hourly wages) of groups of workers with faster than average hours growth. Historically, shifts in employment toward more educated and experienced workers have been the dominant source of labor composition growth. However, many studies have documented that since about 1979 the distribution of earnings has shifted and the relative earnings of more educated and experienced workers has risen faster than for other workers. These trends are reflected in wage equation parameters that are used to construct the labor composition index.

As noted above, the BLS labor composition indexes are weighted sums of growth rates of hours. A standard human capital wage equation is used to construct the labor cost share weights used in these calculations. Relative earnings by educational attainment based on these parameters are found in the following charts. These parameter estimates capture the wage rate differentials between different categories of workers. Using 12 years of school as a reference group, men with 16 years of school, for example, earned approximately 69 percent more than otherwise identical men with 12 years while men with 9-11 years of schooling earned about 15 percent less in 2002. (See Chart 3.)
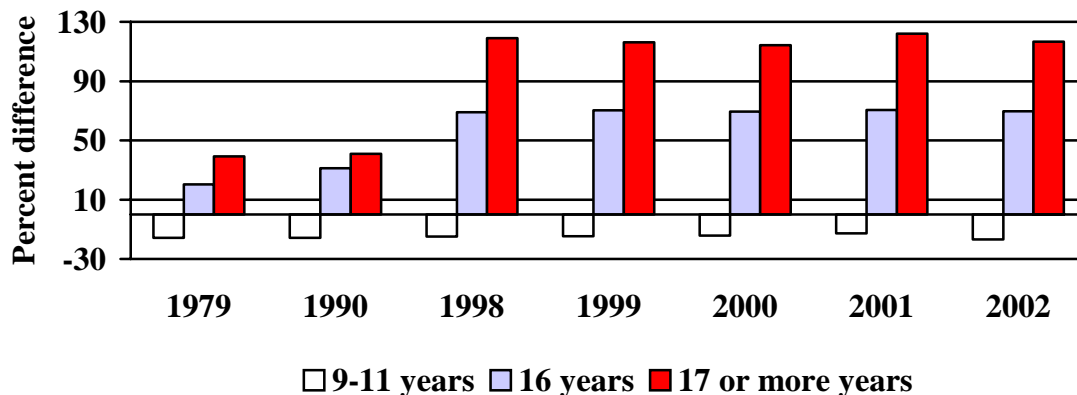
Chart 3. Earnings of men by educational attainment relative to 12 years of school
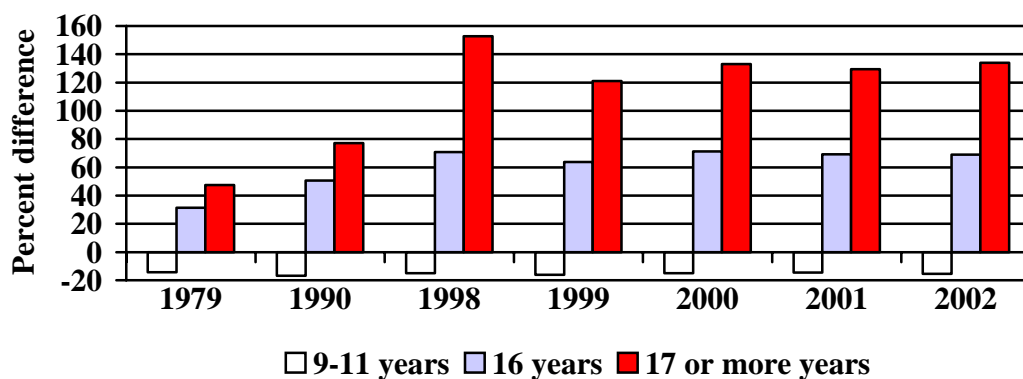
Relative earnings of employees in the private business sector are measured holding all other socioeconomic characteristics constant. Data are based on the March annual demographic file of the Current Population Survey.

While the relative earnings of more educated workers have been rising since the late 1970s, there was little if any trend between 1998 and 2002. The relative earnings of well-educated men held about steady in 2002 for both men with 16 and 17 or more years of schooling. For women, the premium for 17 or more years of school fell slightly while the penalty for those with 9-11 years of school grew modestly. The earnings of women with 16 years of education in 2002 were about 70 percent higher than for those with only 12 years of school. Over the 1998-2002 period, there appears to be little trend in relative earnings of women with differing levels of educational attainment. (See Chart 4.)

Chart 4. Earnings of women by educational attainment relative to 12 years of school

Relative earnings of employees in the private business sector are measured holding other socioeconomic characteristics constant. Data are based on the March annual demographic file of the Current Population Survey.

