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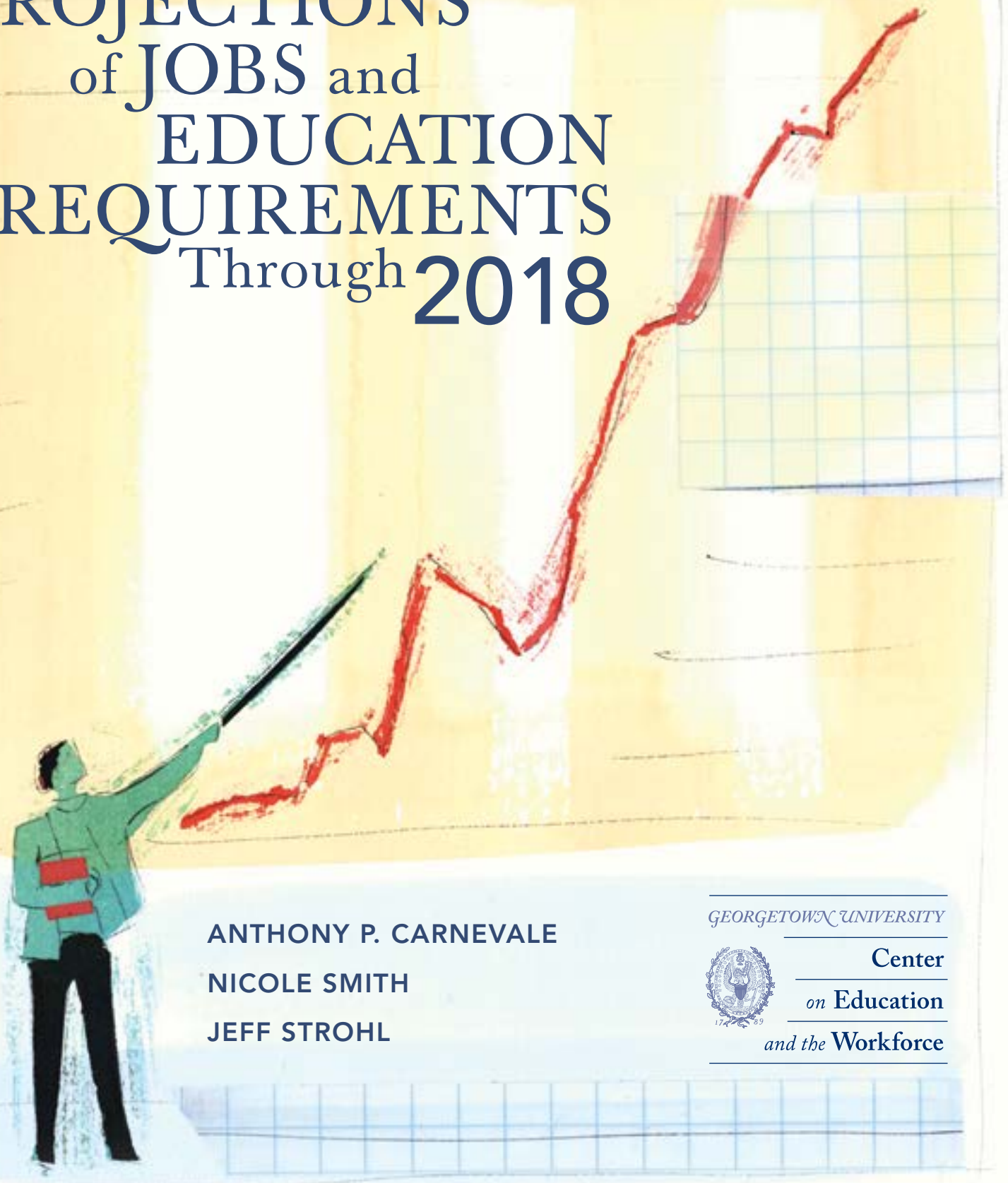
JUNE 2010

PROJECTIONS of JOBS and EDUCATION REQUIREMENTS Through 2018



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Introduction

Why is this forecast of education supply and demand necessary?

We set out to provide a detailed forecast of jobs and their education requirements for two reasons:

First: The ability of individuals to connect education, training, and careers has become key to employability and to attaining and maintaining middle class status.

Second: In spite of its growing importance, our ability to match education alternatives with career options is woefully underdeveloped.

The United States is unable to help people match their educational preparation with their career ambitions—not because it cannot be done but because it simply is not being done. All the information required to align postsecondary educational choices with careers is available, but unused. The forecast in this report demonstrates that projecting education and job requirements is technically feasible with a minimum amount of error. But the current education projections by the Bureau of Labor Statistics (BLS), use a methodology that underestimates the demand for postsecondary education. Compare, for example, the results of a simple test pitting our methodology against the Bureau's. In its 1998 forecast, which covered a 10-year timeline through 2008, the Bureau under-predicted how many workers in the U.S. labor force would have Associate's degrees or better by 19 million. That projection was off by 47 percent. Our methodology, for that same period, over-predicted postsecondary educational demand by about 2 million workers—an error rate of just 4 percent.[i,ii]

Unfortunately, the poor quality of the official projections cascades downward through state and local data systems into the hands of policy makers. These numbers are not the only factor that determines policy, but they are the only data available on the economy's demand for postsecondary education. Because the official data consistently underestimate the demand for postsecondary education, they encourage a consistent bias against investing in postsecondary education and training. Ultimately, the official data misinform the educational choices and career plans of individuals and their counselors.

These are the wrong times for inadequate information on jobs and skill requirements. Not only is the United States climbing out of the worst downturn since the Great Depression, it has transformed from an industrial to a services economy, with all of the pain and upheaval that accompanies such change. Educational and career planning need to catch up and adjust to this new reality.

In the following pages of this introduction, we lay out our case for why postsecondary education and training is critical to helping our nation's workers navigate this transformation successfully. We follow with a brief overview of the report as a whole.

EDUCATION IS A GATEWAY TO FURTHER TRAINING AND GREATER EARNING POTENTIAL.

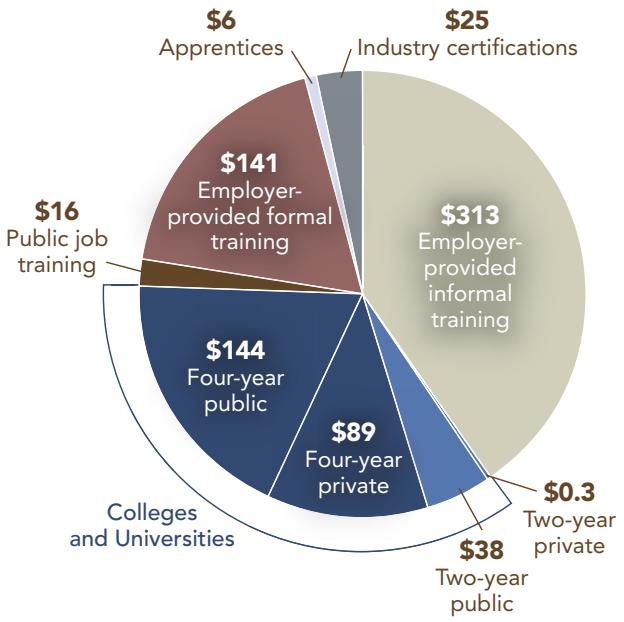
One key to understanding this issue is an appreciation of the overall landscape of postsecondary education and training. College is only one piece of the puzzle. In fact, colleges and universities represent only 35 percent of the entire postsecondary education and training system. The rest consists of on-the-job training, formal employer-provided education programs, military training, apprenticeships, and a variety of other programs (Figure I).

Still, the role of colleges and universities is vital. Among other things, higher education acts as an important gateway to other parts of the postsecondary learning system. Postsecondary education provides entry to the jobs offering the most employer-provided training, plus access to the most powerful, flexible workplace technology. This is reflected in the positive correlation between employer-provided training and employee education levels. College graduates are almost twice as likely as high school graduates to receive formal training from their employers (Figure II).

FIGURE I

$772 billion is spent annually on postsecondary education and training. About 65 percent of these dollars are spent outside of the formal postsecondary education system. (in billions of dollars)

Source: Authors' calculations using data from Integrated Postsecondary Education Data System (IPEDS), Department of Labor Employment and Training Administration (DOLETA), American Association of Community Colleges (AACC), Office of Vocational and Adult Education (OVAE), Survey of Employer Provided Training (DOL), and Bureau of Labor Statistics (BLS)



Access to that training is important because it directly affects an employee's earning power. Training can increase employee wages by 3 to 11 percent, with formal training providing higher returns than informal training (Altonji and Spletzer, 1991; Bishop, 1996; Loewenstein and Spletzer, 1998; Mincer, 1988).

Education, workplace training, and workplace technology tend to be sequential and complementary in producing productivity and earnings. Higher levels of formal education not only increase access to jobs that provide further training, they also increase access to technology that complements, rather than replaces, skills. More highly educated workers use technologies that increase worker autonomy and enhance skills—desktop computers or flexible machine tools, for instance. But less-educated workers tend to use technologies that substitute for skills. Narrow training can compensate for broader educational deficiencies, although it does not provide long-term adaptability—which can be disastrous when narrow tasks are fully automated or shifted offshore.

Access to technology on the job is important to a worker's earning power. Even high school dropouts who use technology at work earn about 15 percent more than those who do not—and the earnings premium for college graduates who use technology is even more significant (Figure III). Good pay and benefits, then, are linked to the sequence of postsecondary educational attainment, achievement, workplace training, and the use of technology on the job.

FIGURE II

Workers with the most education receive the most training. (percent receiving training)

Source: Estimate based on Eck, 1993.

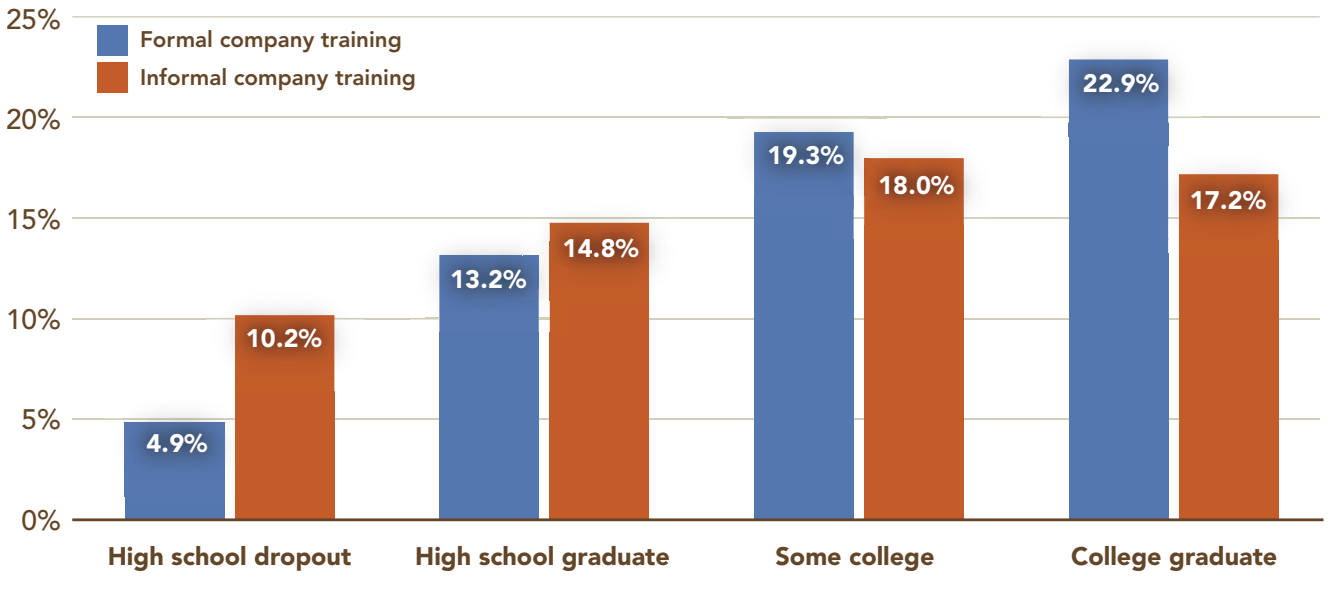
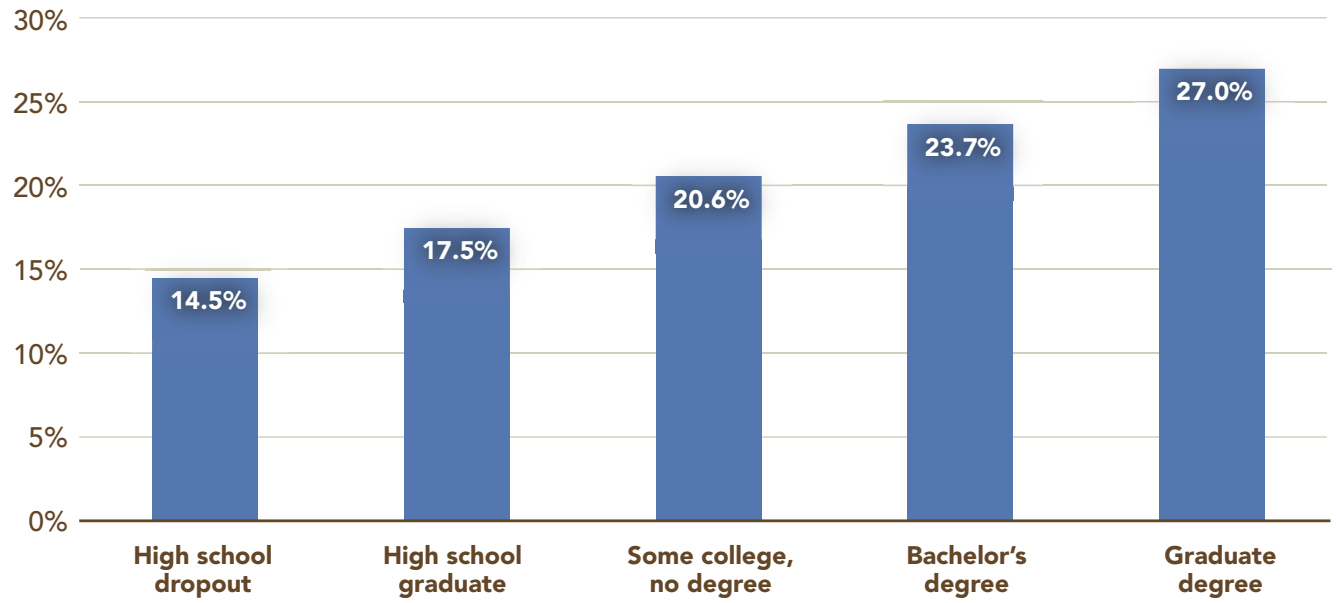


FIGURE III

Workers who use computers can earn more than workers who do not. (percent wage premium earned by workers who use the computer)

Source: Krueger, 1993; Mishel and Bernstein, 1995



A COLLEGE DEGREE IS THE KEY TO UNLOCKING ACCESS TO THE MIDDLE CLASS—OR BETTER.

Postsecondary education has become the threshold requirement for a middle-class family income. But what does that mean at a time when economists fret that the American middle class is actually shrinking?

In the 37-year time frame shown in Table I, the share of people with some college or Associate's degrees in the middle class declined from 53 percent to 45 percent. But the key to understanding this phenomenon is discerning where those people are going when they leave the middle. For example, the share of people with Associate's degrees in the top three income deciles increased from around 28 percent to 35 percent.

Therefore, while it is true that the middle class is declining, a more accurate portrayal of the American class dynamic would be to say that the middle class is dispersing into two opposing streams of upwardly mobile college-haves and downwardly mobile college-have-nots.

Dropouts, high school graduates, and people with some college but no degree are on the down escalator of social mobility, falling out of the middle-income class and into the lower three deciles of family income. In 1970, almost half (46 percent) of high school dropouts were in the middle class. By 2007, the share of dropouts in the middle class had fallen to 33 percent.

TABLE I

Education distribution across household income deciles (1970/2007)

Source: Authors' analysis of March CPS data, various years

1970:	Lower-income class (lower 3 deciles)	Middle-income class (middle 4 deciles)	Upper-income class (upper 3 deciles)
High school dropouts	39%	46%	15%
High school graduates	22%	60%	18%
Some college/ Associate's degree	19%	53%	28%
Bachelor's degree	16%	47%	37%
Graduate degree	13%	46%	41%
2007:			
High school dropouts	59%	33%	7%
High school graduates	35%	45%	19%
Some college	29%	45%	26%
Associate's degree	20%	45%	35%
Bachelor's degree	14%	38%	48%
Graduate degree	9%	30%	61%

In 1970, almost 60 percent of high school graduates were in the middle class. By 2007, the share had fallen to 45 percent.

Over that same period, people with college degrees (Bachelor's and graduate degrees) have either stayed in the middle class or boarded the escalator upwards to the highest three family income deciles.

The share of people with Bachelor's degrees in the middle class declined from 47 percent to 38 percent, decreasing by 9 percentage points. But the share of people with a Bachelor's degree in the top three income deciles jumped from 37 percent to 48 percent. Meanwhile, the share of people with graduate degrees in the middle class declined from 46 to 30 percent—a decrease of 16 percentage points. But, clearly, they were leaving for greener pastures, as the share of people with graduate degrees in the top three income deciles increased from 41 to 61 percent.

POSTSECONDARY WAGES ROSE IN THE 1990s, AND THIS PREMIUM STILL REMAINS.

Wage data, not surprisingly, correlate with this movement into and out of the middle class based on access to postsecondary education. This means that the economy is demanding more and more workers with postsecondary education and employers are willing to pay more for them.

Consider that, since 1983, among prime-age workers between the ages of 25 and 54:

- Earnings of high school dropouts have fallen by 2 percent;
- Earnings of high school graduates have increased by 13 percent;
- Earnings of people with some college or an Associate's degree have increased by 15 percent;
- Earnings of people with Bachelor's degrees have increased by 34 percent;
- Earnings of people with graduate degrees have increased by 55 percent.

Clearly, there is a hierarchical relationship between formal education level and annual wages, which reflects the compensation that employers are willing to pay to workers, on average, for the knowledge, skills, and abilities they attained at every consecutive education level. Figure IV shows the persistent wage premium for those who obtain at least some college, a postsecondary certificate, or an Associate's degree, and the growing wage premium for those with Bachelor's degrees or better.

College graduates earn more relative to high school graduates, and continue to do so, which is the most significant signal that the economy is demanding more highly skilled workers.

FIGURE IV

Wage premium by education. Compared to high school graduates, holders of Bachelor's degrees and better have earned a substantial wage premium since the 1990s. (makes no control for full-time or full-year status of workers)

Source: Authors' analysis of March CPS data, various years

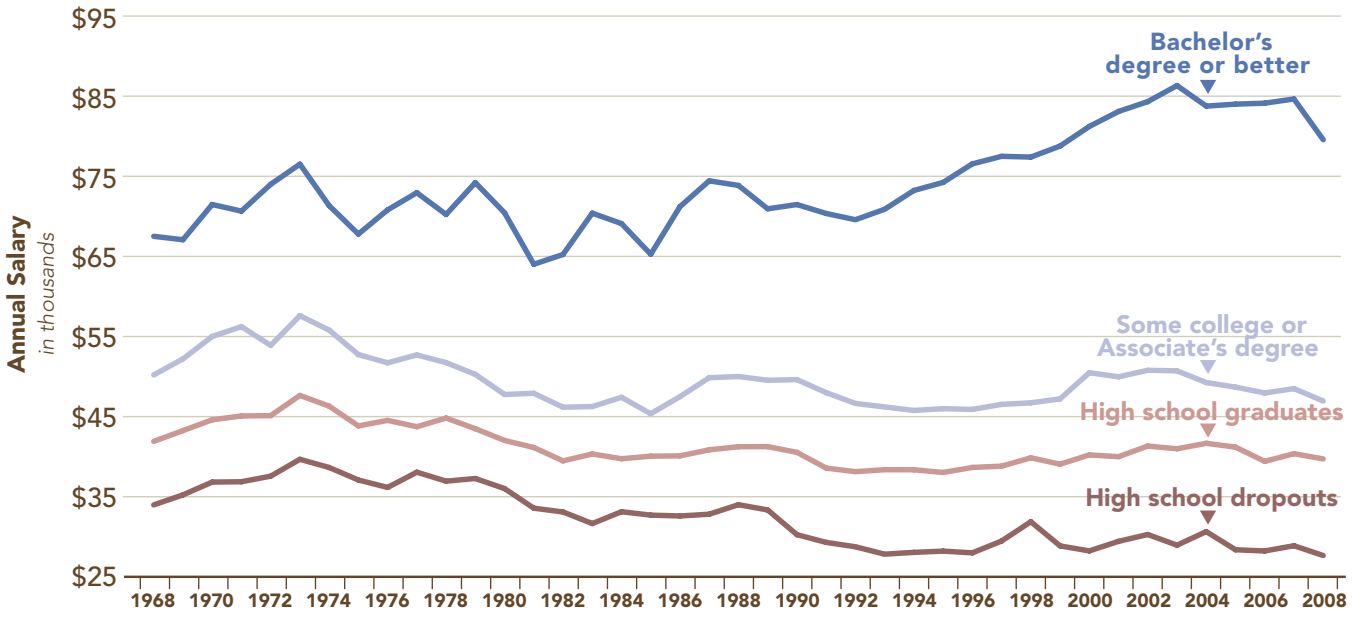
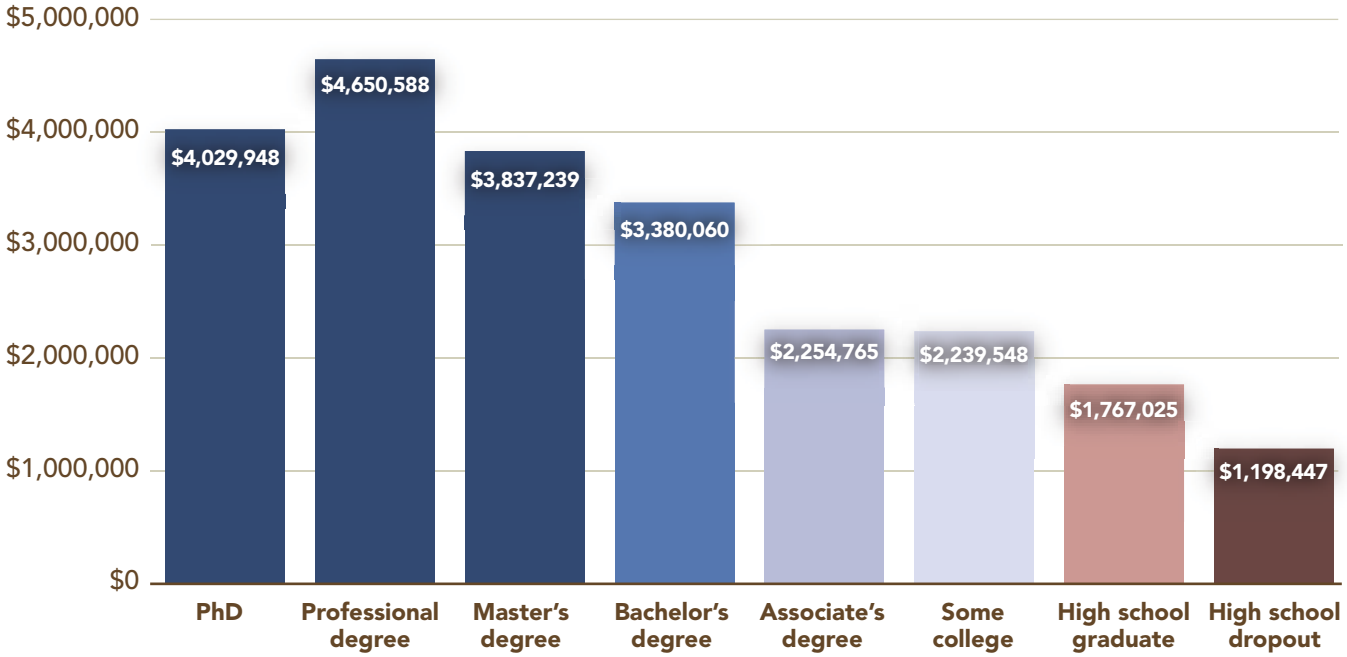


FIGURE V

Estimated average lifetime earnings by education level. (in current dollars)

Source: Authors' analysis of March CPS data, 2008



POSTSECONDARY EDUCATION GIVES LARGE ACCUMULATED EARNINGS OVER A LIFETIME.

The increased earning power conferred by postsecondary education and training is both tangible and lucrative over a worker's lifetime. Figure V shows just how lucrative, by calculating the average career value of educational attainment in 2008 dollars, given the current and projected labor market value of various levels of education.[iii]

Among other things, the chart shows that:

- The range in lifetime earnings by educational attainment is greatest between high school dropouts and professional degrees—a range of $1,198,000 to $4,650,000, or a difference of $3,452,000.
- A high school degree is worth about $569,000 more than being a dropout.
- Having some college but no degree or a postsecondary certificate is worth about $473,000 more than a high school degree.
- An Associate's degree is worth about $15,000 more than some college but no degree.
- A Bachelor's degree is worth about $1.1 million than an Associate's degree.
- A Master's degree is worth $457,000 more than a Bachelor's degree.
- A Doctoral degree is worth about $193,000 more than a Master's degree.
- A Professional degree is worth about $621,000 more than a Doctoral degree.

POSTSECONDARY EDUCATION IS YOUR BEST UMBRELLA IN A RECESSION.

Postsecondary education carries with it one more important advantage in today's economy: protection. Workers with college degrees had the lowest unemployment rates over the past three years, thus receiving the best possible shelter from the Great Recession of 2007. They also have the best prospects for getting hired in the recovery. This means that high school dropouts and graduates without some level of postsecondary education or training are at increased risk of being left behind as the economy plods forward in the long march back to normalcy.

A college education does not make one immune, of course. In today's economy, where 59 percent of the people have at least some college, even some of the most highly educated among us have lost their jobs and many college graduates are scrambling for the reduced pool of jobs available to them. Unemployment rates at all education levels have been climbing and have reached 5 percent for workers with Bachelor's or graduate degrees.

In addition, new college graduates face a depressed labor market that probably will not recover its former vitality until 2015. By then, the economy will have recovered enough jobs to replace the 7.8 million we have lost since December 2007 and create an additional 8 million positions to make up for lost growth in the economy and accommodate new job seekers entering the workforce.

Ultimately, when it rains long enough and hard enough, everyone gets a little wet. Recessions are like that too. But postsecondary education and training is still the best umbrella in any economic storm. It is also an excellent safe harbor where workers can wait out the storm and accumulate new knowledge and expertise to position themselves for the surge in skilled jobs that the recovery will bring.

The emphasis of the recovery will be largely on skilled jobs. Many people who lost jobs that required only a high school education or less will find that their relatively low-skill jobs will not come back at all, lost to automation or overseas competitors. Scores of these job seekers will be left behind because the jobs that survived the recession and the jobs created in the recovery will require postsecondary education or training.

The economy that emerges from the recession will be different than the economy that preceded it. This recession, like the previous two, has intensified the underlying engine of economic change that has been evident at least since the 1980–81 recession. The industrial economy of the 20th century has slowly transformed itself into a new services economy that demands more education and different skills of its workers.

TABLE II

The top occupations for job openings by education level.*

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

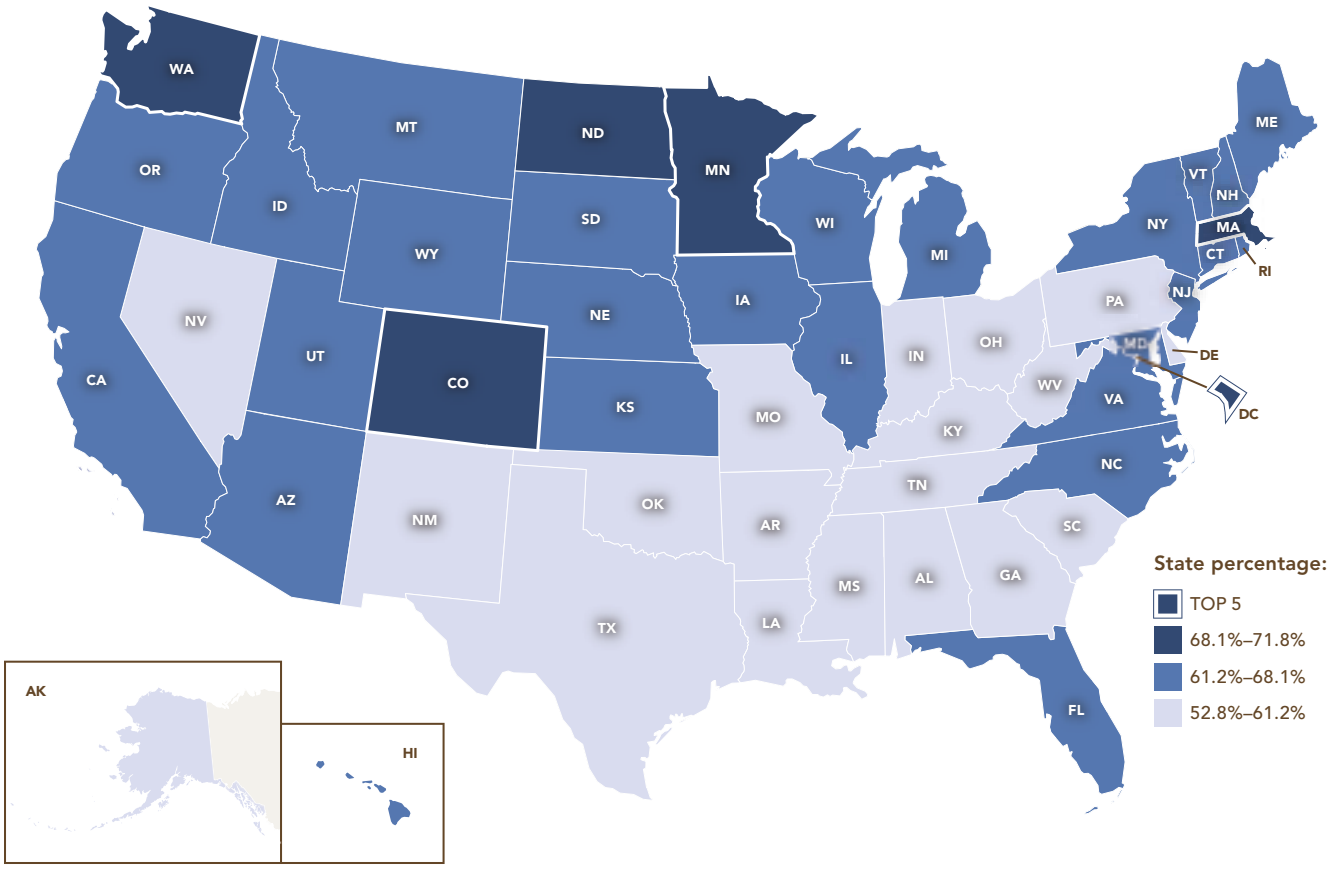
	High school or less	Some college, no degree	Associate's degree	Bachelor's degree	Master's degree and better
Management occupations	17%	14%	10%	39%	20%
Business operations specialists	10%	15%	10%	46%	19%
Financial specialists	7%	10%	9%	57%	17%
Computer and mathematical science occupations	6%	11%	10%	51%	22%
Architects and technicians	3%	3%	6%	56%	32%
Engineers and technicians	20%	15%	26%	27%	13%
Life and physical scientists	2%	1%	0%	43%	54%
Social scientists and technicians	5%	6%	6%	30%	53%
Community and social services occupations	8%	11%	9%	39%	33%
Legal occupations	9%	10%	11%	17%	52%
Education occupations	7%	8%	7%	38%	40%
Arts, design, entertainment, sports, and media occupations	9%	12%	11%	56%	11%
Healthcare practitioners and technical occupations	5%	7%	25%	33%	30%
Healthcare support occupations	41%	27%	21%	9%	2%
Protective service occupations	23%	29%	17%	27%	4%
Food preparation and serving occupations	62%	18%	9%	11%	1%
Building and grounds cleaning and maintenance occupations	75%	12%	5%	7%	1%
Personal care and service occupations	43%	21%	16%	17%	2%
Sales and related occupations	34%	20%	11%	29%	5%
Office and administrative support occupations	35%	28%	15%	19%	2%
Farming, fishing, and forestry occupations	91%	3%	3%	2%	0%
Construction and extraction occupations	72%	13%	9%	6%	1%
Installation, maintenance, and repair occupations	51%	19%	21%	9%	1%
Production occupations	62%	18%	11%	8%	1%
Transportation and material moving occupations	67%	19%	7%	7%	1%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

FIGURE VI

The top states for postsecondary jobs.

Source: Center on Education and the Workforce forecast of educational demand through 2018



Job losses in this recession have already created suffering that will endure well beyond the recovery. But we will only cause new and unnecessary troubles for ourselves and our children if we remain fixated on regaining the jobs hit hardest in this recession. Many jobs are not coming back—especially the blue collar jobs that required high school education or less.

Table II shows the top job openings by education level from 2008 through 2018. For each occupation, it gives the associated education requirements and therefore provides information on where the jobs are by education level. In 2018, 59 percent of Management occupations, for example, will require a Bachelor's degree or better. Associate's degrees are largely concentrated in Engineering and Healthcare practitioners' occupations.

The outlook from a state perspective is summarized in Figure VI and detailed in our State-Level Analysis report. The District of Columbia, Massachusetts, Colorado, Minnesota and Washington state will lead the nation in job openings requiring postsecondary education.

As long as we remain focused on the economic wreckage in our rearview mirror, we will be hurtling into our economic future unprepared. And we are on this collision course with our future because we are facing an undersupply of workers with postsecondary education.

This report, and the forecast it contains, will be a step toward averting that collision.

LOOKING AHEAD: A ROAD MAP TO THE REPORT AND ITS CONTENTS.

This report is divided into five parts that present national forecasts of educational demand from 2008 through 2018 and provide economic context for the findings. These estimates are grounded in occupational and industry forecasts based on a macroeconomic model that generates a cohesive economic outlook for the economy over the next decade.

PART 1 begins by providing an inventory of the current recession. It details job losses and compares this downturn in size

and scope to the previous two recessions and the Great Depression of the 1930s. This chapter also sets the stage for the future of the U.S. economy after the recession ends by showing the pathway out and by relating economic recovery through Gross Domestic Product (GDP), job, and employment growth.

PART 2 provides information on our projections of educational demand by traditional/formal education levels from 2008 by 2018. It gives numbers on the total size of U.S. employment during selected years and provides estimates of the educational demand for job openings by 2018. This chapter makes the case that individual success will require higher education in one form or another by illustrating that nearly two-thirds of the 46.8 million job vacancies between 2008 and 2018 will require some postsecondary education. It also illustrates why the demand for education and training may actually be higher than our forecast suggests.

We offer some historical context for our assertion that we will need increased postsecondary education and training to fill 21st century jobs. This chapter demonstrates that the rise in postsecondary requirements is not a new phenomenon, but one that has existed for quite some time and has accelerated with technological advancement and progress. The chapter defines and discusses the relevance of skill-biased technological change and its role in reshaping job descriptions and the level of knowledge, skills, and abilities required to function in a changing workplace.

Part 2 ends with the estimate that we will under-produce postsecondary graduates by approximately 3 million by 2018. This chapter also outlines all of the assumptions that underlie this general conclusion.

PART 3 describes educational demand by occupation. Demand for workers with postsecondary qualifications is tied tightly to occupations and the skills they require and more loosely to the industries in which they reside. Part 3 fills two roles: first, it presents an occupational forecast by broad categories from 2008 through 2018, and then it gives the educational demand within each occupation from 2008 to 2018. Clear patterns emerge, the most important of which is that the fastest-growing occupations are most often those associated with the highest proportions of jobs that require postsecondary education. Aggregation across occupations by education categories provides national estimates of educational demand. These estimates are presented in terms of sheer size (largest occupations), fastest-growing occupations, and occupations with the highest amounts of postsecondary intensity.

PART 4 describes educational demand by industry. Education requirements are most closely tied to occupations, but the economy produces goods and services by organizing occupations into industries. Moreover, it is industrial growth, through its connection to GDP expansion, that provides the basis for occupational growth through staffing patterns. Part 4 also fills two roles: first, it presents an industrial forecast by broad categories from 2008 through 2018, and then it gives the educational demand within each industry from 2008 to 2018. The pattern that becomes clear is similar to that observed in Part 3—the fastest-growing industries are most often those associated with the highest proportions of postsecondary education.

PART 5 bridges the gap between the economic and the social by making the link between access to opportunities, educational attainment, wages, and household income. This section outlines the simple relationships that exist between education and wages, and the more complex ties between education, wages, and occupational choice. Wages are presented to the reader both in a relative context (comparing wages across occupational groups for one year) and in an absolute context (comparing wages for one occupational group or one educational group across various years). The hierarchical relationship between education and wages is demonstrated from a historical perspective. But because these relationships are not absolute and depend on occupational and industry choice, Part 5 also shows how these sub-associations result in disparate wage outcomes. There is no forecast of wages in Part 5.

The SUMMARY AND CONCLUSIONS chapter summarizes the broad outcomes reached in the preceding five chapters.

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[i] With more staffing resources, our method could also be improved substantially in order to give it more predictive power at a more detailed level. Our point here is not that the government should use our method, but that even minor improvements in the current official methods could give much more robust results.

[ii] In 1996, BLS forecast 36 million Associate's degree or better jobs by 2006. But in 2006, there were 50 million Associate's degree or better jobs, leaving them 40% under the true number.

[iii] These figures are obtained by multiplying average earnings of prime-age (25–54 years old) workers by educational attainment over their expected work life of 40 years. Another way to look at lifetime earnings is to consider the present value of these earnings given that a dollar paid in the future is worth less than a dollar today. A similar rationale is used in calculating interest rates. Using this method we discount lifetime earnings as calculated above assuming a discount rate of 1 percent per year. This discounts each lifetime value by 67 percent. This preset value calculation results in lifetime earnings total as follows: Doctoral degrees ($2.7 million); Professional degrees ($3.1 million); Master's degrees (2.6 million); Bachelor's degrees ($2.3 million); Associate's degrees ($1.5 million); some college, no degree ($1.5 million); high school degree (1.2 million) and dropouts ($800,000).

Part 1

The Recession Is Accelerating the Shift to Jobs Requiring Postsecondary Education.

We are back from the brink, but the tough times are not over.

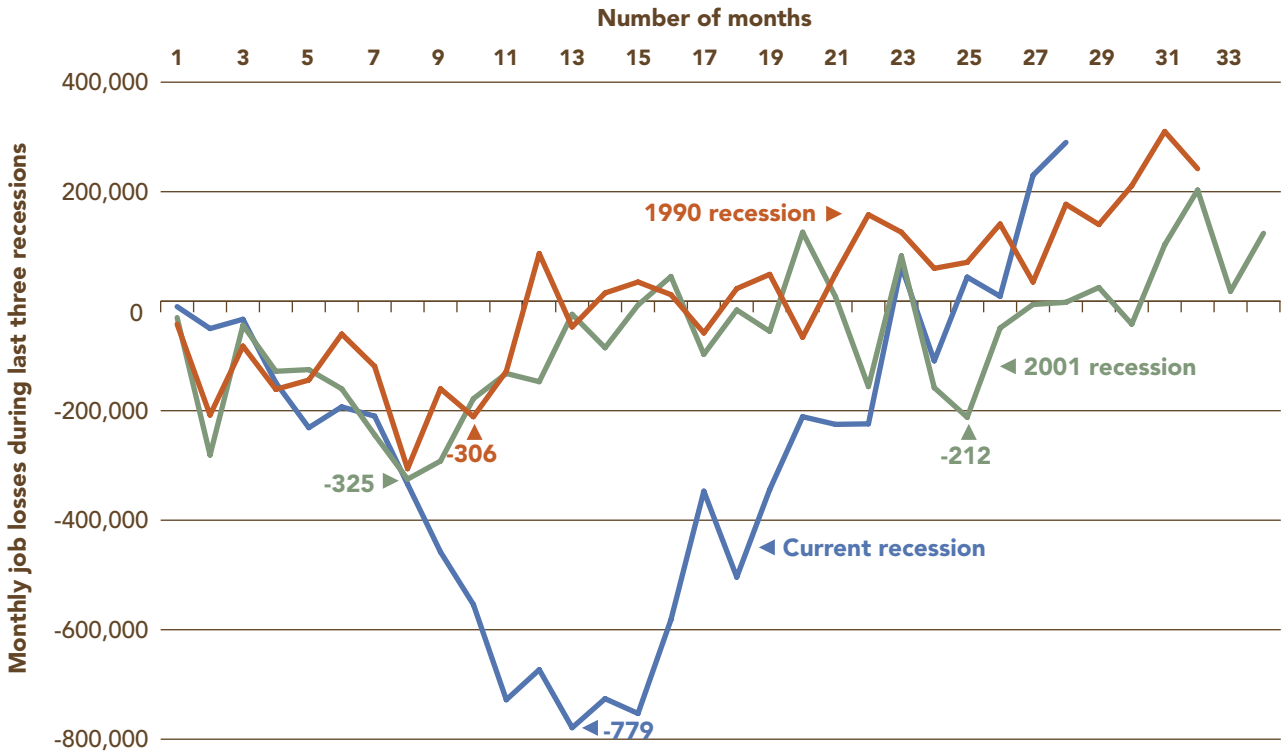
The recession that began in December of 2007 is already 30 months old, but the U.S. economy will not recover its pre-recession employment levels for at least another two years, according to our own forecast and many others. From there, it will take an additional three years to make up for lost growth and create a job market strong enough to accommodate both the casualties of the recession and the millions of new workers who will stream into the workforce from schools across the country. The economy, as a result, will not be completely back on track until 2015.

