What do OES data have to say about increasing wage inequality?

Wage distribution data from the Occupational Employment Statistics survey indicate that wages became more dispersed over the 2002–08 period; occupations paying higher wages tended to have workers with more education and higher level technical skills, while occupations paying lower wages tended to have workers with less education and lower skills

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Most economists concur that wage inequality has been increasing in the United States since the 1970s.[1] However, not all economists agree on the reasons behind this trend.[2] One of the more widely held positions hypothesizes that increasing wage dispersion has been driven by skill-biased technical change benefiting those who possess greater technical skills. Specifically, advancements in technology have boosted the productivity and wages of skilled labor relative to that of unskilled labor.[3] This article uses Occupational Employment Statistics (OES) survey data to explore wage inequality, measure changes in wage dispersion over time, and examine wage growth by occupational group, wage rate, skill level, and ties to technology.

The article first tests whether OES survey wage data support the notion that wage dispersion increased between 2002 and 2008. Then, occupational data are used to determine (1) whether wages for higher skilled occupations increased by more than wages for lower skilled occupations, (2) if so, which occupational groups were exceptions, and (3) whether occupations with the highest wage growth were most closely associated with technological innovation. Educational attainment data from the Current Population Survey are used as a proxy for determining which workers in an occupation are "more skilled" and which are "less skilled."[4]

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OES data; testing wage dispersion

The OES survey is a survey of 1.2 million business establishments conducted in six semiannual panels over a 3-year period. Respondents are asked to list the occupation and wage range for each of their employees. Data from the six most recent panels are used each year to provide wage and employment estimates for more than 800 occupations by area and industry. The OES methodology that allows such detailed area and industry estimates also makes it difficult to use OES data for comparisons across short periods. To minimize both the difficulty of comparison over short periods and the difficulties associated with changes in occupational or methodological definitions, two nonoverlapping data sets, from 2002 and 2008, were selected for the analysis. The virtue of using OES data for this type of analysis is that each period examined includes wage and detailed occupational data on more than 80 million workers.

One of the limitations of using OES data

to explore wage growth is the methodology of collecting data in wage ranges, especially for high-paying occupations. The OES program uses data from the National Compensation Survey to apply values to the wages within each of 12 wage ranges. Mean wage rates and wage growth for occupations with workers earning more than $145,600 per year may be underestimated because of the open-ended upper wage interval. Changes in percentile wage estimates should not be affected by changes in the upper interval as long as the percentile wages are below $145,600.

Results

If wage dispersion has increased over the study period, then the wage growth rate of higher wage earners will exceed that of lower wage earners. This hypothesis can be tested at the most aggregate levels by using the 10th, 25th, 50th (median), 75th, and 90th percentiles of the wage distribution for all occupations and industries from the OES survey. Table 1 shows the national annual wage in 2002 and 2008 for each percentile, along with the percent change. If there is no increase in wage dispersion between 2002 and 2008, then the wage growth would be equivalent across the percentile wages. However, that is not what is observed.

Wage growth by percentile

Nationally, the 10th percentile of the wage distribution increased 15.4 percent over the period examined, while the median wage increased 17.0 percent and the 90th percentile increased 21.8 percent. Inflation-adjusted figures are shown in the last column of table 1; the 90th-percentile workers are the only group to have experienced wage growth that exceeded inflation. As the wage percentiles increase, the growth in wages also increases: by 2008, wages for higher earners exceeded those for lower earners by a larger margin than in 2002. Another way to look at this phenomenon is that in 2002 a worker in the 90th percentile of the wage distribution earned 349 percent more than a worker in the 10th percentile, and by 2008 the worker in the 90th percentile earned 374 percent more than the worker in the 10th percentile.

This evidence of increasing wage dispersion does not necessarily show that individuals or groups of workers experienced the same wage growth as others in their percentile, because a shift may have occurred in the occupations that make up each group over time. Rather, the evidence simply points to a wider distribution of wages, the result of faster wage growth in high-paying occupations, uneven growth in employment between high-paying and low-paying occupations, or a combination of both factors. Faster wage growth may be due to structural changes in the economy that increase the demand for one group of workers relative to others, such as highly skilled workers, technologically oriented workers, or workers in the health care professions. The rest of this article focuses on the wage growth experience of both individual occupations and groups of occupations, and finds evidence that skill-biased technical changes in the occupational structure of the United States are benefiting certain groups more than others. Among those benefiting most are workers with higher levels of skills or education and workers whose jobs are technological in nature.

Wage growth by occupational group

Because national wage data showed evidence of increasing wage dispersion between 2002 and 2008, the data will be examined by occupational group in order to see whether increasing wage growth is found across high-wage or high-skill occupations or is concentrated in just a few occupations. Such an examination also will aid in determining whether increasing wage growth is more prevalent in occupations related to

Table 1. National percentile wage growth, 2002–08

Percentile wage	Year		Percent change in wage	Adjusted for inflation[1]
	2002	2008		
10th	$14,450	$16,680	15.4	–3.6
25th	18,580	21,590	16.2	–2.9
50th	27,690	32,390	17.0	–2.3
75th	43,340	51,540	18.9	–.7
90th	64,900	79,020	21.8	1.7

[1] The inflation rate over the 2002–08 period was 19.7 percent.

improved technology. The Standard Occupational Classification (SOC) system groups occupations by similar skills or work activities, so analysis of the OES data by SOC occupational group will serve as a starting point in looking for patterns in the occupational data.

