Bureau of Labor Statistics
Multifactor Productivity
July 10, 2012

CHANGES IN THE COMPOSITION OF LABOR FOR BLS MULTIFACTOR PRODUCTIVITY MEASURES, 2010

Labor is an important input into the production process, but calculating MFP using the total number of labor hours used implies that every hour worked is equally productive and ignores that fact that labor input is composed of different types of labor. Demographic trends, such as the increasing educational attainment of successive cohorts and the aging of the population, have changed the composition of the workforce over time in ways that impact the productivity of an hour of labor. Other influences, such as business cycles, bring about more transient changes. For example, the workforce tends to become more experienced in recessions because older and more experienced workers are less likely to lose their jobs than younger and less experienced workers.[1] These underlying trends on labor composition and ultimately multifactor productivity are described below.

Ideally MFP would be calculated using numerous labor inputs, one for each type of worker. However, since the BLS's primary source of hours data for productivity measurement, the Current Employment Statistics (CES) survey, does not include any demographic information, it cannot be used this way to account for demographic changes directly. Instead, the BLS uses data from the March Annual Social and Economic Supplement to the Current Population Survey (CPS), which includes demographic details in addition to information on hours worked and earnings, to adjust CES labor hours for changes in composition.

The changes in labor input in the private business and private nonfarm business sectors are equal to the change in CES labor hours plus the changes in labor composition. Labor hours come from the CES production and nonsupervisory worker series, and are adjusted to arrive at a series that measures hours worked for all employees. The change in labor composition is estimated as the difference between the weighted sum of changes in the hours of each type of CPS worker and the un-weighted total change in the hours of all CPS workers combined, where the weights are the relative cost shares. The purpose of the weights is to more heavily weight the hours worked by more productive workers, i.e. those whose marginal product as defined by their wage is higher. To compute the change in labor composition, two consecutive years of March CPS data are distributed into age, education and gender cells. For each cell in each year, total hours worked is computed along with the median hourly wage; these are then used to determine the weights, which are the share of the total wage bill that is accounted for by each cell, averaged over the two years. Next, the year-to-year percentage change in hours worked is computed for each cell, as well as for all workers combined. The labor composition adjustment that is used to adjust CES total hours is the difference between this percent change in total hours worked in the CPS and the weighted sum of the percent changes of hours worked in the individual CPS cells. The labor composition index reported in the following section is computed by selecting a base year and computing the compound growth of labor composition between the base year and the current year.

Recent Changes in Labor Composition

Between 2009 and 2010, labor composition grew by 0.7 percent in both the private business sector and the private nonfarm business sector.

Sector	2009-2010
Private business sector	0.7%
Private nonfarm business sector	0.7%

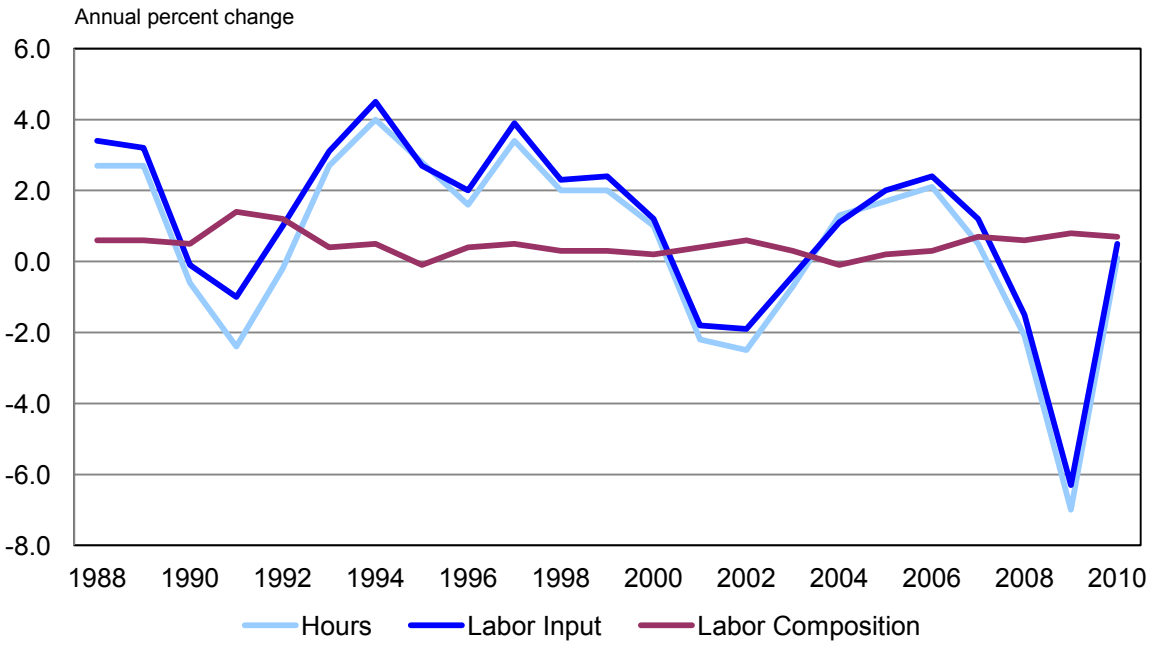
[1] BLS implicitly measures potential experience by age and education.