Work experience parameters can be interpreted in a similar fashion, although the exact calculations are slightly more complex. Estimated work experience is modeled using the characteristics of workers and their work histories taken from a sample of Social Security Administration records (see Bulletin 2426, Labor Composition and U. S. Economic Growth, 1948-90). For 2002, men with 5 years of estimated work experience earn 32 percent more than men with no estimated work experience. Men with 25 years of work experience earn nearly 124 percent more than inexperienced workers. At some point, additional experience ceases to have any positive effect, and wages may cease to increase or fall for some older workers because of job changes, career changes or other reasons. Thus, on average, workers nearing retirement often have somewhat lower wage rates than those in their late 40s. Chart 5 indicates that men with 35 years of work experience earn about twice as much as new entrants but less than those with 25 years of work experience.

Chart 5. Earnings of men by years of estimated work experience relative to inexperienced workers, 1979-2002

Relative to earnings of employees in the private business sector with no experience are measured holding other socioeconomic characteristics constant. Data are based on the March annual demographic file of the Current Population Survey.

Chart 5 shows that men with 5 years of work experience continue to earn between 31 and 35 percent more than inexperienced workers, while the premium paid to workers with more years of experience has varied in an erratic pattern in recent years. The premium paid to men with 15 or more years of work experience dropped between 1998 and 1999 and it has remained near this lower level through 2001. In 2002, further modest declines were observed. This pattern repeats itself for men with 25 and 35 years of work experience.

For women, estimated work experience has less impact on earnings. Over the last 5 years, the return to work experience has varied without any clear trend. (See Chart 6.) In 2002, women with 5 years of work experience earned about 34 percent more than women without any experience, about the same as in the previous four years. A rebound occurred in 2002 for women with 15 years of experience, returning the premium to nearly the 2000 level. For the most experienced workers, women with 25 years, the wage premium jumped in 2002 to about 70 percent, nearly matching the 1998 figure.

Chart 6. Earnings of women by years of estimated work experience relative to inexperienced workers, 1979-2002

Relative to earnings of employees in the private business sector with no experience are measured holding other socioeconomic characteristics constant. Data are based on the March annual demographic file of the Current Population Survey.

To summarize trends in the last five years, the wage pattern for all workers exhibits little change across education groups. This contrasts with the growing returns to education between 1979 and 1997 especially for college educated workers. The returns to work experience for men since 1998 appear to be compressing slightly. For women, changes in relative earnings by work experience between 1998 and 2002 showed little if any trend unlike the substantial increase in the returns to work experience between 1979 and 1990.

Summary and Conclusions

In 2002, the labor composition index for private business increased 1.19 percent, and it increased 1.12 percent in private nonfarm business. These gains were the largest since 1992 and among the largest observed over the 1948-2002 period. While the aging of the baby-boom generation and the increases in educational attainment added to labor composition growth in 2002, a weak labor market strongly reinforced a shift toward more educated and experienced workers. Rising educational attainment generally contributes more than work experience to the growth in the labor composition index, but in 2002 work experience contributes nearly as much as education to labor composition growth.

Table 3. Sources of labor input growth in private business, 1949-2002

(Percentage change)

Year	Labor Input[1,2]	Hours[1]	Labor Composition
1949	-1.41	-1.62	0.21
1950	-2.02	-2.78	0.76
1955	2.47	2.29	0.18
1960	-0.33	-0.84	0.51
1961	0.92	0.37	0.55
1962	1.27	0.33	0.94
1963	0.79	0.57	0.22
1964	1.43	1.38	0.05
1965	1.54	1.64	-0.10
1966	0.60	0.62	-0.02
1967	0.86	0.70	0.16
1968	1.32	1.55	-0.23
1969	1.32	0.97	0.35
1970	-1.48	-1.94	0.46
1971	2.47	2.77	-0.30
1972	3.68	3.63	0.05
1973	2.10	2.29	-0.19
1974	-4.96	-5.60	0.64
1975	2.31	2.27	0.04
1976	3.64	3.90	-0.26
1977	4.59	4.56	0.03
1978	4.88	4.77	0.11
1979	3.94	4.25	-0.31
1980	0.81	0.50	0.31
1981	1.52	0.78	0.74
1982	-0.39	-1.42	1.03
1983	3.07	2.65	0.42
1984	5.40	5.29	0.11
1985	3.34	3.10	0.24
1986	3.31	2.82	0.49
1987	3.14	2.88	0.26
1988	3.42	2.63	0.79
1989	1.52	1.08	0.44
1990	1.81	1.30	0.51
1991	0.62	-0.52	1.14
1992	1.57	0.34	1.23
1993	2.61	2.38	0.23
1994	3.20	2.67	0.53
1995	3.19	3.11	0.08
1996	2.96	2.53	0.43
1997	2.37	1.82	0.55
1998	2.62	2.34	0.28
1999	2.31	1.69	0.62
2000	1.59	1.54	0.05
2001	1.58	0.74	0.84
2002	-1.04	-2.23	1.19

1. Labor input and hours growth rates are based on data from the Current Population Survey
   These growth rates are not the measures used in the calculation of multifactor productivity

2. The growth rate of labor input equals the growth rates of hours and labor composition.