Table 2 shows the mean annual wage for each occupational group in 2002 and 2008. Also listed is the wage difference for each group over the 2002–08 period and the percent change in the wage. To test the hypothesis that those occupational groups which had higher wages in 2002 had the greatest growth between 2002 and 2008, the data in the table are sorted by mean annual wage in 2002. If the highest percent wage growth corresponded perfectly to the highest annual mean wage, then the percent changes in the wage would appear in descending order. In general, as the 2002 wage for the occupational groups decreases, the percent change in the wage decreases with a correlation coefficient of 0.75—although there are notable exceptions.

In most cases, the occupational groups that earned above the mean wage of $35,560 in 2002 experienced wage growth greater than 18.9 percent and those which earned below the mean wage in 2002 experienced lower wage growth. However, there were exceptions. Each occupational group's 2002 wage and percent increase are plotted in chart 1. The upper right-hand quadrant of the chart shows occupations with above-average wages and above-average wage growth, the lower left-hand quadrant occupations with below-average wages and below-average growth. The other two quadrants show the occupational groups that fall outside the trend.

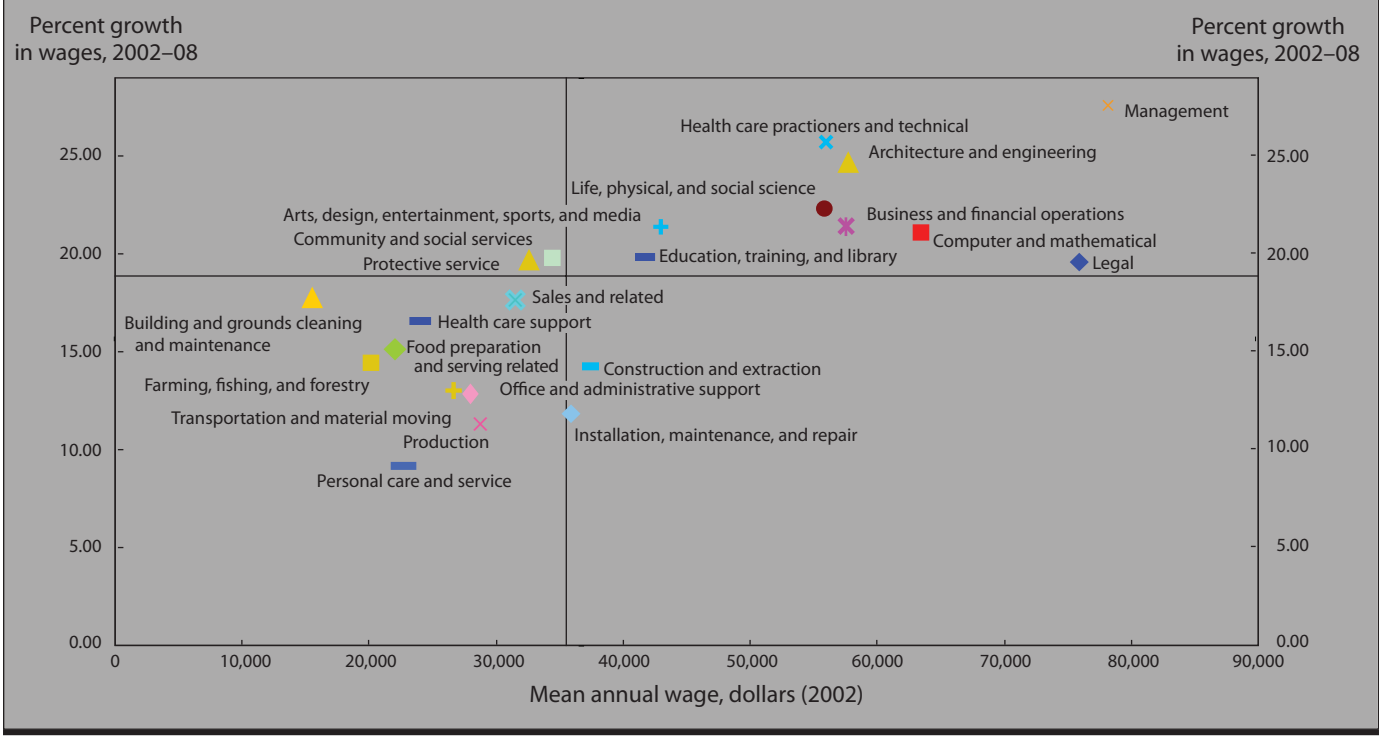
In general, the occupations listed toward the top of table 2 and shown in the upper right quadrant of chart 1 had both the highest wages and the highest wage growth. Among these occupations are architecture and engineering occupations and business and financial operations occupations. Those occupations with the lowest wages had the lowest wage growth and are shown in the lower left quadrant. Included in this group are food preparation and serving related occupations and building and grounds cleaning and maintenance occupations. Two occupations fell outside this trend, experiencing above-average wages and lower-than-average wage growth, and are shown in the lower right quadrant: construction and extraction occupations and installation, maintenance, and repair occupations. Finally, among those occupations with below-average wages were community and social services occupations and protective service occu-