Because the two sectors are similar—the only difference in coverage is the farm sector, which made up 2.3 percent of private business sector hours worked in 2010—subsequent estimates will be presented only for the private business sector. Data for the private nonfarm business sector are available on request.[2]

Chart 1 shows the annual percent changes in labor input, hours worked, and the labor composition index in the private business sector for the 1987-2010 period. The effect of labor composition on labor input has increased over the period shown, as evident by the positive growth rates in all but two years.

As can be seen, changes in the labor composition index have a cyclical component. The labor composition index tends to increase faster during a recession and the early stages of the recovery, because younger and less-educated workers usually lose their jobs first, leaving an older and more-educated workforce. The labor composition index grew faster during the 1990-1992, 2000-2002, 2007-2010 periods. (See chart 1.) See the Bureau of Labor Statistics Employment and Earnings for more detailed data on worker characteristics. (Employment and Earnings are available at http://www.bls.gov/opub/ee/empearn201001.pdf table A-17.)

Chart 1. Labor input, hours worked, and the labor composition index in the private business sector for the 1987-2010 period



Note: Labor input in private business and private nonfarm business is obtained by chained superlative (Tornqvist) aggregation of the hours at work by all persons, classified by age, education, and gender with weights determined by each group's share of the total wage bill. For more information see http://www.bls.gov/news.release/archives/prod3_03212012.pdf.

[2] Labor composition measures are available for 1973-2010, although the current private business and private nonfarm business sectors multifactor productivity NAICS-based measures are only available for 1987-2010.

Recent Changes in the Distribution of Hours Worked

Over the 2006-2010 period, there were two notable changes in the demographic characteristics of workers. First, the educational attainment of the work force continued to increase. (See table 1.) Second, there was a gradual shift in the labor force towards younger workers as Generation Y entered and the Baby Boomers exited the labor force. (See table 2.)

Table 1 shows the distribution of hours worked by men and women in the private business sector by educational attainment. For both sexes, the share of total hours worked by those with college and advanced degrees increased. These increases were fairly evenly distributed over the 5-year period. Looking at all workers in the right hand panel, workers with 16 or more years of schooling saw the largest gain in their share of hours worked from 2006 to 2010.

The hours-weighted average level of educational attainment for men was 13.7 years in 2010, which was lower than women's level of 14.0 years. (See table 1.) The hours-weighted average level of educational attainment for men and women combined was 13.8 years in 2010. The hours weights are the workers' shares of labor compensation, according to the relative size and hourly wages of the group of workers, with groups defined by age and education levels.

Table 1. Distribution of hours worked and hours-weighted mean years of schooling in the private business sector by gender, 2006-2010

Percent

Years of school completed	Men					Women					All workers				
	2006	2007	2008	2009	2010	2006	2007	2008	2009	2010	2006	2007	2008	2009	2010
0-4	0.6	0.5	0.5	0.5	0.5	0.2	0.2	0.2	0.2	0.2	0.8	0.7	0.7	0.7	0.7
5-8	2.1	1.9	1.9	1.7	1.7	0.8	0.7	0.7	0.7	0.7	2.9	2.7	2.6	2.4	2.4
9-11	4.1	3.8	3.6	3.2	3.1	2.1	2.0	1.8	1.8	1.6	6.2	5.8	5.4	5.0	4.7
12	19.8	19.4	19.1	19.0	18.5	12.7	12.3	12.3	12.2	11.7	32.4	31.7	31.4	31.2	30.2
13-15	15.2	15.5	15.4	14.8	15.0	13.1	13.6	13.6	13.9	14.1	28.3	29.1	29.0	28.6	29.1
16	11.7	11.8	11.9	12.3	12.7	8.4	8.7	9.0	9.3	9.5	20.1	20.5	20.9	21.7	22.1
17+	6.0	6.0	6.3	6.3	6.5	3.3	3.6	3.8	4.1	4.3	9.2	9.6	10.0	10.4	10.8
Sum	59.5	58.9	58.7	57.8	58.0	40.6	41.1	41.4	42.2	42.1	99.9	100.1	100.0	100.0	100.0
Mean years of schooling	13.5	13.5	13.6	13.7	13.7	13.7	13.8	13.8	13.9	14.0	13.6	13.7	13.7	13.8	13.8

Note: Only workers between 15 and 65 years old are represented.
Note: Hours worked are from the March Supplement to the Current Population Survey.