In human terms, the toll of this recession has been staggering. Since it began, more than 7.8 million jobs have been lost. In all, 9.7 percent of the workforce is currently idled, and roughly one-third of the unemployed have been out of work for more than six months. The impact has been especially devastating for minority groups: 12.6 percent of Latinos, 16.5 percent of African Americans, and 26.4 percent of teens are unemployed. By comparison, the unemployment rate for white workers is 8.7 percent. A recent report by the Center for Labor Market Studies at Northeastern University detailed the recession's impact on various income groups and concluded that there is a "true labor market depression fac[ing] those in the bottom…of the income distribution."[1]

FIGURE 1.1

This recession has been much deeper than the two preceding ones.

Source: Bureau of Labor Statistics' employment situation summary, various months



There can be little doubt that this recession is the worst economic downturn since the Great Depression. No matter how long it ultimately lasts, the Great Recession of 2007 has already outlived the 16-month slumps of 1973 and 1980, which had previously ranked as the longest declines since World War II. Its job losses, too, outstrip those of the two most recent recessions, those of 1990 and 2001. At the height of the current recession, monthly job losses peaked at 779,000 (Figure 1.1), more than double the worst monthly losses of 1990 and 2001: 306,000 and 325,000, respectively.

Many economists predict we will see months of "jobless recovery," such as we experienced in 1990 and 2001. That means economic output will grow but will not immediately generate job growth. Instead of hiring new workers, employers will ask their existing employees to work longer hours to meet rising demand.[2] Evidence of that phenomenon is mounting already. Gross Domestic Product (GDP) grew by 3.5 percent in the third quarter and 5.7 percent in the fourth quarter of 2009—the fastest pace in six years—but job losses continued, averaging 260,000 and 110,000 over the same period (Figure 1.2). We project that job losses for 2010 will total 300,000, and do not see net gains resuming until 2011.

By then, GDP growth will pick up more steam and the economy will finally start creating more jobs than it loses. The total number of jobs will climb from 142 million to 145 million as employers start hiring again (Figure 1.3). That does not mean everything will be back to normal, however, because the recession not only eliminated 7.8 million jobs, it also stymied job growth, which typically adds an additional 100,000 positions per month to the economy. Once growth resumes, it will take some time for the economy's job creation engine to catch up to where it should have been. As a result, we do not expect employment to reach pre-recession levels until around 2012. From there, it will take another 26 months to replace positions that would have been created had the recession never occurred.

To reach the employment levels we would have attained without a downturn, the economy will need to create a net total of 11 million jobs: 2.6 million new jobs for people who have been entering the labor market since the recession began, added to the 7.8 million existing jobs that were lost. Mark Zandi of Moodys.com estimates that the recently signed "Hire Act" will create only 250,000 jobs by the end of the year. In other words, the economy will not be "back on track" until 2015, even with this addition to job creation flows (Taylor, 2010).

FIGURE 1.2

Although the real Gross Domestic Product (GDP) growth rate will rise to 3.3 percent in 2010, the economy will not begin adding substantial new jobs until 2011. (non-farm payroll employment, plus self-employed)

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018.

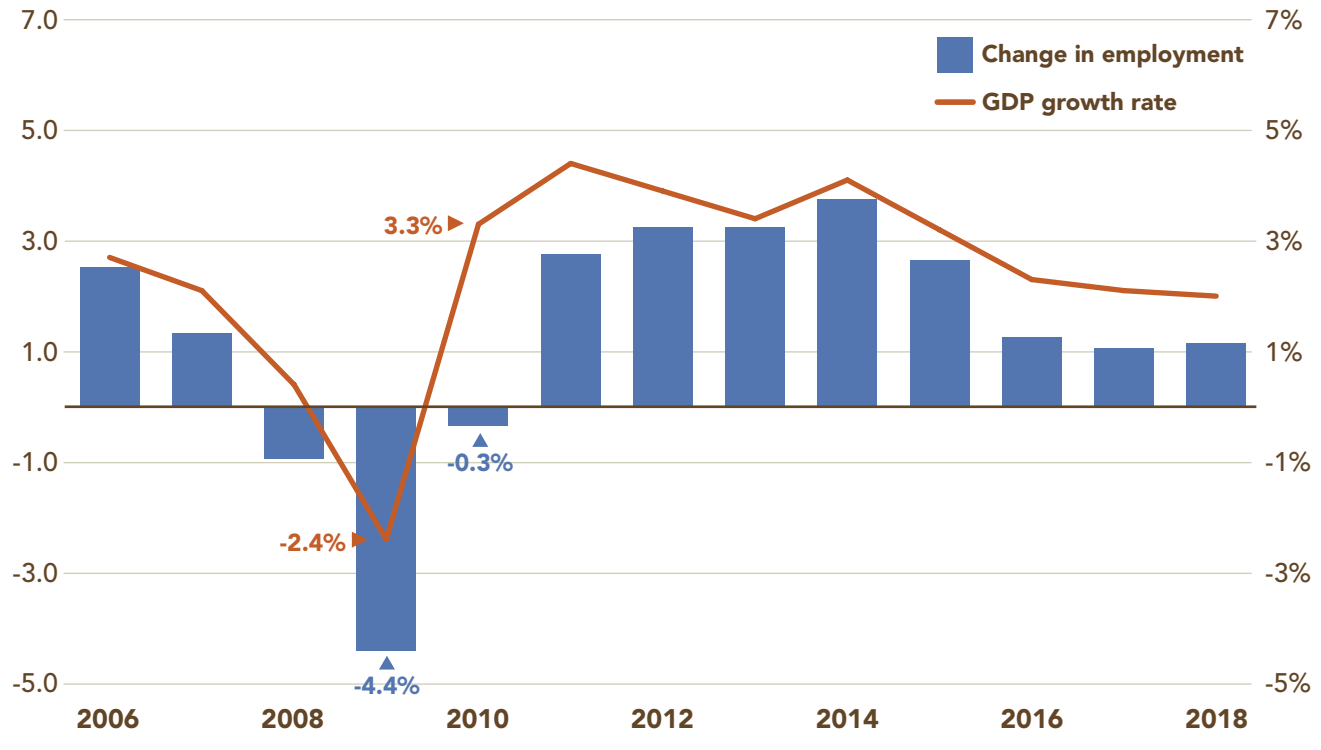
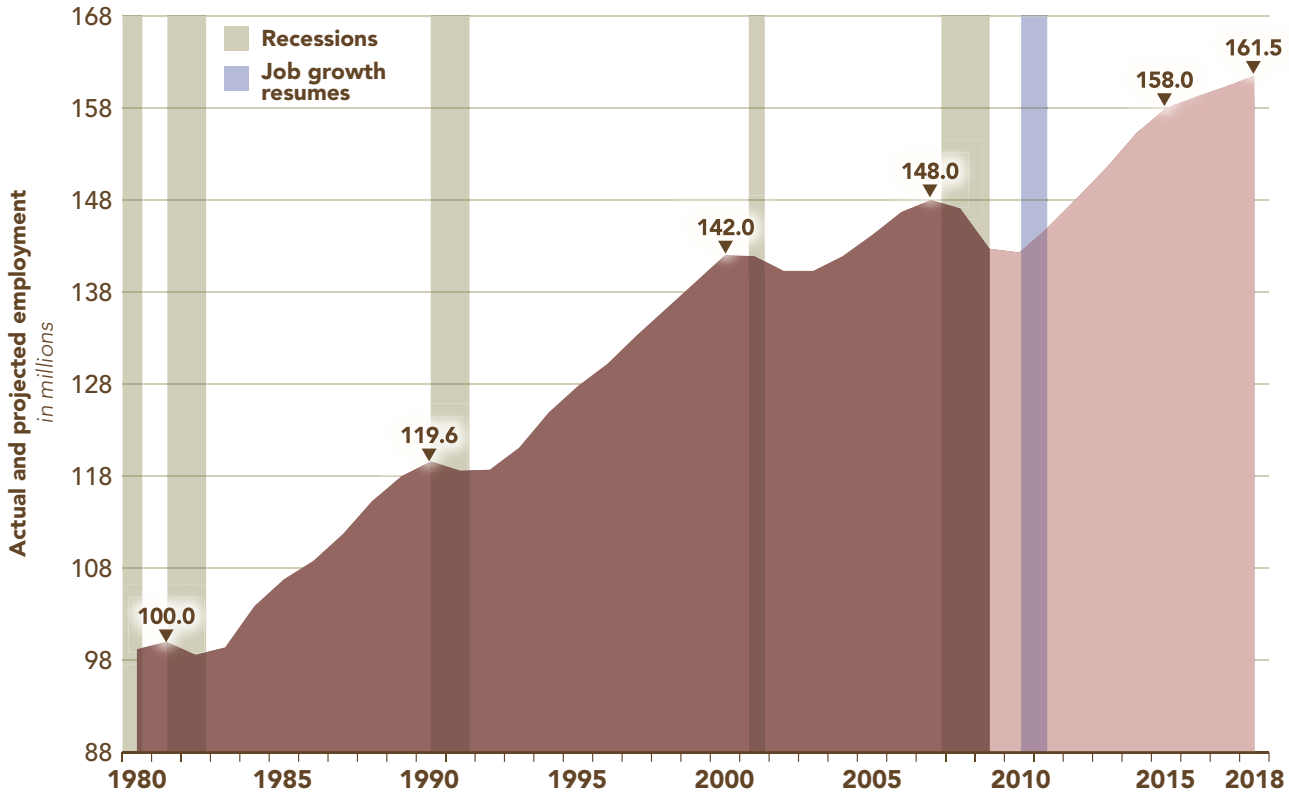


FIGURE 1.3

Employment growth is set to resume in 2011, but the economy will not reach full employment until 2015. (non-farm payroll employment, plus self-employed)

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018.



For many, a full recovery will be a hollow accomplishment. Hundreds of thousands of low-skill jobs in manufacturing, farming, fishing, and forestry have been permanently destroyed because the recession has further prompted employers to either automate those positions or ship them offshore to take advantage of cheap labor. Overall, we project 637,000 jobs in the Manufacturing and Natural Resources industries will meet such fates by 2018.

The jobs that replace them will be very different kinds of jobs, requiring very different kinds of workers—and very different kinds of preparation.

[1] As reported in the New York Times, Feb.10, 2010: "The Worst of the Pain." Bob Herbert.

[2] Each day that the existing workforce puts in 12 minutes longer per day with a workforce of 141 million people equates to 13,558 full-time, full-year jobs (2,080 hours per year). (0.2hr*141,000,000/2,080 hours in full-time year)

Part 2

Our Current Postsecondary System Will Not Meet the Growing Demand for Workers with Postsecondary Education and Training.

The future of employment in the United States boils down to this: success will require higher education, in one form or another.

By 2018, the economy will create 46.8 million openings—13.8 million brand-new jobs and 33 million "replacement jobs," positions vacated by workers who have retired or permanently left their occupations. Nearly two-thirds of these 46.8 million jobs—some 63 percent—will require workers with at least some college education. About 33 percent will require a Bachelor's degree or better, while 30 percent will require some college or a two-year Associate's degree. Only 36 percent will require workers with just a high school diploma or less (Figure 2.1).[3]

This growth in demand for postsecondary education dovetails with two major trends. First, the fastest-growing industries—such as computer and data processing services—require workers with disproportionately higher education levels. Second, over time, occupations as a whole are steadily requiring more education.

The implications of this shift represent a sea change in American society. Essentially, postsecondary education or training has become the threshold requirement for access to middle-class status and earnings in good times and in bad. It is no longer the preferred pathway to middle-class jobs—it is, increasingly, the only pathway.

FIGURE 2.1

By 2018, 63 percent of job openings will require workers with at least some college education.

Source: Center on Education and the Workforce forecasts of educational demand to 2018

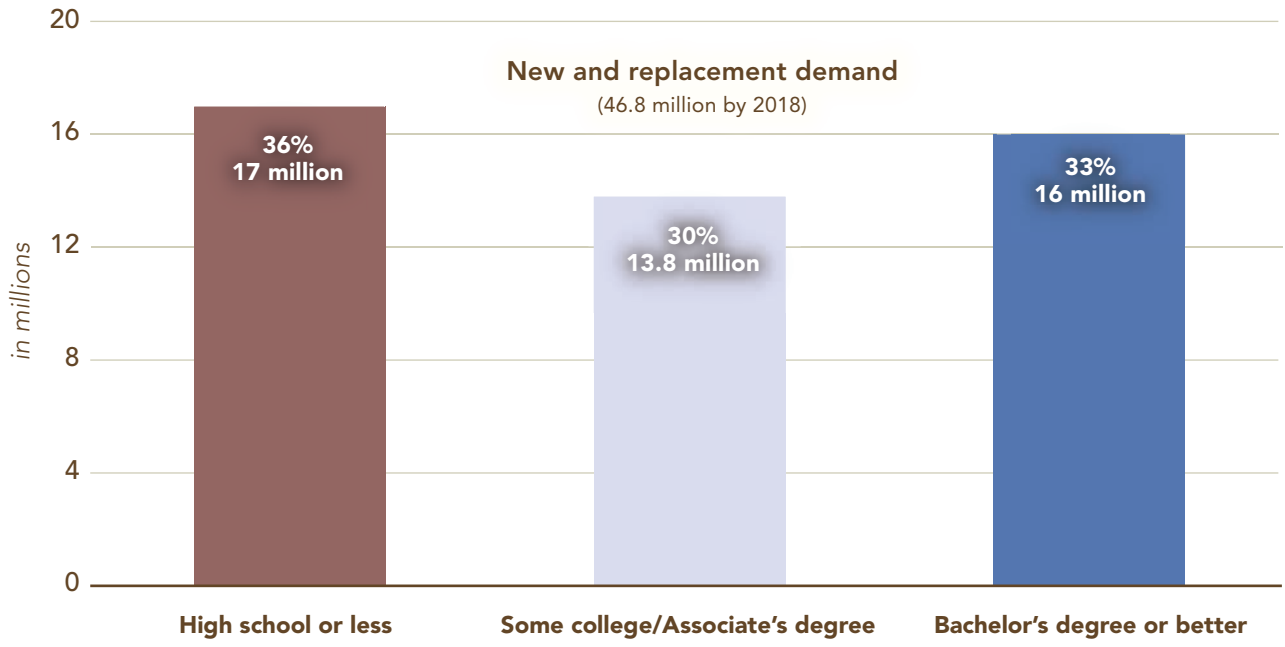
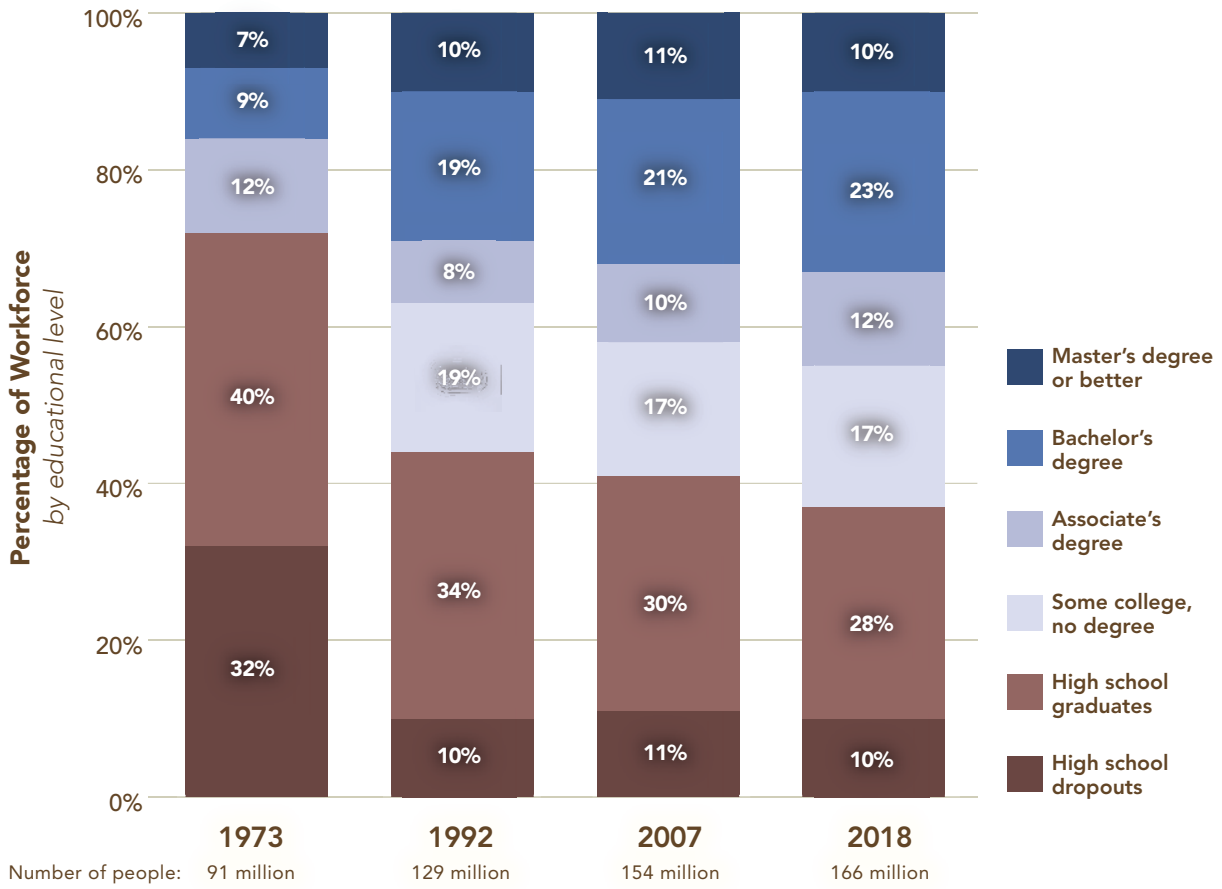


FIGURE 2.2

By 2018, about two-thirds of all employment will require some college education or better.

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand to 2018



Nowadays, about 60 percent of Americans go on to some kind of education or formal training after high school. Almost without anyone noticing—and with no real public debate—access to college has become the essential goal for educational reform in the pre-kindergarten to high school years. Middle-class employability, meanwhile, is now the ultimate standard for educational adequacy from kindergarten through college graduation.

Over the past several decades, about 70 percent of the increase in requirements for postsecondary training has stemmed from upgrades in skills demanded by occupational categories that previously did not require higher education. What we called a "foreman" or "manufacturing supervisor" in the 1960s, for example, has since morphed into new occupations that now require postsecondary education, including the modern manufacturing engineer. A significant but smaller share of the increase (about 28 percent) has resulted from the development of entirely new occupations or the expansion of occupations that already required high levels of postsecondary training. What we called a "medical doctor" in the 1950s has now evolved into a host of new medical specialties that call for a complex set of college-level skill requirements. Middle managers, meanwhile, have divided into a myriad of occupations that now are classified as business services, all requiring significant levels of postsecondary preparation.

For proof of this trend, just look at the statistics. In 1973, there were 25 million jobs that required applicants with at least some college education (Figure 2.2). By 2007, that number had nearly quadrupled to 91 million jobs. Since the early 1970s, the American economy has transformed from one that featured more jobs for high school dropouts than for college graduates, to one where the share of jobs for dropouts has plunged from roughly one-third to 11 percent.

Consider, too, that in 1973 only 28 percent of prime-age workers had any postsecondary education.[4] By 2007 that number had climbed to 59 percent. In fact, the share of workers with an Associate's degree, certificate, or some college has more than doubled from 12 percent to 27 percent of the workforce. The

percentage of workers with Bachelor's degrees also has more than doubled, from 9 percent in 1973 to 21 percent in 2007. Graduate degree holders have increased at a slightly slower pace, going from 7 percent to 11 percent over the same period.

This trend will only continue. By 2018, more than 63 percent of prime-age workers will need some type of postsecondary instruction. The proportion of workers who will need an Associate's degree, certificate, or some college will increase from 27 percent in 2007 to 29 percent in 2018. The share of workers who must have Bachelor's degrees will climb from 21 percent to 23 percent, while the number who require graduate degrees may decline slightly, from 11 percent to 10 percent over the same period.

These projections are high compared to official Bureau of Labor Statistics (BLS) numbers. Nonetheless, we have every reason to believe both sets of numbers underestimate the true demand for postsecondary education. This is because the official data—for several reasons—underestimate postsecondary educational demand in our country. (See Appendix 4 for details.)

For example, postsecondary training programs that result in certificates and certifications are commonly missed by both education and labor data sources. Education data typically count only people who have passed through educational institutions in pursuit of formal degrees, while labor market data do not include certificates or industry-based certifications. Both sets of data, then, ignore the role played by formal and informal learning outside the traditional education system, including industry and occupational licensure, apprenticeships, and employer-based training. How important is this? One national data source suggests that close to 60 million people, or 42 percent of the workforce, need some form of occupational certification, registration, or licensure to perform their jobs. Some 45 million of these certifications are test based.[5]

The official data also understate the importance of postsecondary education and training because they treat all jobs alike. Low-skilled jobs tend to feature an abundance of part-time positions, have high worker turnover, and, as a result, are over-counted in just about everyone's data, including our own. Many of these jobs are transitional in one way or another. Young people commonly take jobs in food services or other low-skill occupations as they work themselves through school or toward better, more skilled jobs they can turn into a career. Such transitional jobs can be found at the other end of the career continuum—retired executives who work as greeters at Wal-Mart, for instance. Jobs data tend to treat openings for such positions the same as openings for long-term career jobs. This exaggerates the significance of low-skilled jobs and, in turn, underestimates the demand for postsecondary education and training.

In other words, as robust as the demand for postsecondary education and training may seem in our forecast, it may actually be greater.

Technology Fuels the Growing Demand for Postsecondary Education.

So, let's pause for a quick recap: demand for education and training is on the rise. And jobs, overall, are requiring more and more postsecondary preparation, regardless of industry.

What is driving this transformation of the American economy?

In a word: technology. In the 19th and 20th centuries, electricity and the internal combustion engine drove the rise of manufacturing and America's shift away from an agrarian economy. Today, computers and related inventions are driving the information revolution and transforming the U.S. economic landscape once again. And, just as the industrial revolution was critical to building a mass K–12 education system to feed workers into the manufacturing industries, the information revolution is spurring the development of a mass postsecondary system to fill the needs of sophisticated new industries, such as computer systems design or financial services. In short, the economic history of the United States is one of lock-step progression between technology and educational attainment.

Integral to this trend is a concept borrowed from labor economics, known as "skill-biased technological change." This simply means that technological development and the organizational changes that come with it favor workers with more education because they have the expertise needed to handle more complex tasks and activities. Demand for these workers, in turn, grows across the board as the technology spreads throughout the economy.

In this case, the technology in question is information technology. Like electricity in the industrial age, the computer is a general purpose technology that works across industries and in the larger society.

Computer-based technology adds new kinds of value to goods and services that were simply impossible in previous economic eras. Computers, for instance, allow for built-in quality measurement at every stage of production, and precise, consistent

service delivery. They also allow customized services by involving customers directly through, say, Internet commerce sites or bank machines. Information technology provides convenience because its accessibility is not limited by time and space—consumers can order goods from anywhere in the world, or deposit paychecks in the middle of the night, if they desire.

The penetration of information technology also has fueled a fundamental change in how businesses are organized. The industrial economy featured two dominant organizational formats—the rigid top-down hierarchies of mass production, and the chaotic atomization of professional services, such as healthcare, education, or business services. The top-down behemoths could deliver standardized goods at low prices, but had little flexibility; service industries provided variety, but little consistency. Now, though, the top-down structure of manufacturing and the fragmented structure of the services sectors are converging in a new format that tries to minimize the weaknesses of each, meld the strengths of both, and add some new twists.

The new format emphasizes flexible networks accountable to common performance standards. As a result, production processes are now just as likely to use goods and services produced by other organizations as those produced in-house. Meanwhile, service and professional industries are often aligned by such standards, pointing everyone toward well-defined outcomes. In medical fields, for instance, health maintenance organizations (HMOs) have helped standardize the delivery of care.

These flexible networks, which now dominate the knowledge economy, require communication and information technologies that allow organizations to connect easily with one another and with their customers. Here, then, is where skill-biased technological change goes to work. Increases in organizational complexity lead to an ever-increasing bias toward skilled and educated workers, because they need more knowledge and training to handle that complexity. Increases in educational attainment, in turn, result in efficiency and productivity gains when better-trained workers are paired with the technologies that make the networks possible. The result is predictable—demand for better-prepared workers goes up.

On the flip side, information technology can depress demand for workers with only high school diplomas or less. Available evidence shows that information technology tends to substitute for the narrow and repetitive work tasks that require low-skilled workers in many industries—which is why many lower-level jobs tend to disappear forever in recessions. Prior to the 1991 recession, roughly one-third of laid-off workers with a high school education or less reclaimed their old—or comparable—positions during recovery periods. In the past two recessions, the numbers were even smaller.

Jobs created in recent recoveries looked nothing like those that were lost, and the people hired for those new positions looked nothing like the people laid off from the old ones. In the past two recessions, the typical job loser was a high school-educated male in a blue collar job, such as manufacturing or construction, working in the middle of the country. In the past two recoveries, the typical job gainer was a female with a postsecondary education who lived on either coast and worked in a service occupation—particularly healthcare, education, or business services.

That picture is not changing. A recent McKinsey Global Institute report suggests that too few American workers are equipped with the skills required to fill attractive jobs in the economy's new growth sectors. In fact, the study claims, 71 percent of U.S. workers are in jobs for which there is either low demand from employers, an oversupply of eligible workers, or both.[6]

These numbers suggest that unless we can find a way to educate the American workforce for the complexities of the knowledge economy, we risk leaving hundreds of thousands of workers behind.

Our Postsecondary System Will Not Produce Enough Graduates.

Economists increasingly worry that America's postsecondary education system cannot keep up with historic increases in the demand for college-educated workers. To explore that concern, we created a stock and flow model to forecast the supply of such workers through 2018.

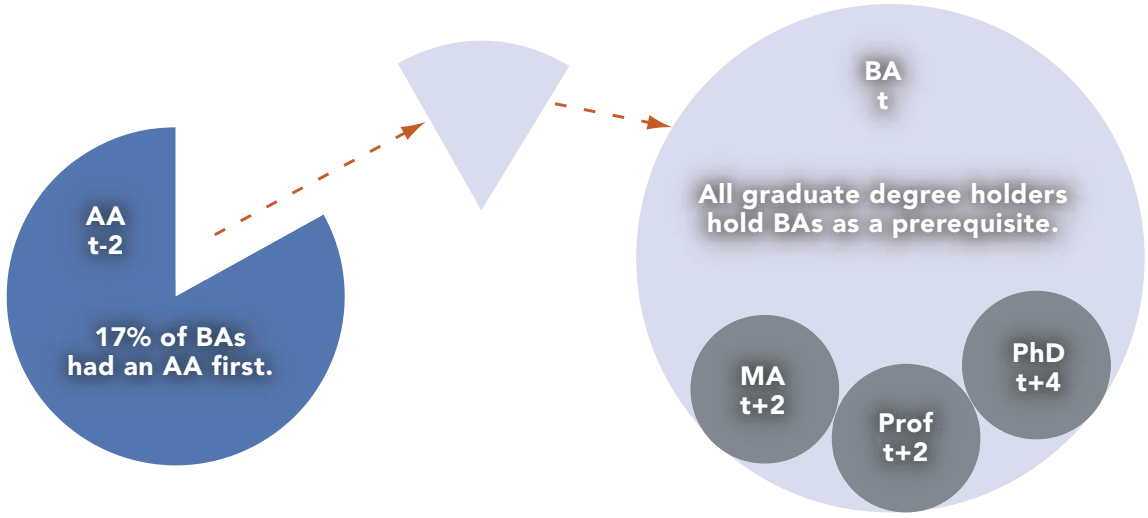
Our findings? The worry is justified. Demand for workers with college educations will outpace supply to the tune of 300,000 per year. By 2018, the postsecondary system will have produced 3 million fewer college graduates than demanded by the labor market.

This finding holds despite hints in a key indicator that demand for workers with postsecondary education might actually be slowing. That indicator is known as the "wage premium"—higher wages paid to college graduates compared to those for employees with no higher education. Goldin and Katz (2008) theorize that dramatic increases in this premium in the 1980s and 1990s were due to a supply slow-down in college graduates. From 2002 to 2008, however, the premium shrunk. Real wages for college-educated Americans decreased in absolute terms over that period, but relative declines in the wage premium

FIGURE 2.3

Adjustment to NCES forecast to obtain an estimate of the supply of college degrees. (t=year)

Source: Center on Education and the Workforce forecasts of educational demand to 2018



compared to the pay for high-school-educated workers have been minimal. Thus, the wage premium still exists, along with an undersupply of college-educated workers.

SUPPLY CALCULATIONS.

To forecast the supply of degrees in the future, we relied on a combination of data sources looking at labor force characteristics, the growth in labor supply, and growth in the number of degrees conferred.

In 2008, according to the March Current Population Survey (CPS) conducted by the Bureau of Labor Statistics, 42 percent of prime working-age Americans (52.2 million) had an Associate's degree or better. To this base, we added adjusted estimates of new degrees conferred in the next 10 years.

The National Center on Education Statistics (NCES) collects and forecasts estimates of the number of degrees conferred annually. The number of degrees conferred actually exceeds the number of people with those qualifications. That is because, in any given year, if someone attains more than one degree, each is counted. NCES estimates of graduation rates and degrees conferred, therefore, are insufficient to estimate the actual flow of graduates into the U.S. economy.

To address this issue, we used a simple calculation to distinguish between degrees and people with degrees.

Typically, 17 percent of people with an Associate's degree will get a Bachelor's degree.[7] We assume that, on average, these people will take another two years to complete their Bachelor's. So, we reduced the stock of terminal Associate degrees (AA) by 17 percent in time period t-2, shown in Figure 2.3.[8] In addition, all advanced degrees require a Bachelor's (BA) as a prerequisite. In time period t, we reduced Bachelor's degrees by the number of Master's (MA) and professional degrees (Prof) in time period t+2, and by the number of PhDs in time period t+4.

Next, we selected 2008 as a base year and found that 52.2 million prime-age Americans had an Associate's degree or better. To this base, we added our adjusted attainment estimate of another 23.4 million workers with Associate's degrees or better by 2018, giving us a preliminary estimate of 75.6 million workers.[9] Then, assuming a labor force outflow of about 25 million workers due to death, disability, and retirement—30 percent of whom had an Associate's degree or better—we cut that total by the appropriate number.[10,11] As a result, our adjusted estimate of the number of Americans with Associate's degrees or better by 2018 was 68.1 million people.

MATCHING SUPPLY AND DEMAND.

Calculating shortages or surpluses of college workers is more complex than merely subtracting demand and supply forecasts from each other, however. Among the complicating factors: many workers hold more than one job, so the number of jobs could exceed the number of workers. Estimates of the number of jobs and the supply of labor to fill them are created by very different and irreconcilable methods. And many economists

argue that, in the long run, there are no real shortages because the wage rate acts as an equalizing factor: it eliminates short-term shortages with premiums, and short-term oversupplies with cuts to that premium. Other factors include jobs sent offshore, changes to immigration policy, technology in the production process and delayed Baby Boomer retirements.

Everything being equal, however, we estimate that the educational demand requirements of new and replacement jobs will be 21.7 million workers with Associate's degrees or better by 2018. Some 23.4 million additional workers will graduate with those degrees by that date. After adjusting for typical rates of labor force participation, we have a "participating" supply estimate of 17.5 million. Finally, to correct for multiple job holdings we turn to the May Workplace Topics II of the CPS which shows that 5 percent of the employed have more than one job.[12]

Adjusting our numbers for all of those factors, by 2018 we end up with a shortfall of workers with Associate's degrees or better of about 3 million. At current rates, degrees conferred would have to increase by about 10 percent a year to eliminate the shortfall—or the economy would need to slow its demand for higher education in its workers.

And that, as we have seen, simply is not happening.

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[3] Jobs that require only high school or less tend to be over-counted because many of them are in occupations and industries with large shares of part-time jobs or jobs with very high turnover (Lacy and Wright, 2009). Low-wage service jobs account for about 20 percent of the jobs but only 14 percent of the hours worked in the economy (Autor and Dorn, 2009). Many workers are just passing through low-wage/low-skill jobs as part of a natural career progression. Jobs that require postsecondary education or training are more likely to be career jobs. There are many more brain surgeons who used to be cashiers than there are cashiers who used to be brain surgeons, but the statistics tend to treat the two jobs equally. For example, for every new job for cashiers that will open up between 2008 and 2018, there will another 13 job openings to replace people who leave the cashier occupation. By way of contrast, for every new job for physicians there will only be 0.8 job openings to fill the jobs of physicians who leave the occupation. Roughly half the workers in low-skill, low-wage occupations move into higher wage categories within five years. Ultimately about 11 percent of Americans are stuck in low-wage, low-skill jobs in the bottom quartile of the wage distribution (Carnevale and Rose, 2001).

[4] Prime-age workers include those aged 25 to 54.

[5] National Assessment of Adult Literacy (2003)—Authors' calculations

[6] Changing the Fortunes of America's Workforce: A Human Capital Challenge. McKinsey Global Institute, June 2009.

[7] Based on a 2003 survey, The National Survey of College Graduates, conducted by the U.S. Census Bureau and National Science Foundation.

[8] For example, we assume that BA's in 2008 will contain some AA's attained in 2006. As a result we decreased 2006 AA's by the amount that will become BA's two years later.

[9] Contrast with unadjusted summation of NCES numbers, which gives an estimate of 36.7 AA's and better between 2008 and 2018.

[10] This assumes that the number of people who retire in 2008 to 2018 will closely follow the number of people who retired in the previous decade (25 million). Dohm (2000) finds that a slightly smaller number of 19 million workers retired during the period 1998 to 2008, which could imply that our static forecast overestimates the retirement number for the decade 2008 to 2018.

[11] Smith and Toder (2005) find that 30 percent of the early Baby Boomer birth cohorts (who will be 62 in 2008–2012) are college graduates. They forecast this proportion to be fairly stable through 2032.

[12] Further, roughly 35 percent of persons with multiple jobs have an Associate's degree or better.

Part 3

Occupation Growth Drives Demand for Postsecondary Education.

Demand for workers with postsecondary qualifications is tied tightly to occupations and the skills they require and more loosely to the industries in which they reside.

This concept is critical to understanding the forces that drive educational demand and to understanding what shapes the U.S. job market. The connection between educational demand and occupation makes sense for a couple of reasons. For one thing, occupations have similar requirements regardless of the industry they are in. Accountants perform comparable tasks whether they are working for a mining company or a hospital—and the training required to do the work is virtually the same. If the tasks of a particular job require a high degree of skill, the demand for workers with postsecondary education or training will be high, regardless of industry.

Industries, on the other hand, are made up of all kinds of occupations, some that demand college degrees and some that do not. This tends to dilute the concentration of postsecondary workers found in many industries and, obviously, affects hiring patterns and waters down demand. In sum, education requirements correlate more to occupation than to industry.

This is reflected in our research, which divided occupations into nine major clusters for analysis, ranging from Blue Collar occupations to the STEM Occupations—Science, Technology, Engineering, Mathematics, and Social Sciences.[13]

Postsecondary demand varies substantially by occupation, depending on the sophistication of the tasks required and the training necessary to perform them. Table 3.1 gives a snapshot of that variation, showing occupations grouped in our nine major clusters and ranked by the share of incumbent workers who have some college education or better.

Demand for postsecondary workers in our occupational clusters reflects two simple, interrelated factors:

- The overall size of an occupation;
- The intensity of postsecondary requirements in an occupation.

This means the biggest clusters can produce many postsecondary positions, even if a relatively small percentage of their total jobs require higher education or training. For example, Sales and Office Support is the largest occupational cluster, and will encompass 43.5 million jobs in 2018 (Table 3.2). Even though this cluster ranks only sixth out of our nine for the percentage of workers with postsecondary education, it ranks first for the total number of workers with at least some college education simply because it is so big.

On the other hand, small clusters can produce many postsecondary jobs despite their overall size. That is because virtually every job they produce demands educated workers. Education Occupations is an example—it is only the fifth-largest occupational cluster (Table 3.2), but employs the second-highest share of workers with some college or better in 2018 (Table 3.1).

We break the occupational clusters into three tiers: those where 80 percent or more of the workers have postsecondary education; those where more than half of the workers have such training; and those where postsecondary employees are less than half of the workforce.

The most intense concentrations of postsecondary workers are in the STEM; Education; Healthcare Professional and Technical; Community Services and Arts; and Managerial and Professional Office Occupations. Those five clusters represent more than 30 percent of total occupational employment and about 45 percent of all jobs for postsecondary workers.

TABLE 3.1

Healthcare has the highest rate of growth in postsecondary attainment.

Source: Authors' analysis of March CPS data, 2008; Center on Education and the Workforce forecast of educational demand through 2018

OCCUPATIONS:	Total occupational employment: Some college or better 2008		Total occupational employment: Some college or better 2018		Rate of growth in postsecondary attainment (upskilling)
	Percentage	Rank	Percentage	Rank	
Healthcare Professional and Technical	93%	1	95%	1	22%
Education	93%	2	93%	2	15%
STEM	90%	3	91%	4	19%
Community Services and Arts	89%	4	91%	3	17%
Managerial and Professional Office	83%	5	87%	5	15%
Sales and Office Support	62%	6	65%	6	14%
Healthcare Support	53%	7	59%	7	38%
Food and Personal Services	41%	8	44%	8	23%
Blue Collar	34%	9	35%	9	7%
TOTAL	60%		63%		16%

The second tier of postsecondary intensity includes Sales and Office Support and Healthcare Support Occupations, while the third tier consists of Food and Personal Services and Blue Collar Occupations. Second- and third-tier occupations include almost 80 percent of all workers in the economy and close to 56 percent of all postsecondary workers.

Growth in the number of jobs that demand postsecondary attainment for a particular occupation will depend on a mix of factors, including its share of postsecondary jobs to begin with, its overall size, and its overall growth. Figure 3.1 shows our nine occupational clusters in 2008 and our forecast for growth by 2018.

All nine categories in Figure 3.1 are growing in their total number of jobs and in the number that require postsecondary education. The percentage of jobs that require higher education is also on the rise across the board.

THE BIGGEST OCCUPATIONAL CLUSTERS INCLUDE THE MOST ENTRY-LEVEL JOBS, DEMAND LESS EDUCATION, AND GROW MORE SLOWLY.

As we examine these clusters a bit more closely, though, certain patterns emerge. The biggest occupational clusters tend to grow slowly and have lower concentrations of postsecondary workers than the smaller, fast-growing clusters. Consider Sales and Office Support, for example. It accounts for the largest share of total jobs, both in 2008 and 2018, but ranks only sixth for postsecondary intensity. About 65 percent of its workers will require some college or better (Table 3.1) in 2018. Sales and Office Support will gain the largest number of jobs simply because the cluster is so big, but will rank next to last for the speed of its growth (Table 3.2).