Table 2. Wage growth of Standard Occupational Classification (SOC) major groups, 2002–08

SOC code	Occupational group	Mean annual wage, 2002	Mean annual wage, 2008	Difference (2008 wage minus 2002 wage)[1]	Percent change
11–0000	Management	$78,870	$100,310	$21,440	27.2
23–0000	Legal	77,330	92,270	14,940	19.3
15–0000	Computer and mathematical	61,630	74,500	12,870	20.9
17–0000	Architecture and engineering	58,020	71,430	13,410	23.1
29–0000	Health care practitioners and technical	53,990	67,890	13,900	25.7
13–0000	Business and financial operations	53,350	64,720	11,370	21.3
19–0000	Life, physical, and social science	52,380	64,280	11,900	22.7
27–0000	Arts, design, entertainment, sports, and media	41,660	50,670	9,010	21.6
25–0000	Education, training, and library	40,160	48,460	8,300	20.7
47–0000	Construction and extraction	36,340	42,350	6,010	16.5
49–0000	Installation, maintenance, and repair	35,780	41,230	5,450	15.2
00–0000	Mean wage for all occupations	35,560	42,270	6,710	18.9
21–0000	Community and social services	34,630	41,790	7,160	20.7
33–0000	Protective service	33,330	40,200	6,870	20.6
41–0000	Sales and related	30,610	36,080	5,470	17.9
51–0000	Production	28,190	32,320	4,130	14.7
43–0000	Office and administrative support	27,910	32,220	4,310	15.4
00–0000	Median wage for all occupations	27,690	32,390	4,700	17.0
53–0000	Transportation and material moving	27,220	31,450	4,230	15.5
31–0000	Health care support	22,410	26,340	3,930	17.5
39–0000	Personal care and service	21,370	24,120	2,750	12.9
37–0000	Building and grounds cleaning and maintenance	20,850	24,370	3,520	16.9
45–0000	Farming, fishing, and forestry	20,220	23,560	3,340	16.5
35–0000	Food preparation and serving related	17,180	20,220	3,040	17.7

[1] Statistically significant at the 90-percent confidence level.

Chart 1. Wages and percent growth in wages, by occupational group, 2002–08



pations, both of which experienced wage increases slightly higher than the average. These two occupations are shown in the upper left quadrant. Groups falling outside the trend are examined further.

Three occupational groups had lower wage growth than would be expected on the basis of their relatively high wage: legal occupations; installation, maintenance, and repair occupations; and construction and extraction occupations. The legal occupations group showed one of the biggest differences between its 2002 wage and its subsequent wage growth: with the 2nd-highest average annual wage in 2002, this group had only the 11th-highest wage growth and is furthest from the trend line in chart 1. Further study of the group reveals that the relatively low wage growth was influenced primarily by lawyers, the legal group's detailed occupation with the most employment, but a relatively low wage growth of 17.8 percent. This comparatively small wage growth may be a reflection of the limitation of the OES data and its methodology of collecting data in wage ranges. The top wage range in the OES survey is $145,600 or more per year, so the survey is less effective in measuring wages of the highest wage earners. Therefore, the wage growth figure for legal occupations may be underestimated. This explanation is supported by an examination of the wages of lawyers who are unaffected by the survey's top-coding methodology. Even the relatively lower paid lawyers showed higher-than-average wage growth: the 10th through 50th percentile of the wage distribution for lawyers showed increases of at least 22.4 percent.

The occupational group with the next-largest difference between its rank in wages in 2002 and its rank in percent change in wages is installation, maintenance, and repair. This group had the 11th-highest overall annual average wage in 2002, but the 20th-highest wage growth. Lower wage growth seems to be the norm for most, but not all, of the detailed occupations within the group, with 41 of the 51 detailed occupations having a percent change in wages that was below 18.9 percent for the period between 2002 and 2008. Some occupations in installation, maintenance, and repair that had large percent-change wage increases include watch repairers; manufactured building and home installers; and powerhouse, substation, and relay electrical and electronics repairers, all of which had wage increases of 21.0 percent or more.

The third group with wage growth that was lower than would be expected on the basis of its 2002 wages was construction and extraction occupations, which had the 10th-highest average wage in 2002, but only the 16th-highest wage growth. The slow growth in this group hides underlying trends for two subgroups: even slower growth

for construction-related occupations and faster-than-average wage growth for oil-and-gas-related occupations. Lower wage growth for occupations associated with residential and commercial construction may have been due to the slowdown in residential building after the housing bubble burst.[5] Occupations associated with the commodities of oil and gas, which, as an industry, had experienced its own bubble in 2007,[6] experienced much faster than average growth. For example, the wage percent change of 4 of the 5 occupations with the highest wage growth in the construction and extraction group, all linked to working with oil and gas, ranged from 31.3 percent to 49.7 percent. In contrast, carpet installers; paperhangers; floor sanders and finishers; carpenters; carpenters' helpers; plumbers', pipefitters', and steamfitters' helpers; construction and maintenance painters; plumbers, pipefitters, and steamfitters; electricians; construction laborers; and other related occupations all had wage percent changes below the average of 18.9 percent.