Table 2 shows the shift in the age distribution toward younger ages. The fraction of hours worked by those 30 and under increased from 18.0 percent in 2006 to 25.6 percent in 2010, while the fraction worked by those over 55 fell from 16.3 percent in 2006 to 13.1 percent in 2010. The movement towards a younger age distribution tends to reduce the labor composition index.

Table 2. Share of total hours worked by workers between 15 and 65 years old in the private business sector, 2006-2010

	Year				
Age	2006	2007	2008	2009	2010
15-20	0.6	1.2	2.0	2.9	4.0
21-25	6.3	7.6	8.4	8.9	10.0
26-30	11.2	11.4	11.7	11.6	11.6
31-35	11.3	11.1	11.1	10.9	10.9
36-40	11.7	11.7	11.7	11.8	11.8
41-45	12.1	12.2	12.1	12.0	11.6
46-50	13.1	13.0	12.8	12.8	12.7
51-55	12.4	12.0	11.9	11.7	11.3
56-60	9.8	9.4	9.0	8.7	8.4
61-65	6.5	6.2	5.8	5.3	4.7

Note: Hours worked are from the March Supplement to the Current Population Survey.

Another way to view changes by age is to look at the share of hours worked by each generation. As the Baby Boomers have started to reach retirement age, their share of hours worked has decreased at a higher rate compared to Generation X while Generation Y's percent distribution has increased. (See table 3.) In 2010, the Baby Boomers worked 38.2 percent of total hours while Generation Y worked 16.4 percent.

Table 3. Hours worked by Baby Boomers, Generation X, and Generation Y in the private business sector, 2006-2010

	Total hours worked (in millions)				Annual percent change				Percent Distribution		
Year	Baby Boomers[1]	Gener-ation X[2]	Gener-ation Y[3]	All Gener-ations[4]	Baby Boomers	Gener-ation X	Gener-ation Y	All Gener-ations	Baby Boomers	Gener-ation X	Gener-ation Y
2006	106,041.2	104,870.6	21,814.9	250,050.5					42.4	41.9	8.7
2007	103,601.1	104,681.8	26,935.1	250,506.2	-2.3	-0.2	23.5	0.2	41.4	41.8	10.8
2008	99,292.2	102,133.4	30,845.6	245,175.5	-4.2	-2.4	14.5	-2.1	40.5	41.7	12.6
2009	92,438.0	96,464.7	32,665.8	232,717.7	-6.9	-5.6	5.9	-5.1	39.7	41.5	14.0
2010	88,659.0	95,580.4	38,025.5	232,187.2	-4.1	-0.9	16.4	-0.2	38.2	41.2	16.4

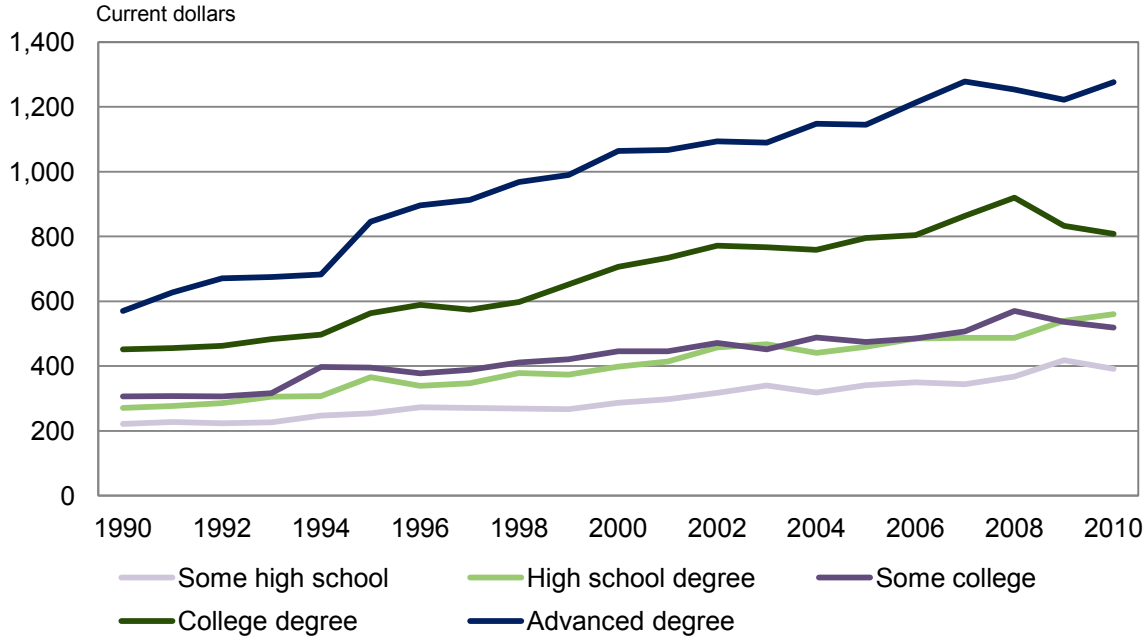
[1] Workers born between 1946 and 1964.
[2] Workers born between 1965 and 1982.
[3] Workers born between 1983 and 2001.
[4] Hours worked are from the March Supplement to the Current Population Survey.
[5] All workers in the labor force are not represented, only the workers born between 1946 and 1983. (Age 15-65).