Postsecondary intensity in Sales and Office Support is pulled down by retail clerks and cashiers. Those two categories make up more than 20 percent of the cluster's workers, and include large concentrations of people with high school education or less. In addition, employment data tends to overestimate the importance of these jobs in the economy. Clerk and cashier occupations tend to be transitional jobs, as discussed in Part 2, with many part-time workers and high turnover.

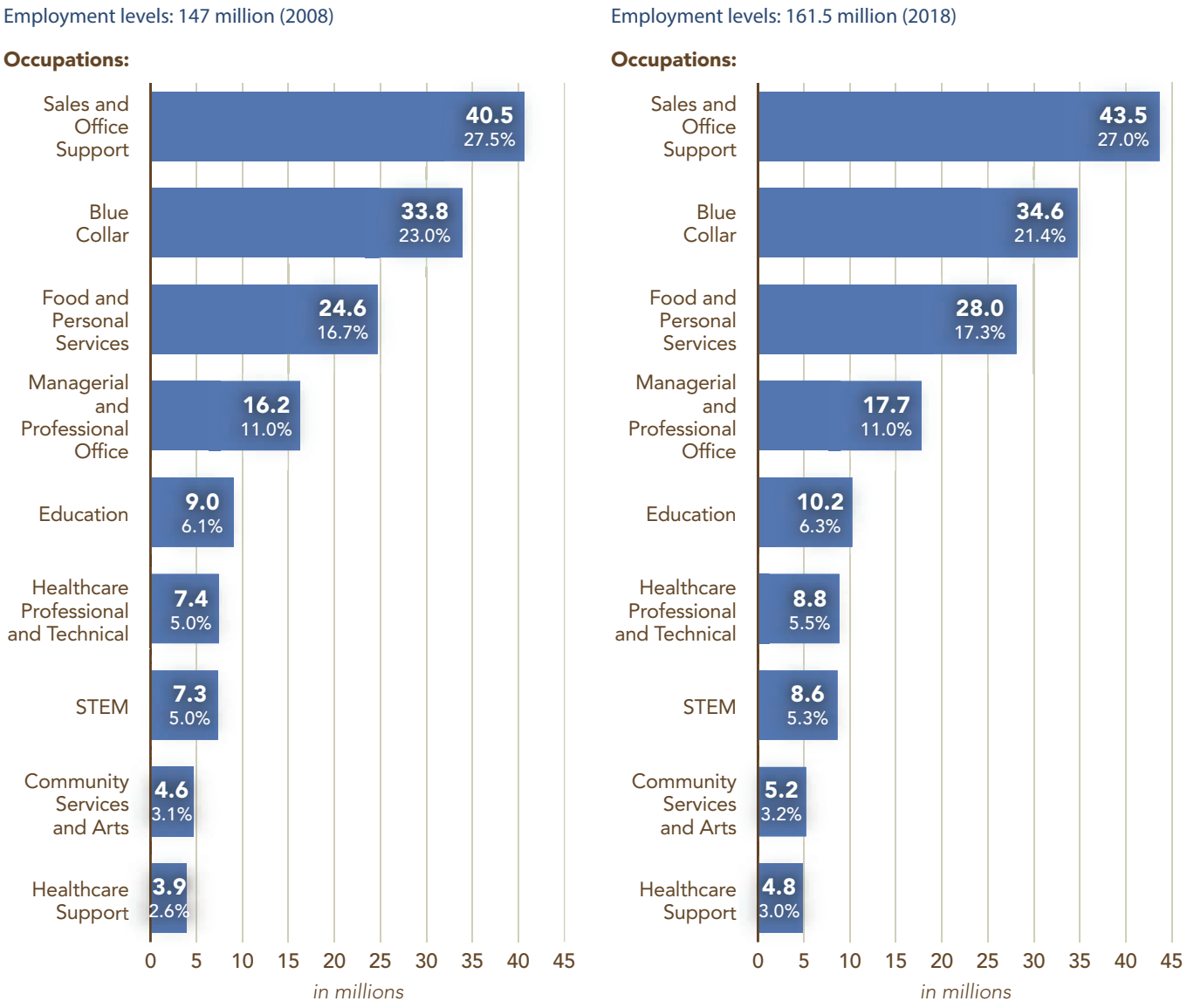
The second-largest occupational cluster, Blue Collar Occupations, follows a similar pattern. It is the slowest growing and has the lowest level of postsecondary attainment of all our clusters (Table 3.1). Only 35 percent of the workers in Blue Collar Occupations will have some college or better by 2018. Blue Collar will grow from 33.8 million jobs to 43.6 million jobs during the forecast period. But, like Sales and Office Support Occupations, it is shrinking as a share of all jobs: dropping from 23 percent to 21.4 percent (Figure 3.1).

Blue Collar does break with the pattern for large clusters in one way, though. Not only is it growing slowly, the number of new jobs it creates is small compared to similar clusters. Sales and Office Support Occupations is a comparable cluster: it ranks first in overall size, and grows slowly compared to other occupations. Still, it ranks second in the actual number of new jobs it creates. Blue Collar, meanwhile, is the second largest occupational cluster, but ranks eighth in overall new job creation.

FIGURE 3.1

Occupations with lower postsecondary concentration are declining as a share of total employment.*

Source: Authors' analysis of March CPS data, 2008; Center on Education and the Workforce forecast of educational demand to 2018



*Percentages indicate each cluster's share of total employment.

The Blue Collar Occupations include jobs in the Manufacturing; Construction; Natural Resources;[14] Installation and Repair; and Transportation industries. All of these have been hard hit by the Great Recession of 2007. Construction alone accounts for 20 percent of all job losses since the recession began. Because these industries have faced such steep declines in the recession, they will bounce back robustly in the short term as the recovery takes us back to normal levels of economic output.

The prospects for long-term growth among Blue Collar Occupations are not good. Over time these occupations will be significantly affected by automation, industry consolidation, and offshore competition. The effects of these forces will be to automate and send repetitive tasks offshore, and increase the requirements for skill and productivity in the jobs that remain.

FAST-GROWING OCCUPATIONS REQUIRE MORE WORKERS WITH HIGHER EDUCATION.

In contrast, consider these five occupational clusters:

- Managerial and Professional Office;
- Education;
- Healthcare Professional and Technical;
- Scientific, Technical, Engineering, Mathematic, and Social Sciences (STEM);
- Community Services and Arts.

These occupations, combined, show a strong bias in favor of workers with Bachelor's and Master's degrees or better. By 2018, they will be home to:

- Only 2 percent of the nation's high school dropouts;
- 10 percent of workers with high school diplomas, but no further education;
- 18 percent of workers with some college but no degree;
- 31 percent of workers with Associate' degrees;
- 56 percent of workers with Bachelor's degrees;
- 85 percent of workers with Master's degrees or better.

Although they are smaller overall, they are growing quickly, because virtually all of them tap into the new knowledge economy and are quickly creating new jobs to service it (Table 3.2). These occupations have high concentrations of workers with postsecondary education and training—ranging between 83 percent and 93 percent in 2008, and 87 percent and 95 percent in 2018. These five major clusters had 44.5 million jobs in 2008, a number that will climb to 50.5 million in 2018. Together, these occupations accounted for more than 30 percent of all jobs in 2008 and will account for 31 percent in 2018.

For sheer number of new jobs created, Managerial and Professional Office ranks third among our nine clusters; Healthcare Professional and Technical ranks fourth; Education ranks fifth; and STEM ranks sixth. In the fastest-growing category, Healthcare Professional ranks second; STEM ranks third; Community Services and Arts ranks fourth; and Education ranks fifth.

Table 3.3 shows the effects of occupational size on the number of jobs by different levels of educational attainment in 2018. The three largest occupational clusters produce larger numbers of jobs in every attainment category, except at the Master's degree level or better. The number of jobs at that level is dominated by the smaller but more postsecondary-intensive occupations.

Table 3.4, then, divides the educational requirements into their occupational shares, while Table 3.5 shows the combined effects of occupational size, growth, and postsecondary educational intensity. The three largest occupations are the Sales and Office Support; Blue Collar; and Food and Personal Services occupations.

The biggest occupational cluster, Sales and Office Support, has a large number of overall jobs and a significant number of postsecondary positions. Because of the combined effects of overall size and postsecondary intensity, Sales and Office Support Occupations rank first in the share of all workers with some college but no degree, Associate's degrees, and Bachelor's degrees.

Blue Collar and Food and Personal Services are the second and third largest occupational clusters (Table 3.3). Because of their size, they produce large numbers of postsecondary workers but have the two lowest shares of postsecondary workers.

In combination, by 2018 these three largest occupational clusters will include:

- 95 percent of the nation's high school dropouts;
- 86 percent of workers with high school diplomas, but no further education;
- 76 percent of workers who have some college but no degree;
- 64 percent of workers with Associate's degrees;
- 43 percent of workers with Bachelor's degrees;
- 14 percent of workers with Master's degrees or better.

Healthcare Support Occupations, meanwhile, are a category unto themselves. They contain 3.9 million jobs, which include the lower-skilled occupations in the healthcare industry. They are less than half the size of the larger and more highly educated Healthcare Professional and Technical Occupations and rank seventh overall in postsecondary intensity. But Healthcare Support also is the fastest-growing cluster, going from 3.9 million to 4.8 million jobs between 2008 and 2018. Still, because of its small scale, it will only rank seventh in total number of jobs added.

Figure 3.2 provides a summary of education requirements by occupation as of 2018.

TABLE 3.2

With the exception of Healthcare Support, the fastest-growing occupations have the highest concentration of postsecondary attainment.

Source: Authors' analysis of March CPS data, 2008; Center on Education and the Workforce forecast of educational demand through 2018

	2008		2018		Difference 2008–2018		Ranking	
OCCUPATIONS:	Total employment (thousands)	Rank	Total employment (thousands)	Rank	Change in employment (thousands)	Rate of growth: Percent change in employment	Largest growth	Fastest rate of growth
Sales and Office Support	40,503	1	43,543	1	3,040	8%	2	8
Blue Collar	33,800	2	34,641	2	842	2%	8	9
Food and Personal Services	24,552	3	27,996	3	3,443	14%	1	6
Managerial and Professional Office	16,186	4	17,684	4	1,498	9%	3	7
Education	8,956	5	10,234	5	1,278	14%	5	5
Healthcare Professional and Technical	7,352	6	8,813	6	1,461	20%	4	2
STEM	7,320	7	8,553	7	1,233	17%	6	3
Community Services and Arts	4,552	8	5,209	8	657	14%	9	4
Healthcare Support	3,879	9	4,826	9	947	24%	7	1
TOTAL	147,100		161,500		14,400	10%		

TABLE 3.3

The number of jobs by educational demand in 2018. (in thousands)

Source: Center on Education and the Workforce forecast of educational demand through 2018

	Total employment		High school dropouts		High dchool graduates		Some college, no degree		Associate's degree		Bachelor's degree		Master's degree or better	
OCCUPATIONS:	#	Rank	#	Rank	#	Rank	#	Rank	#	Rank	#	Rank	#	Rank
Sales and Office Support	43,543	1	2,326	3	12,838	2	10,909	1	5,902	1	10,070	1	1,499	5
Blue Collar	34,641	2	7,123	1	15,323	1	5,805	2	3,665	2	2,388	8	338	8
Food and Personal Services	27,996	3	5,312	2	10,376	3	5,176	3	2,954	3	3,706	4	472	7
Managerial and Professional Office	17,684	4	254	5	2,033	4	2,340	4	1,767	5	7,519	2	3,772	2
Education	10,234	5	60	6	654	7	826	7	675	8	3,906	3	4,113	1
Healthcare Professional and Technical	8,813	6	0	9	450	8	611	8	2,161	4	2,924	6	2,667	3
STEM	8,553	7	28	8	729	6	866	6	1,054	6	3,615	5	2,262	4
Community and Arts	5,209	8	41	7	411	9	584	9	526	9	2,521	7	1,126	6
Healthcare Support	4,826	9	316	4	1,650	5	1,316	5	1,015	7	433	9	95	9

TABLE 3.4

Educational demand across occupations in 2018.

Source: Center on Education and the Workforce forecast of educational demand through 2018

	Total employment		High school dropouts		High school graduates		Some college, no degree		Associate's degree		Bachelor's degree		Master's degree or better	
OCCUPATIONS:	% in Occ.	Rank	% in Occ.	Rank	% in Occ.	Rank	% in Occ.	Rank	% in Occ.	Rank	% in Occ.	Rank	% in Occ.	Rank
Sales and Office Support	27%	1	15%	3	29%	2	38%	1	30%	1	27%	1	9%	5
Blue Collar	21%	2	46%	1	34%	1	20%	2	19%	2	6%	8	2%	8
Food and Personal Services	17%	3	34%	2	23%	3	18%	3	15%	3	10%	4	3%	7
Managerial and Professional Office	11%	4	2%	5	5%	4	8%	4	9%	5	20%	2	23%	2
Education	6%	5	0%	6	1%	7	3%	7	3%	8	11%	3	25%	1
Healthcare Professional and Technical	5%	6	0%	9	1%	8	2%	8	11%	4	8%	6	16%	3
STEM	5%	7	0%	8	2%	6	3%	6	5%	6	10%	5	14%	4
Community and Arts	3%	8	0%	7	1%	9	2%	9	3%	9	7%	7	7%	6
Healthcare Support	3%	9	2%	4	4%	5	5%	5	5%	7	1%	9	1%	9
TOTAL	100%		100%		100%		100%		100%		100%		100%	

TABLE 3.5

Educational demand within occupations in 2018.

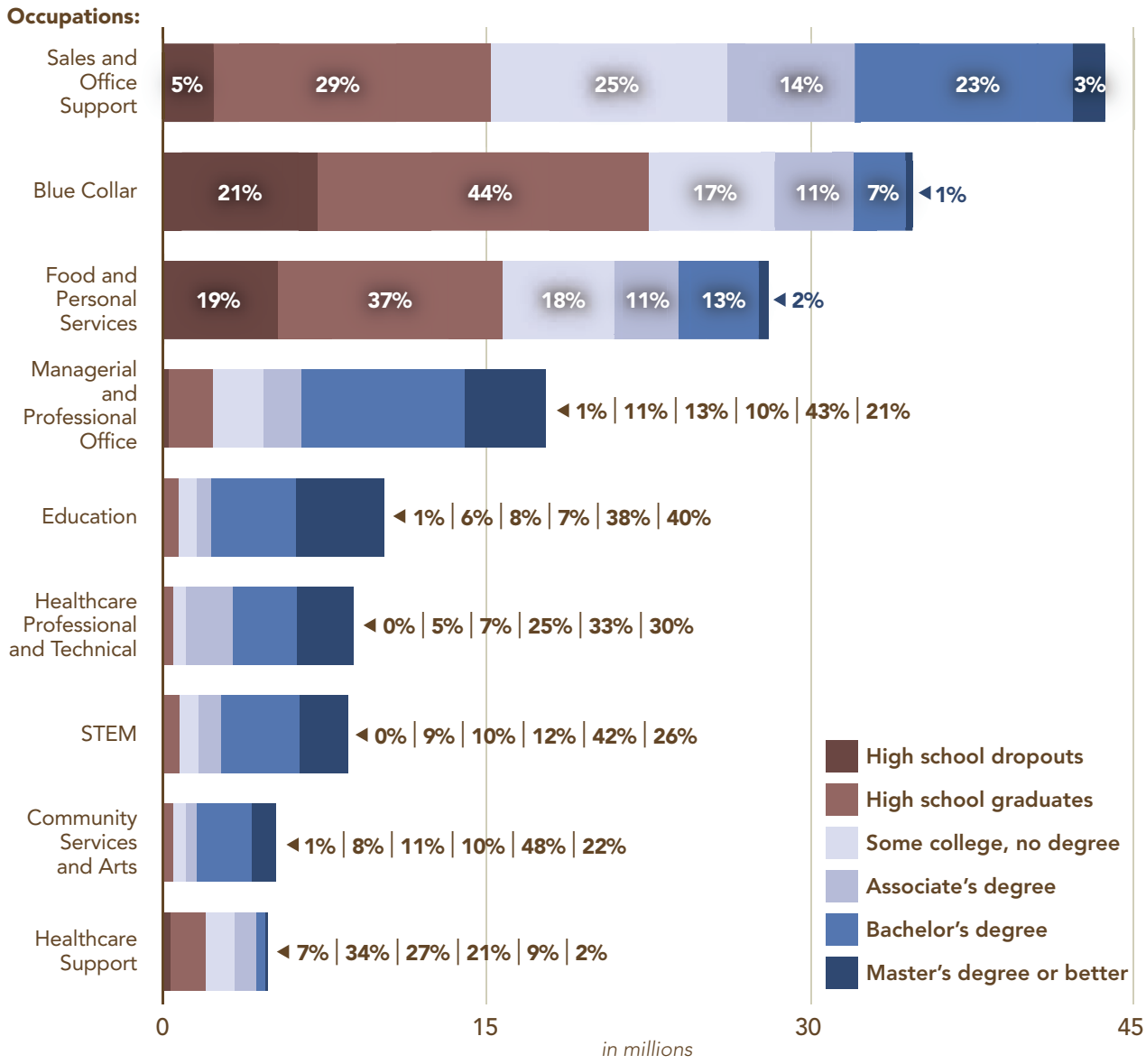
Source: Center on Education and the Workforce forecast of educational demand through 2018

	High school dropouts		High school graduates		Some college, no degree		Associate's degree		Bachelor's degree		Master's degree or better		
OCCUPATIONS:	% of Occ.	Rank	% of Occ.	Rank	% of Occ.	Rank	% of Occ.	Rank	% of Occ.	Rank	% of Occ.	Rank	Total
Blue Collar	21%	1	44%	1	17%	4	11%	5	7%	9	1%	9	100%
Food and Personal Services	19%	2	37%	2	18%	3	11%	6	13%	7	2%	8	100%
Healthcare Support	7%	3	34%	3	27%	1	21%	2	9%	8	2%	7	100%
Sales and Office Support	5%	4	29%	4	25%	2	14%	3	23%	6	3%	6	100%
Managerial and Professional Office	1%	5	11%	5	13%	5	10%	8	43%	2	21%	5	100%
Community and Arts	1%	6	8%	6	11%	6	10%	7	48%	1	22%	4	100%
Education	1%	7	6%	7	8%	8	7%	9	38%	4	40%	1	100%
STEM	0%	8	9%	8	10%	7	12%	4	42%	3	26%	3	100%
Healthcare Professional and Technical	0%	9	5%	9	7%	9	25%	1	33%	5	30%	2	100%
TOTAL	10%		28%		18%		12%		23%		10%		100%

FIGURE 3.2

Occupational employment in 2018 and educational demand within occupations.

Source: Center on Education and the Workforce forecast of educational demand through 2018



Occupations, Education, and Job Openings

As we noted in Part 2 of this report, there are two kinds of job openings. There are brand-new positions created as an occupation grows, and there are pre-existing jobs that people leave behind when they retire or move into other occupations. Together, as both kinds of positions become vacant, they create job openings, which represent the real number of new workers who will be required by a particular occupation.

Between 2008 and 2018 there will be just under 47 million job openings, which will include 14.4 million new and 32.4 million replacement jobs. Some 29.9 million of these openings—63 percent of the total—will require at least some college education (Table 3.6).

Even a cursory glance at the numbers show that the opportunities for workers at the bottom end of the educational attainment spectrum are becoming much more limited. Here is a cumulative look at how the 46.8 million openings will break down:

- 4.4 million, or 9 percent of the total, will be open to high school dropouts;
- 12.5 million, or 27 percent, will be open to workers with high school diplomas but no further education;
- 8.2 million, or 17 percent, will be open to workers with at least some college but no degree;
- 5.7 million, or 12 percent, will be open to workers with Associate's degrees;
- 11.1 million, or 24 percent, will be open to workers with Bachelor's degrees;
- 4.9 million, or 10 percent, will be open to workers with Master's degrees or better.

A closer look at occupations and job openings (Table 3.7) reveals some patterns. Generally, there are more job openings in the larger occupational categories and in the lower-skilled and lower-wage occupations. That is because most openings occur when workers leave an occupation, not when a new job is created. Occupations that employ large numbers of young workers—such as Retail Sales and Food and Personal Services—generate large numbers of job openings. That is because young people leave low-skilled and low-wage jobs as they gain education and move on in their careers. Replacement job openings diminish as workers move into higher-skilled and higher-wage jobs that they tend to keep until retirement. For example, among lawyers, there will be 1.5 replacement jobs for every new job between 2008 and 2018. In comparison, there will be 13 replacements for every new cashier job.

TABLE 3.6

Job openings for workers with some college or better in 2018. (in thousands)

Source: Center on Education and the Workforce forecast of educational demand through 2018

	Total job openings requiring Some college or better		Total job openings by 2018	Some college or better share of total job openings	Rank of Some college or better job openings	Growth rate of Some college or better job openings	
OCCUPATIONS:	#	Rank	#	%	Rank	%	Rank
Sales and Office Support	8,290	1	12,705	65%	6	20%	6
Food and Personal Services	4,559	2	10,211	45%	8	19%	8
Managerial and Professional Office	3,942	3	4,519	87%	5	24%	5
Education	2,793	4	3,003	93%	2	31%	4
Blue Collar	2,686	5	7,745	35%	9	8%	9
Healthcare Professional and Technical	2,635	6	2,777	95%	1	36%	1
STEM	2,611	7	2,831	92%	3	36%	2
Community Services and Arts	1,544	8	1,691	91%	4	34%	3
Healthcare Support	788	9	1,330	59%	7	20%	7
TOTAL	29,848		46,811	63%		20%	

TABLE 3.7

Share of jobs by educational demand in 2018. (in thousands)

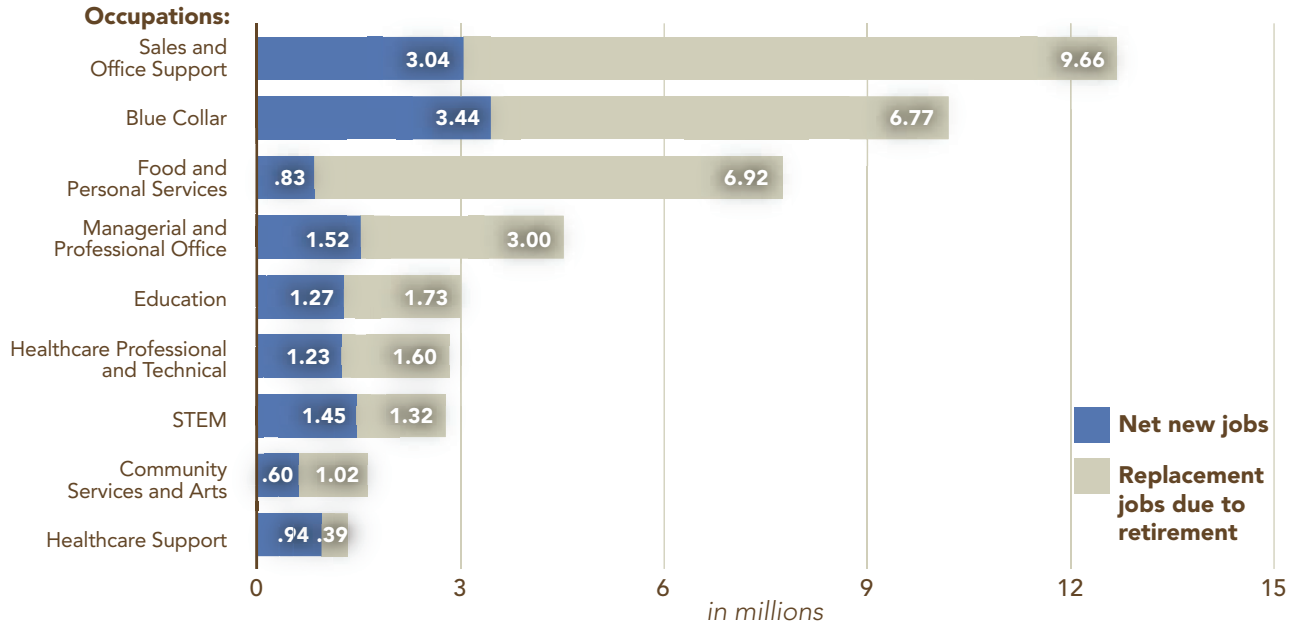
Source: Center on Education and the Workforce forecast of educational demand through 2018

OCCUPATIONS:	Total		High school dropout		High school graduate		Some college, no degree		Associate's degree		Bachelor's degree		Master's degree or better	
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank
Sales and Office Support	27%	1	16%	3	30%	2	38%	1	30%	1	27%	1	10%	5
Food and Personal Services	22%	2	43%	1	30%	1	23%	2	19%	2	12%	3	4%	7
Blue Collar	17%	3	37%	2	27%	3	16%	3	14%	3	5%	8	2%	8
Managerial and Professional Office	10%	4	1%	5	4%	4	7%	4	8%	5	17%	2	20%	2
Education	6%	5	0%	6	2%	7	3%	7	3%	8	10%	5	25%	1
STEM	6%	6	0%	8	2%	6	3%	6	6%	6	11%	4	16%	4
Healthcare Professional and Technical	6%	7	0%	9	1%	8	2%	8	12%	4	8%	6	17%	3
Community Services and Arts	4%	8	0%	7	1%	9	2%	9	3%	9	7%	7	7%	6
Healthcare Support	3%	9	2%	4	4%	5	4%	5	5%	7	1%	9	1%	9
TOTAL	100%		100%		100%		100%		100%		100%		100%	

FIGURE 3.3

New and replacement job openings and occupational distribution between 2008 and 2018.

Source: Authors' analysis of March CPS data, 2008; Center on Education and the Workforce forecast of educational demand to 2018



Job openings due to replacement needs tend to be important in declining or slow-growing occupations. Production occupations are a good example. Almost 350,000 jobs will disappear by 2018, but retirements and other departures will create more than 2 million openings. Postal workers are also a case in point. Some 70,000 positions in that category will disappear by 2018, but there will be more than 125,000 job openings to replace departed workers.

FIGURE 3.4

Total job openings and the distribution of educational demand within occupations.

Source: Center on Education and the Workforce forecast of educational demand through 2018

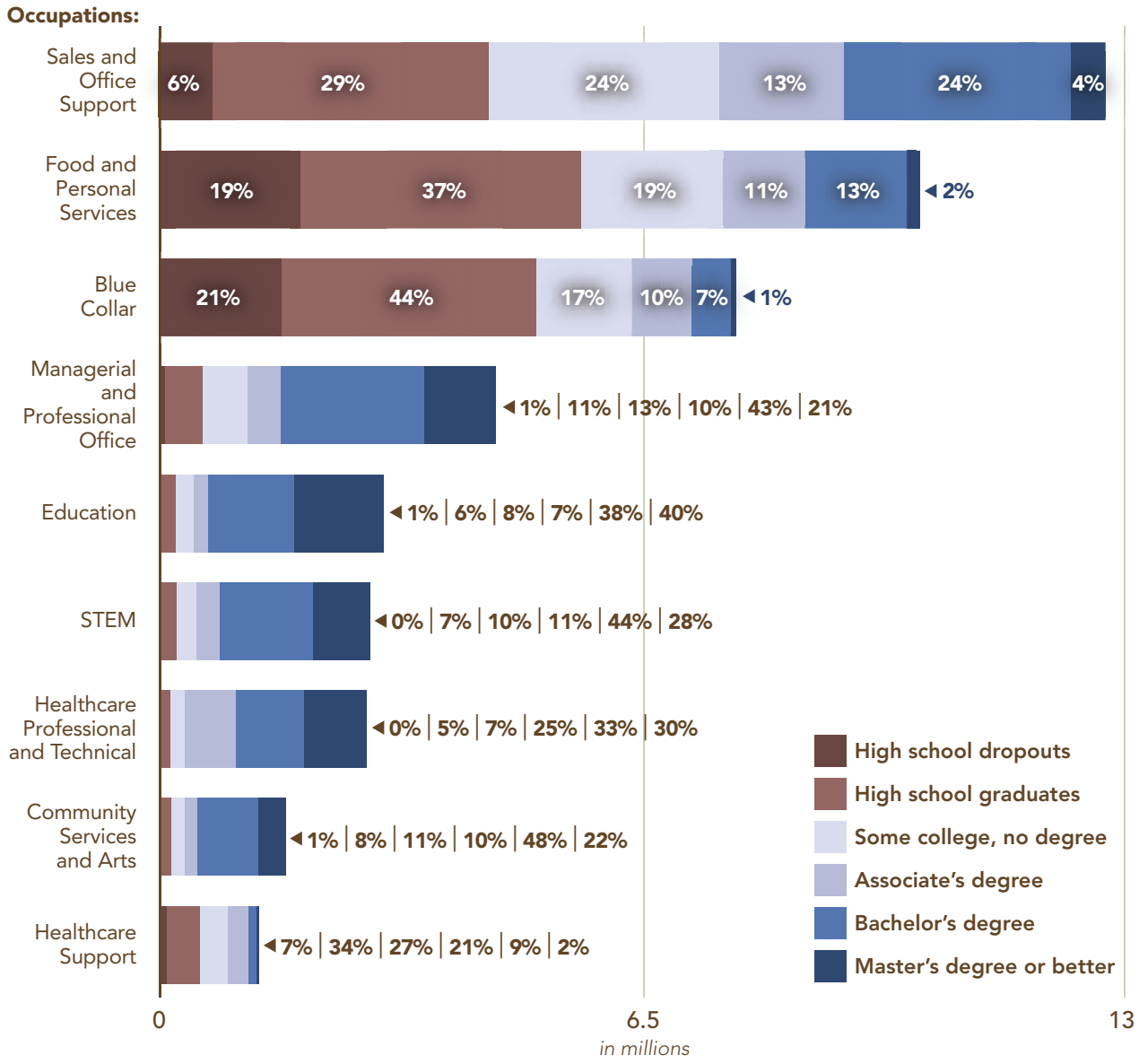


Figure 3.3 offers a graphic look at the importance of net new jobs versus replacement openings for our nine major occupational clusters. Sales and Office Support Occupations account for the largest growth in total job openings, but the ratio of new jobs to replacements is relatively low because of high turnover in cashier and retail clerk jobs. Much the same is true in Food and Personal Services Occupations, which have high concentrations of young people in lower-paid, lower-skilled positions.

In Blue Collar Occupations, too, the vast majority of openings come from replacement jobs. In fact, the ratio of replacement to new jobs is more than eight to one, the highest among the nine occupational categories. The ratio of new jobs to replacements is much closer in the highly skilled, smaller, and faster-growing occupations. In the two fastest-growing clusters—Healthcare Professional and Technical and Healthcare Support Occupations—new jobs actually exceed replacements.

Keeping the big picture trends in mind, we now will look at how job openings and education requirements will play out in a number of individual occupations. Figure 3.4 shows education requirements, by occupation, for job openings that we forecast will occur by 2018.

Sales and Office Support Occupations

- SALES OCCUPATIONS for example, cashiers, insurance agents, real estate brokers, and retail salespersons
- OFFICE AND ADMINISTRATIVE SUPPORT OCCUPATIONS for example, secretaries and administrative assistants, bookkeepers, and customer service representatives

This is the largest cluster of occupations we examined, and it will provide the biggest share of job openings between now and 2018.

The cluster breaks into two groups of occupations: sales positions, and office and administrative support positions. Together, they number about 40.5 million jobs—employing about 27.5 percent of the nation's 147 million workers—in 2008. By 2018, that number will be 43.5 million, about 27 percent of 162 million total workers. We forecast that Sales and Office Support Occupations will provide 12.7 million job openings between 2008 and 2018. That breaks down to 3 million net new jobs and 9.7 million openings to replace retiring workers.

More than half of all workers in the Sales and Office Support Occupations are concentrated in two industries—Wholesale and Retail Trade Services (38 percent) and Financial Services (14 percent). Between 2008 and 2018, jobs in these occupations will open across a full range of industries, but will again cluster in those two.

By 2018, Sales and Office Support Occupations will provide 8.3 million openings for people with at least some college education or better. In total, there will be openings for:

- 707,000 high school dropouts;
- 3.7 million high school graduates;
- 3.1 million workers with some college, but no degree;
- 1.7 million workers with Associate's degrees;
- 3.0 million workers with Bachelor's degrees;
- 468,000 workers with Master's degrees or better.

The share of workers in Sales and Office Support with at least some college or better increased from 47 percent in 1983 to 60 percent in 2008 and is projected to hit 66 percent in 2018. This set of occupations had the sixth-highest concentration of postsecondary workers in 2007 and will hold that overall position in 2018 as well.

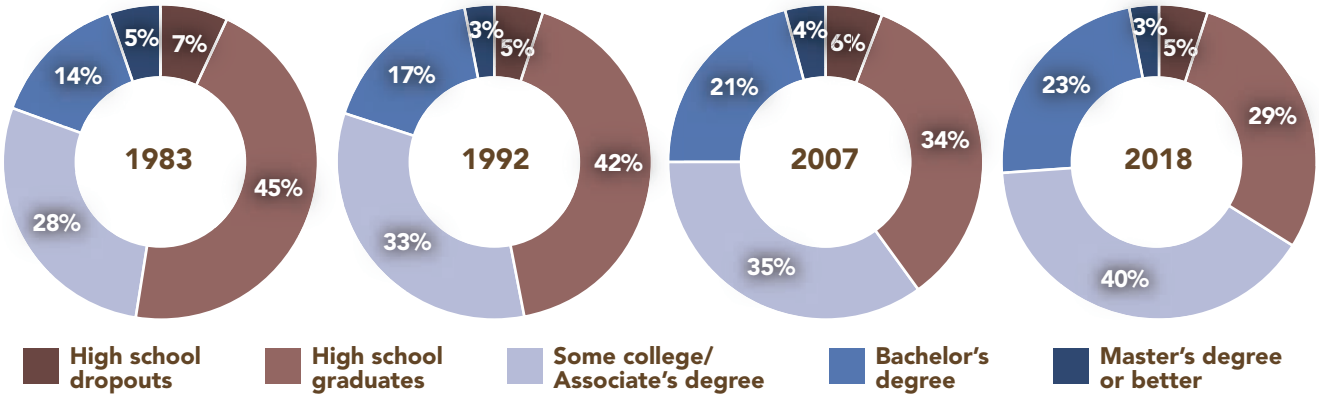
Sales and Office Support includes several positions with concentrations of postsecondary certificates, including:

- Travel Agents, 45 percent;
- Sales Representatives, 45 percent;
- Real Estate Agents, 40 percent;
- Procurement Clerks, 27 percent;
- Medical Secretaries, 21 percent.

FIGURE 3.5

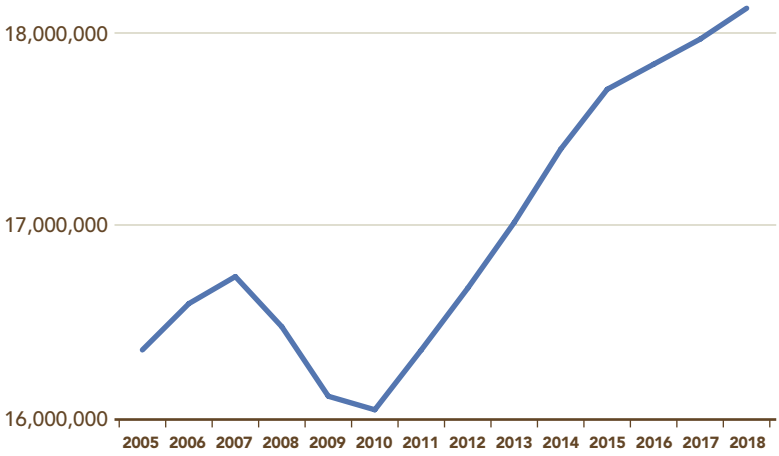
Educational Attainment in Sales and Office Support Occupations (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



SALES OCCUPATIONS

Sales Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	1,054,304	6%	1,262,629	7%
High school graduates	4,961,210	30%	4,948,653	27%
Some college	3,537,404	21%	3,698,190	20%
Associate's degree	1,609,994	10%	1,973,317	11%
Bachelor's degree	4,473,917	27%	5,307,133	29%
Master's degree	755,351	4.6%	832,121	5%
Professional degree	66,538	0.4%	67,789	0.4%
Doctorate degree	16,823	0.1%	37,627	0.2%

	National Employment Trends (2005–2018)		
	Sales and related occupations	Total	Percentage
2005	16,359,866	144,200,000	11.3%
2006	16,599,701	146,700,000	11.3%
2007	16,741,425	148,000,000	11.3%
2008	16,475,542	147,100,000	11.2%
2009	16,119,373	142,700,000	11.3%
2010	16,051,309	142,300,000	11.3%
2011	16,359,820	145,100,000	11.3%
2012	16,676,469	148,300,000	11.2%
2013	17,016,901	151,600,000	11.2%
2014	17,403,599	155,300,000	11.2%
2015	17,714,530	158,000,000	11.2%
2016	17,836,239	159,200,000	11.2%
2017	17,965,037	160,300,000	11.2%
2018	18,127,461	161,500,000	11.2%

[SOC 41-1011–SOC 41-9099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

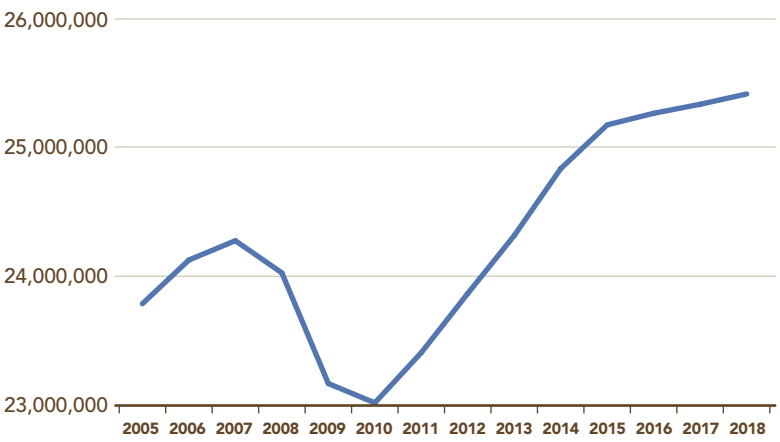
Sales occupations make up 11 percent of all the jobs in the U.S. economy. Employment in these positions follows increases and decreases in Gross Domestic Product (GDP) and consumer spending. Sales occupations were hard hit by the recession, both because of the general GDP decline and because of wealth lost when homes and 401(k) accounts plunged in value. The number of sales positions will grow with the recovery but will be constrained by lower rates of consumer spending for some time to come. In addition, computer technology is automating more and more of these jobs as we move toward e-commerce. New information-based technologies allow consumers to control and customize their interactions with retailers and wholesalers. Consumers can, for example, now perform routine bank transactions at any time of day, or buy products from retailers anywhere in the world through the Internet.[15] Even so, employers will still add sales workers to perform more highly skilled, nonroutine functions and transactions that technology cannot handle.

Educational attainment in Sales occupations is diverse and depends on the industry and the goods and services that are being sold. While more than half of the people in Sales occupations are relatively low-skilled cashiers and retail sales workers, the rest of these occupations are diverse in their educational profiles.[16] For example, the share of cashiers with a Bachelor's degree was 6 percent in 2007, with 4 percent having an Associate's degree, and 23 percent having some college education.

Sales occupations will provide 6.3 million total job openings between 2008 and 2018: 1.7 million net new jobs and 4.6 million openings from retirements. Some 4.2 million of these new and replacement jobs will require some college education or more. The largest proportion of workers hired for these positions (29 percent) will require a Bachelor's degree.

OFFICE AND ADMINISTRATIVE SUPPORT OCCUPATIONS

Office and Administrative Support Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	1,097,282	5%	1,063,847	4%
High school graduates	8,398,588	35%	7,889,573	31%
Some college	6,660,866	28%	7,210,360	28%
Associate's degree	3,065,300	13%	3,928,275	15%
Bachelor's degree	4,205,300	18%	4,762,528	19%
Master's degree	540,186	2.2%	471,802	2%
Professional degree	47,787	0.2%	76,714	0.3%
Doctorate degree	12,765	0.1%	12,557	0.05%

	National Employment Trends (2005–2018)		
	Office and administrative support occupations	Total	Percentage
2005	23,791,813	144,200,000	16.5%
2006	24,126,027	146,700,000	16.4%
2007	24,281,598	148,000,000	16.4%
2008	24,028,073	147,100,000	16.3%
2009	23,167,812	142,700,000	16.2%
2010	23,022,760	142,300,000	16.2%
2011	23,407,909	145,100,000	16.1%
2012	23,865,786	148,300,000	16.1%
2013	24,323,359	151,600,000	16.0%
2014	24,841,609	155,300,000	16.0%
2015	25,181,373	158,000,000	15.9%
2016	25,274,223	159,200,000	15.9%
2017	25,335,516	160,300,000	15.8%
2018	25,415,657	161,500,000	15.7%

[SOC 43-1011–SOC 43-9199]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Office and Administrative Support occupations make up 16 percent of all jobs. These occupations will continue to grow, especially in healthcare, but will slow in coming years as computer technology takes on more of the information storage and mail tasks that are part of many of these occupations. They will slip to 15.7 percent of the workforce by 2018 in part because of job losses among positions focused on information retrieval, storage, and transmission.