Like construction and extraction, production occupations had wage growth that was lower than expected. The group had the 15th-highest average wage in 2002, but the 21st-highest wage growth. Low growth was prevalent throughout the occupational group, with 91 of the 111 comparable occupations, representing 91 percent of the group's employment, having below-average wage growth.

Eleven occupation groups had higher wage growth than would be expected on the basis of their 2002 wage rank. The 5 groups with the greatest positive difference between their 2002 wage positions and wage growth positions were food preparation and serving; building and grounds cleaning and maintenance; farming, fishing, and forestry occupations; health care support occupations; and community and social services occupations. All 5 groups had below-average wages, and 4 of the 5 had below-average wage growth, resulting in wages in 2008 that were even further from the average than they were in 2002 and contributing to increased wage dispersion. These lower paying groups of occupations had smaller wage increases compared with the groups of occupations that grew less than their wage rank would indicate: the average annual wage increase of the 5 groups that went up in wage percent growth rank was $4,198, whereas the average annual wage increase of the 5 groups that went down in rank was $8,680, more than double.

Two of the occupational groups with higher growth than would be expected from their 2002 wages were food preparation and serving related occupations and building and grounds cleaning and maintenance occupations. Food preparation and serving related occupations had the lowest overall wage in 2002, but the 13th-highest wage increase. Relatively high wage growth was seen in only 5 of the 16 occupations in this group and was concentrated in just 1 occupation: waiters and waitresses, an occupation making up approximately 21 percent of total employment in the group and having a wage percent change of 24.2 percent. In contrast, combined food preparation and serving workers including fast-food workers, an occupation making up nearly 24 percent of total employment in the group, had a wage percent change of 14.9 percent.

Building and grounds cleaning and maintenance occupations also had a large difference between the group's annual average wage position in 2002, namely, 20th, and its wage growth position, 15th. The wage percent change was set predominantly by maids and housekeeping cleaners, an occupational component that accounted for approximately 49 percent of the group's total employment and had a wage percent change of 16.6 percent. Wage growth for the building and grounds cleaning and maintenance group was in a narrower range than that of most other groups, with a low of 15.7 percent and a high of 20.2 percent.

Skills, technology, and wage growth

To measure the impact of the demand for workers of different skill levels on wage growth (under the assumption that occupations in which wages have climbed the most are the most in demand), education data[7] from the CPS were linked to occupational data from the OES survey. The BLS Employment Projections program has identified the typical educational background of workers in each occupation: high school (HS); high school/some college (HS/SC); high school/some college/college (HS/SC/C); some college (SC); some college/college (SC/C); and college (C). (See note 4.) The 741 matching detailed occupations between 2002 and 2008 were sorted by percent change in wage, and the 50 occupations with the lowest and highest statistically significant percent changes in wages are shown in tables 3 and 4, respectively. Among occupations with the lowest growth, the ones that are most likely affected by the OES wage methodology, such as lawyers, were excluded from the table, because the top wage range might mask higher wage growth.[8]

Chart 2 shows the general relationship between educational clusters and wage growth over the 2002–08 period for all occupations in each educational cluster. In general, higher average wage growth is associated with increasing levels of education. An exception is the "some college" (SC) category, whose average wage growth was lower than that of the "high school/some college/college" (HS/SC/C) cat-

Table 3. Occupations with the lowest percent growth in wages, 2002–08

SOC code	Occupational title	Average annual wage, 2002	Average annual wage, 2008	CPS education level	Difference (2008 wage minus 2002 wage)	Percent change
53–4013	Rail yard engineers, dinkey operators, and hostlers	$40,600	$34,850	High school/ some college	–$5,750	–14.2
33–2022	Forest fire inspectors and prevention specialists	40,720	36,400	High school/ some college/ college	–4,320	–10.6
41–9091	Door-to-door salesworkers, news and street vendors, and related workers	30,120	27,600	High school/ some college/ college	–2,520	–8.4
47–4091	Segmental pavers	29,630	28,450	High school/ some college	–1,180	–4.0
29–1011	Chiropractors	83,440	81,340	College	–2,100	–2.5
49–9093	Fabric menders, except garment	28,580	27,920	High school/ some college	–660	–2.3
15–2091	Mathematical technicians	42,920	42,100	College	–820	–1.9
25–1043	Forestry and conservation science teachers, postsecondary	68,030	67,400	College	–630	–.9
39–6011	Baggage porters and bellhops	22,440	23,170	High school/ some college	730	3.3
53–7071	Gas compressor and gas pumping station operators	42,920	44,410	High school/ some college	1,490	3.5
51–9031	Cutters and trimmers, hand	24,630	25,540	High school	910	3.7
51–3093	Food cooking machine operators and tenders	23,160	24,110	High school/ some college	950	4.1
27–2022	Coaches and scouts	34,170	35,580	Some college/ college	1,410	4.1
53–2022	Airfield operations specialists	40,850	42,550	Some college/ college	1,700	4.2
53–4011	Locomotive engineers	51,280	53,470	High school/ some college	2,190	4.3
27–2023	Umpires, referees, and other sports officials	27,010	28,330	Some college/ college	1,320	4.9
53–4041	Subway and streetcar operators	46,810	49,330	High school/ some college	2,520	5.4
51–9192	Cleaning, washing, and metal pickling equipment operators and tenders	24,780	26,140	High school/ some college	1,360	5.5
51–4081	Multiple machine tool setters, operators, and tenders, metal and plastic	31,050	32,780	High school/ some college	1,730	5.6
51–9197	Tire builders	35,990	38,080	High school/ some college	2,090	5.8
33–3052	Transit and railroad police	45,750	48,540	Some college/ college	2,790	6.1
53–7072	Pump operators, except wellhead pumpers	38,640	41,020	High school/ some college	2,380	6.2
17–3021	Aerospace engineering and operations technicians	52,990	56,280	High school/ some college	3,290	6.2
45–4021	Fallers	32,090	34,180	High school	2,090	6.5
43–5111	Weighers, measurers, checkers, and samplers, recordkeeping	26,740	28,500	High school/ some college	1,760	6.6

