April 8, 2003

Changes in the Composition of Labor for BLS Multifactor Productivity Measures, 2001

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 2001 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 2002 Current Population Survey (CPS) of households, the labor composition index for 2001 increased at the following rates:

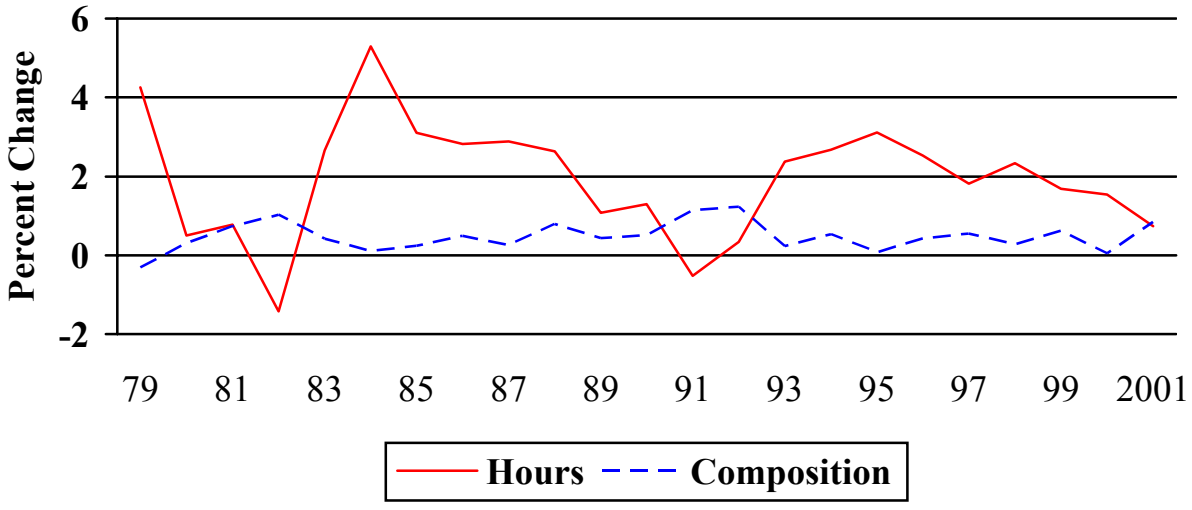
Sector	2000-2001
Private business	0.84%
Private nonfarm business	0.85%

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 0.84 percent increase in the labor composition index for the private business sector was the largest increase since 1992 when labor composition rose more than 1 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.

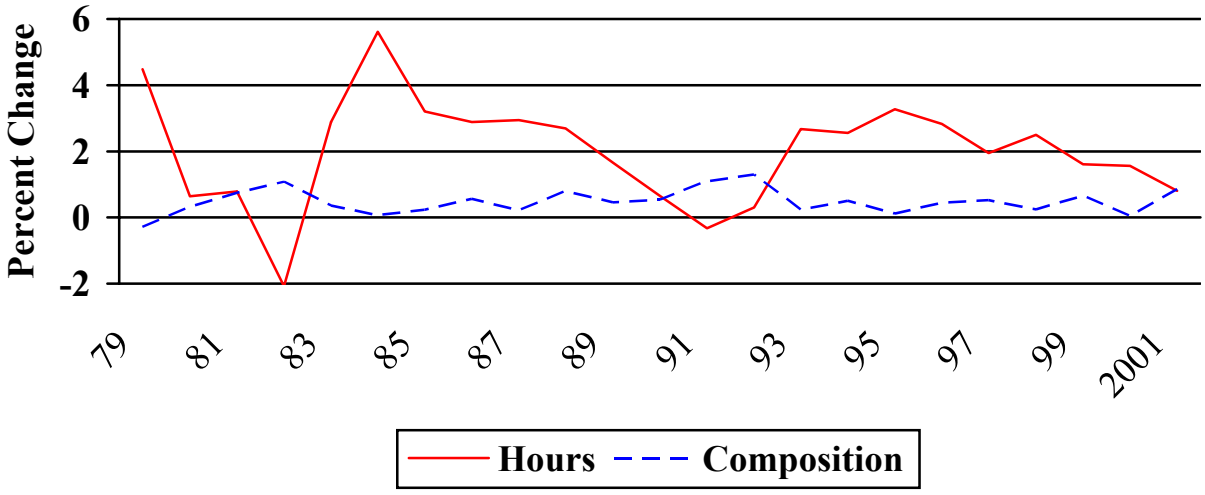
Table 3 (at the end of this document) divides the sources of labor input growth for the private business sector. While annual changes in labor input as measured by the Current Population Survey are usually dominated by changes in hours, labor composition growth generally provides a small but steady positive contribution to labor input. Labor composition contributes about 20 percent of labor input growth over the 1948-2001 period.

Chart 1. Changes in the labor composition index and hours in private business, 1979-2001



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, 1979-2001



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. In 2001, average schooling did not increase for men, but it did continue to advance for women. Work experience levels increased rapidly throughout the 1997-2000 period especially for men, due largely to the aging of the baby boom cohort. In 2001, 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.