Among Office and Administrative Support occupations, educational attainment is roughly divided into 22 percent with a Bachelor's degree or better; 43 percent with some college or an Associate's degree; and 35 percent with a high school diploma or less. This pattern is driven by industry employment along an educational continuum. At the low end of the continuum are industries such as retail that tend to rely on sales workers with high school or less. At the other end are industries such as finance that rely on sales workers with postsecondary educations.

The education profile among Administrative Support occupations is heavily weighted toward the "high school or less" end of the continuum. More than 60 percent of Administrative Support jobs are held by people with a high school education or less, with some notable exceptions. Some 20 percent of the 24 million office support workers had Bachelor's degrees or higher in 2008. Stereotypes fall when we look closely, for instance, at Secretaries and Administrative Assistants—1.2 million of these workers have postsecondary degrees, and 47 percent have Bachelor's degrees and higher.

Office and Administrative Support occupations will provide 6.4 million total job openings between 2008 and 2018: 1.4 million net new jobs and 5 million retirement openings. Some 4.1 million of these new and replacement jobs will require some college education or more, with the largest proportion (31 percent) requiring only a high school diploma.

Blue Collar Occupations

- FARMING, FISHING, AND FORESTRY OCCUPATIONS
- CONSTRUCTION AND EXTRACTION OCCUPATIONS for example, carpenters, laborers, electricians, and miners
- INSTALLATION, MAINTENANCE, AND REPAIR OCCUPATIONS for example, mechanics and HVAC technicians
- PRODUCTION OCCUPATIONS for example, assembly workers, machinists, welders, and inspectors
- TRANSPORTATION AND MATERIAL MOVING OCCUPATIONS for example, bus and truck drivers, taxi drivers, and service station attendants

Blue Collar jobs are the second-largest occupational cluster and will provide the third-largest share of job openings between 2008 and 2018. In 2008, this cluster included 33.8 million jobs, or 23 percent of all positions. Blue Collar's share of all jobs will decline by about 1.6 percent between 2008 and 2018, but it will still add roughly 800,000 net new positions over the decade.

Blue Collar Occupations are highly concentrated: more than 80 percent are in five industries. Four of these are in goods production and one—Transportation and Utilities—is a service industry. Blue Collar Occupations are distributed among these industries as follows:

- Manufacturing industries, 29.1 percent;
- Construction, 27.6 percent;
- Transportation and Utilities, 12.4 percent;
- Wholesale and Retail Trade, 10 percent;
- Natural Resources, 3.9 percent.

Blue Collar positions are a majority of the jobs in all but one of these industries: Wholesale and Retail Trade. Two of these industries will decline in size, according to our projections: Manufacturing and Natural Resources. With the exception of Wholesale and Retail Trade, industries where Blue Collar Occupations are concentrated tend to rank in the bottom half for growth in total job openings among the 13 industry groups we examined for this forecast.

Blue Collar Occupations will provide nearly 7.8 million job openings between 2008 and 2018, including roughly 830,000 net new jobs and 6.9 million openings to replace retirees. Those openings will include 2.7 million for people with at least some college or better. In total, there will be job openings for:

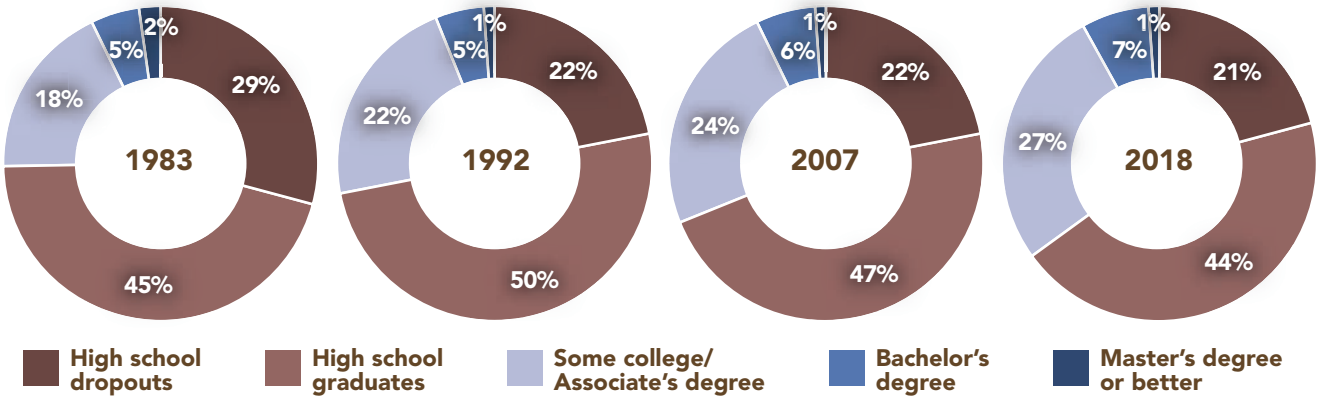
- 1.6 million high school dropouts;
- 3.4 million high school graduates;
- 1.3 million workers with some college but no degree;
- 800,000 workers with Associate's degrees;
- 526,000 workers with Bachelor's degrees;
- 74,000 workers with Master's degrees or better.

Whether or not Blue Collar Occupations require postsecondary education depends to some extent on the industry where they reside. Only 18 percent of the workers in Blue Collar positions in Natural Resources—where most jobs are Blue Collar—have at least some college or better. In the other three industries where most jobs fit the Blue Collar category, the share of workers with at least some college education tops 30 percent—but these shares are still well below the norms of other occupations and industries. On the whole, Blue Collar Occupations are still dominated by positions that require high

FIGURE 3.6

Educational Attainment in Blue Collar Occupations (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

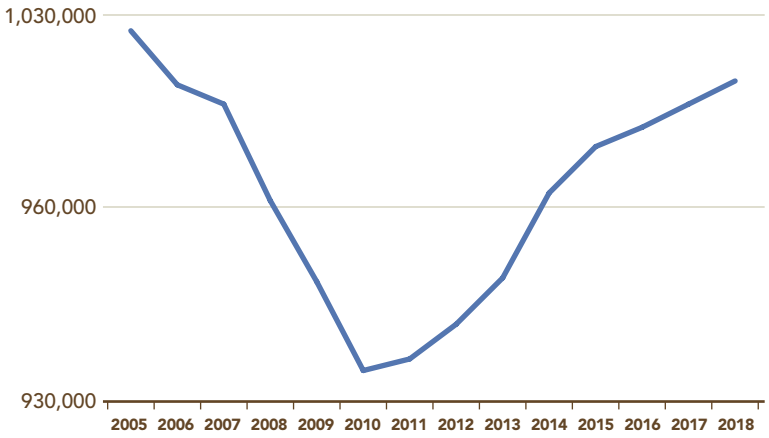


school or less. In 1983, 75 percent of Blue Collar workers had high school educations or less. That number had dropped to 69 percent by 2007, and we project that it will fall to 65 percent by 2018.

Prospects for growth in employment and demand for postsecondary education differ among the various segments of the Blue Collar occupational cluster. In the following pages, we will take a more detailed look at some of those segments.

FARMING, FISHING, AND FORESTRY OCCUPATIONS

Farming, Fishing, and Forestry Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	482,713	49%	601,762	59%
High school graduates	330,769	34%	319,140	31%
Some college	94,807	10%	34,999	3%
Associate's degree	23,294	2%	32,152	3%
Bachelor's degree	32,845	3%	22,504	2%
Master's degree	4,996	0.5%	-	0%
Professional degree	12,769	1.3%	2,390	0.2%
Doctorate degree	-	0.0%	1,004	0.1%

	National Employment Trends (2005–2018)		
	Farming, fishing, and forestry occupations	Total	Percentage
2005	1,026,222	144,200,000	0.7%
2006	1,012,263	146,700,000	0.7%
2007	1,007,047	148,000,000	0.7%
2008	982,193	147,100,000	0.7%
2009	961,523	142,700,000	0.7%
2010	938,389	142,300,000	0.7%
2011	941,136	145,100,000	0.6%
2012	950,150	148,300,000	0.6%
2013	962,490	151,600,000	0.6%
2014	984,090	155,300,000	0.6%
2015	996,622	158,000,000	0.6%
2016	1,001,589	159,200,000	0.6%
2017	1,007,221	160,300,000	0.6%
2018	1,013,951	161,500,000	0.6%

[SOC 45-1099–SOC 45-4029]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

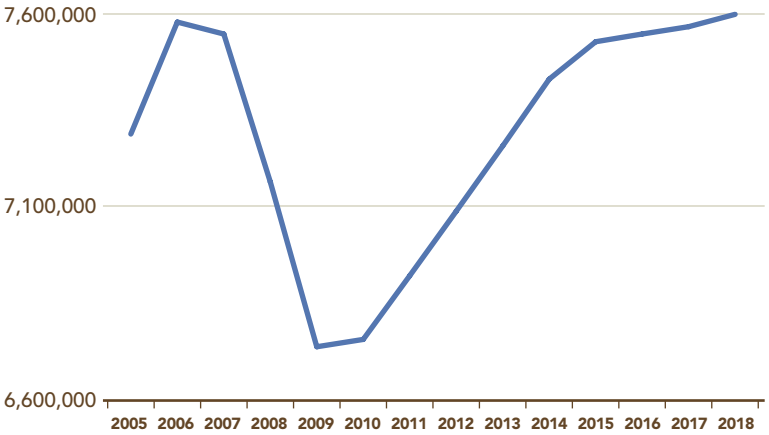
Farming, Fishing, and Forestry occupations represent less than a single percent of all U.S. jobs, roughly 1 million positions. The category's share of the workforce will not grow, either—although it will generate more than 270,000 job openings between 2008 and 2018.

In 2008, 83 percent of Farming, Fishing, and Forestry occupations required no more than a high school education. These occupations employed the highest share of high school dropouts among major occupation groups, and that share will increase to almost 90 percent by 2018. Roughly a third of the jobs in Farming, Fishing, and Forestry will require a high school degree, and less than 10 percent will require some college or better.

Farming, Fishing, and Forestry occupations will provide 272,000 total job openings between 2008 and 2018: 32,000 net new jobs and 240,000 from retirements. About 9 percent of these positions will require some college or more, with the largest proportion (59 percent) not even requiring a high school diploma.

CONSTRUCTION AND MINING OCCUPATIONS

Construction and Extraction Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	1,851,243	26%	2,270,189	30%
High school graduates	3,254,081	45%	3,203,355	42%
Some college	1,031,542	14%	956,306	13%
Associate's degree	558,630	8%	672,387	9%
Bachelor's degree	394,963	6%	422,769	6%
Master's degree	55,176	0.8%	58,563	1%
Professional degree	10,123	0.1%	11,120	0.1%
Doctorate degree	16,823	0.1%	37,627	0.2%

	National Employment Trends (2005–2018)		
	Construction and extraction occupations	Total	Percentage
2005	7,290,931	144,200,000	5.1%
2006	7,580,093	146,700,000	5.2%
2007	7,549,370	148,000,000	5.1%
2008	7,166,715	147,100,000	4.9%
2009	6,739,863	142,700,000	4.7%
2010	6,758,655	142,300,000	4.7%
2011	6,923,441	145,100,000	4.8%
2012	7,090,679	148,300,000	4.8%
2013	7,259,628	151,600,000	4.8%
2014	7,432,747	155,300,000	4.8%
2015	7,529,505	158,000,000	4.8%
2016	7,549,212	159,200,000	4.7%
2017	7,568,620	160,300,000	4.7%
2018	7,600,333	161,500,000	4.7%

[SOC 47-1011–SOC 47-5099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Construction and Mining occupations account for about 5 percent of overall U.S. employment. Growth prospects for output and employment in Construction are strong, but much less robust for Mining.

Construction was hard hit by the recession. While the industry accounts for 6 percent of the nation's workers, some 20 percent of the jobs lost during this recession have come from the Construction industry. Because Construction has been particularly hard hit and many projects were canceled or put on hold, there will be growing pent-up demand for new housing and other structures. This backlog, plus demands for new infrastructure, will trigger a strong recovery in the industry.

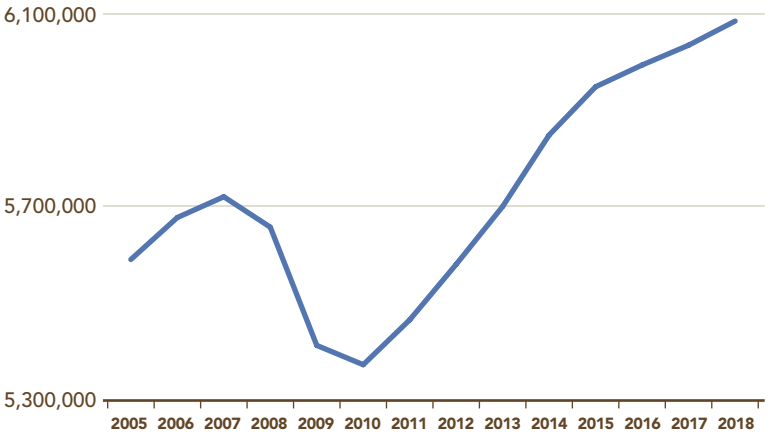
Employment in Mining occupations, except coal, is expected to decline by more than 10 percent between 2008 and 2018. This forecast is consistent with ongoing trends in the mining industry. With the exception of coal mining, employment in the industry is expected to drop as prices for oil, gas, and other fuel stabilize over the next decade, barring major supply interruptions. In addition, technology changes will continue to automate mining processes and occupational tasks.

In 2008, a quarter of the jobs in Construction and Mining occupations were open to high school dropouts, and that should increase to almost a third by 2018. More than 40 percent of the jobs in these occupations will be open to high school graduates and roughly a third will go to people with at least some college or better. Only about 6 percent of workers in these occupations have Bachelor's degrees, and they tend to be concentrated in occupations such as Building Inspectors.

Construction and Mining occupations will provide 1.8 million total job openings between 2008 and 2018: 437,000 net new jobs and 1.4 million openings from retirements. Some 517,000 of these new and replacement jobs will require some college or more, with the largest proportion (42 percent) requiring a high school diploma.

INSTALLATION, MAINTENANCE, AND REPAIR OCCUPATIONS

Installation, Maintenance, and Repair Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	611,611	10%	594,747	10%
High school graduates	2,459,025	42%	2,494,579	41%
Some college	1,154,468	20%	1,151,003	19%
Associate's degree	1,154,468	20%	1,259,531	21%
Bachelor's degree	422,658	7%	521,128	9%
Master's degree	26,664	0.5%	49,338	1%
Professional degree	7,924	0.1%	12,416	0.2%
Doctorate degree	9,770	0.2%	3,617	0.1%

	National Employment Trends (2005–2018)		
	Installation, maintenance, and repair occupations	Total	Percentage
2005	5,592,705	144,200,000	3.9%
2006	5,679,474	146,700,000	3.9%
2007	5,722,412	148,000,000	3.9%
2008	5,659,795	147,100,000	3.8%
2009	5,414,906	142,700,000	3.8%
2010	5,374,534	142,300,000	3.8%
2011	5,467,942	145,100,000	3.8%
2012	5,582,107	148,300,000	3.8%
2013	5,702,831	151,600,000	3.8%
2014	5,850,706	155,300,000	3.8%
2015	5,950,984	158,000,000	3.8%
2016	5,995,079	159,200,000	3.8%
2017	6,036,395	160,300,000	3.8%
2018	6,086,360	161,500,000	3.8%

[SOC 49-1011–SOC 49-9099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Installation, Maintenance, and Repair occupations account for 3.8 percent of overall U.S. employment. This statistic is constant throughout the forecast horizon as these occupations grow at a steady rate compared to overall job growth. Currently, about 10 percent of people in these occupations are high school dropouts.

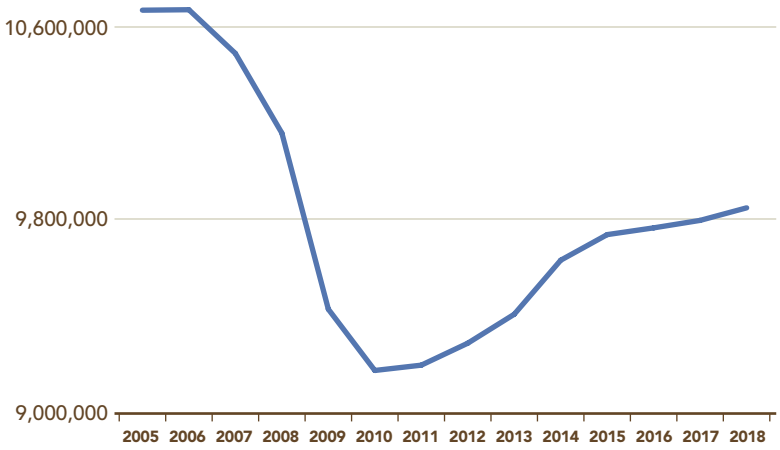
Educational attainment in Installation and Repair is almost equally distributed between high school (42 percent) and some college and Associate's degrees (40 percent), while 7 percent of workers in these jobs have Bachelor's degrees.

These occupations provide about 3 percent of the total new and replacement jobs we forecast. The largest proportion (41 percent) of new and replacement workers in Installation, Maintenance, and Repair occupations will be those with high school diplomas.

Installation, Maintenance, and Repair occupations will provide 1.3 million total job openings between 2008 and 2018: 424,000 net new jobs and 919,000 openings from retirements. About 662,000 of these jobs will require some college or more.

PRODUCTION OCCUPATIONS

Production Occupations (2005–2018)



	National Employment Trends (2005–2018)		
	Production occupations	Total	Percentage
2005	10,671,900	144,200,000	7.4%
2006	10,673,845	146,700,000	7.3%
2007	10,492,568	148,000,000	7.1%
2008	10,162,411	147,100,000	6.9%
2009	9,432,569	142,700,000	6.6%
2010	9,178,914	142,300,000	6.5%
2011	9,200,252	145,100,000	6.3%
2012	9,291,796	148,300,000	6.3%
2013	9,411,784	151,600,000	6.2%
2014	9,635,298	155,300,000	6.2%
2015	9,741,229	158,000,000	6.2%
2016	9,769,304	159,200,000	6.1%
2017	9,800,120	160,300,000	6.1%
2018	9,852,642	161,500,000	6.1%

	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	1,918,461	19%	1,826,073	19%
High school graduates	4,777,230	47%	4,330,386	44%
Some college	1,846,693	18%	1,790,156	18%
Associate's degree	823,849	8%	1,041,464	11%
Bachelor's degree	679,864	7%	751,142	8%
Master's degree	94,245	1%	95,535	1%
Professional degree	8,725	0.1%	8,988	0.1%
Doctorate degree	13,343	0.1%	8,898	0.1%

[SOC 51-1011–SOC 51-9199]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Production occupations account for 6.9 percent of overall employment, although that will fall to 6.1 percent by 2018, representing a net loss of 300,000 jobs.

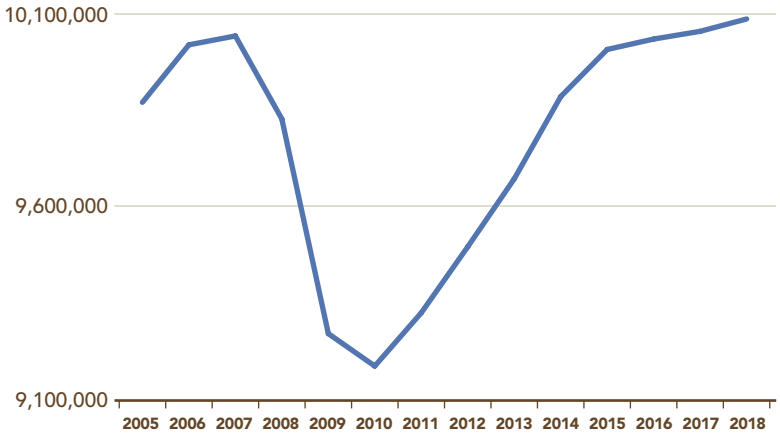
The recession has been catastrophic for this sector. To date, 30 percent of the nation's net job losses have been in Manufacturing, principally in production occupations. The deep impact of the recession on manufacturing will be followed by an initial recovery that will increase production jobs, but growth will then slow as the economy returns to its longer-term declining trend.

Almost 20 percent of jobs in Production occupations go to high school dropouts, while about 47 percent—the largest concentration—goes to high school graduates. An additional 26 percent of workers in these occupations have some college or an Associate's degree, and about 8 percent have a Bachelor's degree.

Production occupations will provide 1.8 million total job openings between 2008 and 2018, a loss of 317,000 net new jobs plus 2.1 million openings from retirements. About 668,000 of those positions will require some college or more, with the largest proportion (44 percent) requiring a high school diploma.

TRANSPORTATION AND MATERIAL MOVING OCCUPATIONS

Transportation and Material Moving Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	1,893,742	19%	1,829,827	18%
High school graduates	4,784,851	49%	4,975,347	49%
Some college	1,942,884	20%	1,873,010	19%
Associate's degree	535,586	5%	659,410	7%
Bachelor's degree	573,951	6%	670,140	7%
Master's degree	85,530	1%	55,931	1%
Professional degree	7,867	0.1%	19,428	0.2%
Doctorate degree	4,610	0.05%	5,026	0.05%

	National Employment Trends (2005–2018)		
	Transportation and material moving occupations	Total	Percentage
2005	9,872,217	144,200,000	6.8%
2006	10,021,093	146,700,000	6.8%
2007	10,044,425	148,000,000	6.8%
2008	9,829,021	147,100,000	6.7%
2009	9,273,801	142,700,000	6.5%
2010	9,189,770	142,300,000	6.5%
2011	9,327,780	145,100,000	6.4%
2012	9,498,546	148,300,000	6.4%
2013	9,674,881	151,600,000	6.4%
2014	9,887,129	155,300,000	6.4%
2015	10,009,468	158,000,000	6.3%
2016	10,036,610	159,200,000	6.3%
2017	10,056,331	160,300,000	6.3%
2018	10,088,120	161,500,000	6.2%

[SOC 53-1011–SOC 53-7199]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Transportation and Material Moving occupations tend to rise and fall with economic output and consumption—especially for goods. As the economy grows and demand for goods increases, truck drivers, pilots, and other transport occupations increase employment in order to move products to institutions and consumer outlets. In 2008, these occupations included 9.8 million positions, or 7 percent of all the jobs in the United States. Over the next decade, Transportation and Material Moving will grow by more than 250,000 positions, but decline slightly as a share of all jobs, due to faster growth in other occupations.

Almost 20 percent of jobs in Transportation and Material Moving will be accessible to high school dropouts between 2008 and 2018. Another 49 percent will be accessible to high school graduates, while roughly a quarter will go to workers with some college education or Associate's degrees.

Occupations in this category will provide 2.5 million total job openings between 2008 and 2018: 254,000 net new jobs and 2.2 million openings from retirements. About one-third of these jobs will require some college or more, with the largest proportion (49 percent) requiring a high school diploma.

Food and Personal Services Occupations

- FOOD PREPARATION AND SERVING OCCUPATIONS for example, cooks, waiters, and waitresses
- PERSONAL CARE OCCUPATIONS for example, personal and home care aides, child care workers, and hairdressers and cosmetologists
- BUILDING AND GROUNDS CLEANING AND MAINTENANCE OCCUPATIONS for example, maids, janitors, and groundskeepers
- PROTECTIVE SERVICE OCCUPATIONS for example, firefighters, police officers, correctional officers, and security guards

The Food and Personal Services Occupations are the third-largest of our occupational clusters, and will provide the second-largest share of job openings through 2018. This cluster includes 24.6 million positions, or 16.7 percent of all jobs in the economy. These occupations generally have low educational attainment and, to some extent, are overstated in the data because there is so much turnover and so many are part-time. Many are first jobs that people take while they are in school, or temporary stepping-stones toward better-paying jobs in more skilled occupations. Nonetheless, Food and Personal Services will grow to 28 million jobs by 2018, increasing its number of positions by 3.4 million and its share of all jobs to 17.3 percent.

This cluster is forecast to produce 10.2 million job openings between 2008 and 2018—about 3.4 million net new jobs and an additional 6.8 million replacement openings. About 53 percent of all workers in these occupations are concentrated in the Leisure and Hospitality industry, with an additional 18 percent in Healthcare Services and 15 percent in Personal Services. Job openings in Food and Personal Services Occupations between 2008 and 2018 will provide 4.6 million openings for people with at least some college or better. In total, there will be jobs for:

- 1.9 million high school dropouts;
- 3.8 million high school graduates;
- 1.9 million workers with some college but no degree;
- 1.1 million workers with Associate's degrees;
- 1.3 million workers with Bachelor's degrees;
- 173,000 workers with Master's degrees or better.

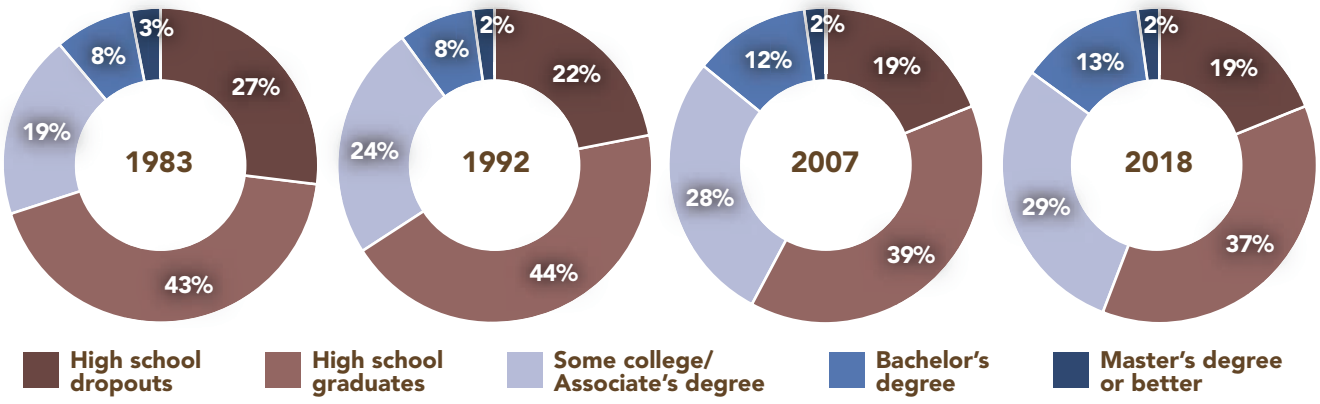
The share of workers with at least some college education or better in these occupations increased from 30 percent in 1983 to 42 percent in 2007 and is projected to increase to 44 percent in 2018. Food and Personal Services had the eighth-highest concentration of postsecondary workers out of nine occupational clusters in 2008, and it will hold that position in 2018.

On the following pages, we will examine some of the specific categories of jobs that make up the Food and Personal Services Occupations cluster.

FIGURE 3.7

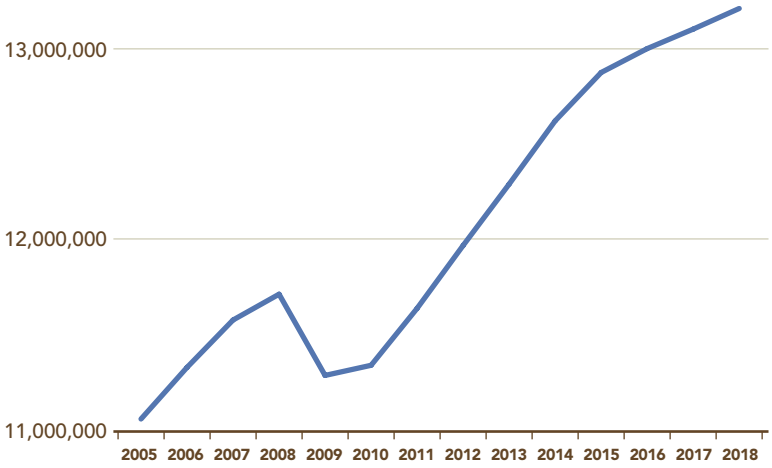
Educational Attainment in Food and Personal Services Occupations (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



FOOD PREPARATION AND SERVING OCCUPATIONS

Food Preparation and Serving Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	2,636,232	22%	2,852,248	22%
High school graduates	4,882,079	42%	5,274,378	40%
Some college	2,139,776	18%	2,356,779	18%
Associate's degree	811,118	7%	1,167,538	9%
Bachelor's degree	1,121,891	10%	1,418,252	11%
Master's degree	95,156	1%	84,243	1%
Professional degree	21,751	0.2%	27,939	0.2%
Doctorate degree	10,095	0.1%	31,756	0.2%

	National Employment Trends (2005–2018)		
	Food preparation and serving occupations	Total	Percentage
2005	11,065,766	144,200,000	7.7%
2006	11,335,863	146,700,000	7.7%
2007	11,583,113	148,000,000	7.8%
2008	11,718,098	147,100,000	8.0%
2009	11,293,777	142,700,000	7.9%
2010	11,346,837	142,300,000	8.0%
2011	11,644,312	145,100,000	8.0%
2012	11,973,361	148,300,000	8.1%
2013	12,294,233	151,600,000	8.1%
2014	12,625,381	155,300,000	8.1%
2015	12,878,944	158,000,000	8.2%
2016	13,003,918	159,200,000	8.2%
2017	13,105,806	160,300,000	8.2%
2018	13,213,133	161,500,000	8.2%

[SOC 35-1011–SOC 35-9099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

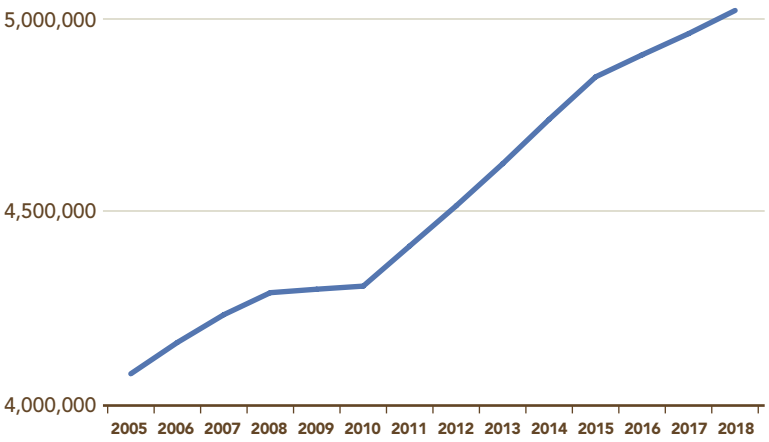
During the recession, jobs in this occupational group have been affected in two ways. They have declined overall, and they also shifted from higher-cost restaurants to fast food establishments as people have cut back on spending while they weather the financial crisis. As the recovery gains momentum, however, the ongoing shift from cooking at home to buying prepared foods and eating out will continue to grow.

Food Preparation and Serving occupations provide low-wage and low-skilled jobs, and the distribution of postsecondary attainment will remain stable in this group between 2008 and 2018. More than 20 percent of incumbents will continue to be high school dropouts and another 40 percent will be high school graduates. Slightly less than 20 percent will have some college education, while the number with Associate's degrees will grow a bit, from 7 percent to 9 percent. Employees with Bachelor's degrees or better will stay at roughly 12 percent of the total.

This occupational category will provide 5.3 million total job openings between 2008 and 2018, with 1.5 million net new jobs and 3.8 million openings from retirements. Some 2 million of these jobs will require some college or more, with the largest proportion (40 percent) requiring a high school diploma.

PERSONAL CARE AND SERVICE OCCUPATIONS

Personal Care and Service Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	472,853	11%	560,528	11%
High school graduates	1,578,380	37%	1,615,320	32%
Some college	913,198	21%	1,030,340	21%
Associate's degree	515,800	12%	824,663	16%
Bachelor's degree	689,683	16%	868,939	17%
Master's degree	114,824	2.7%	107,220	2%
Professional degree	8,218	0.2%	16,717	0.3%
Doctorate degree	-	0%	-	0%

	National Employment Trends (2005–2018)		
	Personal care and service occupations	Total	Percentage
2005	4,082,320	144,200,000	2.8%
2006	4,163,863	146,700,000	2.8%
2007	4,235,496	148,000,000	2.9%
2008	4,292,956	147,100,000	2.9%
2009	4,301,383	142,700,000	3.0%
2010	4,309,362	142,300,000	3.0%
2011	4,413,258	145,100,000	3.0%
2012	4,517,510	148,300,000	3.0%
2013	4,626,713	151,600,000	3.1%
2014	4,741,420	155,300,000	3.1%
2015	4,851,432	158,000,000	3.1%
2016	4,908,062	159,200,000	3.1%
2017	4,963,027	160,300,000	3.1%
2018	5,023,726	161,500,000	3.1%

[SOC 39-1011–SOC 39-9099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

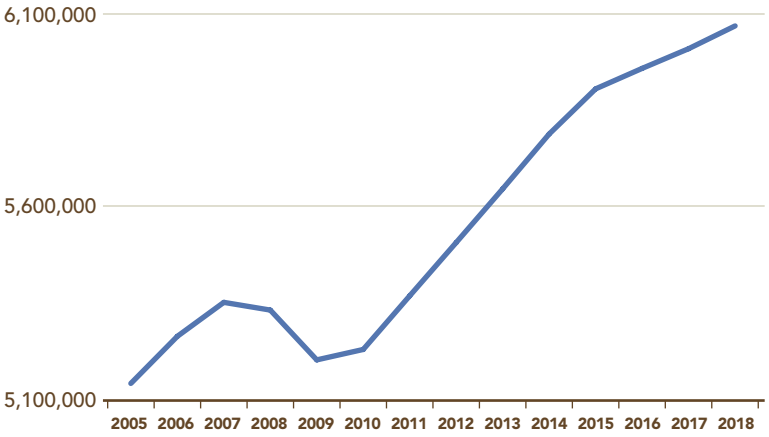
Personal Care occupations account for about 3 percent of overall jobs and will grow by more than 700,000 positions through 2018. Growth in these occupations is influenced by demography, as services for dependent populations increase. Almost 400,000 of the new jobs will come from increases in home care aides as elderly Baby Boomers require more assistance at home. At the other end of the demography spectrum, more than 150,000 jobs will result from the expansion of preschool services for children. The demographic demand for growth in Personal Care occupations has provided some protection against the Great Recession of 2007. The extent of job losses in these occupations has been mild compared to other occupations requiring similar education levels, thus making Personal Care and Services fairly recession proof.

Postsecondary education and training over the forecast period are projected to climb in these occupations. The share of jobs available to people with high school diplomas or less will decline slightly, from 48 percent to 43 percent, while the share with some college or an Associate's degree will increase by 4 percent.

Personal Care will provide 1.9 million total job openings between 2008 and 2018: 735,000 net new jobs and 1.1 million job openings from retirements. Some 1.1 million of these positions will require some college or more, with the largest proportion (32 percent) requiring a high school diploma.

BUILDING AND GROUNDS CLEANING AND MAINTENANCE OCCUPATIONS

Building and Grounds Cleaning and Maintenance Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	1,598,306	30%	1,864,141	31%
High school graduates	2,405,075	45%	2,687,729	44%
Some college	679,027	13%	735,373	12%
Associate's degree	264,816	5%	317,370	5%
Bachelor's degree	325,414	6%	404,503	7%
Master's degree	51,335	1%	53,629	1%
Professional degree	4,681	0.1%	2,717	0.04%
Doctorate degree	5,958	0.1%	5,156	0.1%

	National Employment Trends (2005–2018)		
	Building and grounds cleaning and maintenance occupations	Total	Percentage
2005	5,144,407	144,200,000	3.6%
2006	5,266,670	146,700,000	3.6%
2007	5,354,647	148,000,000	3.6%
2008	5,334,612	147,100,000	3.6%
2009	5,205,019	142,700,000	3.6%
2010	5,232,631	142,300,000	3.7%
2011	5,371,565	145,100,000	3.7%
2012	5,509,480	148,300,000	3.7%
2013	5,648,808	151,600,000	3.7%
2014	5,790,195	155,300,000	3.7%
2015	5,907,558	158,000,000	3.7%
2016	5,960,511	159,200,000	3.7%
2017	6,011,563	160,300,000	3.8%
2018	6,070,619	161,500,000	3.8%

[SOC 37-1011–SOC 37-3019]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

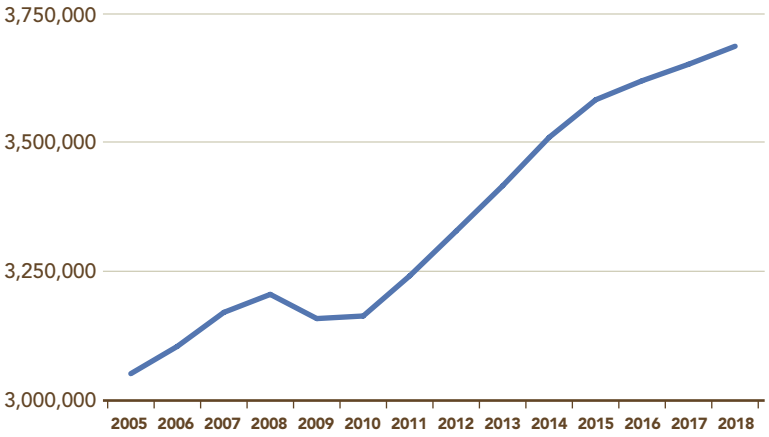
Building and Grounds Cleaning and Maintenance occupations currently account for 3.6 percent of all jobs, but that percentage will increase to 3.8 percent in 2018 as it adds more than 700,000 new positions. Growth will be driven by increasing public and private construction and the growing tendency for households to contract out building and grounds maintenance.

Other than Farming, Fishing, and Forestry, where high school dropouts currently represent 48 percent of the workforce, Building and Grounds Cleaning and Maintenance occupations have the highest share of dropouts, at roughly 30 percent. About 45 percent of the workers in this category will continue to hold high school degrees over the decade; 12 percent will hold Associate's degrees and 7 percent will hold Bachelor's degrees or better.

Building and Grounds Cleaning and Maintenance will provide 1.7 million total job openings between 2008 and 2018: 740,000 net new jobs and 955,000 openings from retirements. Some 424,000 of these new and replacement jobs will require some college or more. The largest proportion (44 percent) will require a high school diploma.

PROTECTIVE SERVICES OCCUPATIONS

Protective Services Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	64,635	2%	34,689	1%
High school graduates	882,397	28%	798,371	22%
Some college	941,078	29%	1,053,878	29%
Associate's degree	478,449	15%	644,373	17%
Bachelor's degree	732,047	23%	1,013,821	27%
Master's degree	98,367	3%	116,613	3%
Professional degree	4,935	0.2%	14,559	0.4%
Doctorate degree	4,784	0.1%	11,778	0.3%

	National Employment Trends (2005–2018)		
	Protective services occupations	Total	Percentage
2005	3,052,131	144,200,000	2.1%
2006	3,105,804	146,700,000	2.1%
2007	3,171,237	148,000,000	2.1%
2008	3,206,691	147,100,000	2.2%
2009	3,159,523	142,700,000	2.2%
2010	3,164,998	142,300,000	2.2%
2011	3,242,016	145,100,000	2.2%
2012	3,329,886	148,300,000	2.2%
2013	3,417,134	151,600,000	2.3%
2014	3,511,336	155,300,000	2.3%
2015	3,584,217	158,000,000	2.3%
2016	3,621,972	159,200,000	2.3%
2017	3,653,976	160,300,000	2.3%
2018	3,688,083	161,500,000	2.3%

[SOC 33-1011–SOC 33-9099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Protective Services require the most highly educated workers of any category in this grouping of occupations. They account for 2.2 percent of all jobs and will add almost 500,000 more by 2018. Job increases will divide between about 400,000 new security guards and 100,000 police and law enforcement jobs. Increasing demand will be driven by population growth and security personnel in a growing number of commercial buildings.