Table 3. Continued—Occupations with the lowest percent growth in wages, 2002–08

SOC code	Occupational title	Average annual wage, 2002	Average annual wage, 2008	CPS education level	Difference (2008 wage minus 2002 wage)	Percent change
51–4122	Welding, soldering, and brazing machine setters, operators, and tenders	31,620	33,700	High school/ some college	2,080	6.6
25–9021	Farm and home management advisors	41,850	44,630	College	2,780	6.6
23–1022	Arbitrators, mediators, and conciliators	55,970	59,650	College	3,680	6.6
39–6032	Transportation attendants, except flight attendants and baggage porters	20,940	22,370	High school/ some college/ college	1,430	6.8
41–9011	Demonstrators and product promoters	25,360	27,150	High school/ some college/ college	1,790	7.1
47–5051	Rock splitters, quarry	28,070	30,160	High school/ some college	2,090	7.4
51–6064	Textile winding, twisting, and drawing-out machine setters, operators, and tenders	22,810	24,600	High school	1,790	7.8
51–9132	Photographic processing machine operators	21,080	22,740	High school/ some college	1,660	7.9
49–2096	Electronic equipment installers and repairers, motor vehicles	27,600	29,770	High school/ some college	2,170	7.9
19–4093	Forest and conservation technicians	32,700	35,320	Some college/ college	2,620	8.0
53–4021	Railroad brake, signal, and switch operators	45,750	49,400	High school/ some college	3,650	8.0
51–4034	Lathe and turning machine tool setters, operators, and tenders, metal and plastic	31,450	34,070	High school/ some college	2,620	8.3
49–9063	Musical instrument repairers and tuners	33,210	35,950	High school/ some college	2,740	8.3
51–9041	Extruding, forming, pressing, and compacting machine setters, operators, and tenders	28,070	30,430	High school/ some college	2,360	8.4
51–9022	Grinding and polishing workers, hand	24,940	27,100	High school/ some college	2,160	8.7
39–4011	Embalmers	36,160	39,320	High school/ some college/ college	3,160	8.7
43–5081	Stock clerks and order fillers	21,240	23,140	High school/ some college	1,900	8.9
49–9098	Helpers—installation, maintenance, and repair workers	23,560	25,670	High school	2,110	9.0
47–3011	Helpers—brickmasons, blockmasons, stonemasons, and tile and marble setters	27,170	29,610	High school	2,440	9.0
51–4194	Tool grinders, filers, and sharpeners	31,080	33,880	High school/ some college	2,800	9.0
31–9095	Pharmacy aides	19,700	21,500	High school/ some college	1,800	9.1
49–2092	Electric motor, power tool, and related repairers	34,030	37,110	High school/ some college	3,080	9.1
47–2171	Reinforcing iron and rebar workers	40,640	44,380	High school	3,740	9.2
47–3014	Helpers—painters, paperhangers, plasterers, and stucco masons	22,260	24,330	High school	2,070	9.3
19–4051	Nuclear technicians	61,220	66,910	Some college/ college	5,690	9.3