As can be seen in the charts above, cyclical effects also appear in the labor composition index. For example, labor composition index growth rates greater than 1 percent appear in the charts only in the recession years 1982 and during and just after the recession of July 1990 to March 1991. At the beginning of an economic recession, 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, economic expansions begin by re-employing 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. Therefore it is typical for an index of labor composition to increase relatively rapidly during recessions and relatively slowly as economic expansions mature. Consistent with this pattern, labor composition growth in 2001 grew faster than any year since 1991-92.

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 2001. However, employment continued to rise for workers age 45 years and older. Only among workers with an associate or college degree did employment rise.

Changes in the Distribution of Hours

Table 1 below shows the distribution of hours of men 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 in 2001. The share of hours rebounded sharply for men with post-graduate schooling while men with 16 years of schooling increased their share of hours modestly. Offsetting this shift, men with less than a high school diploma also gained in their share of hours. The share of hours worked by men with a high school diploma has been generally declining and the decline was quite pronounced in 2001. Men with 13-15 years of schooling also experienced large declines in their share of hours worked although the long-term trend in unclear. The hours-weighted average level of educational attainment for men remained at 13.4 years between 1998 and 2001.

Table 1. Distribution of hours by years of school completed
Men and women in private business 1997-2001
(Percent)

Years	Men					Women				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
0-4	0.96	0.82	0.89	0.92	1.06	0.51	0.51	0.54	0.57	0.59
5-8	3.40	3.34	3.40	3.35	3.63	2.09	2.04	2.09	2.18	2.15
9-11	7.82	7.76	7.45	7.20	7.35	6.26	6.62	6.37	6.37	6.03
12	34.81	34.50	33.86	33.98	33.31	35.84	35.33	34.51	33.79	33.68
13-15	25.99	25.89	26.25	26.41	25.84	31.54	31.65	32.19	31.96	31.77
16	18.17	18.96	18.90	19.16	19.26	17.59	17.84	18.15	18.78	18.91
17+	8.85	8.74	9.26	8.98	9.59	6.17	6.01	6.16	6.34	6.87
Mean	13.34	13.38	13.42	13.42	13.41	13.42	13.41	13.45	13.47	13.51

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 prevailed again in 2001. From 1997-99, the women with at least some college education gained at the expense of high school graduates and dropouts. In 2001 as in 2000, only women with at least a college degree increased their share of hours. The erosion of hours worked by women with a high school diploma continued. The net result was that hours-weighted average schooling levels for working women increased slightly in 2001.

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 2001 while the average jumped more than a half year for women.

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 37-55) 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 2001 with 20-29 years of potential experience, however, did not increase their share of hours, in part because labor force participation rates and unemployment rates offset some of their population gains.

Instead, the largest gains were made among the oldest workers. The employment of those age 55-64 actually rose more than 2 percent in 2001 even while overall employment fell. The gain for workers over 65 years was even greater. For workers with 30 or more years of potential experience, their share of hours worked rose more than 1 percentage point, an extremely large increase.

Table 2. Distribution of hours by years of potential experience
Men and women in private business, 1996-2001
(percent)

Years	Men					Women				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
0-4	11.49	11.72	11.70	11.69	11.29	14.65	14.85	14.81	15.33	14.45
5- 9	12.52	12.32	12.01	12.07	11.97	12.66	12.68	12.17	11.95	11.79
10-14	13.73	13.48	13.25	12.85	12.97	12.76	12.38	12.19	11.66	11.54
15-19	15.34	14.63	14.54	14.04	13.64	13.68	13.72	13.42	13.43	12.91
20-29	26.35	26.75	27.17	27.54	26.97	25.32	25.26	26.04	26.38	26.47
30-39	14.25	14.68	14.61	15.22	16.18	14.84	15.19	15.21	15.23	16.27
40+	6.30	6.43	6.72	6.59	6.98	6.08	5.92	6.16	6.02	6.56
Mean	19.40	19.53	19.72	19.83	20.13	18.85	18.84	19.06	19.06	19.58

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).

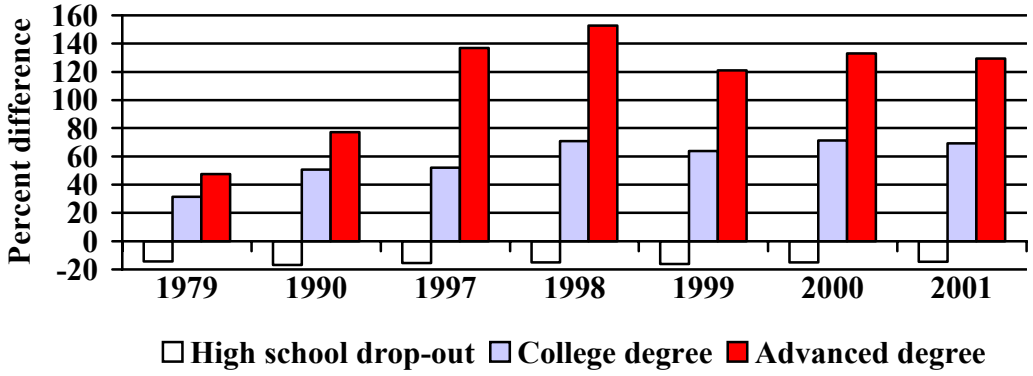
Inexperienced workers now include some of the children of the baby boom cohort, sometimes designated the "baby boom echo." However, growth in the population of 16-19 year olds was slower than for other groups and declining labor force participation and rising unemployment rates resulted in a declining employment share for teens. As a result, the share of hours worked by all workers but especially for women with less than 5 years of potential experience fell sharply in 2001.