Wage Structure

The wage structure can affect the labor composition index when the hours worked by the different demographic groups change at different rates. To illustrate, suppose that the hours of college-educated workers increase by the same rate that the hours of high school educated workers decrease. Labor input can either increase or decrease depending on the relative weights of these two groups. The higher wages of college-educated workers tends to increase their relative weight in the labor composition index, while their smaller total number of hours worked tends to reduce their weight. Wage growth matters if growth rates differ across demographic groups. In the above example, faster wage growth among college graduates would increase their relative weight and cause labor input to increase at an even faster rate. It is important to note, however, that if the hours of all groups grow at the same rate then differences in wage levels and growth rates across demographic groups do not affect the growth of the labor input.

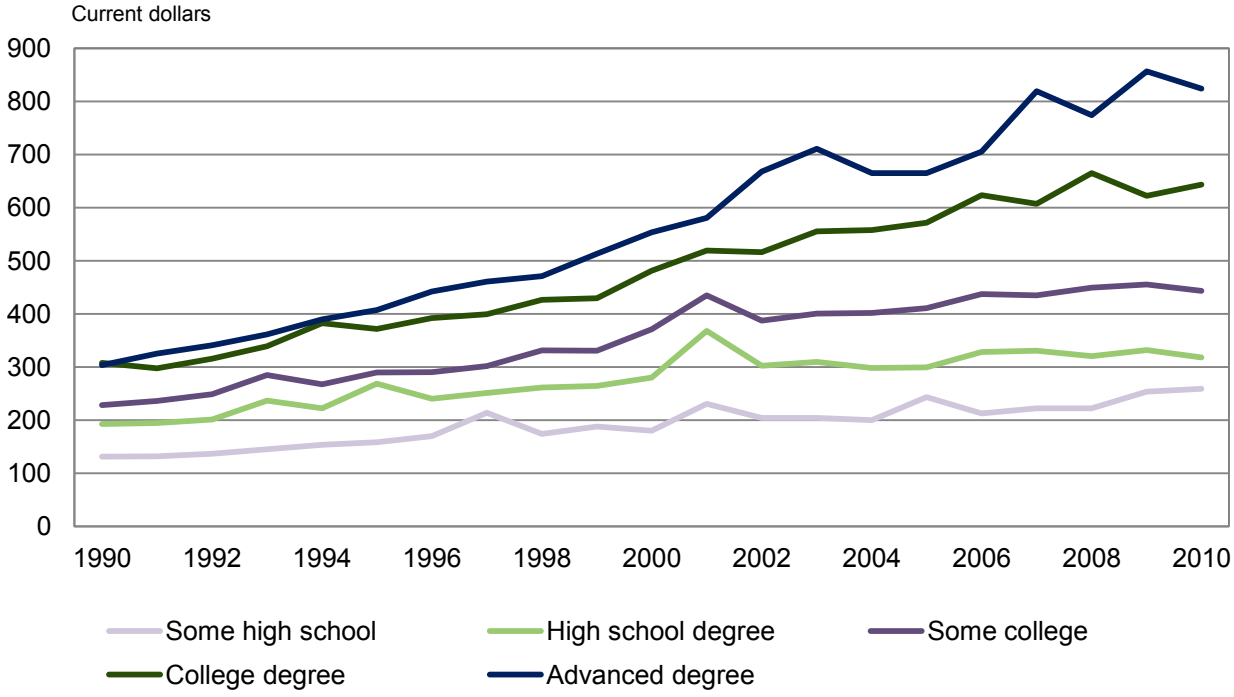
Earnings by educational attainment for men and women in the private business sector are shown in charts 2 and 3 respectively. Earnings for men and women with an advanced degree continued to trend upward in 2010 after decreasing in 2008 and 2009. Men with a college degree saw their earnings decrease in 2009 and 2010.