Table 4. Occupations with the highest percent growth in wages, 2002–08

SOC code	Occupational title	Average annual wage, 2002	Average annual wage, 2008	CPS education level	Difference (2008 wage minus 2002 wage)	Percent change
47–5012	Rotary drill operators, oil and gas	$36,320	$54,370	High school	$18,050	49.7
11–2031	Public relations managers	69,870	101,220	College	31,350	44.9
11–3061	Purchasing managers	66,250	94,300	Some college/ college	28,050	42.3
27–4032	Film and video editors	44,540	62,500	Some college/ college	17,960	40.3
25–1071	Health specialties teachers, postsecondary	72,820	102,000	College	29,180	40.1
45–1012	Farm labor contractors	26,220	36,640	High school/ some college	10,420	39.7
27–2041	Music directors and composers	39,270	54,840	Some college/ college	15,570	39.6
17–2171	Petroleum engineers	85,540	119,140	College	33,600	39.3
29–1051	Pharmacists	75,140	104,260	College	29,120	38.8
19–3022	Survey researchers	30,360	42,060	College	11,700	38.5
11–9081	Lodging managers	38,110	52,550	High school/ some college college	14,440	37.9
19–4041	Geological and petroleum technicians	41,470	57,080	High school/ some college college	15,610	37.6
11–2011	Advertising and promotions managers	69,200	94,720	College	25,520	36.9
53–7033	Loading machine operators, underground mining	32,480	44,230	High school	11,750	36.2
11–9121	Natural sciences managers	90,400	123,140	College	32,740	36.2
33–9021	Private detectives and investigators	34,250	46,480	Some college/ college	12,230	35.7
11–2021	Marketing managers	87,170	118,160	Some college/ college	30,990	35.6
47–5071	Roustabouts, oil and gas	24,160	32,660	High school	8,500	35.2
19–3091	Anthropologists and archeologists	42,380	57,300	College	14,920	35.2
27–2012	Producers and directors	61,500	83,030	College	21,530	35.0
19–1021	Biochemists and biophysicists	65,620	88,450	College	22,830	34.8
19–2021	Atmospheric and space scientists	61,000	82,080	College	21,080	34.6
11–3011	Administrative services managers	59,350	79,500	High school/ some college/ college	20,150	34.0
25–1021	Computer science teachers, postsecondary	55,330	74,050	College	18,720	33.8
19–3041	Sociologists	56,520	75,460	College	18,940	33.5
11–3031	Financial managers	83,080	110,640	Some college/ college	27,560	33.2
29–2034	Radiologic technologists and technicians	40,150	53,230	Some college/ college	13,080	32.6
35–1011	Chefs and head cooks	32,000	42,410	High school/ some college	10,410	32.5
51–6092	Fabric and apparel patternmakers	31,890	42,190	High school	10,300	32.3
47–5011	Derrick operators, oil and gas	31,780	41,980	High school	10,200	32.1
45–2011	Agricultural inspectors	31,380	41,330	High school/ some college college	9,950	31.7

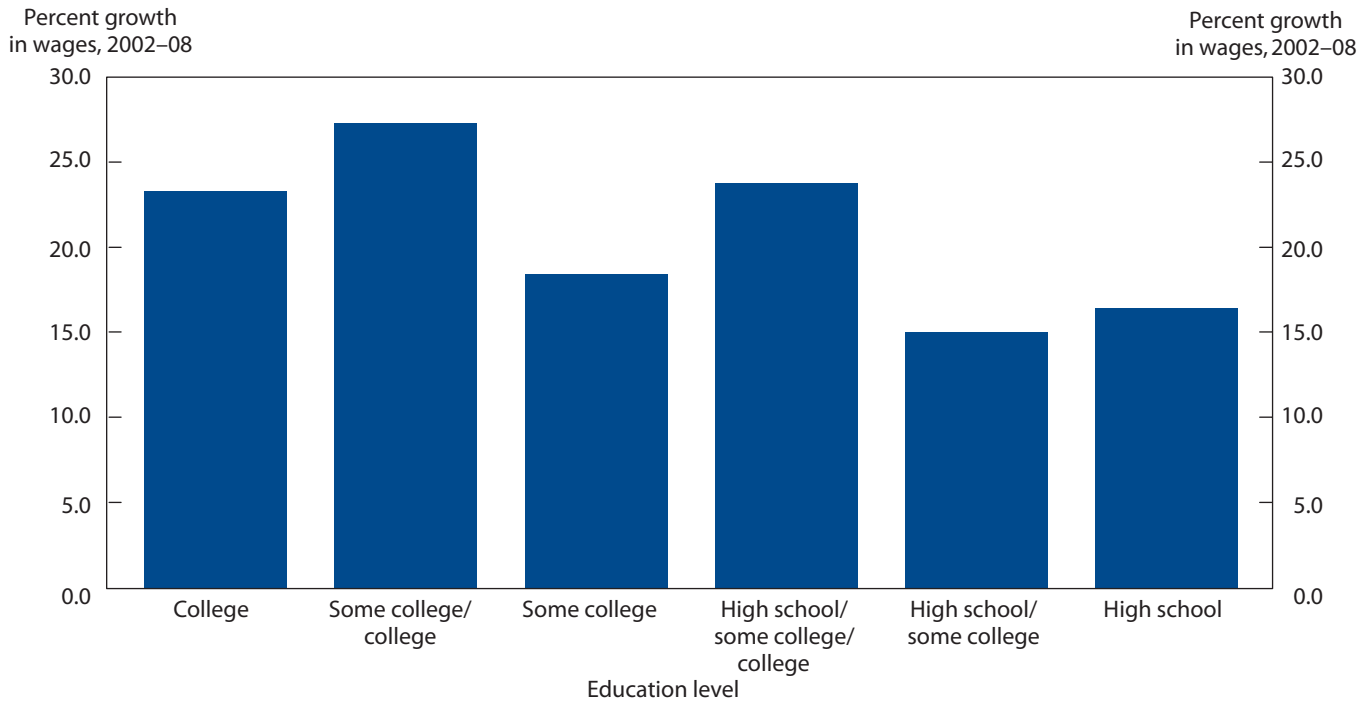
Table 4. Continued—Occupations with the highest percent growth in wages, 2002–08