Wage Equation Estimates

The labor composition index is affected by both shifts in the distribution of hours employed and by changes in the relative wage rates received by different groups of workers. For example, suppose that the total hours of highly educated workers are growing more rapidly than the hours of less educated workers. Then, all else equal, an increase in the wage rates of highly educated workers relative to less well-educated workers will result in an increase in the growth rate of the labor composition index. Many studies have shown that returns to schooling and work experience increased throughout the 1980s and early 1990s. 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 high school graduates as a reference group, male college graduates, for example, earned approximately 69 percent more than otherwise identical high school graduates while high school drop-outs earned about 15 percent less in 2001. (See Chart 3.)

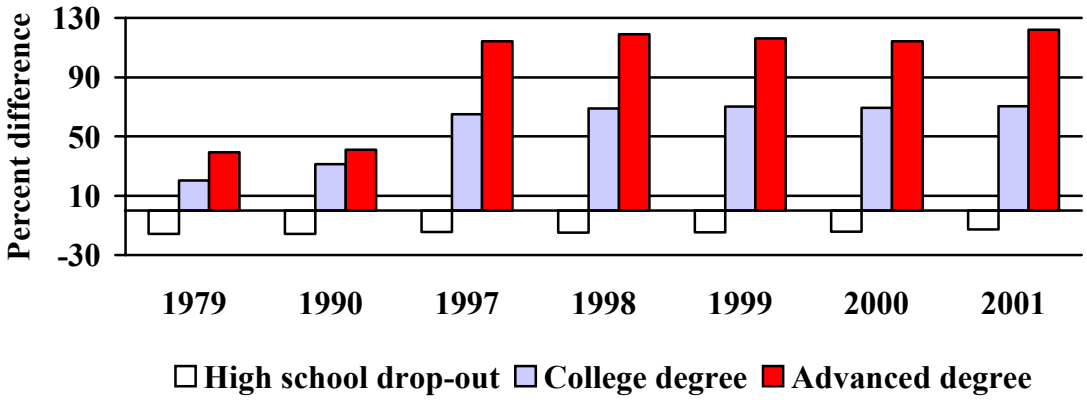
Chart 3. Earnings of men by educational attainment relative to high school graduates



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 1997 and 2001. The relative earnings of well-educated men held about steady in 2001 for both men with college degrees and advanced degrees. For women, no change in relative earnings is apparent. The earnings of college graduates in 2001 were about 70 percent higher than those of high school graduates. Earnings of women with advanced degrees were 122 percent higher, a slight increase over 2000. (See Chart 4.)

Chart 4. Earnings of women by educational attainment relative to high school graduates



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 2001, men with 5 years of estimated work experience earn 33 percent more than men with no estimated work experience. Men with 25 years of work experience earn nearly 130 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 more than 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, 1979-2000

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 may also hint at a break in the compression in the relative earnings of men with different amounts of estimated work experience over the last 5 years. While men with 5 years of work experience continue to earn between 31 and 35 percent more than inexperienced workers, the premium paid to workers with more years of experience has slightly but steadily eroded until 2001. The premium paid the men with 15 or more years of work experience declined more than 10 percent from 1997 to 2000, but nearly half of that decline was erased in 2001.

For women, estimated work experience has less impact on earnings. Furthermore, over the last 5 years the return to work experience has varied without any clear trend. (See Chart 6.) In 2001, women with 5 years of work experience earned about 33 percent more than women without any experience, about the same as in the previous four years. A small drop occurred in 2001 for women with 15 years of experience who earned about than 77 percent more than inexperienced female workers. Again, this is comparable to the previous four years. For the most experienced workers, women with 25 years, the wage premium edged up in 2001 to about 61 percent although the premium averaged about 65 percent in the 1997-2000 period.

Chart 6. Earnings of women by years of estimated work experience relative to inexperienced workers, 1979-2000

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.

Over 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 were compressed between 1997 and 2000, but expanded in 2001. For women, changes in relative earnings by work experience between 1997 and 2001 showed little if any trend unlike the substantial increase in the returns to work experience between 1979 and 1997.

Summary and Conclusions

In 2001, the labor composition index for private business increased 0.84 percent, and it increased 0.85 percent in private nonfarm business. These gains were the largest since 1992. While the aging of the baby-boom generation and the increases in educational attainment added to labor composition growth in 2001, cyclical trends strongly reinforced a shift toward more experienced workers. However, the substantial increases in work experience add modestly to labor composition growth because as the "average" worker ages relative earnings shift less than in previous years. Rising educational attainment continues to contribute more than work experience to the growth in the labor composition index.

Table 3. Sources of labor input growth in private business, 1949-2001

(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

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.