Chart 2. Average weekly earnings by educational attainment for men in the private business sector for the 1990-2010 period



Note: Relative earnings of employees in the private business sector are measured holding all characteristics constant. Data are based on the March supplement to the Current Population Survey.

Chart 3. Average weekly earnings by educational attainment for women in the private business sector for the 1990-2010 period



Note: Relative earnings of employees in the private business sector are measured holding characteristics constant. Data are based on the March supplement to the Current Population Survey.

Published labor input measures

Labor composition growth generally provides a small but steady positive contribution to labor input. Within a growth accounting framework, an increase in the labor composition index, or workers' skill levels, has the same effect on output and productivity growth as an increase in hours worked. A 1.0 percent increase in labor composition is equivalent to a 1.0 percent increase in hours worked.

Tables 4 and 5 present all three published measures for the private business sector. Over the period from 1987 through 2010 labor input increased by 1.0 percent annually, with labor composition accounting for half of that increase. The increase in the labor composition index for 2010 was about the same as the increase for the previous three years. Hours worked fell 0.1 percent and labor input rose 0.6 percent, the first increase in labor input since 2007.

Table 4. Labor input, hours worked and labor composition in the private business sector, for the 1987-2010 period

Year	Labor Input[1]	Hours Worked[2]	Labor Composition
1988	3.4	2.7	0.6
1989	3.2	2.7	0.6
1990	-0.1	-0.6	0.5
1991	-1.0	-2.4	1.4
1992	1.0	-0.2	1.2
1993	3.1	2.7	0.4
1994	4.5	4.0	0.5
1995	2.7	2.8	-0.1
1996	2.0	1.6	0.4
1997	3.9	3.4	0.5
1998	2.3	2.0	0.3
1999	2.4	2.0	0.3
2000	1.2	1.0	0.2
2001	-1.8	-2.2	0.4
2002	-1.9	-2.5	0.6
2003	-0.4	-0.7	0.3
2004	1.1	1.3	-0.1
2005	2.0	1.7	0.2
2006	2.4	2.1	0.3
2007	1.2	0.5	0.7
2008	-1.4	-2.1	0.6
2009	-6.5	-7.2	0.8
2010	0.6	-0.1	0.7
1987-2010	1.0	0.5	0.5
1987-1990	2.1	1.6	0.6
1990-1995	2.0	1.3	0.7
1995-2000	2.4	2.0	0.3
2000-2007	0.3	0.0	0.3
2007-2010	-2.5	-3.2	0.7

1. Hours at work by age, education, and gender group are weighted by each group's share of the total wage bill.
2. Hours at work for nonproduction and supervisory workers are derived using data from the CPS, CES, and National Compensation Survey (NCS).

Table 5. Labor input, hours worked and labor composition in the private business sector, 1987-2010

Indexes 2005=100

Year	Labor Input[1]	Hours[2]	Labor Composition
1987	76.35	82.83	92.18
1988	78.92	85.11	92.73
1989	81.47	87.36	93.25
1990	81.37	86.81	93.74
1991	80.55	84.71	95.09
1992	81.38	84.55	96.25
1993	83.92	86.84	96.63
1994	87.69	90.29	97.13
1995	90.02	92.80	97.01
1996	91.81	94.31	97.35
1997	95.41	97.51	97.85
1998	97.57	99.45	98.11
1999	99.89	101.48	98.43
2000	101.11	102.50	98.65
2001	99.33	100.25	99.09
2002	97.40	97.73	99.66
2003	96.97	97.06	99.91
2004	98.06	98.29	99.77
2005	100.00	100.00	100.00
2006	102.39	102.13	100.25
2007	103.58	102.62	100.93
2008	102.10	100.51	101.58
2009	95.49	93.29	102.37
2010	96.04	93.17	103.08

1. Hours at work by age, education, and gender group are weighted by each group's share of the total wage bill.
2. Hours at work for nonproduction and supervisory workers are derived using data from the CPS, CES, and National Compensation Survey (NCS).