SOC code	Occupational title	Average annual wage, 2002	Average annual wage, 2008	CPS education level	Difference (2008 wage minus 2002 wage)	Percent change
53–5021	Captains, mates, and pilots of water vessels	51,430	67,730	High school/ some college college	16,300	31.7
17–2061	Computer hardware engineers	76,150	100,180	Some college/ college	24,030	31.6
53–7031	Dredge operators	29,740	39,040	High school	9,300	31.3
47–5013	Service unit operators, oil, gas, and mining	31,480	41,320	High school	9,840	31.3
17–1022	Surveyors	42,630	55,980	College	13,350	31.3
25–1192	Home economics teachers, postsecondary	53,650	70,420	College	16,770	31.3
11–3021	Computer and information systems managers	90,440	118,710	Some college/ college	28,270	31.3
31–2011	Occupational therapist assistants	36,950	48,440	Some college	11,490	31.1
17–2131	Materials engineers	64,310	84,200	College	19,890	30.9
29–1111	Registered nurses	49,840	65,130	Some college/ college	15,290	30.7
17–2021	Agricultural engineers	55,730	72,850	College	17,120	30.7
27–1027	Set and exhibit designers	37,250	48,660	Some college/ college	11,410	30.6
29–1126	Respiratory therapists	40,700	53,150	Some college/ college	12,450	30.6
25–1193	Recreation and fitness studies teachers, postsecondary	46,480	60,700	College	14,220	30.6
13–2041	Credit analysts	49,530	64,580	Some college/ college	15,050	30.4
53–2012	Commercial pilots	58,000	75,500	Some college/ college	17,500	30.2
11–3071	Transportation, storage, and distribution managers	65,070	84,520	High school/ some college/ college	19,450	29.9
41–9031	Sales engineers	69,200	89,770	College	20,570	29.7
11–9033	Education administrators, postsecondary	71,630	92,920	College	21,290	29.7

egory. This relatively low growth was due to changes in the occupational employment composition of the group. The SC category has only four occupations in it, each of which grew between 20.4 percent and 31.1 percent; however, employment increases in the lowest paid occupation—emergency medical technicians and paramedics—lowered the wage growth for the group. Another exception is the "college" (C) category, whose average wage growth was lower than that of both the "high school/some college/college" (HS/SC/C) and "some college/college" (SC/C) categories. The college category is dominated by the employment of elementary, middle, and secondary school teachers, who make up nearly 25 percent of total employment in the category. Teachers had wage growth rates ranging from 18.2 percent to 19.2 percent. In addition, the wage percent change of the "some college/college" (SC/C) category was higher than that of the "college" (C) category, largely because of both registered nurses, who made up 14.1 percent of employment with a wage percent change of 30.7 percent, and business managers, accounting for approximately 20.8 percent of employment with wage percent changes from 21.8 percent to 33.2 percent.

Table 3, which lists the 50 occupations with the lowest wage growth during 2002–08, provides evidence of the link between skills or education and wage dispersion. Most of the occupations in this table require relatively

Chart 2. Wage growth, by education level, 2002–08



low levels of skill. Twelve of the 50 occupations listed are production occupations, 7 are from the transportation and material-moving group, and there are 5 occupations each from the construction and extraction group and the installation, maintenance, and repair group. Thirty-nine of the occupations with the lowest wage growth have educational levels ranging from high school through high school/some college/college. Only 11 of the occupations have high educational levels of some college or college.

Table 4 offers further evidence of the connection between skills or education and wage dispersion. The table lists the 50 occupations with the highest wage growth from 2002 to 2008, most of which require relatively high levels of skill. Eleven of the occupations are from the management group; 6 are in the life, physical, and social science group; and 5 are in the architecture and engineering group. In contrast to the occupations listed in table 3, only 15 occupations in table 4 have educational levels ranging from high school through high school/some college/college. Thirty-five of the 50 occupations have an educational level of either some college or college.

In comparing Tables 3 and 4, a few generalizations may be made in support of the skill- or education-biased wage-change hypothesis. According to this hypothesis, occupations that work with computers and new technology should have the highest wage growth and college-educated workers are in the best position to take advantage of such productivity-increasing technology. In fact, table 4 does have a preponderance of college-educated occupations, compared with table 3.

Although the broad group of computer and mathematical science occupations, which are the most directly related to many types of technology, did not show the highest wage growth, there is support for the hypothesis within the occupational group. In this regard, the detailed occupation consisting of computer and information research scientists had the highest percent change in wages in the group. This is an occupation that requires high levels of education or talent to invent or design solutions to problems in the field of computer hardware and software. In comparison, the occupation consisting of computer support specialists had the lowest percent change in wages of all detailed occupations in the group and may indeed be suffering stagnating wages because technology has allowed workers in the occupation to be replaced by automated assistants, online help, and technical support workers located overseas. This is the downside of advancing technology: workers are finding that their skills are being replaced by that very technology, in one way or another. Simply put, one of the occupations in the computer and mathematical science occupational

group is taking advantage of higher education while the other is losing ground because of automation.