The current proportion of high school dropouts among workers in this field is only 2 percent and will fall to 1 percent by 2018, the lowest level among all Food and Personal Services Occupations. Almost 30 percent of these workers have high school diplomas. This occupational cluster also has the highest level of postsecondary participation. In 2008, some 29 percent of workers in these occupations had some college but no degree; 15 percent had Associate's degrees; and 26 percent had Bachelor's degrees or better. The share of those with Associate's degrees or better is projected to grow by 6 percentage points by 2018.

Protective Service occupations will provide 1.3 million total job openings by 2018: 478,000 net new jobs and 849,000 openings from retirements. About 1 million of these jobs will require some college or more. The largest proportion (29 percent) will require some college.

Managerial and Professional Office Occupations

- MANAGEMENT OCCUPATIONS
- BUSINESS OPERATIONS SPECIALIST OCCUPATIONS for example, human resources, management analysts, and purchasing agents
- FINANCIAL SPECIALIST OCCUPATIONS for example, accountants and auditors, financial advisors, and loan officers
- LEGAL OCCUPATIONS for example, lawyers, paralegals, and judges

Managerial and Professional Office Occupations is the fourth-largest of our occupational clusters and will provide the fourth-largest share of job openings over the next decade. These occupations account for 16.2 million jobs, 11 percent of the U.S. total. They will maintain that share and grow to 17.7 million jobs by 2018.

Much of the growth in these occupations will come as a result of the increasing complexity of the business landscape as employers try to function in ever more complicated networks and regulatory environments, while coping with fast-paced economic and technological changes. While businesses will hire much of their managerial, technical, and professional talent as in-house employees, an increasing share will also come from consultants in the Professional and Business Services industry. Employment in management and technical consulting is expected to grow by more than 800,000 employees by 2018. Computer systems design and related services also will drive growth, both in external consulting and internal hiring. Employment services—including human resources professionals hired internally and contracted out to temporary help agencies—will grow, as well.

Almost half of Managerial and Professional Office Occupations (49.6 percent) are concentrated in three industries: About 20 percent are in Professional and Business Services; 18 percent are in Financial and Business Services; and 12 percent are in Manufacturing.

Managerial and Professional Office Occupations constitute a greater share of workers in some industries than others. Financial Services has the largest share of managers and professionals, with more 40 percent of employees falling into those occupations. The Professional and Business Services industry has the second-largest concentration at 36 percent.

The type of industry makes a difference in determining the educational attainment of Managerial and Professional workers. Fewer than 60 percent of managers in Farming, Fishing, and Forestry have at least some college, while more than 90 percent in Professional and Business Services have some college or better.

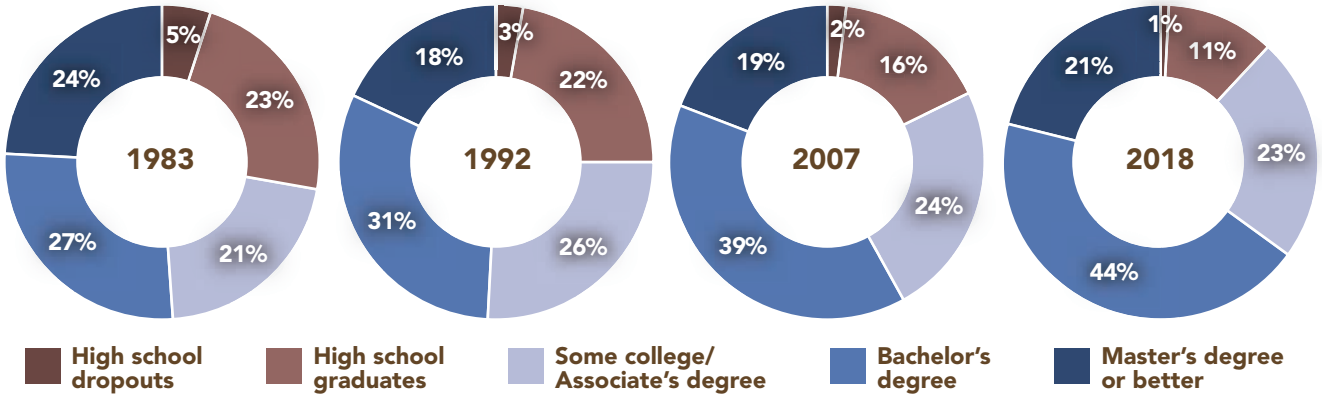
Managerial and Professional Office Occupations will provide the fourth-largest share of job openings through 2018, adding 4.5 million by that year. Some 1.5 million will be net new jobs, while another 3 million will replace retiring workers. Job openings in this occupational cluster between 2008 and 2018 will provide 1.9 million openings for people with Bachelor's degrees. In total, there will be openings for:

- 63,000 high school dropouts;
- 514,000 high school graduates;
- 598,000 workers with some college but no degree;
- 452,000 workers with Associate's degrees;
- 1.9 million workers with Bachelor's degrees;
- 967,000 workers with Masters degrees or better.

FIGURE 3.8

Educational Attainment in Managerial and Professional Office Occupations (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



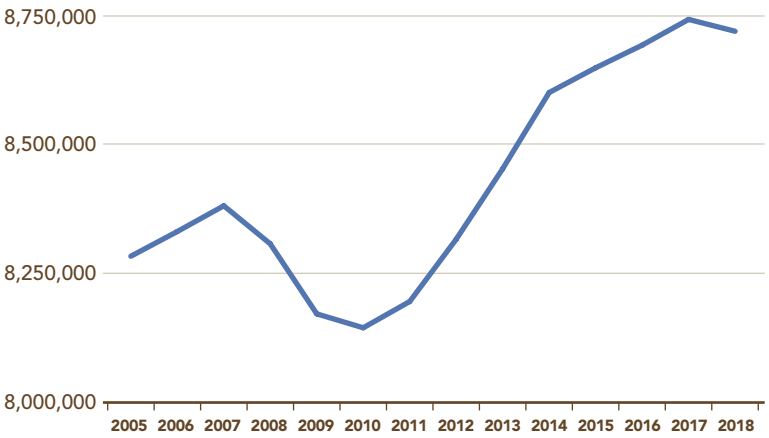
The share of postsecondary workers with at least some college or better in Managerial and Professional Office Occupations has always been relatively high. That share increased from 72 percent in 1983 to 82 percent in 2007 and is projected to climb to 88 percent in 2018. Managerial and Professional Office Occupations had the fourth-highest concentration of postsecondary workers in 2007 and will hold onto that position in 2018.

It will employ 11.3 million people with Bachelor's degrees or better in 2018, making it the fifth-largest occupational cluster for that level of postsecondary attainment.

On the following few pages, we will look at some of the component occupational groups of the Managerial and Professional Office Occupations cluster in more detail.

MANAGEMENT OCCUPATIONS

Management Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	200,219	2%	187,650	2%
High school graduates	1,533,020	18%	1,286,929	15%
Some college	1,396,229	17%	1,221,470	14%
Associate's degree	735,558	9%	883,113	10%
Bachelor's degree	2,961,667	36%	3,403,499	39%
Master's degree	1,292,712	16%	1,503,594	17%
Professional degree	84,512	1%	110,485	1%
Doctorate degree	104,866	1.3%	124,469	1%

	National Employment Trends (2005–2018)		
	Managerial occupations	Total	Percentage
2005	8,284,189	144,200,000	5.7%
2006	8,332,663	146,700,000	5.7%
2007	8,382,281	148,000,000	5.7%
2008	8,308,782	147,100,000	5.6%
2009	8,172,600	142,700,000	5.7%
2010	8,145,422	142,300,000	5.7%
2011	8,196,444	145,100,000	5.6%
2012	8,317,053	148,300,000	5.6%
2013	8,454,849	151,600,000	5.6%
2014	8,602,964	155,300,000	5.5%
2015	8,650,492	158,000,000	5.5%
2016	8,694,122	159,200,000	5.5%
2017	8,744,416	160,300,000	5.5%
2018	8,721,208	161,500,000	5.4%

[SOC 11-1011–SOC 11-9199]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

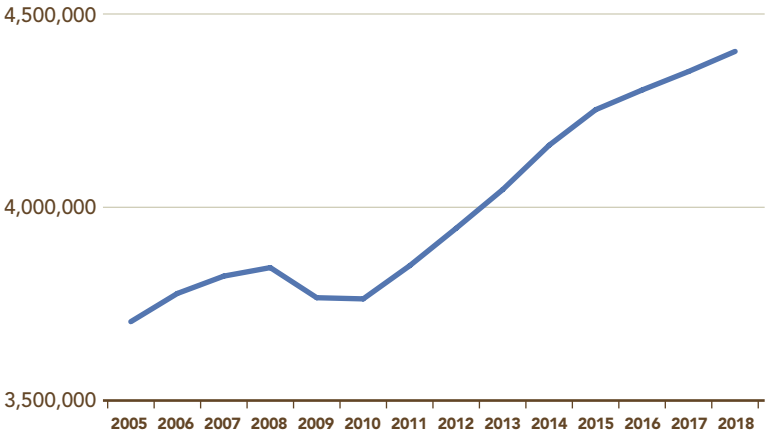
Management Occupations include employees with general responsibility for strategic decision making and day-to-day decision-making at a policy level. This category accounts for 5.6 percent of total employment and will grow from 8.3 million jobs in 2008 to 8.7 million jobs in 2018, an increase of about 400,000. Not all managerial jobs will grow, though. They will decline in the Natural Resources industry as its companies continue to consolidate into larger enterprises.

Only 2 percent of those in Management Occupations are high school dropouts. Some 26 percent have some college or an Associate's degree, and 54 percent have a Bachelor's degree or better. The share of workers with postsecondary education in this category will increase by 4 percentage points over the decade.

Management Occupations will provide 2.1 million total job openings by 2018: 400,000 net new jobs and 1.7 million openings from retirements. About 1.8 million of these positions will require some college or more, with the largest proportion (43 percent) requiring a Bachelor's degree.

BUSINESS OPERATIONS SPECIALIST OCCUPATIONS

Business Operations Specialist Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	48,729	1%	34,520	1%
High school graduates	618,973	16%	418,731	10%
Some College	574,877	15%	651,662	15%
Associate's degree	341,529	9%	453,076	10%
Bachelor's degree	1,591,779	41%	2,017,243	46%
Master's degree	592,248	15%	734,991	17%
Professional degree	33,827	0.9%	57,594	1%
Doctorate degree	42,449	1.1%	36,532	1%

	National Employment Trends (2005–2018)		
	Business operations specialist occupations	Total	Percentage
2005	3,704,859	144,200,000	2.6%
2006	3,777,148	146,700,000	2.6%
2007	3,822,879	148,000,000	2.6%
2008	3,844,410	147,100,000	2.6%
2009	3,766,826	142,700,000	2.6%
2010	3,763,146	142,300,000	2.6%
2011	3,849,071	145,100,000	2.7%
2012	3,946,017	148,300,000	2.7%
2013	4,046,427	151,600,000	2.7%
2014	4,161,008	155,300,000	2.7%
2015	4,253,881	158,000,000	2.7%
2016	4,304,549	159,200,000	2.7%
2017	4,352,001	160,300,000	2.7%
2018	4,404,349	161,500,000	2.7%

[SOC 13-1011–SOC 13-1199]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

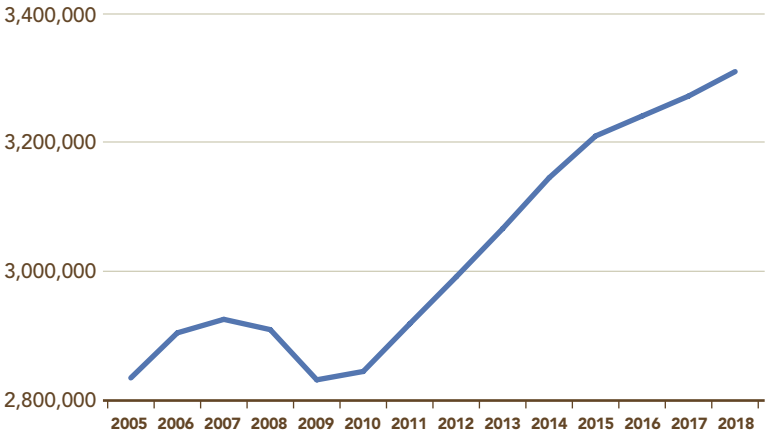
Business Operations Specialist jobs are occupations where individuals have managerial authority over particular functions, such as purchasing, billing, human resources, public relations, and marketing. Business Operations Specialists account for about 2.6 percent of all employment. They are a little more than half the size of Management occupations and will go from 3.8 million jobs in 2008 to 4.4 million in 2018, an increase of about 600,000.

Only 1 percent of workers in these positions are high school dropouts. About 24 percent have some college or an Associate's degree, while 58 percent have a Bachelor's degree or better. The share with postsecondary education will increase by 8 percentage points over the decade.

Business Operations Specialist occupations will provide 1.2 million total job openings by 2018: 560,000 net new jobs and 649,000 openings from retirements. Some 1.1 million of these new hires will require some college or more, and the largest proportion of them (46 percent) will have a Bachelor's degree.

FINANCIAL SPECIALIST OCCUPATIONS

Financial Specialist Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	23,443	1%	17,447	1%
High school graduates	268,580	9%	224,936	7%
Some college	333,301	11%	336,907	10%
Associate's degree	297,021	10%	291,685	9%
Bachelor's degree	1,470,955	51%	1,881,309	57%
Master's degree	489,543	17%	511,711	15%
Professional degree	18,195	0.6%	39,160	1%
Doctorate degree	9,398	0.3%	7,868	0.2%

	National Employment Trends (2005–2018)		
	Financial specialist occupations	Total	Percentage
2005	2,835,064	144,200,000	2.0%
2006	2,905,568	146,700,000	2.0%
2007	2,926,037	148,000,000	2.0%
2008	2,910,438	147,100,000	2.0%
2009	2,832,851	142,700,000	2.0%
2010	2,845,069	142,300,000	2.0%
2011	2,919,561	145,100,000	2.0%
2012	2,992,125	148,300,000	2.0%
2013	3,067,737	151,600,000	2.0%
2014	3,146,441	155,300,000	2.0%
2015	3,211,800	158,000,000	2.0%
2016	3,242,112	159,200,000	2.0%
2017	3,273,677	160,300,000	2.0%
2018	3,311,023	161,500,000	2.1%

[SOC 13-2011–SOC 13-2099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Financial Specialist occupations account for about 2 percent of all jobs and they are concentrated in the Finance, Professional Services, and Real Estate industries.

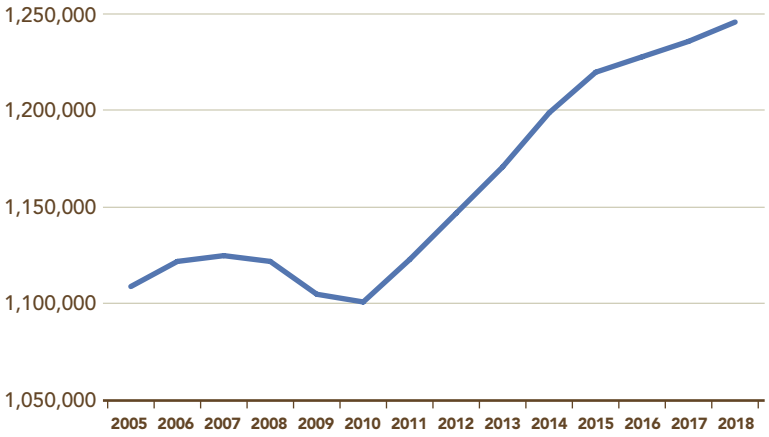
The Finance industry has been widely blamed for helping to bring on the Great Recession of 2007, and it has paid a price. Some 537,000 financial jobs have been lost since the start of the recession, although the industry has been far from decimated. Financial Specialist occupations include a wide variety of occupations, including appraisers; budget, credit, and financial analysts; loan officers; and tax preparers and examiners. These occupations will grow from 2.9 million jobs in 2008 to 3.3 million by 2018, a net increase of 400,000 jobs.

Postsecondary degrees are highly concentrated in this occupation category. Almost 70 percent of current workers have Bachelor's degrees or better. Another 21 percent have some college or an Associate's degree. Less than 10 percent have no formal education beyond high school, and only 1 percent are high school dropouts.

Financial Specialist occupations will provide 854,000 total job openings by 2018: 405,000 net new jobs and 449,000 openings from retirements. Some 791,000 of these positions will require some college or more, and the largest proportion (57 percent) will require a Bachelor's degree.

LEGAL OCCUPATIONS

Legal Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	17,427	2%	13,953	1%
High school graduates	87,054	8%	102,290	8%
Some college	90,532	8%	130,165	10%
Associate's degree	104,993	9%	138,664	11%
Bachelor's degree	176,521	16%	216,168	17%
Master's degree	80,918	7%	57,732	5%
Professional degree	466,038	42%	470,419	38%
Doctorate degree	99,078	9%	116,807	9%

	National Employment Trends (2005–2018)		
	Legal occupations	Total	Percentage
2005	1,109,088	144,200,000	0.8%
2006	1,122,839	146,700,000	0.8%
2007	1,125,915	148,000,000	0.8%
2008	1,122,560	147,100,000	0.8%
2009	1,105,306	142,700,000	0.8%
2010	1,101,623	142,300,000	0.8%
2011	1,123,557	145,100,000	0.8%
2012	1,147,171	148,300,000	0.8%
2013	1,171,841	151,600,000	0.8%
2014	1,199,304	155,300,000	0.8%
2015	1,220,239	158,000,000	0.8%
2016	1,228,566	159,200,000	0.8%
2017	1,236,514	160,300,000	0.8%
2018	1,246,198	161,500,000	0.8%

[SOC 23-1011–SOC 23-2099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Legal occupations account for less than 1 percent of the nation's jobs. They include lawyers, judges, arbitrators, and paralegals. Legal occupations will generate 332,000 total job openings between 2008 and 2018, including 124,000 net new jobs and 208,000 openings due to retirement.

This category is heavily weighted toward graduate and professional education. In 2008, 42 percent of incumbent workers had professional degrees, 9 percent had PhDs, and 7 percent had Master's degrees.

Sixteen percent, meanwhile, had Bachelor's degrees and 17 percent had Associate's degrees or some college. Only 10 percent of workers have high school diplomas or less. Between 2008 and 2018, there will be a shift of 4 percentage points from professional degrees to Bachelor's and Associate's degrees, reflecting stronger growth in paralegals and other occupations below the professional degree level.

Some 301,000 of the new and replacement jobs in the category will require some college or more. The largest proportion (38 percent) of new hires will need a professional degree.

Education Occupations

Education Occupations form the fifth-largest occupational set examined for this report and will provide a commensurate share of job openings between 2008 and 2018. These occupations currently account for 9 million jobs and will grow to 10.2 million by 2018, a net increase of 1.3 million new jobs. Education, Training, and Library Occupations will produce 3 million job openings over the decade, including 1.3 million net new jobs and 1.7 job openings from retirement.

This category includes a wide variety of occupations, but is dominated by preschool and K–16 teachers.

Job openings will include:

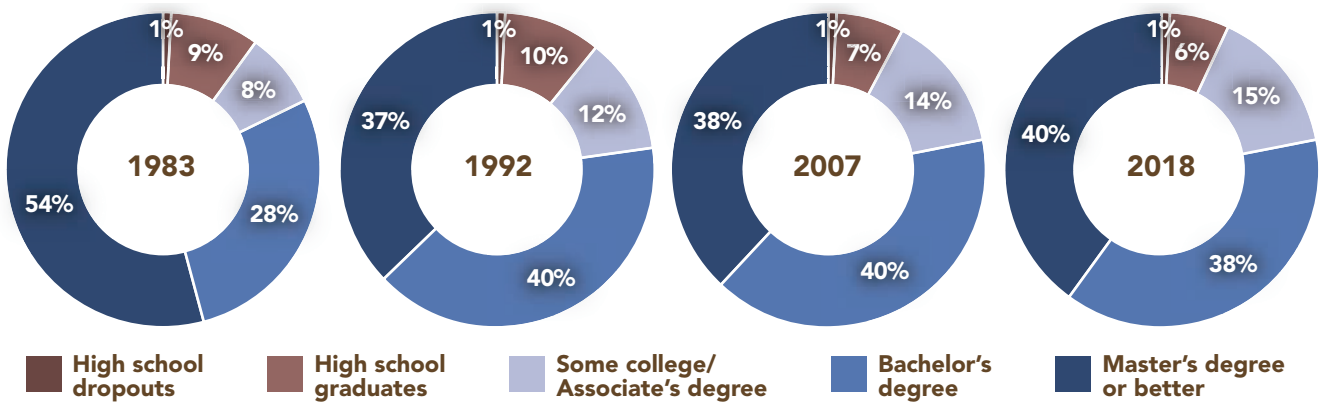
- more than 550,000 for postsecondary teachers;
- roughly 450,000 for high school teachers;
- more than 850,000 for elementary and middle school teachers;
- almost 250,000 openings for preschool and kindergarten teachers;
- more than 200,000 openings for special education teachers.

Education Occupations—along with Science, Technology, Engineering, Mathematics, and Social Sciences Occupations (STEM)—show the highest concentrations of jobs requiring postsecondary education.

FIGURE 3.9

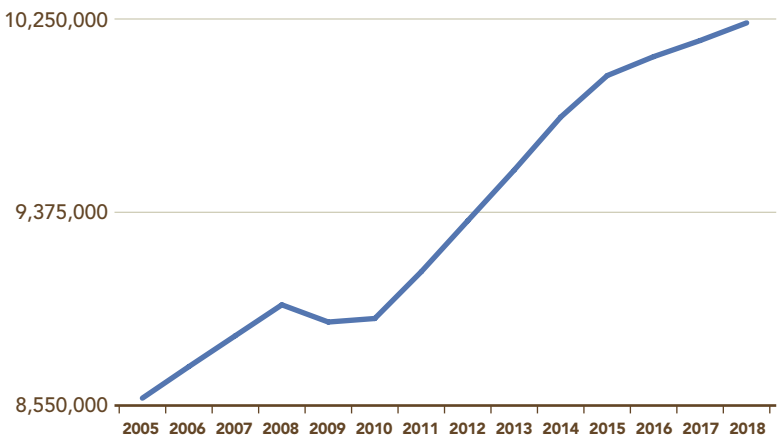
Educational Attainment in Education Occupations (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



EDUCATION OCCUPATIONS

Education Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	58,552	1%	60,302	1%
High school graduates	595,458	7%	654,477	6%
Some college	698,385	8%	825,721	8%
Associate's degree	492,910	6%	674,515	7%
Bachelor's degree	3,513,430	39%	3,906,200	38%
Master's degree	3,022,305	34%	3,461,068	34%
Professional degree	135,441	2%	190,260	2%
Doctorate degree	439,732	5%	461,665	5%

	National Employment Trends (2005–2018)		
	Education occupations	Total	Percentage
2005	8,533,538	144,200,000	5.9%
2006	8,676,164	146,700,000	5.9%
2007	8,816,895	148,000,000	6.0%
2008	8,956,212	147,100,000	6.1%
2009	8,878,388	142,700,000	6.2%
2010	8,894,739	142,300,000	6.3%
2011	9,106,600	145,100,000	6.3%
2012	9,337,838	148,300,000	6.3%
2013	9,567,173	151,600,000	6.3%
2014	9,807,430	155,300,000	6.3%
2015	9,995,547	158,000,000	6.3%
2016	10,081,541	159,200,000	6.3%
2017	10,154,268	160,300,000	6.3%
2018	10,234,209	161,500,000	6.3%

[SOC 25-1099–SOC 25-9099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Healthcare Professional and Technical Occupations

Healthcare Professional and Technical Occupations rank as the fifth-largest cluster and will provide the seventh-largest share of job openings over the next decade. Growth in healthcare employment is remarkably resilient. As the population ages and as advances in pharmaceuticals, medical technology, and healthcare practices make it possible to treat more diseases, demand for these services will only grow.

Spending on healthcare is estimated at about 16 percent of GDP and growing rapidly. Demand pressures are so strong that the Healthcare industry has increased employment by almost 650,000 jobs since the recession began. Healthcare is one of the few sectors that registered employment gains and so stayed relatively insulated during the downturn.

All healthcare occupations will experience robust growth. Registered nurses and health technologists will each grow by more than half a million jobs. These occupations will lead occupational growth over the next decade and account for most of the growth in healthcare.

In 2008, this category had about 7.4 million jobs, around 5 percent of the nation's total of 147 million workers. The number is projected to increase to 8.8 million, or 5.5 percent of the country's 162 million workers, in 2018. Healthcare occupations are forecast to provide 2.8 million job openings by 2018: 1.5 million net new jobs and an additional 1.3 million replacement openings.

These positions are weighted toward postsecondary degrees. In 2008, about 25 percent of healthcare workers had an Associate's degree, making these occupations the most intensive for that category among all major occupations.[17] In addition:

- 9 percent of workers have some college but no degree;
- 31 percent have Bachelor's degrees;
- 11 percent have Master's degrees;
- 13 percent have Professional degrees;
- 5 percent have PhDs.

Here is a breakdown of educational requirements projected for the 2.8 million job openings projected for Healthcare Professional and Technical Occupations by 2018. In total, there will be job openings for:

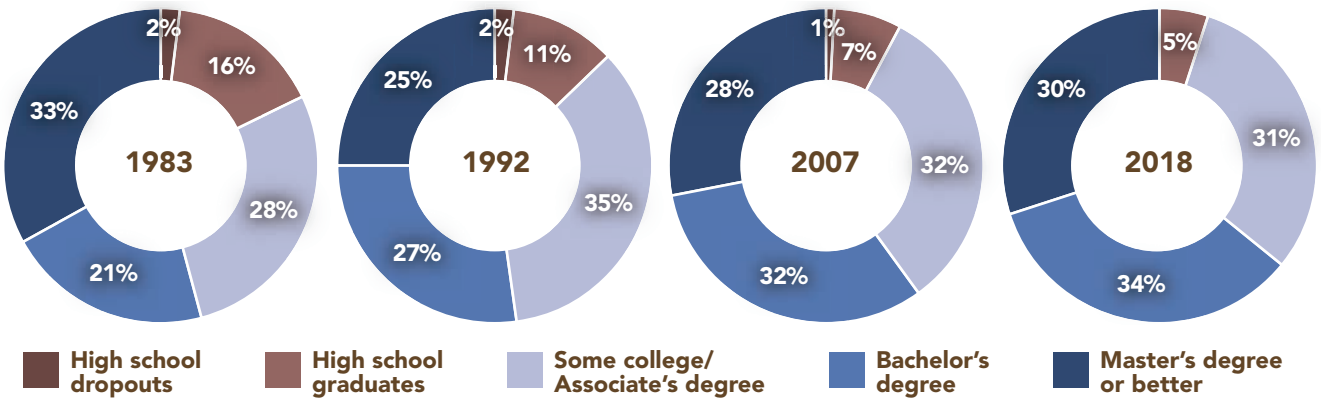
- 0 high school dropouts;
- 142,000 high school graduates;
- 192,000 workers with some college but no degree;
- 681,000 workers with Associate's degrees;
- 921,000 workers with Bachelor's degrees;
- 840,000 workers with Master's degrees or better.

The share of workers with at least some college or better in this occupational category increased from 82 percent in 1983 to 92 percent in 2007 and is projected to increase to 95 percent in 2018. The Healthcare Professional and Technical Occupations; Education Occupations; and Science, Technology, Engineering, Mathematics, and Social Sciences Occupations had the highest concentrations of postsecondary workers in 2008 and will continue through 2018.

FIGURE 3.10

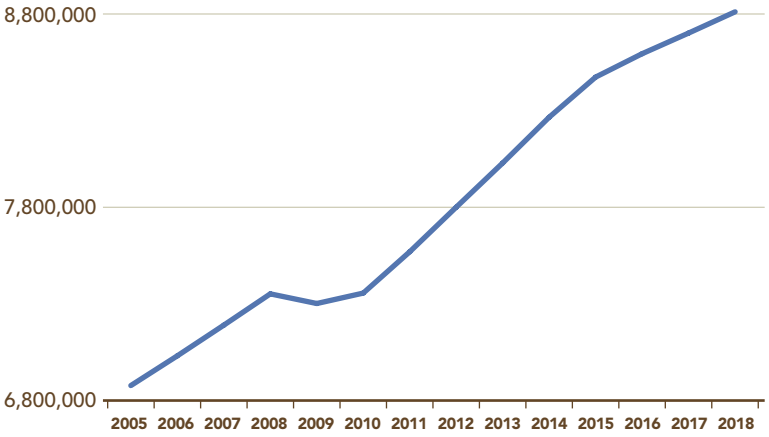
Educational Attainment in Healthcare Professional and Technical Occupations (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



HEALTHCARE PROFESSIONAL AND TECHNICAL OCCUPATIONS

Healthcare Professional and Technical Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	25,331	0.3%	-	0%
High school graduates	495,848	7%	450,038	5%
Some college	640,038	9%	610,671	7%
Associate's degree	1,811,139	25%	2,161,139	25%
Bachelor's degree	2,264,542	31%	2,924,180	33%
Master's degree	818,804	11%	1,076,558	12%
Professional degree	963,617	13%	952,263	11%
Doctorate degree	333,127	5%	638,304	7%

	National Employment Trends (2005–2018)		
	Healthcare professional and technical occupations	Total	Percentage
2005	6,877,443	144,200,000	4.8%
2006	7,031,830	146,700,000	4.8%
2007	7,190,943	148,000,000	4.9%
2008	7,352,445	147,100,000	5.0%
2009	7,302,684	142,700,000	5.1%
2010	7,356,965	142,300,000	5.2%
2011	7,570,269	145,100,000	5.2%
2012	7,801,689	148,300,000	5.3%
2013	8,030,230	151,600,000	5.3%
2014	8,267,083	155,300,000	5.3%
2015	8,475,364	158,000,000	5.4%
2016	8,596,672	159,200,000	5.4%
2017	8,703,162	160,300,000	5.4%
2018	8,813,149	161,500,000	5.5%

[SOC 29-1011–SOC 29-9099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Scientific, Technology, Engineering, Mathematics, and Social Sciences (STEM) Occupations

- COMPUTER AND MATHEMATICAL SCIENCE OCCUPATIONS
- ARCHITECTS AND TECHNICIANS OCCUPATIONS
- ENGINEERS AND TECHNICIANS OCCUPATIONS
- LIFE AND PHYSICAL SCIENCES OCCUPATIONS
- SOCIAL SCIENCES OCCUPATIONS

STEM, as this group of occupations is known, is the sixth-largest cluster and will also provide the sixth-largest share of job openings in the economy over the next decade. While these occupations are not large in number, they generate the technological changes that shape all other occupations. In 2008, STEM Occupations accounted for about 7.3 million jobs, or about 5 percent of the 147 million in the U.S. economy. By 2018, they are projected to increase to 8.6 million jobs, or 5.3 percent of the nation's 162 million total positions.

The STEM Occupations are broadly represented in all industries, but are most concentrated in the Professional and Business Services (21 percent) and Information Services (14 percent) industries.

This cluster of occupations is forecast to provide 2.8 million job openings through 2018, including 1.2 million net new jobs and an additional 1.6 million replacement openings. Here is a breakdown of projected STEM openings by education requirements. In total, there will be job openings for:

- 9,000 high school dropouts;
- 210,000 high school graduates;
- 274,000 workers with some college but no degree;
- 313,000 workers with Associate's degrees;
- 1.2 million workers with Bachelor's degrees;
- 779,000 workers with Master's degrees or better.

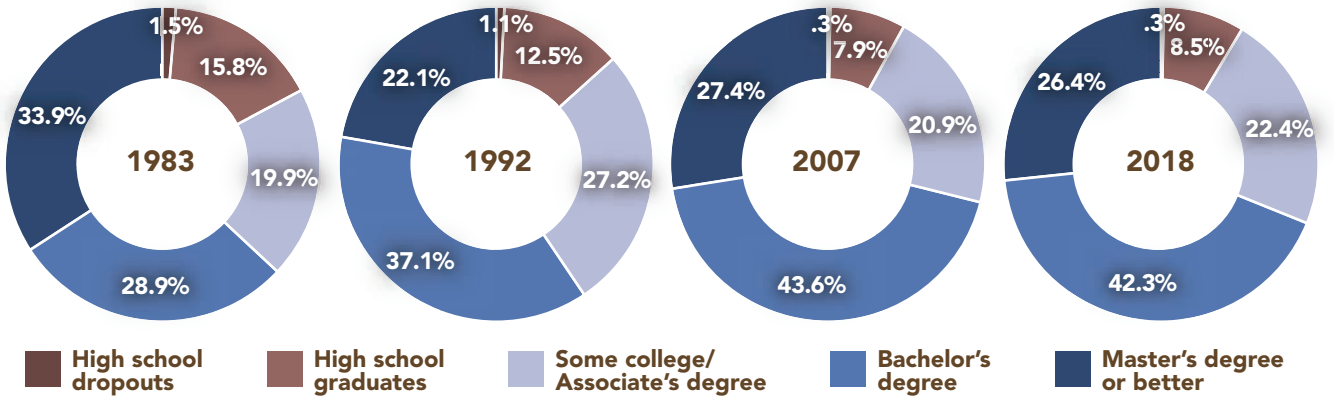
The share of workers with at least some college or better in STEM Occupations has always been high. Almost 83 percent of STEM employees had at least some postsecondary education in 1983, and that number climbed to 92 percent in 2008 and is projected to remain there through 2018. STEM Occupations, along with several other occupational clusters, ranked at the top for their concentrations of postsecondary workers in 2007 and will hold onto that ranking in 2018.

The STEM cluster of occupations includes a wide gamut of scientific and technical job categories. We detail some of those in the following pages.

FIGURE 3.11

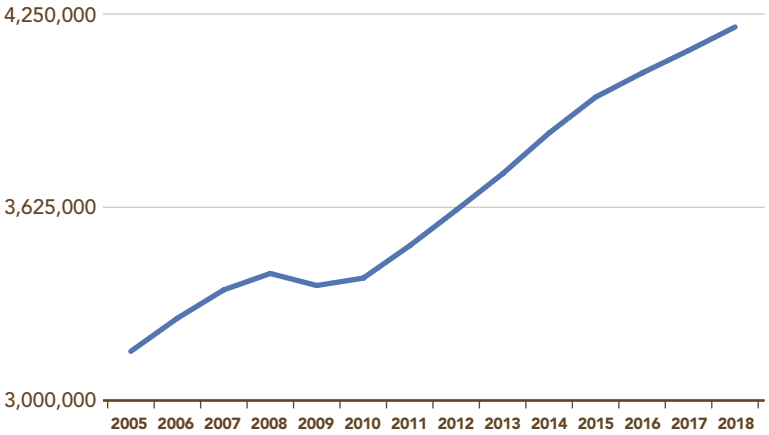
Educational Attainment in STEM Occupations (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



COMPUTER AND MATHEMATICAL SCIENCE OCCUPATIONS

Computer and Mathematical Science Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	18,009	1%	21,406	1%
High school graduates	251,618	7%	229,500	5%
Some college	393,410	12%	476,684	11%
Associate's degree	336,159	10%	408,244	10%
Bachelor's degree	1,658,123	49%	2,127,160	51%
Master's degree	684,770	20%	844,819	20%
Professional degree	22,378	0.7%	39,267	1%
Doctorate degree	46,710	1.4%	62,463	1%

	National Employment Trends (2005–2018)		
	Computer and mathematical science occupations	Total	Percentage
2005	3,159,691	144,200,000	2.2%
2006	3,266,901	146,700,000	2.2%
2007	3,358,592	148,000,000	2.3%
2008	3,411,177	147,100,000	2.3%
2009	3,372,432	142,700,000	2.4%
2010	3,396,901	142,300,000	2.4%
2011	3,501,083	145,100,000	2.4%
2012	3,616,619	148,300,000	2.4%
2013	3,734,782	151,600,000	2.5%
2014	3,866,375	155,300,000	2.5%
2015	3,982,783	158,000,000	2.5%
2016	4,060,081	159,200,000	2.6%
2017	4,133,008	160,300,000	2.6%
2018	4,209,542	161,500,000	2.6%

[SOC 15-1011–SOC 15-2099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Computer and Mathematical Science occupations are the largest category in the STEM cluster. They accounted for 3.4 million jobs in 2008, or 2.3 percent of all jobs, and will grow to 4.2 million jobs in 2018, or 2.6 percent of the total.

Education levels for Computer and Mathematical Science occupations are currently concentrated in Bachelor's and Master's degrees (69 percent) and that should increase to 71 percent by 2018. In addition, the demand for workers with some college and Associate's degrees for Computer and Mathematical Science occupations is significant (22 percent), although it should dip to 21 percent by 2018. Some 1.5 million positions will be available in the category through 2018: 798,000 net new jobs and 707,000 replacement openings. This represents about 3 percent of the total new and replacement jobs forecast during that period and reflects a relatively greater demand for highly skilled computer and mathematical sciences workers to replace retirees. About 94 percent of these new and replacement jobs will require some college or more, with the largest proportion (51 percent) requiring a Bachelor's degree.

Computer and Mathematical Science occupations are dominated by Computer occupations, although Mathematical Science occupations will grow by roughly 20 percent from a relatively small base of nearly 120,000 jobs in 2008.

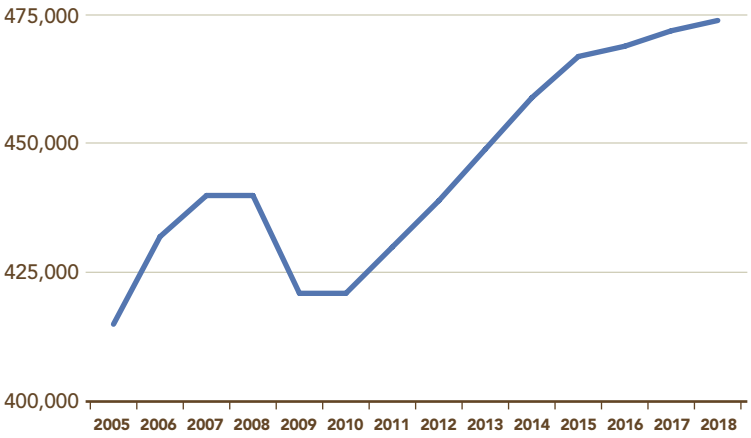
Computer Specialists account for the largest share of growth in this category. People in these occupations help institutions and individuals keep up with the rapid pace of computer technological change and new network applications. Computer Specialists account for more than 700,000 of the 800,000 new jobs that will be created in this category of occupations. The number of computer programmers will decline, however, as programming gives way to the increased use of software interfaces.

This occupational category will grow in every industry because of its integral role in broad-based technology change. Still, almost half of the growth will occur in Professional and Business Services, which houses Computer Systems Design, the economy's fifth-fastest growing industry. It will grow by nearly $100 billion in output and

almost 700,000 jobs over the decade. Growth will be driven by demand for increasingly sophisticated Internet and intranet capabilities; the need to connect with mobile computer and communications technologies; the expansion of electronic healthcare records; and increasing demand for computer-related security.