Technology may enhance the productivity of workers in fields other than computer science. For example, the collection, processing, and analysis of medical information is more efficient with advanced technology, allowing medical workers to serve more individuals. Also, pharmacists filling prescriptions for new drugs use technology to help screen customers for adverse drug interactions. In another application of technology, nurses may enter notes concerning a patient's progress on a wireless portable memory device that instantly becomes available to the doctor. Finally, the nuclear medical technologist using a new magnetic resonance imaging (MRI) device to scan a patient for disease can improve productivity by having the results of the scan uploaded almost instantaneously to the patient's electronic file for diagnosis. Again, workers with high levels of education and skill are in the best position to take advantage of productivity-increasing technology.

More support for this hypothesis is found in table 3, which lists lesser skilled occupations that are more likely to suffer from the other side of the increased use of technology: labor replacement. For instance, workers in manufacturing occupations may be replaced by robots or computerized manufacturing. Similarly, demonstrators and product promoters may be replaced with virtual online demonstrators and product promoters. Finally, door-to-door salesworkers, news and street vendors, and related workers may suffer from the availability of Internet news and targeted e-mail and phone advertising.

OES DATA SUPPORT THE HYPOTHESIS that wage dispersion continued from 2002 to 2008. National wage distribution data show a clear positive correlation between percentile levels and wage increases: the higher the percentile, the higher is the percent change in wages. In addition, occupational groups with higher average wages in 2002 tended to have the highest subsequent wage growth.

Examining wage growth by occupational group provides insight into the types of jobs that have experienced the largest wage increases. The five occupational groups with the highest wage growth are management occupations; health care practitioners and technical occupations; architecture and engineering occupations; life, physical, and social science occupations; and education, training, and library occupations. In contrast, the occupational groups with the lowest wage growth were personal care and service occupations; food preparation and serving related occupations; farming, fishing, and forestry occupations; construction and extraction occupations; and production occupations. In sum, occupations usually associated with higher education and higher technical skills have had higher wage growth than occupations with lower education and skill requirements. □

Notes

[1] Aaron Steelman and John A. Weinberg, "What's Driving Wage Inequality?" *Economic Quarterly* (Federal Reserve Bank of Richmond), summer 2005, pp. 1–17, cite this general consensus among economists.

[2] David H. Autor, Lawrence F. Katz, and Melissa S. Kearney, "The Polarization of the U.S. Labor Market," NBER Working Paper No. 11986 (National Bureau of Economic Research, January 2006), pp. 1–19ff.

[3] Steelman and Weinberg, "What's Driving Wage Inequality?"

[4] See "Occupational Projections and Training Data" (Bureau of Labor Statistics, no date), on the Internet at **www.bls.gov/emp/optd** (visited June 17, 2009). Data on educational attainment by occupation come from the Current Population Survey and are given in *Occupational Projections and Training Data*, Bulletin 2602 (Bureau of Labor Statistics, December 2007). Chapter 1, "Education and Training Classification Systems," says,

> The educational attainment cluster system sorts occupations according to the highest level of educational attainment of current workers....
>
> If an education level represents the highest educational attainment of at least 20 percent of workers in an occupation, that education level is included in the education category of the occupation. For example, if more than 60 percent of workers have a high school diploma or less, less than 20 percent have some college or an associate degree, and less than 20 percent have a bachelor's or higher degree, that occupation is considered a high school (HS) occupation. However, if more than 20 percent have a high school degree or less, more than 20 percent have attended some college or held an associate degree, and less than 20 percent have a bachelor's or higher degree, the occupation is considered to be a high school/some college (HS/SC) occupation.

[5] For a discussion of job losses in residential construction, see the BLS news release "The Employment Situation: May 2008" (Bureau of Labor Statistics, June 6, 2008), on the Internet at **www.bls.gov/news.release/archives/empsit_06062008.pdf** (visited June 17, 2009). For a look at when the housing bubble burst, see "Nationally, Home Prices Began 2009 with Record Declines According to the S&P/Case-Shiller Home Price Indices," *Standard & Poor's Press Release*, May 26, 2009, on the Internet at **www2.standardandpoors.com/spf/pdf/index/CSHomePrice_Release_052619.pdf** (visited June 17, 2009); see especially chart, p. 1.

[6] For an examination of the oil and gas industry, see "Oil Price History and Analysis," on the Internet at **www.wtrg.com/prices.htm** (visited June 17, 2009).

[7] Education is often linked with skill. Other influences on skill include experience, training, and individuals' abilities—for instance, creativity.

[8] The OES top wage range was $145,600 or more for panels prior to November 2005. Currently, the top wage range is $166,400 or more. In either case, because respondents cannot report their actual top wage, the top wage range may mask wage growth for the highest wage earners over time.