ARCHITECTURE AND ARCHITECTURAL TECHNICIAN OCCUPATIONS

Architecture and Architectural Technician Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	242	0.1%	1,053	0.2%
High school graduates	15,208	3%	13,331	3%
Some college	30,350	7%	15,206	3%
Associate's degree	28,949	7%	27,634	6%
Bachelor's degree	230,269	52%	264,399	56%
Master's degree	115,818	26%	133,360	28%
Professional degree	8,080	2%	7,748	2%
Doctorate degree	11,739	3%	12,194	3%

	National Employment Trends (2005–2018)		
	Architecture and architectural technician occupations	Total	Percentage
2005	415,146	144,200,000	0.3%
2006	432,743	146,700,000	0.3%
2007	440,064	148,000,000	0.3%
2008	440,656	147,100,000	0.3%
2009	421,233	142,700,000	0.3%
2010	421,013	142,300,000	0.3%
2011	430,072	145,100,000	0.3%
2012	439,687	148,300,000	0.3%
2013	449,341	151,600,000	0.3%
2014	459,486	155,300,000	0.3%
2015	467,087	158,000,000	0.3%
2016	469,815	159,200,000	0.3%
2017	472,136	160,300,000	0.3%
2018	474,926	161,500,000	0.3%

[SOC 17-1011–SOC 17-1022; SOC 17-3012–SOC 17-3019; SOC 17-3031]

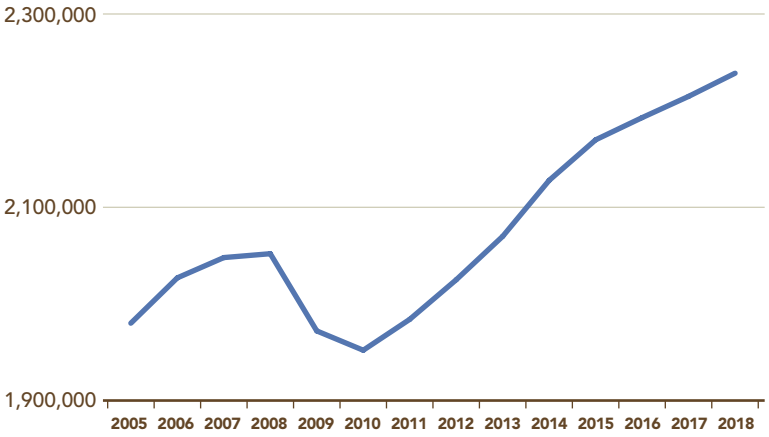
Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Architects and Architectural Technicians accounted for more than 440,000 jobs in 2008, about 0.3 percent of overall employment. They will increase by roughly 30,000 jobs by 2018 and are concentrated in the Professional and Business Services, Durable Manufacturing, and Construction industries. During the recession, job losses in this category have been severe. Sharp decreases in employment since 2007 reflect the battering taken by the Manufacturing and Construction industries in the recession.

Education levels are currently concentrated in Bachelor's degrees and Master's degrees (78 percent of current workers) and will increase to 84 percent by 2018. This category will provide 266,000 total job openings by 2018: 34,000 net new jobs and 231,000 openings from retirement. About 257,000 of these openings will require some college education, with the largest concentration (56 percent) requiring a Bachelor's degree.

ENGINEERS AND ENGINEERING TECHNICIAN OCCUPATIONS

Engineers and Engineering Technician Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	71,000	3%	5,246	0.2%
High school graduates	338,594	16%	433,498	19%
Some college	359,624	18%	325,252	15%
Associate's degree	470,703	23%	581,429	26%
Bachelor's degree	526,220	26%	604,506	27%
Master's degree	224,932	11%	240,476	11%
Professional degree	34,984	2%	17,562	1%
Doctorate degree	26,280	1%	31,397	1%

	National Employment Trends (2005–2018)		
	Engineers and engineering technician occupations	Total	Percentage
2005	1,980,588	144,200,000	1.4%
2006	2,027,266	146,700,000	1.4%
2007	2,048,425	148,000,000	1.4%
2008	2,052,338	147,100,000	1.4%
2009	1,972,149	142,700,000	1.4%
2010	1,952,861	142,300,000	1.4%
2011	1,984,516	145,100,000	1.4%
2012	2,025,906	148,300,000	1.4%
2013	2,070,202	151,600,000	1.4%
2014	2,128,102	155,300,000	1.4%
2015	2,170,895	158,000,000	1.4%
2016	2,193,772	159,200,000	1.4%
2017	2,215,180	160,300,000	1.4%
2018	2,239,368	161,500,000	1.4%

[SOC 17-2011–SOC 17-2199; SOC 17-3021–SOC 17-3031]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Engineers and Engineering Technicians account for the second-largest share of jobs in STEM Occupations. They accounted for 2 million jobs in 2008, or 1.4 percent of all jobs. This category of occupations will grow by 187,000 jobs through 2018 and maintain its 1.4 percent share.

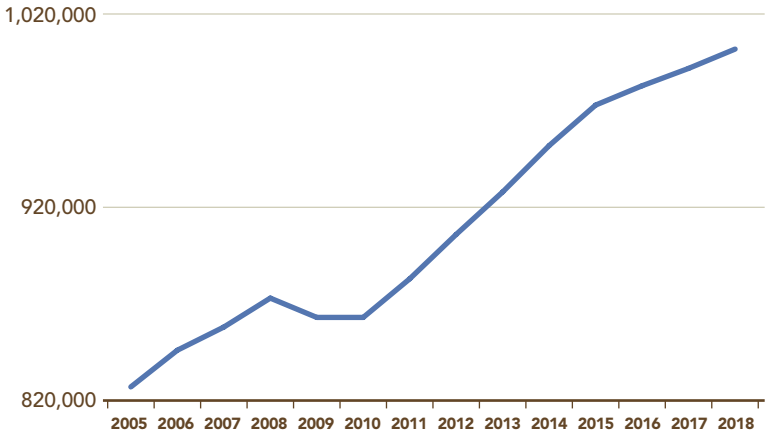
The largest growth in this cluster will be for civil engineers, who will be employed in updating the nation's infrastructure. Openings for civil engineers will increase by more than 100,000 to fill newly created jobs and replace workers projected to retire over the next decade.

Engineers are concentrated in the Professional and Business Services; Durable Manufactures; Public Administration; and Construction industries. The above graph shows that steep job losses will be followed by a robust return. The sharp decreases in employment most likely reflect losses connected to construction and infrastructure during the Great Recession.

Educational attainment for this occupational category currently concentrates in Bachelor's and Master's degrees (56 percent), increasing to 63 percent by 2018. There is also significant demand for workers with some college education and Associate's degrees. In 2008, 18 percent of incumbent workers had some college but no degree and another 23 percent had an Associate's degree—a percentage that will increase to 26 percent by 2018. Engineers and related occupations will generate 522,000 total job openings by 2018: 187,000 net new jobs and 335,000 replacement openings. Some 420,000 of these jobs will require at least some college education, with the largest proportion (27 percent) requiring a Bachelor's degree.

LIFE AND PHYSICAL SCIENCES OCCUPATIONS

Life and Physical Sciences Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	-	0%	-	0%
High school graduates	17,958	2%	20,299	2%
Some college	26,493	3%	11,085	1%
Associate's degree	16,669	2%	-	0%
Bachelor's degree	368,244	42%	430,905	43%
Master's degree	267,649	31%	281,855	28%
Professional degree	24,078	2.8%	28,962	3%
Doctorate degree	152,326	17%	229,590	23%

	National Employment Trends (2005–2018)		
	Life and physical sciences occupations	Total	Percentage
2005	827,280	144,200,000	0.6%
2006	846,550	146,700,000	0.6%
2007	858,311	148,000,000	0.6%
2008	873,416	147,100,000	0.6%
2009	863,449	142,700,000	0.6%
2010	863,929	142,300,000	0.6%
2011	883,968	145,100,000	0.6%
2012	906,305	148,300,000	0.6%
2013	928,734	151,600,000	0.6%
2014	952,941	155,300,000	0.6%
2015	973,288	158,000,000	0.6%
2016	983,729	159,200,000	0.6%
2017	992,865	160,300,000	0.6%
2018	1,002,696	161,500,000	0.6%

[SOC 19-1011–SOC 19-2099; SOC 19-4011–SOC 19-4099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Life and Physical Sciences occupations account for a tiny share (0.6%) of total employment, amounting to about 873,000 jobs in 2008 but are expected to add almost another 130,000 positions by 2018. This occupational category will provide 263,000 total job openings by 2018: 129,000 net new jobs and 134,000 openings from retirements. About 258,000 of these jobs will require some college education or more, with the largest proportion (43 percent) requiring a Bachelor's degree.

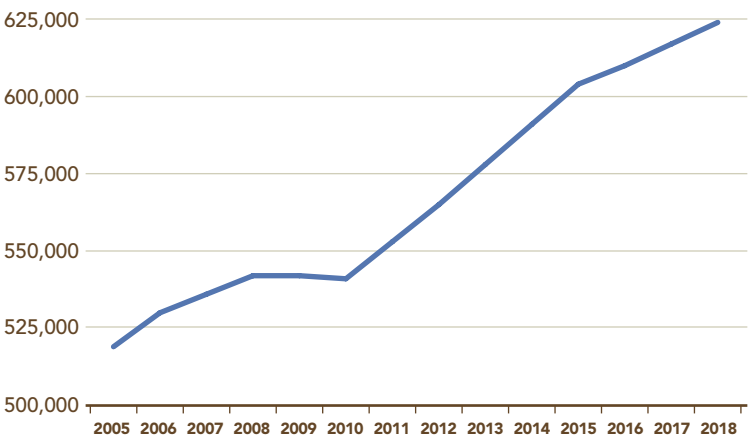
The educational attainment of Life and Physical Sciences occupations is concentrated in Bachelor's and Master's degrees (73 percent), but there is a significant demand for Doctoral degree jobs, too—17 percent in 2008, climbing to 23 percent in 2018.

Life Sciences occupations include Biologists, Zoologists, Agricultural and Food Scientists, Conservation Scientists, and Medical Scientists. Medical Scientists represent the largest share of Life Sciences occupations and will experience the greatest growth between 2008 and 2018, increasing by almost 50,000 over the period. Medical Scientists search for new treatments, and thereby expand the demand for healthcare. With retirements, job openings for Medical Scientists will total more than 70,000.

Physical Sciences occupations include Astronomers, Physicists, Chemists, and Environmental Scientists. Environmental Health Scientists represent the largest share of the Physical Sciences category and will experience the greatest growth by 2018, increasing by almost 25,000 over the period. With retirements, job openings for Environmental Health Scientists will number almost 50,000.

SOCIAL SCIENCES OCCUPATIONS

Social Sciences Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	6,914	1%	-	0%
High school graduates	39,117	7%	32,398	5%
Some college	36,153	7%	36,859	6%
Associate's degree	27,769	5%	36,285	6%
Bachelor's degree	186,603	34%	186,966	30%
Master's degree	106,752	20%	143,586	23%
Professional degree	46,408	9%	47,880	8%
Doctorate degree	92,576	17%	140,411	22%

	National Employment Trends (2005–2018)		
	Social sciences occupations	Total	Percentage
2005	519,829	144,200,000	0.4%
2006	530,260	146,700,000	0.4%
2007	536,335	148,000,000	0.4%
2008	542,292	147,100,000	0.4%
2009	542,495	142,700,000	0.4%
2010	541,919	142,300,000	0.4%
2011	553,750	145,100,000	0.4%
2012	565,490	148,300,000	0.4%
2013	578,020	151,600,000	0.4%
2014	591,682	155,300,000	0.4%
2015	604,614	158,000,000	0.4%
2016	610,818	159,200,000	0.4%
2017	617,106	160,300,000	0.4%
2018	624,385	161,500,000	0.4%

[SOC 19-3011–SOC 19-3099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Social Sciences occupations account for only about 0.4 percent of overall U.S. employment, and are concentrated in the Healthcare, Education, Professional Services, and Public Administration industries. Social Sciences occupations accounted for roughly 550,000 jobs in 2008 and will grow by more than 82,000 jobs by 2018. Between growth and retirements, total job openings may total as high as 275,000 jobs over the decade. More than half the growth in Social Sciences occupations will come from increases in demand for Market and Survey Research workers.

Education levels in this occupational category are concentrated in Bachelor's and Master's degrees (54 percent), although that number is expected to dip slightly to 53 percent by 2018. There also is a significant demand for workers with Doctoral degrees—17 percent of today's jobs require a PhD, and that is expected to reach 22 percent by 2018.

Community Services and Arts Occupations

- ARTS, DESIGN, ENTERTAINMENT, SPORTS, AND MEDIA OCCUPATIONS
- COMMUNITY AND SOCIAL SERVICES OCCUPATIONS

Community Services and Arts Occupations rank eighth in size out of the nine occupational clusters we studied, accounting for 4.6 million jobs in 2008 or 3.1 percent of all jobs. This category is expected to add almost 700,000 jobs between now and 2018, increasing its workforce to about 5.2 million. Occupations in Community Services and Arts can be found in high concentrations in the Healthcare Services (20 percent), Professional and Business Services (14 percent), Personal Services (13 percent), Information (11 percent), and Leisure and Hospitality (11 percent) industries.

We forecast that Community Services and Arts Occupations will provide 1.7 million job openings between 2008 and 2018, including 700,000 net new jobs and an additional 1 million openings to replace retiring workers. Job openings in Community Services and Arts Occupations through 2018 will include 1.5 million openings for people with at least some college or better. In total, there will be job openings for:

- 13,000 high school dropouts;
- 133,000 high school graduates;
- 189,000 workers with some college but no degree;
- 171,000 workers with Associate's degrees;
- 818,000 workers with Bachelor's degrees;
- 366,000 workers with Master's degrees or better.

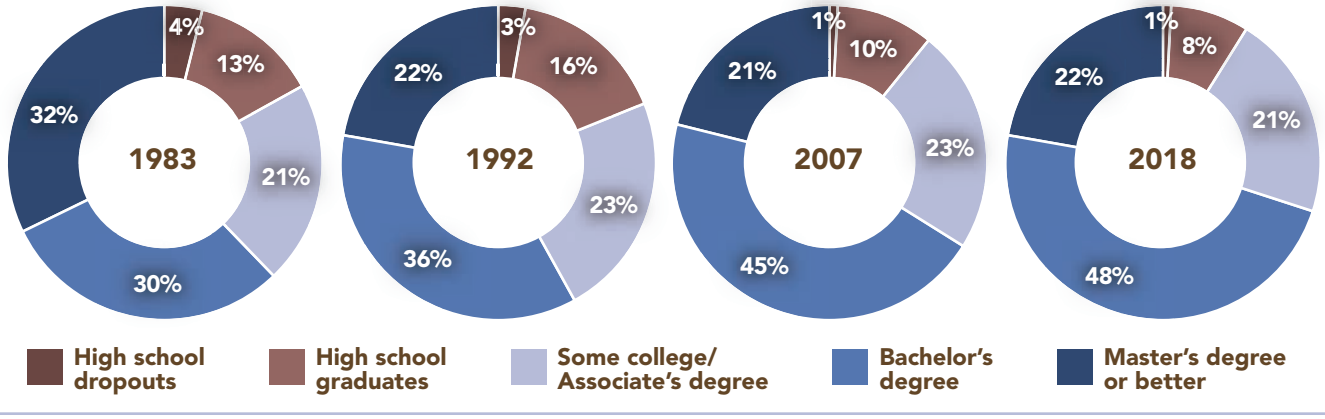
The share of workers with some college education or better in this occupation category has always been relatively high. Almost 83 percent of its occupations required at least some postsecondary education in 1983, increasing to 92 percent in 2007. That figure is projected to dip to 91 percent in 2018, though.

We now will look in more detail at the two significant groups that make up this cluster of occupations.

FIGURE 3.12

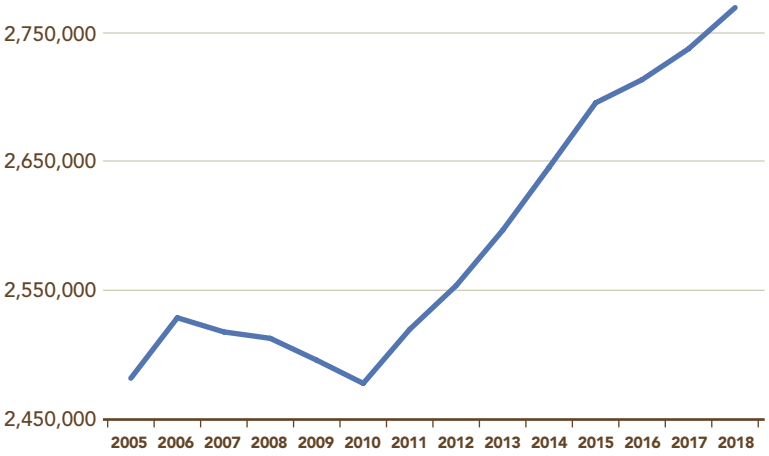
Educational Attainment in Community Services and Arts Occupations (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



ARTS, DESIGN, ENTERTAINMENT, SPORTS, AND MEDIA OCCUPATIONS

Arts, Design, Entertainment, Sports, and Media Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	35,617	1%	35,666	1%
High school graduates	258,357	10%	221,909	8%
Some college	344,522	14%	319,207	12%
Associate's degree	260,355	10%	311,387	11%
Bachelor's degree	1,321,774	53%	1,564,233	56%
Master's degree	262,567	10%	277,799	10%
Professional degree	14,926	1%	19,175	1%
Doctorate degree	15,586	1%	21,575	1%

	National Employment Trends (2005–2018)		
	Arts, design, entertainment, sports, and media occupations	Total	Percentage
2005	2,482,444	144,200,000	1.7%
2006	2,529,836	146,700,000	1.7%
2007	2,518,244	148,000,000	1.7%
2008	2,513,702	147,100,000	1.7%
2009	2,496,212	142,700,000	1.7%
2010	2,478,872	142,300,000	1.7%
2011	2,520,981	145,100,000	1.7%
2012	2,554,690	148,300,000	1.7%
2013	2,597,011	151,600,000	1.7%
2014	2,646,436	155,300,000	1.7%
2015	2,696,508	158,000,000	1.7%
2016	2,714,015	159,200,000	1.7%
2017	2,738,208	160,300,000	1.7%
2018	2,770,951	161,500,000	1.7%

[SOC 27-1011–SOC 27-4099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Arts, Design, Entertainment, Sports, and Media account for the largest share of occupations in this cluster. The category accounted for 2.5 million jobs in 2008 and should increase to 2.8 million by 2018, an increase of roughly 300,000 jobs.

Virtually all of the occupations in this cluster will grow except for Radio and Television Announcers and News Analysts, Reporters, and Correspondents, which will only create about 75,000 new job openings to replace retirees. This cluster will provide 900,000 total job openings between now and 2018: 267,000 net new jobs and 633,000 openings from retirements. About 816,000 of these new and replacement jobs will require some college or more. The largest proportion (56 percent) of new hires will require a Bachelor's degree.

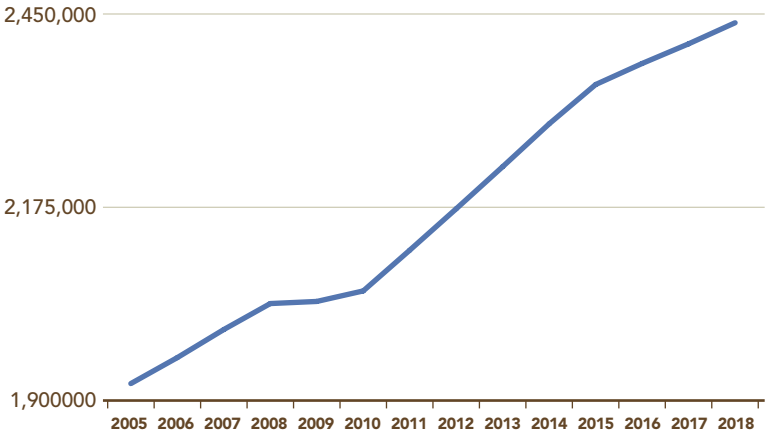
Arts, Design, Entertainment, Sports, and Media occupations divide into three large groups: Art and Design occupations (834,000); Entertainment and Sports occupations (740,000); and Media and Communications occupations (827,000).

Occupations in this cluster concentrate in the Arts, Information, and Professional Services industries. Job creation and losses in this sector traditionally correlate with economic conditions, as consumers shy away from these luxury goods during economic downturns and reward themselves with these activities during a boom.

Education levels in Arts, Design, Entertainment, Sports, and Media occupations are currently concentrated in Bachelor's and Master's degrees (63 percent), which is projected to increase to 66 percent by 2018. Typically, educational demand in these occupations varies. Bachelor's and Master's degrees predominate, but in some occupations—such as athletics—high school education or less is dominant.

COMMUNITY AND SOCIAL SERVICES OCCUPATIONS

Community and Social Services Occupations (2005–2018)



	National Employment Trends (2005–2018)		
	Community and social services occupations	Total	Percentage
2005	1,924,116	144,200,000	1.3%
2006	1,961,904	146,700,000	1.3%
2007	2,001,965	148,000,000	1.4%
2008	2,038,247	147,100,000	1.4%
2009	2,041,758	142,700,000	1.4%
2010	2,056,083	142,300,000	1.4%
2011	2,114,280	145,100,000	1.5%
2012	2,173,853	148,300,000	1.5%
2013	2,233,685	151,600,000	1.5%
2014	2,294,450	155,300,000	1.5%
2015	2,350,007	158,000,000	1.5%
2016	2,380,203	159,200,000	1.5%
2017	2,408,094	160,300,000	1.5%
2018	2,438,065	161,500,000	1.5%

	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	26,181	1%	5,378	0.2%
High school graduates	172,792	8%	189,323	8%
Some college	220,079	11%	264,309	11%
Associate's degree	131,158	6%	214,988	9%
Bachelor's degree	749,616	37%	956,291	39%
Master's degree	651,721	32%	761,540	31%
Professional degree	52,190	3%	46,238	2%
Doctorate degree	34,510	2%	-	0%

[SOC 21-1011–SOC 21-2099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

Community and Social Services occupations account for 1.4 percent of the nation's total employment. These occupations provided more than 2 million jobs in 2008 and should grow to more than 2.4 million in 2018, an increase of roughly 400,000 jobs. This cluster's share of the nation's overall employment is expected to go from 1.4 percent to 1.5 percent.

These occupations are concentrated in the Healthcare Services (20 percent); Professional and Business Services (14 percent); Personal Services (13 percent); and Leisure and Hospitality (13 percent) industries.

Expansion in Community and Social Services is directly related to the growth in healthcare and education and the growing need for counseling and social services among the elderly. Social Workers account for the largest share of Community and Social Services occupations, totaling some 650,000 jobs. By 2018, they are expected to add another 100,000 positions. Community and Social Services occupations will provide more than 260,000 job openings between 2008 and 2018—100,000 from new jobs and more than 150,000 to replace retirees.

Counselors of various kinds represent more than 660,000 jobs in this cluster of occupations. Among them: Mental Health Counselors, Substance Abuse Counselors, Rehabilitation Counselors, and Educational and Vocational Counselors. Community and Social Services occupations will provide more than 250,000 job openings between 2008 and 2018.

The broader cluster of Community and Social Services occupations will provide 792,000 jobs by 2018: 400,000 net new jobs and 392,000 openings from retirements. About 729,000 of these positions will require some college or more. The largest proportion (39 percent) will require a Bachelor's degree. Education levels among workers in this category currently concentrate in Bachelor's and Master's degrees (69 percent), and that number will remain stable over the decade. The largest increases will come in jobs requiring Associate's degrees, which will go from 6 percent in 2008 to 9 percent in 2018. Community and Social Services occupations have the fourth-highest concentration of current workers with at least some college or better.

Healthcare Support Occupations

Healthcare Support Occupations is the smallest of our nine occupational clusters, accounting for 3.9 million jobs in 2008, or 2.6 percent of all jobs. The overall size of this occupational group will increase by 2018, however, climbing to 4.8 million positions, or 3 percent of total U.S. employment. Healthcare Support is forecast to provide 1.9 million job openings by 2018, including 948,000 net new job openings and an additional 390,000 replacement openings.

The largest share of employees in these occupations work as Nursing Aides, Orderlies, and Attendants (1.5 million) and Home Health Aides (921,000). The Home Health Aide category will grow the fastest as the Baby Boom generation ages and care shifts from institutions to private homes as a cost-containing measure. There will be more than 550,000 openings for Home Health Aides between now and 2018, including 460,000 new jobs and more than 90,000 replacement positions.

Overall openings in Healthcare Support will provide jobs for:

- 87,000 high school dropouts;
- 455,000 high school graduates;
- 363,000 workers with some college but no degree;
- 280,000 workers with Associate's degrees;
- 119,000 workers with Bachelor's degrees;
- 26,000 workers with Master's degrees or better.

Education levels for workers in Healthcare Support Occupations divide almost evenly between those with high school diplomas or less (47 percent) and those with some college or better (53 percent). That ratio will change over the next several years because the share of workers with at least some postsecondary education is projected to increase to 59 percent by 2018. The percentage of workers with at least some college or better in this occupational cluster traditionally has been relatively low. These occupations currently rank in the bottom three of our nine occupational clusters in the share of current workers with at least some postsecondary education, along with Food and Personal Services Occupations and Blue Collar Occupations.

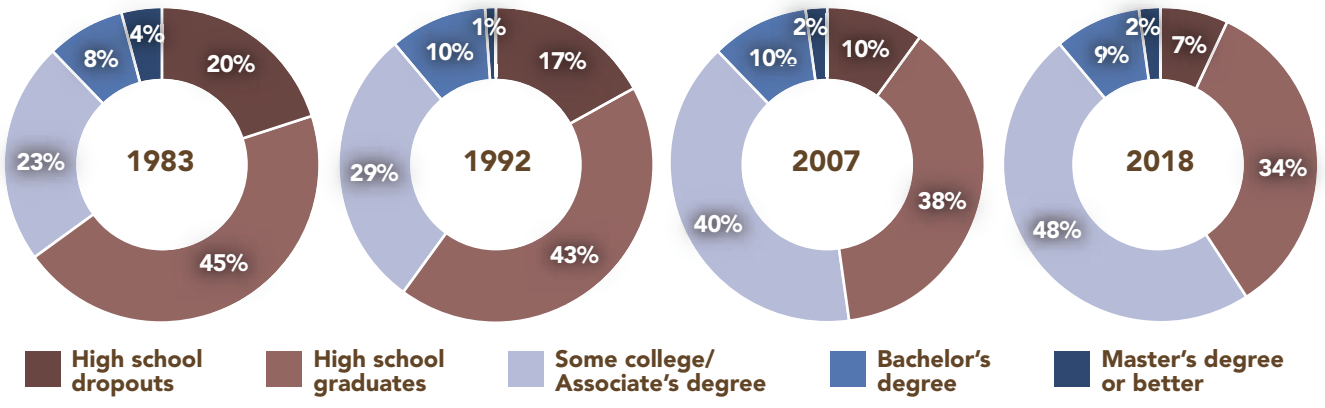
Still, the picture for Healthcare Support has been improving over time. Roughly 35 percent of those workers had at least some postsecondary education in 1983, rising to 52 percent in 2007 and projecting to 59 percent through 2018. The largest increases have come among workers with some college but no degree. Many of these incumbent workers have earned postsecondary certificates. In fact, 46 percent of Nursing Aides and Orderlies and Attendants (the second-largest employment category in this cluster) hold postsecondary certificates (Appendix 6). A significant share of other occupations also holds postsecondary certificates, including:

- Massage Therapists, 57 percent;
- Dental Assistants, 56 percent;
- Medical Transcriptionists, 29 percent;
- Medical Assistants, 23 percent.

FIGURE 3.13

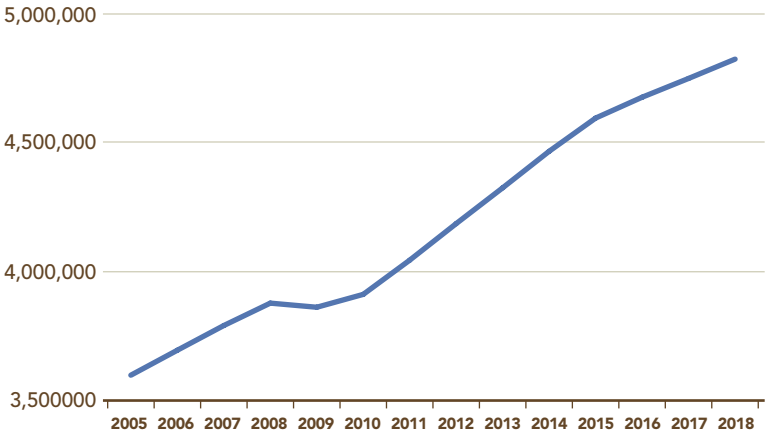
Educational Attainment in Healthcare Support Occupations (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



HEALTHCARE SUPPORT OCCUPATIONS

Healthcare Support Occupations (2005–2018)



	Education Requirements (2008/2018)			
	2008	Percentage	2018	Percentage
High school dropouts	387,239	10%	316,220	7%
High school graduates	1,417,948	37%	1,650,170	34%
Some college	998,108	26%	1,316,377	27%
Associate's degree	658,685	17%	1,015,012	21%
Bachelor's degree	366,924	9%	433,370	9%
Master's degree	38,450	1%	70,863	1%
Professional degree	5,843	0.2%	13,033	0.3%
Doctorate degree	5,728	0.1%	11,191	0.2%

	National Employment Trends (2005–2018)		
	Healthcare support occupations	Total	Percentage
2005	3,598,454	144,200,000	2.5%
2006	3,695,688	146,700,000	2.5%
2007	3,791,749	148,000,000	2.6%
2008	3,878,925	147,100,000	2.6%
2009	3,862,145	142,700,000	2.7%
2010	3,912,825	142,300,000	2.7%
2011	4,045,710	145,100,000	2.8%
2012	4,187,280	148,300,000	2.8%
2013	4,326,664	151,600,000	2.9%
2014	4,468,050	155,300,000	2.9%
2015	4,597,129	158,000,000	2.9%
2016	4,678,692	159,200,000	2.9%
2017	4,751,713	160,300,000	3.0%
2018	4,826,236	161,500,000	3.0%

[SOC 31-1011–SOC 31-9099]

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

[13] STEM occupations are defined as computer and mathematical science occupations, engineers and technicians and life and physical sciences occupations, and social sciences. We've chosen a more comprehensive definition that includes the social sciences, but are able to exclude it for some analyses.

[14] Natural Resources industries include farming, fishing, forestry, hunting and mining.

[15] As a result, we project a precipitous decline in telemarketers—more than 30,000 jobs—as e-commerce gains market share.

[16] The actual volume and importance of these jobs as careers tend to be overstated in the data. Many more of the workers in the lowest-skilled occupations are part-time and there is usually high turnover compared with higher-skilled jobs. For instance, there is more turnover in part-time work for cashiers and retail service workers than for people with Bachelor's degrees or better in managerial, professional, or STEM occupations. In addition, these low-skilled, high-turnover jobs are often transitional occupations that people take on for short periods in their lives, not long-term career occupations. People who take these lower-tier positions are often passing through on their way to more schooling or better jobs. Sometimes, relatively high-skilled older workers or others in transitional stages of their lives take these jobs. A common example: the former business executive who retires and takes on a job as a greeter at Wal-Mart.

[17] Healthcare Professional and Technical Occupations were the most Associate-intensive in 2008 (25%), followed by Engineers and Technicians Occupations (23%), Healthcare Support Occupations (23%), Installation, Maintenance, and Repair Occupations (20%), and Protective Services (15%).

Part 4

Industry and Education Forecast (2008–2018).

Education requirements are most closely tied to occupations, but the economy produces goods and services by organizing occupations into industries. Demand for postsecondary education within an industry depends on the occupational mix. The greatest intensity in the demand for workers with postsecondary education occurs in a cluster of fast-growing services industries. They each have workforces dominated—75 percent to 90 percent—by workers with at least some postsecondary education or training. These include:

- Information Services;
- Professional and Business Services;
- Financial Services;
- Private Education Services;
- Healthcare Services;
- Government and Public Education Services.

The middle tier of postsecondary concentration includes Construction and a set of old-line services industries where the share of workers with higher education hovers around 50 percent. These include:

- Construction;
- Transportation and Utilities Services;
- Wholesale and Retail Trade Services;
- Leisure and Hospitality Services;
- Personal Services.

Figure 4.1 summarizes the distribution of education requirements by industry in 2018.

The bottom tier includes mostly goods production in Manufacturing and Natural Resources, where the share of postsecondary workers ranges between 30 percent and 40 percent of the industry workforces.

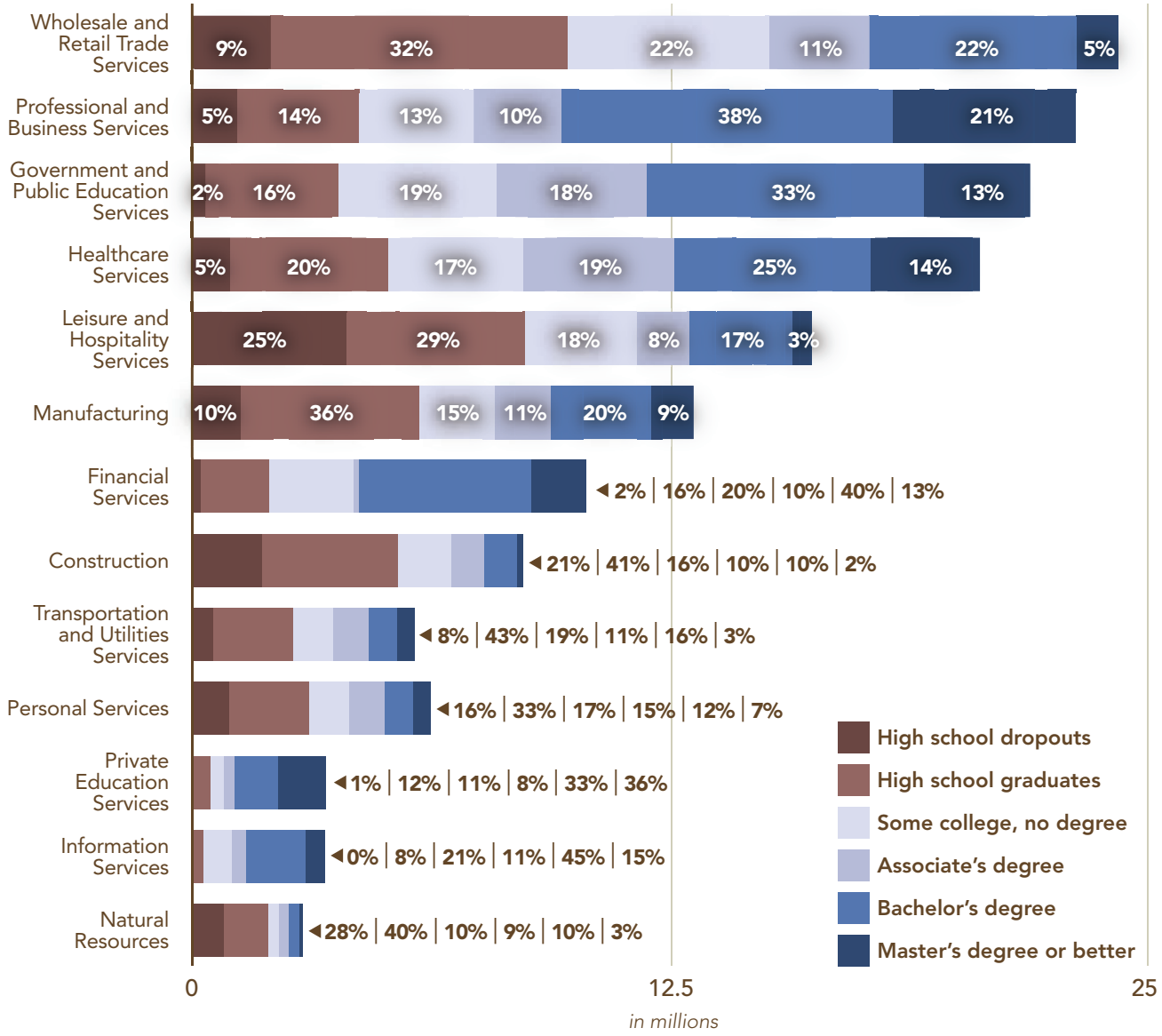
Increasingly, manufacturing and old-line service industries are being replaced by new service industries as those with the most job openings. In Table 4.1, we see Professional and Business Services and Healthcare Services lead in total openings. Other key industries driving employment growth, such as Information Services, have substantial postsecondary education requirements, too. The two industries—Manufacturing and Natural Resources—forecast to decline by 2018 rank eighth (55 percent) and 13th (31 percent) in their requirements for hiring workers with at least some college education or better.

Industry growth drives employment and the rise and fall of different industries leads to changes in the composition of educational demand as the need for different occupations shifts. Industries are defined by the goods and services they produce, not by the diverse occupational and educational characteristics of their employees. For example, everyone who works in manufacturing is part of the manufacturing industry whether they are managers, accountants, computer professionals, janitors, or frontline technicians and operatives. We detailed the link between occupational growth and educational demand in the preceding section of this report.

FIGURE 4.1

Educational demand within industries in 2018.

Source: Center on Education and the Workforce forecast of educational demand through 2018



SERVICES INDUSTRIES DOMINATE THE ECONOMY, PROVIDE MOST U.S. JOBS.

In modern economic systems, industries are divided into three groups depending on whether they extract natural resources from the earth, make material goods, or provide services. Over time, services industries have become dominant players in the U.S. economy. Services generated 65 percent of all jobs in 1973, increasing to 83 percent in 2007. This shift will continue going forward, with Services projected to grow to 85 percent by 2018 (Figure 4.2).

Trends in the demand for workers with postsecondary education and training have aligned with these broad industry shifts. The slowest-growing industries, in terms of output (Table 4.2), are those where higher education requirements are lowest. The share of postsecondary workers has grown in the Services and Goods-producing sectors, but not in the Natural Resource industries. Since 1983, the share of workers with at least some college education has increased from 50 percent to 64 percent in Services industries and from 34 percent to 46 percent in Goods-producing industries. In recent history, employment levels in Natural Resources have declined and so has demand for workers with postsecondary educations.

TABLE 4.1

Total job openings for workers with some college or better by industry. (in thousands)

Source: Center on Education and the Workforce forecast of educational demand through 2018

INDUSTRIES:	Total job openings requiring Some College or better		Total job openings 2018	Some college or better share of total job openings by industry	Rank of Some college or better job openings	Largest rate of Some college or better job openings compared to total 2008 employment	
	#	Rank	#	%	Rank	%	Rank
Professional and Business Services	6,404	1	7,895	81%	5	33%	3
Healthcare Services	5,550	2	7,389	75%	6	34%	2
Wholesale and Retail Trade Services	4,374	3	7,363	59%	7	20%	7
Private Education Services	2,969	4	3,435	86%	2	106%	1
Leisure and Hospitality Services	2,826	5	6,095	46%	11	20%	6
Financial Services	2,600	6	3,156	82%	4	26%	5
Government and Public Education Services	1,974	7	2,391	83%	3	9%	11
Manufacturing	1,096	8	2,000	55%	8	8%	12
Personal Services	1,036	9	2,026	51%	9	18%	8
Information Services	902	10	985	92%	1	29%	4
Transportation and Utilities Services	827	11	1,695	49%	10	13%	9
Construction	813	12	2,147	38%	12	10%	10
Natural Resources	105	13	335	31%	13	4%	13

FIGURE 4.2

The composition of the U.S. workforce is increasingly concentrated in Services industries. By 2018, 85% of all workers will be employed in the Services sector.

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

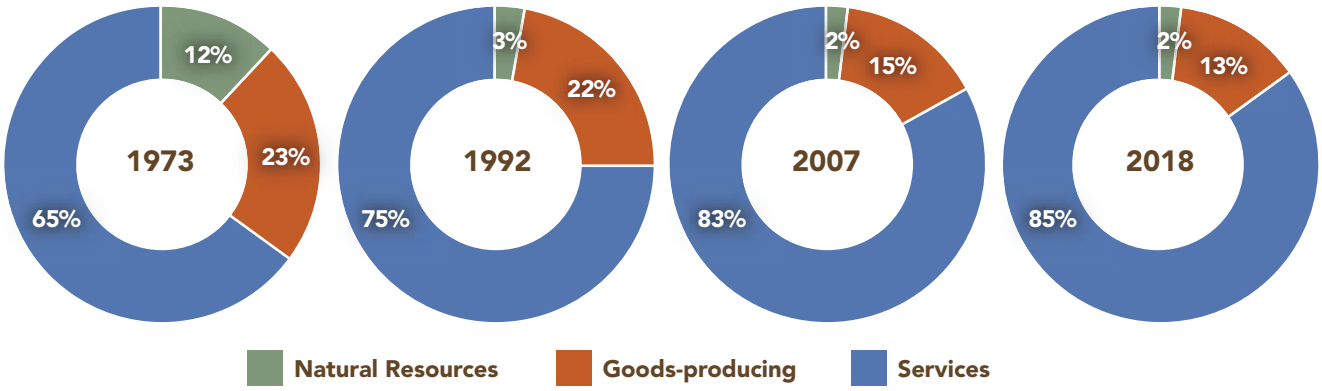


TABLE 4.2

Output growth by industry.

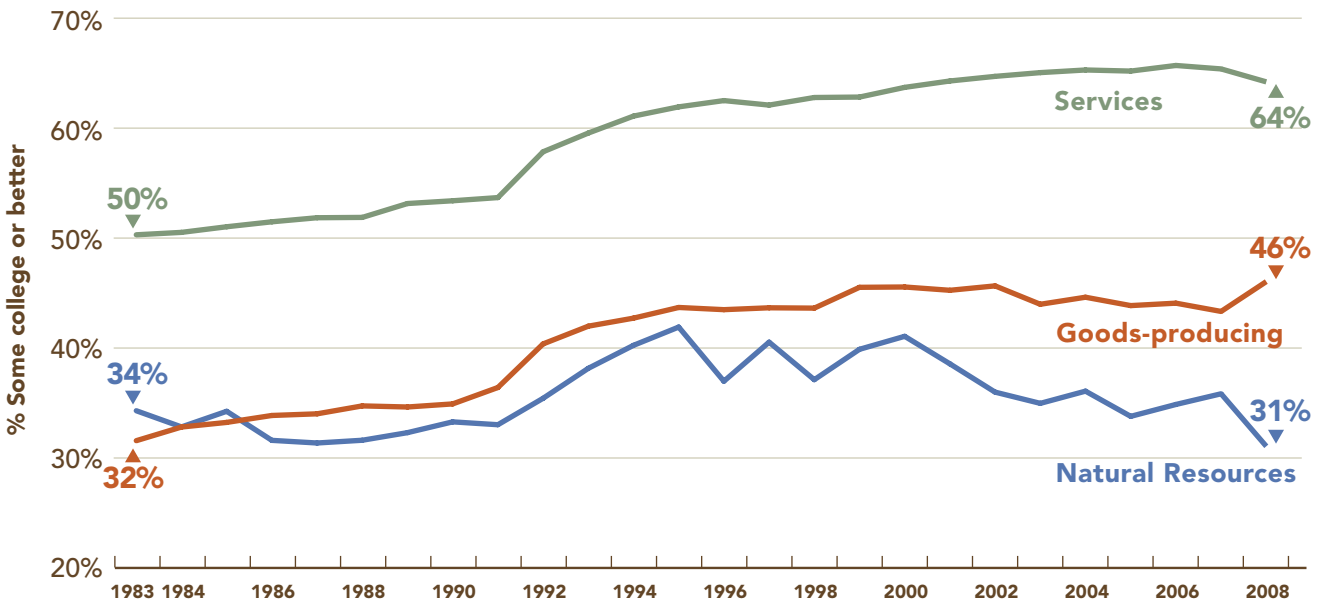
Source: Table 2.7 from the Bureau of Labor Statistics (BLS) Employment Projection Tables available at http://www.bls.gov/emp/tables.htm, visited on Jan. 31, 2010.

	2008		2018		Change 2008–2018		Ranking	
INDUSTRIES:	Output in billions $	Total output rank	Output in billions $	Total output rank	Change in total output $	Rate of growth: Percent change in output	Fastest rate of growth	Largest change in output
Manufacturing	3,985	1	4,923	1	938	24%	7	3
Professional and Business Services	2,506	2	3,553	3	1,046	42%	4	2
Wholesale and Retail Trade Services	2,296	3	3,641	2	1,345	59%	2	1
Government and Public Education Services	2,264	4	2,595	4	332	15%	11	7
Healthcare Services	1,302	5	1,861	6	560	43%	3	5
Financial Services	1,256	6	1,775	7	519	41%	5	6
Information Services	1,106	7	1,865	5	759	69%	1	4
Construction	861	8	1,141	8	280	33%	6	8
Leisure and Hospitality Services	748	9	884	9	136	18%	8	9
Natural Resources	524	10	546	10	22	4%	13	13
Personal Services	463	11	539	11	77	17%	10	10
Transportation and Utilities Services	319	12	349	12	30	9%	12	11
Private Education Services	156	13	184	13	28	18%	9	12

FIGURE 4.3

The Services and Goods-producing industries show increasing demand for postsecondary education over time, but the demand for postsecondary workers in Natural Resources industries has declined.

Source: Authors' analysis of March CPS data, various years



Some of the declines in employment are due to increased productivity. For instance, both Manufacturing and Natural Resources are forecast to increase output by $938 billion (24 percent) and $22 billion (4 percent) even as their workforces shrink (Table 4.2). Other employment shifts reflect changes in the relative economic importance of various industries. Information Services, Wholesale and Retail Trade Services, and Healthcare Services are the three fastest-growing industry sectors, while Manufacturing and Natural Resources rank seventh and 13th. Overall, industries with the fastest-growing output have the highest education requirements (Figure 4.3).

DIVIDING THE ECONOMY INTO 13 INDUSTRIES.

We have grouped the results from our detailed industry forecasting model into 13 industries, including 10 Services industries, two Goods-producing industries, and a single category where we grouped Natural Resources industries. Table 4.3 details employment in these Industries and shows how our forecast projects them to change by 2018.

Natural Resources industries include:

- Agriculture, forestry, fishing, hunting, and mining.

Goods-producing industries include:

- Manufacturing;
- Construction.

Services industries include:

- Wholesale and Retail Trade Services;
- Transportation and Utilities Services;
- Information Services;
- Financial Services;
- Professional and Business Services;
- Private Education Services;
- Healthcare Services;
- Leisure and Hospitality Services;
- Personal Services;
- Government and Public Education Services.

TABLE 4.3

Employment growth and decline by industry in 2008/2018. (in thousands)

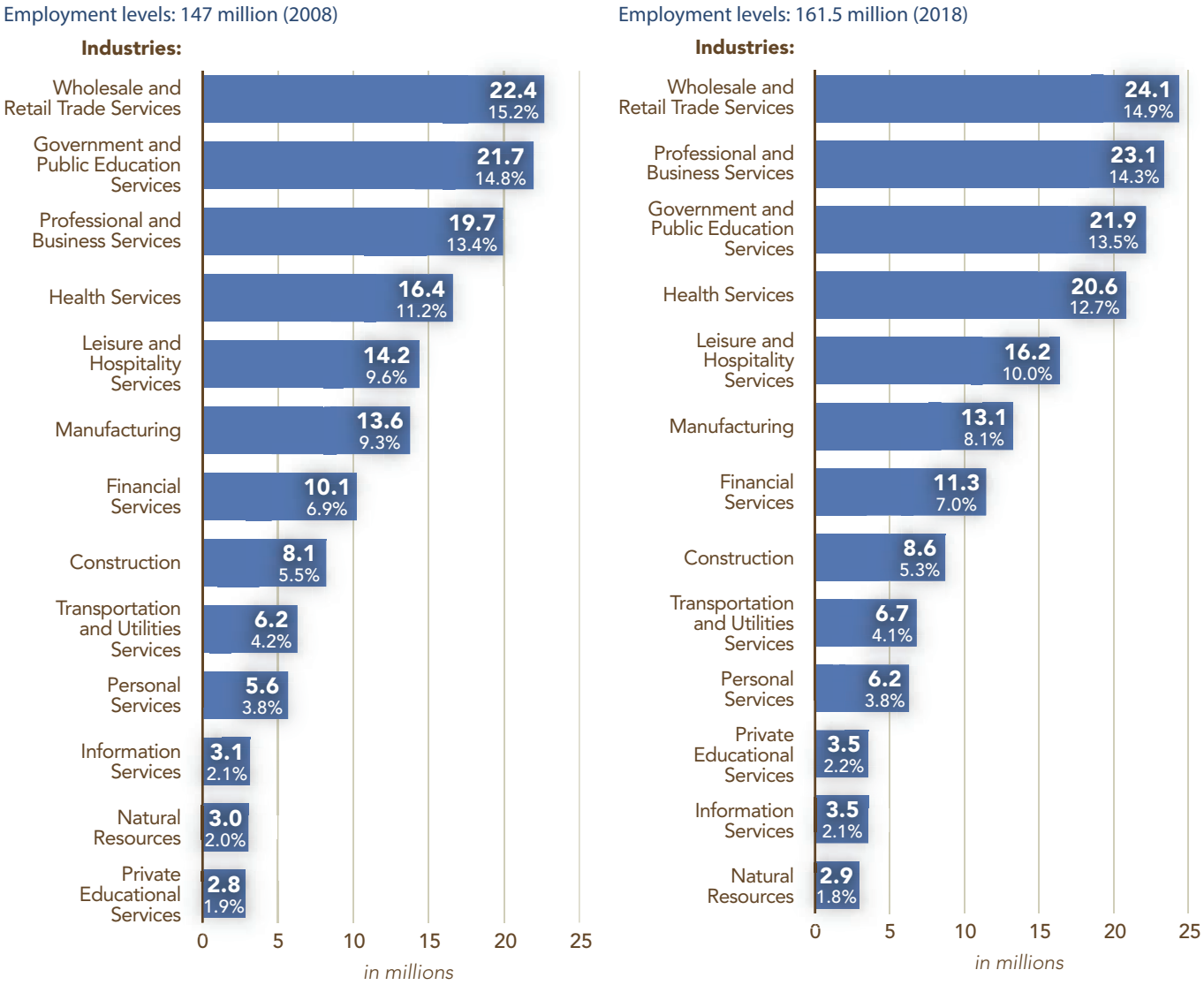
Source: Authors' analysis of March CPS data, 2008; Center on Education and the Workforce forecast of educational demand through 2018

	2008		2018		Difference 2008–2018		Ranking	
INDUSTRIES:	Total employment	Rank	Total employment	Rank	Change in employment	Rate of growth: Percent change in employment	Largest change #	Fastest rate of growth
Wholesale and Retail Trade Services	22,405	1	24,145	1	1,740	8%	4	9
Government and Public Education Services	21,735	2	21,860	3	125	1%	11	11
Professional and Business Services	19,682	3	23,058	2	3,375	17%	2	3
Healthcare Services	16,440	4	20,554	4	4,114	25%	1	1
Leisure and Hospitality Services	14,186	5	16,155	5	1,968	14%	3	4
Manufacturing	13,646	6	13,080	6	-566	-4%	13	13
Financial Services	10,096	7	11,344	7	1,248	12%	5	5
Construction	8,124	8	8,629	8	505	6%	9	10
Transportation and Utilities Services	6,167	9	6,687	9	520	8%	8	8
Personal Services	5,647	10	6,212	10	566	10%	7	7
Information Services	3,137	11	3,461	12	324	10%	10	6
Natural Resources	2,953	12	2,883	13	-70	-2%	12	12
Private Education Services	2,798	13	3,482	11	684	24%	6	2

FIGURE 4.4

Industrial distribution of total employment in 2008/2018.

Source: Authors' analysis of March CPS data, 2008; Center on Education and the Workforce forecast of educational demand through 2018



*Percentages indicate each industry's share of total employment.

In our base year, 2008, the industry mix was heavily weighted in favor of services rather than goods production. The top five industries ranked by total employment in 2008 make up 64 percent of the total workforce. They are Wholesale and Retail Trade Services, Government and Public Education Services, Professional and Business Services, Healthcare Services, and Leisure and Hospitality Services. Our projections show a continuing shift as Goods-producing and Natural Resources industries decline and Services industries increase as a share of total employment. The decline in Manufacturing and Natural Resources is not a new phenomenon. In fact, permanent loss of employment opportunities in these sectors defines the structural change that characterized the recessions of 1991 and 2001. So does the growing opportunity in the Services industries—a phenomenon that will continue unabated through 2018. Figure 4.4 describes the distribution of industry employment in both 2008 and 2018.

INDUSTRY OUTPUT AND EMPLOYMENT GROWTH.

Change in industry output is not always the best predictor of demand for education and employment. Rising output can signal increased productivity and increased contributions to national wealth. That can mean growth in some kinds of jobs but declines in others that at first glance are difficult to balance out.

In Manufacturing, for instance, new computer-based technologies, new work processes, and more complex global production networks allow the industry to achieve higher and higher levels of output with fewer and fewer workers (Table 4.2). Many workers who perform routine tasks lose their jobs, as employers either automate those processes or send them offshore to take advantage of lower labor costs. This has reduced the overall number of jobs in domestic manufacturing, but the jobs that remain are those that demand non-routine work and, therefore, require higher skill.[18] As a result, in Manufacturing as well as in Natural Resources industries, when output increases, jobs do not increase commensurately—or actually decline.

Truly declining industries are rare. They are characterized by drops in both industry output and employment. These tend to be in the old-line Manufacturing and Natural Resources sectors. They include industries such as tobacco, apparel, textile, paper products, and newspapers. In many cases, these industries have been moved offshore.

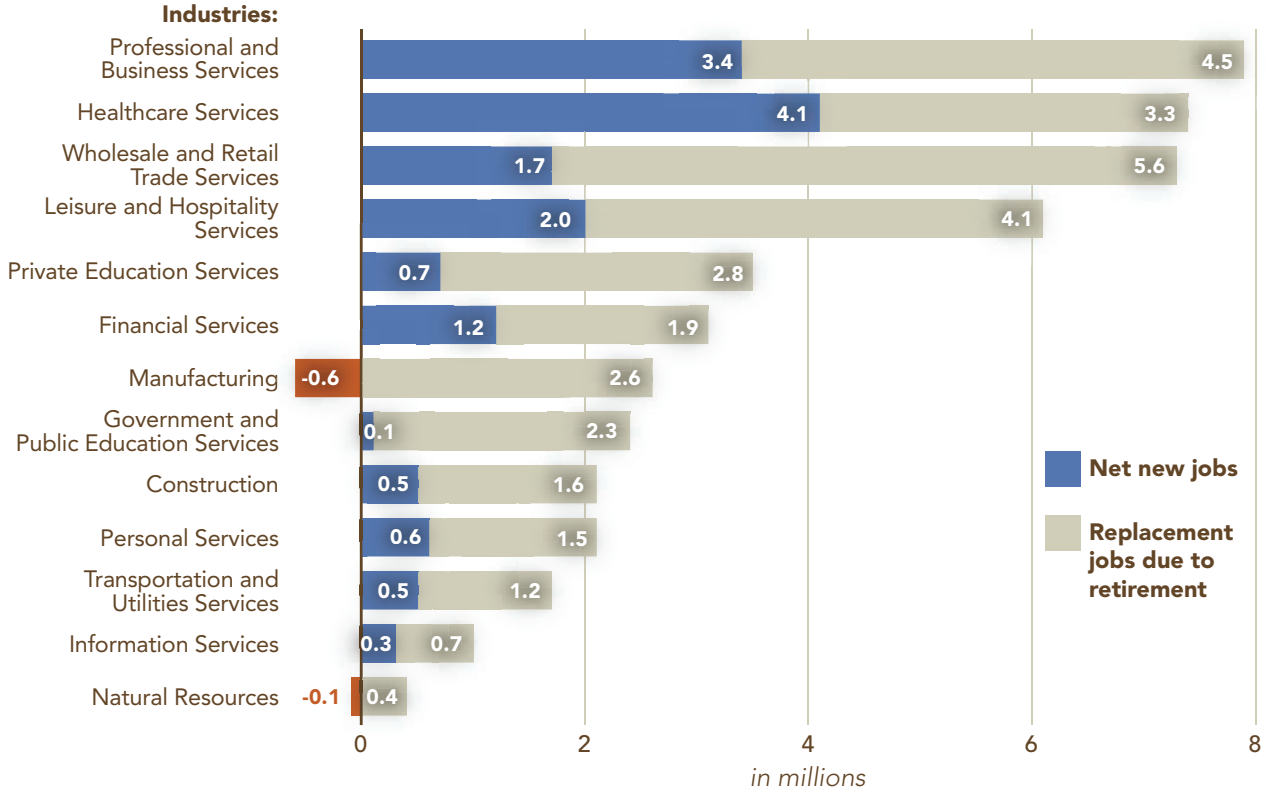
Most job decline comes from technology change and automation, not from declining demand for products or services. Technology, especially computer-based technology, makes it possible to create higher productivity—more output with fewer people. The ability of computer-based technologies to increase output without increasing employment can be striking. Some examples are the following:

- The computer and peripheral equipment manufacturing industry is projected to increase output almost fivefold, from about $200 billion to almost $1 trillion dollars between 2008 and 2018. At the same time, the industry will shed nearly 60,000 jobs, dropping from more than 180,000 to less than 125,000 positions.
- The Semiconductor and Electronic Component Manufacturing industry is projected to increase output by more than

FIGURE 4.5

Industrial distribution of net new and replacement jobs through 2018. Healthcare Services has the largest proportion of net new jobs and the second largest fraction of job openings through 2018.

Source: Center on Education and the Workforce forecast of educational demand through 2018



175 percent, growing from about $170 billion to more than $300 billion in output. Over the same period, employment in the industry will decline by some 145,000, going from 432,000 jobs in 2008 to 287,000 in 2018.

- Output in Telecommunications Services will increase by 170 percent, from almost $500 billion in 2008 to more than $800 billion in 2018. Over the same period, the industry will lose almost 100,000 jobs.
- Insurance Services will lose as many as 60,000 jobs, even as the industry's output increases by more than $60 billion.

Because of technology improvements, output tends to grow faster than jobs in virtually every industry, although it can vary considerably. The effect of technology tends to be more powerful in Goods production than in Services, but its effects on Services industries are still powerful. Over the next decade, output in Services is expected to increase by roughly 25 percent, almost $5 trillion. Over the same period, Services employment is expected to increase by about half that rate—roughly 12 percent, or some 14 million jobs.

DECLINING INDUSTRIES STILL HAVE JOB OPENINGS.

There will be jobs following the recession; job openings exist even now. That is because industry growth only tells part of the story—replacement jobs due to retirement are the other part.[19] Figure 4.5 details these openings by industry by 2018.

We forecast 46.8 million job openings between 2008 and 2018 and there will be many openings for workers with a postsecondary education in both declining industries and in those that will grow. Service industries provide virtually all of the net new jobs over the decade, since Manufacturing and Natural Resources will decline over that time. The Healthcare Services industry leads in job creation and will post 4.1 million net new jobs between 2008 and 2018 (Figure 4.5). Other Services industries with high net new job creation include Professional and Business Services (3.4 million net new jobs); Leisure and Hospitality (2 million net new jobs); Wholesale and Retail Trade Services (1.7 million net new jobs); Financial Services (1.2 million net new jobs); Private Education Services (683,000 net new jobs); and Government and Public Education (123,000 net new jobs). Because of their huge productivity gains, Information Services only provide 294,000 net new jobs in spite of an increase in output of more than $700 billion. Transportation Services and Utilities follow a similar pattern, creating only 520,000 net new jobs as it increases output by more than $250 billion. While Manufacturing and Natural Resources lose jobs, there is one exception in the Goods-production sector: Construction. That industry tends to rise in good times and fall in bad. So, although it was hammered during the recession, construction will bounce back during the recovery, creating 505,000 net new jobs between 2008 and 2018.

The largest source of openings always comes from replacement jobs. In fact, these often occur at triple the number of openings due to growth. Replacement job growth will be particularly large over the next decade as the Baby Boom generation retires. Even assuming that Baby Boomers stay in the labor force beyond age 55 at unusually high rates, we still forecast a total of 32.4 million replacement job openings over the next decade. As with new jobs, the lion's share of these replacement positions will come in the Services industries.

Wholesale and Retail Trade Services will have the highest replacement job levels, totaling 5.6 million over the coming decade. Much the same is true in the Leisure and Hospitality Services industry, the third-largest source of replacement jobs, at 4.1 million. With the exception of Information Services, because of its unusually high productivity rates, replacement jobs are robust in all of the remaining services industries. Professional and Business Services will have the second-largest replacement rate at 4.5 million jobs over the decade, followed by:

- Healthcare Services, 3.3 million replacement jobs;
- Private Education Services, 2.8 million;
- Government and Public Education Services, 2.3 million;
- Financial Services, 1.9 million;
- Personal Services, 1.5 million;
- Transportation and Utilities Services, 1.2 million.

Except for the Construction industry, replacement jobs will be the only source of openings over the next decade in the Goods-production and Natural Resources industries. Construction produces 1.6 million replacement jobs along with its 505,000 new posts. Manufacturing is projected to decline in total jobs but will still produce 2.6 million replacement positions—more than half of the 10 Services industries. There will be no new jobs created in the Natural Resources sector, but 406,000 replacement jobs will open up there by 2018.

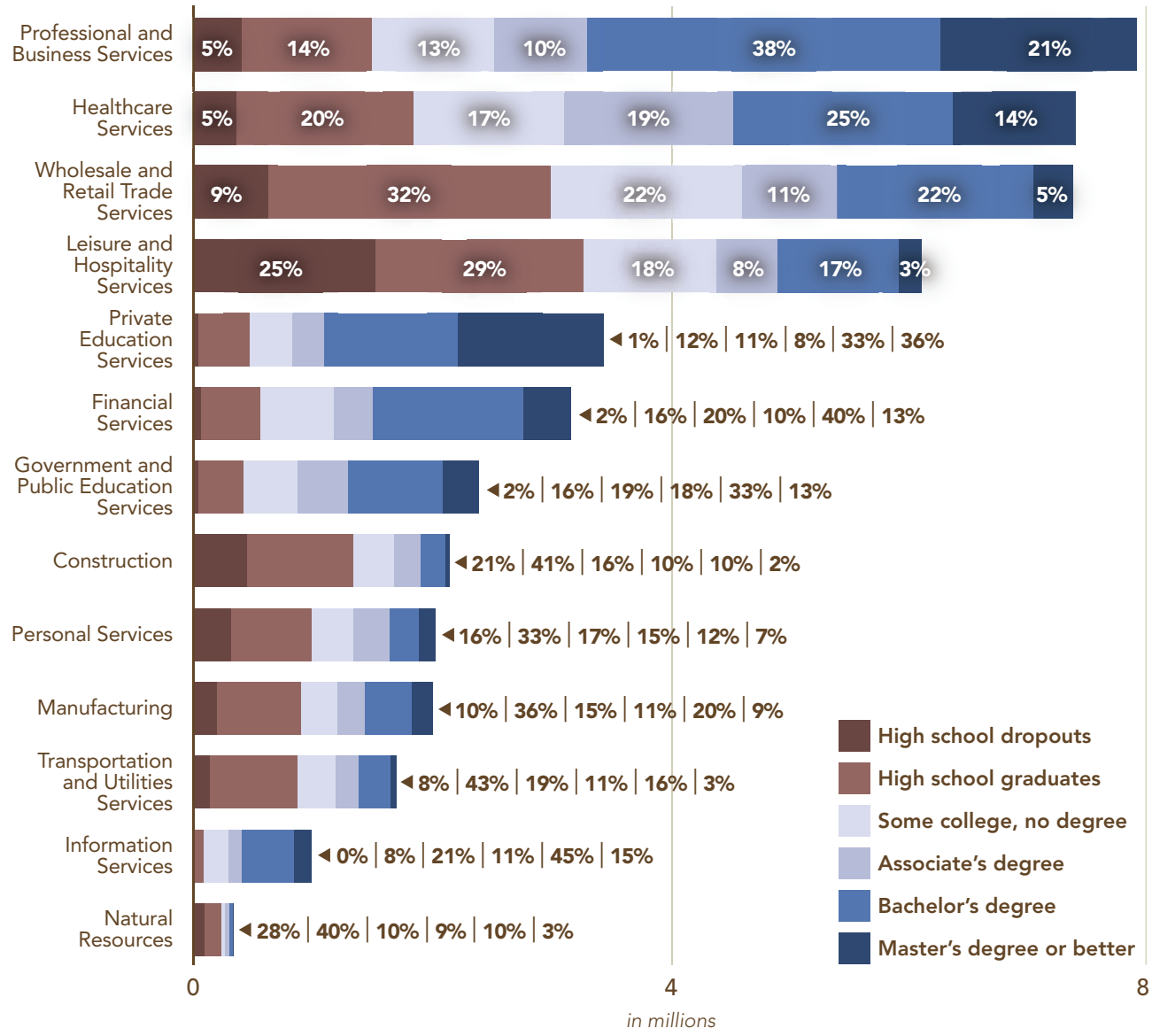
NEW JOBS DEMAND POSTSECONDARY EDUCATION.

The 14.4 million newly created jobs through 2018 will overwhelmingly require secondary education. Overall, the ratio of new to replacement jobs is about 0.3:1, while for positions requiring a Master's degree and better this ratio is 0.69:1 (1.77 million/2.93 million). The ratio of new to replacement jobs grows between high school and Master's level jobs.

FIGURE 4.6

Total job openings and educational demand by industry in 2018.

Source: Center on Education and the Workforce forecast of educational demand through 2018



Much of this distribution of job openings reflects an economy that is shifting toward industries that are growing and requiring more education of their workers. This, combined with the retirement of highly educated Baby Boomers, is a driver behind the ever-increasing demand for higher education in the labor market.

The economy is continuously in flux, but increasing educational requirements is a thread that runs throughout. As we have explained in previous sections, this is not a new trend. Some of the increasing demand comes about because employment gains are most robust in industries that require more education of its workers. This is fairly clear in the data. But another important, albeit less visible, driver is skill-biased technological change, or shifts in an industry's technology that favor more skilled workers. This pattern is picked up by our forecasting method (Appendix 4), and it contributes to a significant share of the educational demand observed in Figure 4.6.

Table 4.4, meanwhile, details how projected employment in 2018 will reinforce postsecondary educational demand and how the distribution of total employment works against people with high school diplomas or less. Wholesale and Retail Trade Services is forecast as the top-ranked industry, providing employment for many less-educated workers.

TABLE 4.4

Employment and educational demand in 2018 by industry. (in thousands)

Source: Center on Education and the Workforce forecast of educational demand through 2018

	Total		High school dropouts		High school graduates		Some college, no degree		Associate's degree		Bachelor's degree		Master's degree or better	
INDUSTRIES:	#	Rank	#	Rank	#	Rank	#	Rank	#	Rank	#	Rank	#	Rank
Wholesale and Retail Trade Services	24,145	1	2,054	2	7,747	1	5,241	1	2,629	3	5,384	3	1,090	7
Professional and Business Services	23,058	2	1,172	5	3,181	7	2,995	4	2,265	4	8,649	1	4,795	1
Government and Public Education Services	21,860	3	347	10	3,466	6	4,127	2	3,909	2	7,246	2	2,764	3
Healthcare Services	20,554	4	991	6	4,124	4	3,519	3	3,936	1	5,116	4	2,866	2
Leisure and Hospitality Services	16,155	5	4,030	1	4,636	3	2,937	5	1,351	6	2,691	6	510	8
Manufacturing	13,080	6	1,262	4	4,646	2	1,984	7	1,459	5	2,612	7	1,116	6
Financial Services	11,344	7	218	11	1,781	10	2,220	6	1,177	7	4,506	5	1,442	4
Construction	8,629	8	1,809	3	3,554	5	1,387	8	878	9	837	11	163	12
Transportation and Utilities Services	6,687	9	553	9	2,872	8	1,263	9	768	10	1,050	10	181	11
Personal Services	6,212	10	970	7	2,065	9	1,064	10	914	8	750	12	448	10
Private Education Services	3,482	11	40	12	432	12	366	12	263	12	1,142	9	1,238	5
Information Services	3,461	12	-	13	292	13	736	11	382	11	1,548	8	504	9
Natural Resources	2,883	13	818	8	1,159	11	281	13	258	13	276	13	92	13

The second- (Professional and Business Services) and third- (Government and Public Education Services) largest industries, however, rank fifth and 10th (out of 13) for jobs with less-than-high school requirements and seventh and sixth for positions requiring high school diplomas. On the other hand, these same two industries rank first and second for Bachelor's degree requirements and first and third, respectively, for graduate level requirements.

On the following few pages, we look in more detail at what lies ahead for job seekers, broken down by industry and levels of education.

High School Dropouts

Workers without high school diplomas will be concentrated in the Leisure and Hospitality (28 percent); Wholesale and Retail Trade (14 percent); and Construction (13 percent) industries. Those sectors will account for 55 percent of less-than-high school employment (Figure 4.7). Job openings for these workers follow the same pattern—nearly twice as many openings will occur in Leisure and Hospitality as in Wholesale and Retail Trade Services. Openings in Construction will rank just beneath those in Wholesale and Retail. Typically, replacement jobs drive openings for the low-skilled workforce, and that will be true going forward, too. In the case of Manufacturing and Natural Resources, all of the openings will be replacements.

High School Graduates

Employment of high school graduates will be concentrated in Wholesale and Retail Trade Services (19 percent), with an additional 34 percent spread across Manufacturing (12 percent), Leisure and Hospitality (12 percent), and Healthcare Services (10 percent). Openings will be strong for high school graduates in these industries (Figure 4.8). Overall growth in Healthcare Services will benefit workers with high school educations, as will replacement demand across the economy.

FIGURE 4.7

Distribution of high school dropouts employed by industry in 2018.

Source: Center on Education and the Workforce forecast of educational demand to 2018

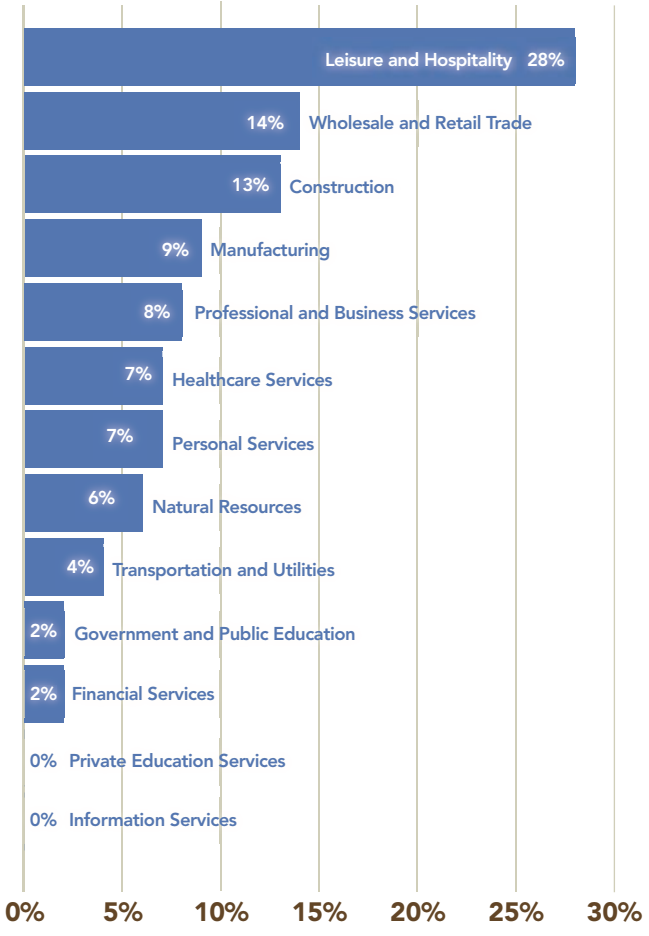
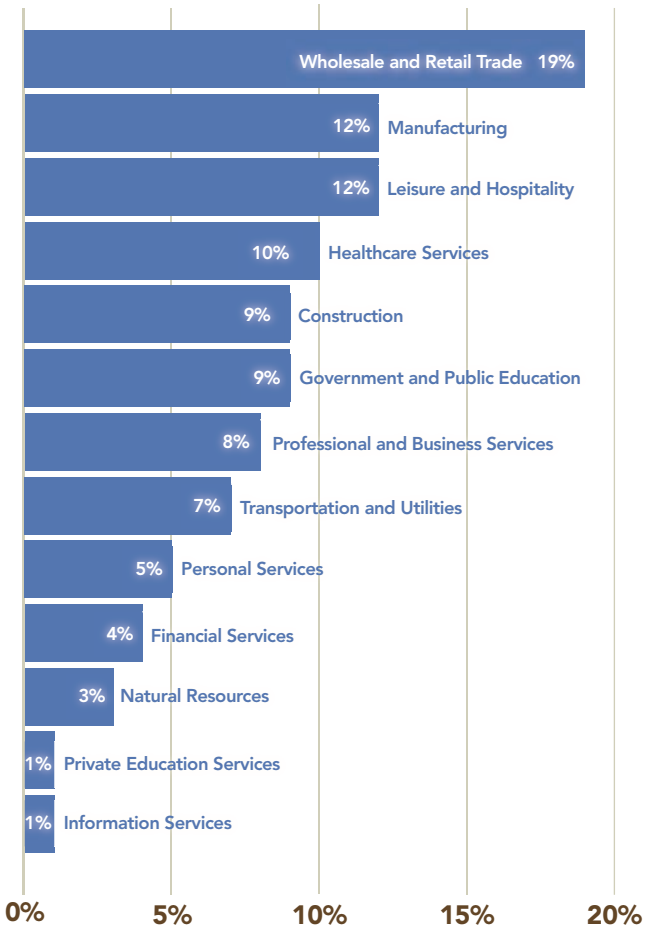


FIGURE 4.8

Distribution of high school graduates employed by industry in 2018.

Source: Center on Education and the Workforce forecast of educational demand to 2018



Some College Education

Workers with some college education will find a third of their employment in Wholesale and Retail Trade (19 percent) and Government and Public Education (15 percent), with another third of employment spread across Healthcare Services (13 percent), Professional and Business Services (11 percent), and Leisure and Hospitality (10 percent). Workers with some college will benefit from growth in Healthcare Services, but will find their strong hold on employment in Government and Public Education supported almost entirely by replacement demand (Figure 4.9).

Associate's Degree

Demand for Associate's degrees will be concentrated in Healthcare Services (19 percent) and Government and Public Education (19 percent). These workers will also have a strong presence in Wholesale and Retail (13 percent) and Professional and Business Services (11 percent). Job openings will be strongest in Healthcare Services, where specific Associate-level jobs will be dominated by openings from growth. New job openings will also be plentiful in Professional and Business Services. Overall, a large number of openings will occur in Wholesale and Retail Trade, although most of these will be derived from retirement (Figure 4.10).

FIGURE 4.9

Distribution of workers with some college education but no degree employed by industry in 2018.

Source: Center on Education and the Workforce forecast of educational demand to 2018

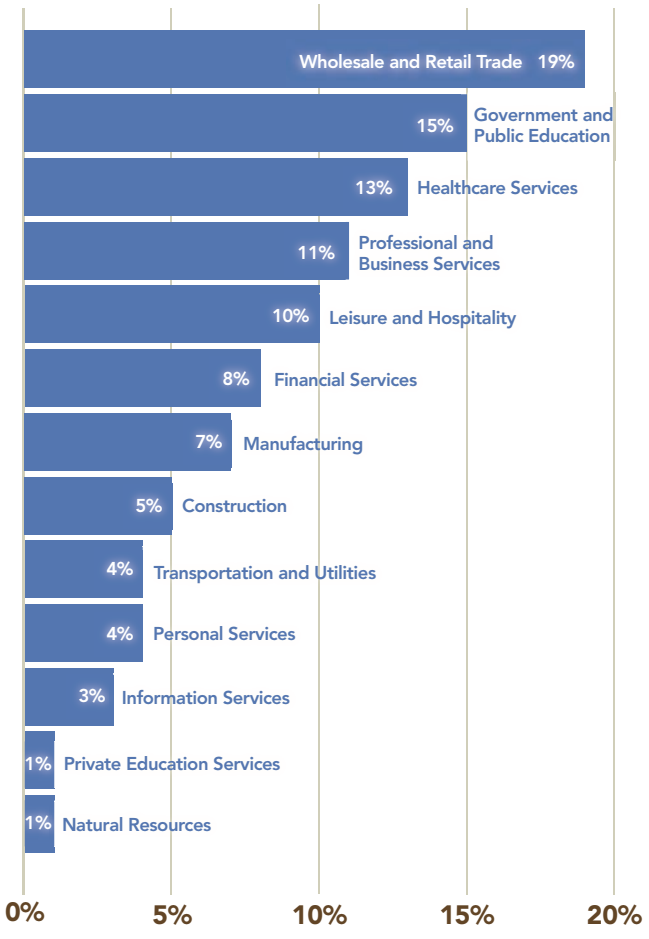
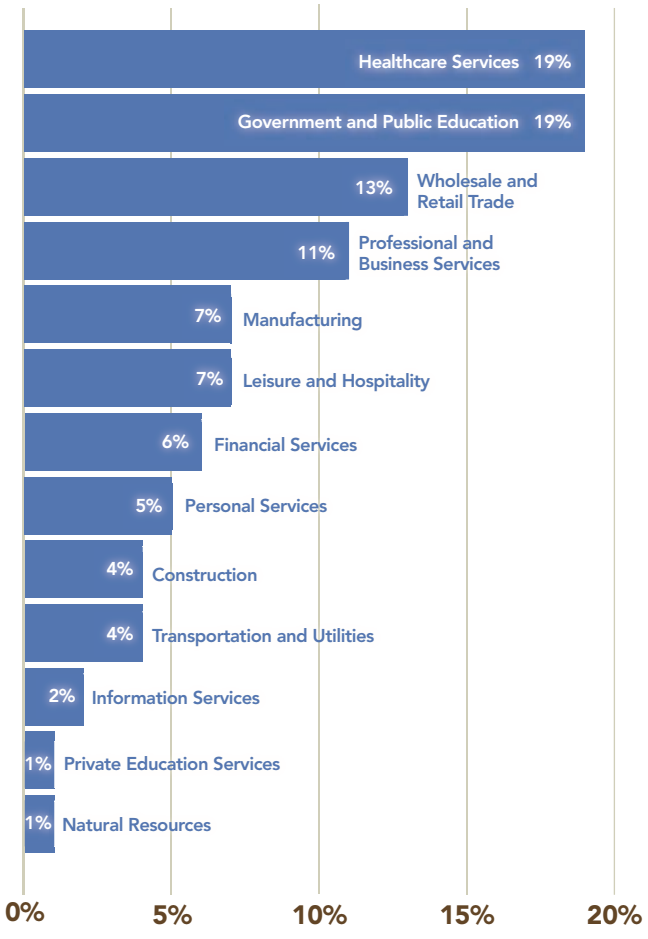


FIGURE 4.10

Distribution of Associate's degree holders employed by industry in 2018.

Source: Center on Education and the Workforce forecast of educational demand to 2018



Bachelor's Degrees

Seventy-four percent of workers with Bachelor's degrees will be employed in Professional and Business Services (21 percent), Government and Public Education (17 percent), Wholesale and Retail Trade (13 percent), Healthcare Services (13 percent), and Financial Services (11 percent). New job openings will be strong in Professional and Business Services and Financial Services. Overall openings will be largest in Professional and Business Services, Healthcare Services, and Wholesale and Retail Trade. Openings will be robust, but slightly fewer in number, in Financial Services, Private Education Services, Leisure and Hospitality, and Government and Public Education (Figure 4.11).

Master's Degrees and Better

While graduate-level workers will be spread across the 2018 economy, they will concentrate quite heavily in Professional and Business Services (28 percent). Another third will be employed in Healthcare Services (17 percent) and Government and Public Education (16 percent). Many of the opportunities for workers with graduate degrees in Professional and Business Services and Healthcare Services will stem from growth in those industries, where new openings will exceed those from replacement. Overall openings will also be high in Private Education Services (Figure 4.12).

FIGURE 4.11

Distribution of Bachelor's degree holders employed by industry in 2018.

Source: Center on Education and the Workforce forecast of educational demand to 2018

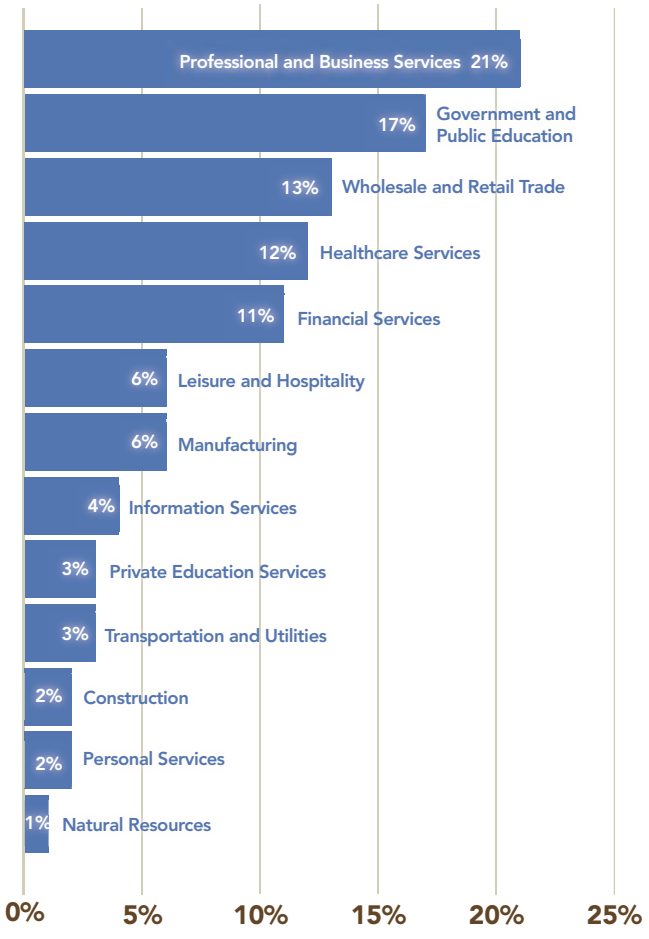


FIGURE 4.12

Distribution of graduate degree holders employed by industry in 2018.

Source: Center on Education and the Workforce forecast of educational demand to 2018

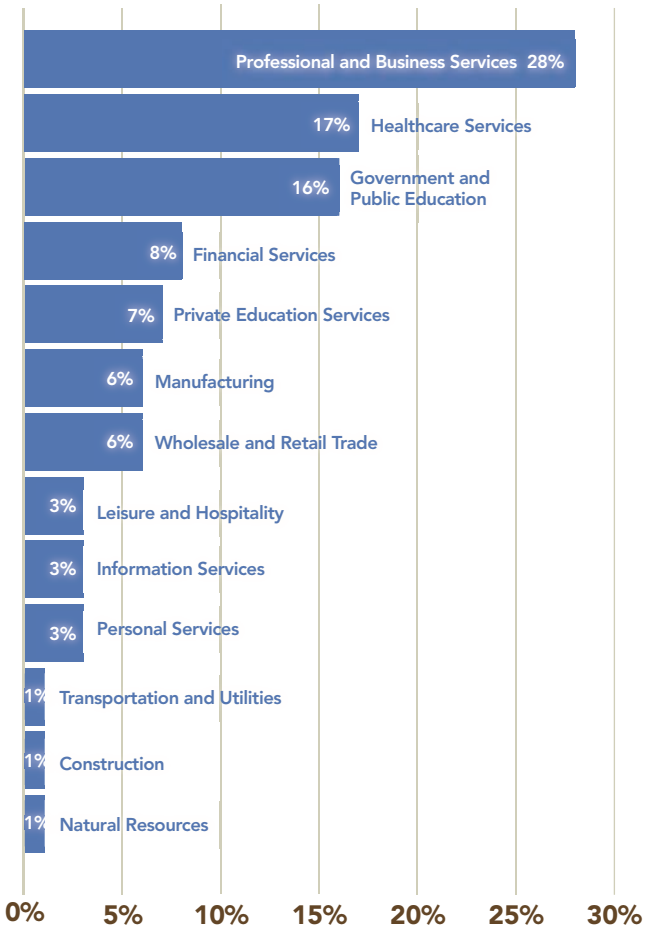


TABLE 4.5

Employment and educational demand in 2018 by industry.

Source: Center on Education and the Workforce forecast of educational demand to 2018

	High school dropouts		High school graduates		Some college, no degree		Associate's degree		Bachelor's degree		Master's degree or better		
INDUSTRIES:	% of industry	Rank	% of industry	Rank	% of industry	Rank	% of industry	Rank	% of industry	Rank	% of industry	Rank	Total
Natural Resources	28%	1	40%	3	10%	13	9%	11	10%	13	3%	10	100%
Leisure and Hospitality Services	25%	2	29%	7	18%	6	8%	12	17%	9	3%	11	100%
Construction	21%	3	41%	2	16%	9	10%	9	10%	12	2%	13	100%
Personal Services	16%	4	33%	5	17%	7	15%	3	12%	11	7%	8	100%
Manufacturing	10%	5	36%	4	15%	10	11%	5	20%	8	9%	7	100%
Wholesale and Retail Trade Services	9%	6	32%	6	22%	1	11%	7	22%	7	5%	9	100%
Transportation and Utilities Services	8%	7	43%	1	19%	4	11%	4	16%	10	3%	12	100%
Professional and Business Services	5%	8	14%	11	13%	11	10%	10	38%	3	21%	2	100%
Healthcare Services	5%	9	20%	8	17%	8	19%	1	25%	6	14%	4	100%
Financial Services	2%	10	16%	10	20%	3	10%	8	40%	2	13%	5	100%
Government and Public Education Services	2%	11	16%	9	19%	5	18%	2	33%	4	13%	6	100%
Private Education Services	1%	12	12%	12	11%	12	8%	13	33%	5	36%	1	100%
Information Services	0%	13	8%	13	21%	2	11%	6	45%	1	15%	3	100%
TOTAL	9%		25%		17%		12%		26%		11%		100%

Overall, the importance of education in the 2018 economy can be seen in how it is used across industries. The top three industries expected to employ high school dropouts—Natural Resources, Leisure and Hospitality Services, and Construction—rank 10th, ninth, and eighth in terms of their forecasted 2018 output. They will increase their output by 13, 8, and 6 percent, respectively. These same industries are 13th, ninth, and 12th in their relative requirements for workers with Bachelor's degrees, and 10th, 11th, and 13th in their relative demand for graduate-level employees. Bottom line: Industries with lower education requirements will grow more slowly than sectors that require more educational attainment (Table 4.5).

Table 4.6, meanwhile, shows the industries that are important drivers of demand within the workforce for workers at each education level. Wholesale and Retail Trade Services will support 15 percent of total projected 2018 employment; Professional and Business Services will generate 14 percent; and Government and Public Education Services will employ 14 percent. Combined, these three industries will employ 24 percent of high school dropouts, 36 percent of high school graduates, 45 percent of workers with some college, 43 percent of workers with Associate's degrees, 51 percent with Bachelor's degrees, and 50 percent of the graduate-level workforce. Leisure and Hospitality Services will provide the most jobs for the less-than-high-school labor force, while Wholesale and Retail Trade Services will rank highest for high school graduates and for workers with some college education. Associate's degree requirements are highest in the Healthcare Services industry, and Professional and Business Services provide the most jobs for the Bachelor's and better workforce (Table 4.6).

We forecast the 2018 economy to be one with significant postsecondary requirements—a continuation of trends already working in the 2008 economy. Table 4.7 details the requirement of some-college-or-better workers by industry, ranked by share of this postsecondary requirement, and demonstrates how this demand will change by industry by 2018. Our forecast shows some of the strongest demand will be in industries requiring the most intense concentrations of workers with at least some college or better.

TABLE 4.6

Concentration of educational demand within industries in 2018.

Source: Center on Education and the Workforce forecast of educational demand to 2018

INDUSTRIES:	Total		High school dropouts		High school graduates		Some college, no degree		Associate's degree		Bachelor's degree		Master's degree or better	
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank
Wholesale and Retail Trade Services	15%	1	14%	2	19%	1	19%	1	13%	3	13%	3	6%	7
Professional and Business Services	14%	2	8%	5	8%	7	11%	4	11%	4	21%	1	28%	1
Government and Public Education Services	14%	3	2%	10	9%	6	15%	2	19%	2	17%	2	16%	3
Healthcare Services	13%	4	7%	6	10%	4	13%	3	19%	1	12%	4	17%	2
Leisure and Hospitality Services	10%	5	28%	1	12%	3	10%	5	7%	6	6%	6	3%	8
Manufacturing	8%	6	9%	4	12%	2	7%	7	7%	5	6%	7	6%	6
Financial Services	7%	7	2%	11	4%	10	8%	6	6%	7	11%	5	8%	4
Construction	5%	8	13%	3	9%	5	5%	8	4%	9	2%	11	1%	12
Transportation and Utilities Services	4%	9	4%	9	7%	8	4%	9	4%	10	3%	10	1%	11
Personal Services	4%	10	7%	7	5%	9	4%	10	5%	8	2%	12	3%	10
Private Education Services	2%	11	0%	12	1%	12	1%	12	1%	12	3%	9	7%	5
Information Services	2%	12	0%	13	1%	13	3%	11	2%	11	4%	8	3%	9
Natural Resources	2%	13	6%	8	3%	11	1%	13	1%	13	1%	13	1%	13
TOTAL	100%		100%		100%		100%		100%		100%		100%	

TABLE 4.7

Share of industry employees with some college education or better in 2008.

Source: Authors' analysis of March CPS data, 2008; Center on Education and the Workforce forecast of educational demand to 2018

INDUSTRIES:	Some college or better 2008*	% of total industry employment 2008	Change 2008–2018		Rank	
			#*	%	Fastest (%)	Largest (#)
Government and Public Education Services	16,502	76%	1,545	9%	5	10
Professional and Business Services	14,060	71%	4,645	33%	1	2
Healthcare Services	11,808	72%	3,630	31%	2	3
Wholesale and Retail Trade Services	11,728	52%	2,616	22%	3	6
Financial Services	7,588	75%	1,758	23%	4	5
Manufacturing	6,660	49%	511	8%	9	11
Leisure and Hospitality Services	6,446	45%	1,044	16%	6	7
Construction	3,317	41%	-51	-2%	13	13
Transportation and Utilities Services	2,901	47%	361	12%	10	8
Personal Services	2,883	51%	293	10%	11	9
Information Services	2,364	75%	805	34%	7	1
Private Education Services	2,306	82%	703	30%	8	4
Natural Resources	919	31%	-13	-1%	12	12

*(in thousands)

Demand for Education by Industry: A More Detailed Discussion.

As we have seen, the demand for workers with a postsecondary education has been growing and will continue to grow, especially with the expansion of Services industries. Postsecondary demand has also been growing—and will continue to do so—in Manufacturing, Construction, and other Goods-producing industries. The sole exception to the trend is Natural Resources. The concentration of postsecondary workers has not grown in that group of industries and will not grow significantly over the next decade.

If we look across the entire economy, we find that one-third of all job openings will require a Bachelor's degree or better. A slightly smaller proportion of workers (30 percent) will require some postsecondary education—such as a certificate, certification, or an Associate's degree—and another 37 percent will be high school graduates or dropouts (Figure 4.13).

Natural Resources (69 percent), Construction (62 percent), and Leisure and Hospitality Services (54 percent) will have the most jobs requiring workers with high school educations or less (Table 4.8). At the other end of the spectrum, Private Education Services (68 percent), Information Services (59 percent), and Professional and Business Services (58 percent) will have the largest volume of total job openings requiring a Bachelor's degree or more.

Four industries drive openings for workers at all education levels. Those industries are Professional and Business Services (17 percent), Healthcare Services (16 percent), Wholesale and Retail Trade Services (16 percent), and Leisure and Hospitality Services (13 percent). Private Education Services is an outlier, in that it will have the third-largest set of openings requiring workers with Bachelor's degrees or higher.

Table 4.9 details how openings from growth compare to replacement openings as drivers of educational demand. As shown, the distribution of educational attainment among openings will include jobs for:

- 15.2 million workers with high school diplomas or less;
- 8 million workers with some college education, but no degree;
- 5.6 million workers with Associate's degrees;
- Nearly 18 million workers with Bachelor's degrees or better.

FIGURE 4.13

By 2018, 30 million new and replacement jobs will require some college or better.

Source: Center on Education and the Workforce forecast of educational demand through 2018

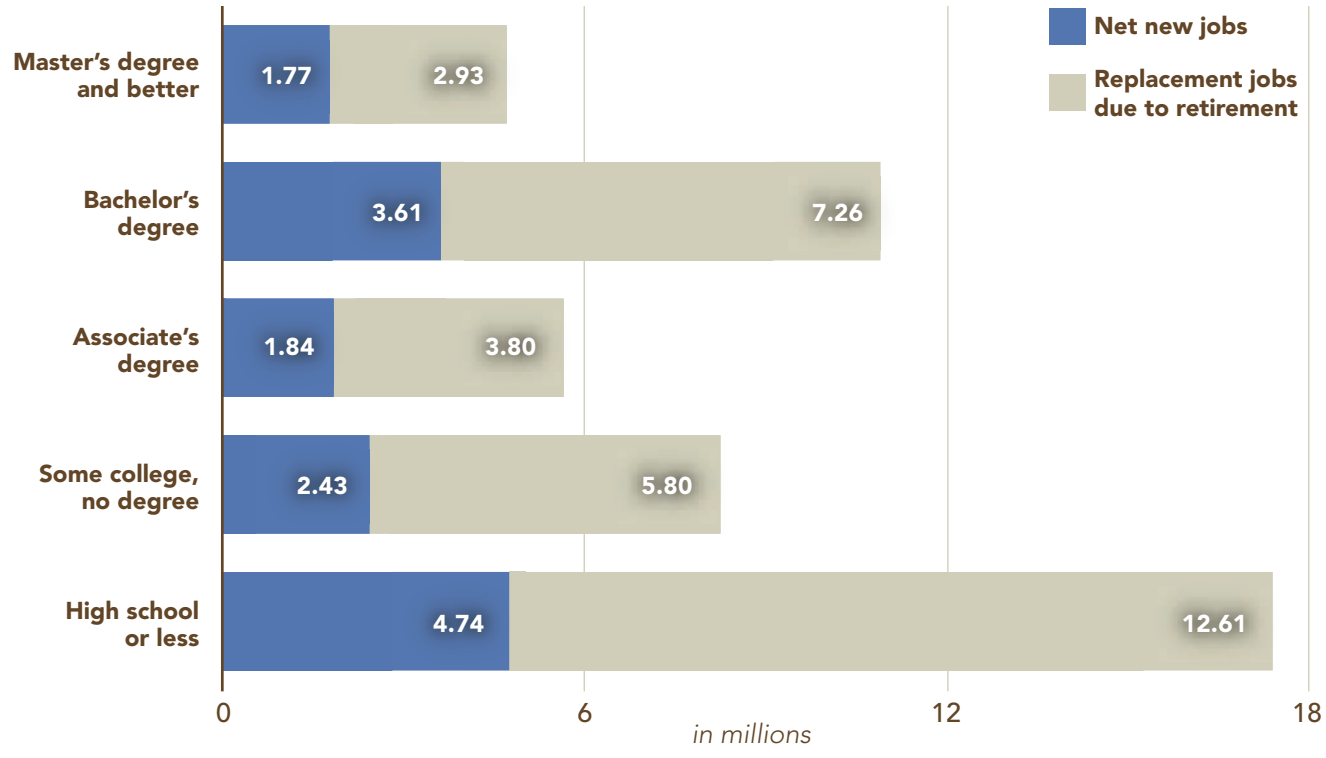


TABLE 4.8

Educational concentration of total job openings across industries in 2018.

Source: Center on Education and the Workforce forecast of educational demand through 2018

INDUSTRIES:	High school or less		Some college, no degree		Associate's degree		Bachelor's degree or better		Total
	% of industry	Rank	% of industry	Rank	% of industry	Rank	% of industry	Rank	
Natural Resources	69%	1	10%	13	9%	11	13%	12	100%
Construction	62%	2	16%	9	10%	9	12%	13	100%
Leisure and Hospitality Services	54%	3	18%	6	8%	12	20%	9	100%
Transportation and Utilities Services	51%	4	19%	4	11%	4	18%	11	100%
Personal Services	49%	5	17%	7	15%	3	19%	10	100%
Manufacturing	45%	6	15%	10	11%	5	29%	7	100%
Wholesale and Retail Trade Services	41%	7	22%	1	11%	7	27%	8	100%
Healthcare Services	25%	8	17%	8	19%	1	39%	6	100%
Professional and Business Services	19%	9	13%	11	10%	10	58%	3	100%
Financial Services	18%	10	20%	3	10%	8	52%	4	100%
Government and Public Education Services	17%	11	19%	5	18%	2	46%	5	100%
Private Education Services	14%	12	11%	12	8%	13	68%	1	100%
Information Services	8%	13	21%	2	11%	6	59%	2	100%

TABLE 4.9

Educational demand for new and replacement jobs through 2018. (in thousands)

Source: Center on Education and the Workforce forecast of educational demand through 2018

INDUSTRIES:	High school dropouts		High school graduates		Some college, no degree		Associate's degree		Bachelor's degree		Master's degree or better	
	New	Repl	New	Repl	New	Repl	New	Repl	New	Repl	New	Repl
Construction	106	344	208	676	81	264	51	167	49	159	10	31
Financial Services	24	37	196	300	244	374	129	198	496	758	159	243
Government and Public Education Services	2	36	20	359	23	428	22	405	41	752	16	287
Healthcare Services	198	158	825	658	704	561	787	628	1,023	816	573	457
Information Services	0	0	25	58	62	147	32	76	131	309	43	101
Leisure and Hospitality Services	491	1,030	565	1,185	358	751	165	345	328	687	62	130
Manufacturing	-55	248	-201	911	-86	389	-63	286	-113	512	-48	219
Natural Resources	-20	115	-29	163	-7	40	-6	36	-7	39	-2	13
Other Services	88	228	188	486	97	251	83	215	68	177	41	105
Private Education Services	8	32	85	342	72	290	52	208	224	902	243	978
Professional and Business Services	172	230	466	624	438	587	331	444	1,266	1,696	702	940
Transport and Utilities Services	43	97	223	504	98	222	60	135	82	184	14	32
Wholesale and Retail Trade Services	148	478	559	1,804	378	1,220	190	612	388	1,254	79	254
TOTAL	1,205	3,033	3,130	8,070	2,462	5,524	1,833	3,755	3,976	8,245	1,892	3,790

Except for Construction, the Goods-producing industries all have lower levels of employees with postsecondary training or education than the Services industries. This is especially evident in Manufacturing and Natural Resources, where there is no new net job growth. Only about one-third of workers in the Manufacturing and Natural Resources industries have at least some postsecondary education or training—a level of postsecondary workers that is exceeded in every services industry.

Construction, as noted, is the exception in Goods production. It is growing, and almost half of its employees had at least some postsecondary education or training in 2008. This level exceeds the share of postsecondary workers in the Services industries with the lowest shares of postsecondary workers. Only 45 percent of workers in Leisure and Hospitality Services, for example, have postsecondary training.

Natural Resources

- For example, farming, fishing, forestry, hunting, and mining

They are what remains of the extractive economy that dominated the United States until after the Civil War. They are now among the nation's smallest industries, both in output and employment. In 2008, Natural Resources industries employed about 3 million workers, or some 2 percent of the workforce. Overall employment in this sector will decline by 2018 to 2.9 million workers, or 1.8 percent of the workforce.

With the exception of coal mining, where there is some small job growth because of the overwhelming demand for domestic energy sources, Natural Resources industries will increase their output but not the number of jobs. All 300,000 job openings we forecast for Natural Resources in 2018 will come from the retirement of existing workers, ranking it at bottom of the 13 industries we examined for the number of job openings.

Natural Resources has the lowest level of postsecondary employment of all industry categories. The total number of jobs has been declining in this industry over time, although the occupations that remain increasingly have required postsecondary education. In 1983, the Natural Resources industries employed only 22 percent of U.S. workers with at least some college education. That share had increased to 34 percent by 1992 and stayed at that level through 2008. Our projections show continued increase by 2018, from 34 percent to 38 percent.

Of the 300,000 job openings in the Natural Resources industries, 105,000 will require at least some college.

Natural Resources industries will have openings for:

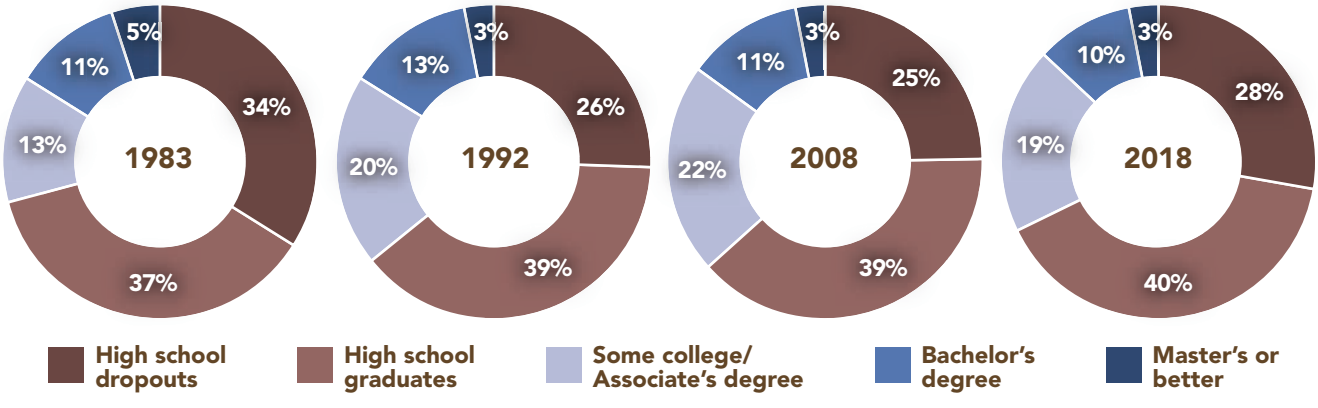
- 95,000 workers who dropped out of high school;
- 135,000 high school graduates;
- 32,000 workers with some college, but no degree;
- 30,000 workers with Associate's degrees;
- 32,000 workers with Bachelor's degrees;
- 11,000 workers with Master's degrees or better.

Figure 4.14 shows that education requirements have been relatively constant in this industry, with some shifting away from high school dropouts. The level of workers with high school diplomas was 37 percent in 1983 and will be 40 percent in 2018, while dropouts will decline from 34 percent in 1983 to 28 percent in 2018.

FIGURE 4.14

Educational Attainment in Natural Resources (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



Goods-producing Industries

- Includes Manufacturing and Construction

The Goods-producing industries provided more than 20 million jobs in 2008, roughly 15 percent of total positions. These industries produced more than $5 trillion in output in 2008, which means they provided almost 25 percent of national output using only 15 percent of the nation's workers. Goods production will grow more than $1 trillion and provide 4.7 million job openings between 2008 and 2018, including 505,000 net new jobs and 4.2 million replacement jobs.

Employment levels in Goods-producing industries have been most affected by computer-based technologies that automate routine tasks. More routine Goods-production functions have been outsourced and moved off-shore to less costly and lower skilled workers.

The share of postsecondary workers in Goods-production has increased as technology has automated routine functions, leaving behind more challenging tasks that require postsecondary skill or training. Goods-production workers with at least some postsecondary education or training constituted 46 percent of the industry's workforce in 2008, a figure that will grow to 48 percent in 2018. Those levels compare to 60 percent of all workers in the economy as a whole for 2008, and 63 percent projected for 2018.

Manufacturing

Manufacturing includes makers of nondurable goods that are quickly used up, such as cosmetics or office supplies, and durable goods, such as cars, that are used for several years. For many years, Manufacturing was the nation's largest employer, although that peaked in 1979. In 2008, Manufacturing was still our largest industry as measured by the value of its output, but ranked sixth for employment with some 13.6 million workers or about 9 percent of the nation's workforce. Manufacturing is expected to remain our largest industry as measured by output, but employment is expected to decline by 4 percent between 2008 and 2018. It will increase its output by almost $1 trillion by 2018, yet Manufacturing's share of total output, its share of total employment, and its actual employment level all are expected to decline over the next decade.

As a result of the industry's ability to increase output with fewer employees, all job openings in manufacturing will come from retirement and other replacement needs. The Manufacturing industry will provide 2 million job openings between 2008 and 2018. Although we project that the industry will have some 2.6 million openings to replace retiring workers, about 565,000 of those jobs will be lost permanently, shrinking the number of actual openings. The industry will rank eighth in total jobs openings, all from replacement of retiring workers.

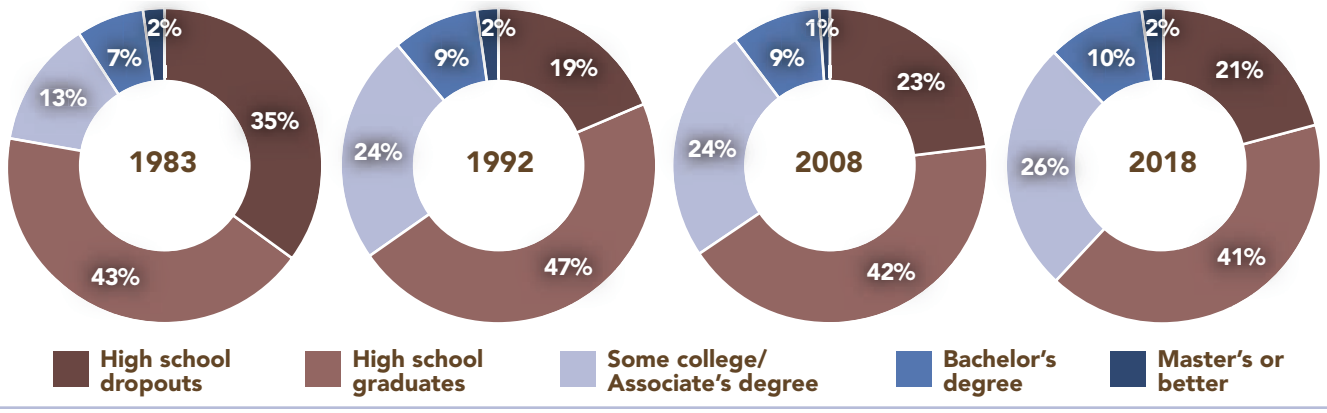
By 2018 we project Manufacturing industry jobs will fall to about 13 million from its 2008 level of 13.6 million. Increasing automation and global trade are the primary causes of Manufacturing decline. Employment declines will occur both in traditional Manufacturing and in newer industries. The fastest decline occurs in apparel, textile, and leather goods, but the largest declines will occur in electronics, transportation equipment, and metal products.

Output growth will be led by the manufacture of computer and information technologies—the technologies at the heart of structural change and increasing demand for postsecondary education throughout the economy. Ironically, though, the information technology manufacturing industries are victims of

FIGURE 4.15

Educational Attainment in Manufacturing (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



their own revolution. They experience the most intense productivity increases from automation, which results in falling employment. As a case in point, the computer and peripheral equipment manufacturing industry will grow by almost $800 billion in output—while its employment is expected to decline by almost 60 percent.

In contrast, as employment plunges in the manufacturing of computers and peripheral equipment, it will explode in a related Services industry field. Computer systems design and related services—part of Professional and Business Services—are expected to add some 650,000 jobs by 2018.

Some quick Manufacturing facts:

- Manufacturing jobs, as noted earlier, have been declining for decades but the jobs that remain require more postsecondary education to perform. In 1983, the industry employed just 22 percent of the nation's workers with at least some college education. The share increased to 34 percent by 1992 and has remained at the same level through 2008. Our projections show a small increase in the share of Manufacturing workers with at least some college from 34 percent to 38 percent.
- Manufacturing, along with Natural Resources industries, has the lowest shares of workers with postsecondary education or training among our 13 industry designations now and in our forecast for 2018.
- Postsecondary workers are underrepresented in the Manufacturing industry workforce. Manufacturing employs 9 percent of the total workforce, but just 7 percent of all postsecondary workers.

By 2018, Manufacturing will have openings for:

- 192,000 workers who dropped out of high school;
- 710,000 high school graduates;
- 303,000 workers with some college but no degree;
- 223,000 workers with Associate's degrees;
- 400,000 workers with Bachelor's degrees;
- 179,000 workers with Master's degrees or better.

High school graduates and dropouts have lost employment share in Manufacturing since 1983 when they captured 43 and 35 percent of employment. Combined, they are projected to employ 62 percent in 2018. Over the same period, requirements for workers with some college and Associate's degrees double from 13 percent to 26 percent (Figure 4.15).

Construction

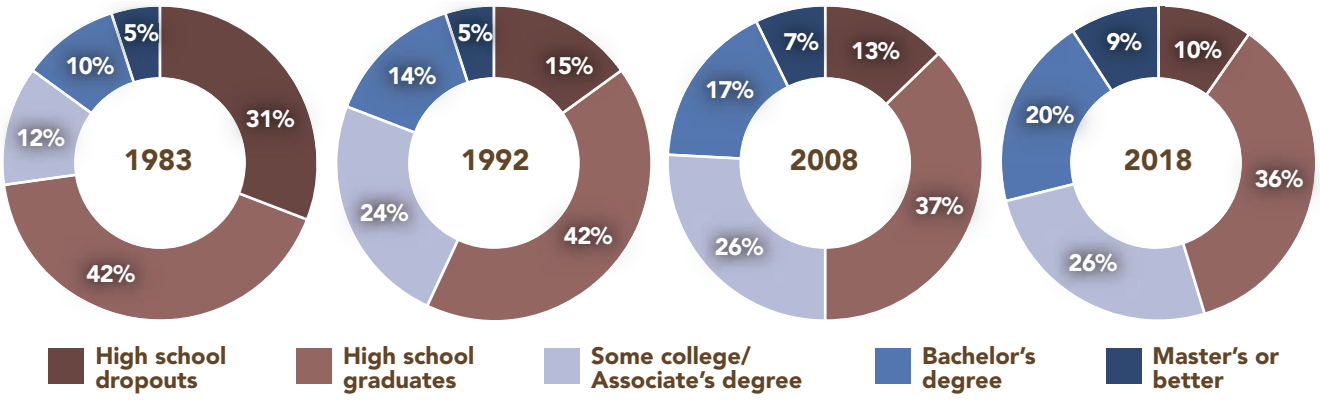
Construction is the nation's ninth-largest industry as measured by output and our eighth-largest industry employer, with 8.1 million workers, or 6 percent of the nation's workforce. In our forecast, employment will increase in this industry by 500,000 workers, but because of even larger growth in other industries, Construction's share of the workforce will decline from 6 percent to 5 percent. Because of its growth, Construction is the exception to the rule among Goods-producing industries. Construction is expected to add 505,000 new jobs over the next decade, plus an additional 1.6 million openings to replace retiring workers.

As with other industries hard hit by the recession, the forecast growth reflects a low starting point in 2008, caused by the virtual halt in construction after the economic crisis hit. Investment in residential housing will increase substantially, though, as housing starts race to catch up with pent-up demand that has been growing since the housing collapse.

FIGURE 4.16

Educational Attainment in Construction (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



An aging Baby Boom generation will add to the residential construction demand as the building of retirement communities and remodeling of existing structures surge with retirements. Baby Boomers also will add to nonresidential construction through increased demand for medical facilities and nursing homes. A substantial share of nonresidential construction will be driven by demographic shifts between geographic regions, creating demand for new infrastructure ranging from schools to retirement homes. Infrastructure investments that were put on hold in the recession and replacement or modernization of existing structures also will add to the coming surge in construction as the recovery gains momentum

Some quick Construction facts:

- The Construction industry has the highest share of postsecondary jobs among all the Goods-producing industries. Construction ranks eighth in the share of workers with at least some postsecondary education in 2008 and in our 2018 projections.
- The share of postsecondary workers in Construction has grown from 17 percent in 1983 to 50 percent in 2008, and we project that share will grow to 54 percent by 2018.
- Postsecondary workers are underrepresented in the Construction industry workforce. The industry employs 6 percent of all workers, but includes just 3 percent of all postsecondary workers.
- In 2008, postsecondary workers in Construction were divided between those with some college or an Associate's degree (26 percent), those with Bachelor's degrees (17 percent), and those with Master's or other graduate degrees (7 percent). The other 50 percent are divided between workers with high school diplomas and those who dropped out.

The Construction industry will provide 2.1 million job openings between 2008 and 2018, and 800,000 of those will require at least some college education.

Construction will have openings for:

- 450,000 workers who dropped out of high school;
- 885,000 high school graduates;
- 345,000 workers with some college but no degree;
- 219,000 workers with Associate's degrees;
- 208,000 workers with Bachelor's degrees;
- 41,000 workers with Master's degrees or better.

The industry is projected to move away from employing large numbers of high school dropouts toward requiring substantial postsecondary education. The demand for high school graduates will decline from 42 percent in 1983 to 36 percent of employment in 2018, while the requirement for at least some college or better doubles from 27 percent in 1983 to 54 percent in 2018 (Figure 4.16).

Services Industries

Services industries, a broad category consisting of 10 of the 13 major industries, accounted for almost 117 million jobs in 2008, and we forecast that number will swell to more than 131 million jobs in 2018. That means Services jobs will go from 73 percent of the total jobs in the economy to almost 80 percent. Economic output will grow explosively, too. Over the same period, output in Services industries will increase from $11 trillion to $20 trillion, boosting their share of total output from 65 percent to 73 percent.

Consider this contrast: Only one of the Goods-producing industries—Construction—is expected to grow in overall size. The reverse is true for Service Industries. Only one—Utilities—is expected to decline in overall size by 2018.

Services industries will provide some 42 million job openings between 2008 and 2018, including all 14 million of the economy's new jobs and 28 million openings to replace retiring workers. About 63 percent of these openings will require at least some college education.

Services industries will have openings for:

- 3.5 million workers who have dropped out of high school;
- 9.5 million high school graduates;
- 7.3 million workers with some college but no degree;
- 5.1 million workers with Associate's degrees;
- 11.5 million workers with Bachelor's degrees;
- 5.4 million workers with Master's degrees or better.

Services industries have been the primary source of value added, of Gross Domestic Product, growth, and of postsecondary demand—all of which is characteristic of the nation's shift from an industrial to a postindustrial economy. Service tasks often require interaction with other people and are not always routine. Services industries include many sectors that require robust knowledge, skills, and abilities. For example, doctors, lawyers, financial analysts, and teachers constantly deal with diverse problems and people, and they require both skill and knowledge to solve a constant stream of diverse problems. Heightened requirements for advanced knowledge, skill, and abilities make Services a natural seedbed for increasing postsecondary demand.

Many in the Services industries are college-educated, white collar workers who are responsible for deploying new technical capabilities throughout the economy. Many also are increasingly skilled technical and nonmanagerial workers who provide a growing share of value added to products and services in the postindustrial economy. In many ways, this dynamic has created a strong link between skill-biased technology change and growth in Services—both of which result in strong demand for workers with postsecondary educations. These workers do not make consumer goods or new technologies like manufacturers do, grow things like farmers, or wrest and refine natural resources like miners and loggers do. But they are, nonetheless, on the frontlines of the new postindustrial economy because they have their own skills: they can bend to their wills the new computer and communications technologies that have revolutionized modern economic activity.

In the pages that follow, we will look at some of the specific industries in this group and their employment prospects.

Information Services

- for example, newspaper publishers, libraries and archives, Internet service providers, the motion picture and videos industry, plus all other broadcast industries

This is the signature services industry in the new knowledge economy. Because of its extraordinary productivity, Information Services is distinguished by its output growth and the intensity of its demand for postsecondary education more than for its employment share. Information Services produced $769 billion in output in 1998, grew to $1.1 trillion in 2008, and is projected to grow to $1.9 trillion in 2018. Information Services moved from our ninth-largest industry in overall output in 1989, to seventh in 2008, and is projected to move into sixth by 2018.

Information Services employs only about 2 percent of the workforce, which ranked it among the three smallest industry employers in 2008, and it won't grow substantially between now and 2018. Information Services accounted for 3.1 million jobs in 2008, and we forecast that it will employ 3.4 million workers in 2018—an increase of about 290,000. The industry will create 985,000 total job openings by 2018 and will rank 12th out of our 13 industries in job openings. Still, Information Services is a core asset, producing the computing services, communications technology, and media that are at the core of the nation's postindustrial transformation. Industry employment boomed in the 1990s as part of the tsunami wave at the start of the computer revolution, but it has grown at a slow and steady pace ever since.

Because it sits at the heart of the economy's computer and communications technology change, the Information Services industry is a mixed bag of rapid growth and decline. Telecommunications and publishing are expected to lose more than 200,000 jobs over the next decade. Demand for non-electronic publishing is expected to continue to decline. And

while demand for telecommunications is expected to rise by more than $340 billion as homes and businesses invest in an expanding range of communications services, increasing automation will reduce new job growth. As a result, job openings in publications and telecommunications will come entirely from the replacement of retirees. The strongest employment growth in this sector will come from software publishing, Internet publishing, the development of Web search and service portals, and associated customer services as electronic media capture market share from more traditional media.

The relatively slow growth in Information Services employment is due to the technology shift between paper and electronic publishing. Paper-based newspaper, periodical, book, reference, and directory publishers are projected to lose jobs over the decade as those functions shift to electronic media. Moreover, net job growth relative to output in these functions is expected to decline because electronic media is less labor-intensive.

The share of postsecondary workers in Information Services has increased dramatically over time. From 1983 to 2008, the share of workers with at least some postsecondary education or training rose from 33 percent to 78 percent, and we project it will rise to 91 percent by 2018. Information Services had the second-highest share of postsecondary workers in 2008 at 79 percent. We project that trend will continue through 2018 as that share goes even higher, to 91 percent.

Workers with postsecondary education or training are overrepresented in the Information Services workforce. The industry employs just 2 percent of the nation's workers but 3 percent of its postsecondary workers. Information Services will provide 985,000 job openings between 2008 and 2018, and 902,000 of those will require at least some college.

Information Services will have openings for:

- 0 high school dropouts;
- 83,000 high school graduates;
- 209,000 workers with some college but no degree;
- 109,000 workers with Associate's degrees;
- 440,000 workers with Bachelor's degrees;
- 143,000 workers with Master's degrees or better.

Change in the Information Services industry has been profound. In 1983, the industry supported significant employment for workers with high school degrees or less, but now has virtually no opportunity for workers with that level of education. Sixty-seven percent of the industry's jobs in 1983 required a high school diploma or less, but this will shrink to 9 percent for high school graduates in 2018, with no jobs for high school dropouts (Figure 4.17).

Financial Services

- For example, finance, insurance, and real estate, as well as leasing and rental activities

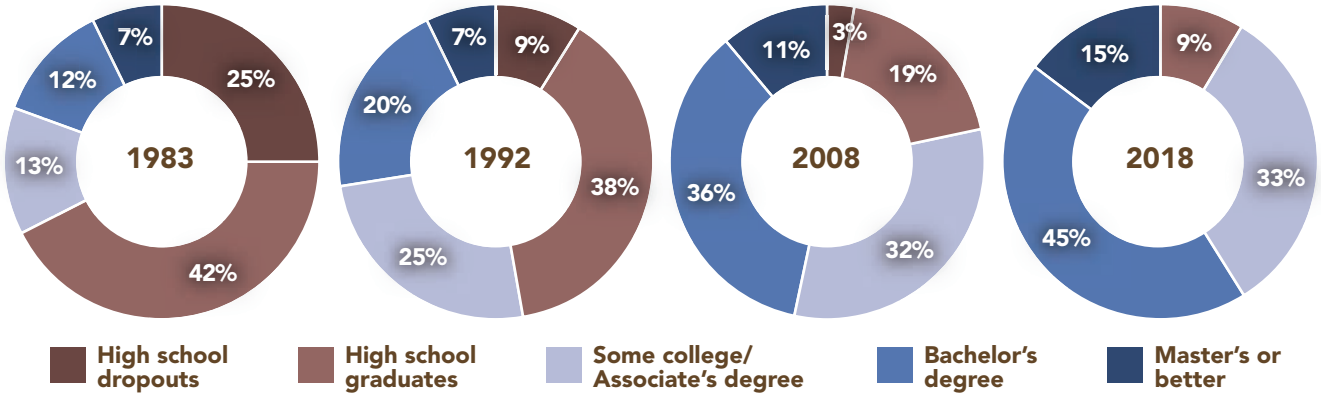
As measured by economic output, Financial Services is the second-largest industry in the economy and will remain so through 2018. It will grow from $3 trillion to almost $4 trillion over the next decade.

While Financial Services ranks second as measured by economic output, it was seventh in overall employment in 2008 and will keep that ranking in 2018. The industry employed 7 percent of all workers in 2008. Although its share of employment will remain stable, the Financial Services industry will increase its

FIGURE 4.17

Educational Attainment in Information Services (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



actual employment by 1.2 million workers over the decade, growing from 10 million jobs to 11.2 million. The industry will rank eighth in overall job openings between 2008 and 2018, creating 3.1 million job openings that will include 1.2 million net new jobs and 1.9 million jobs to replace retiring workers.

Financial Services has grown markedly over recent decades as a result of several factors. Among them are the shift from defined benefit to defined contribution retirement plans; increasing consumer debt for mortgages, postsecondary education, and consumer durables such as automobiles; and the globalization of Financial Services. Workers in this sector have been hit hard by the Great Recession of 2007, largely because the crisis was triggered by a financial and housing market collapse. But because of their pervasive role in modern economic institutions and because of the steep loss of jobs in the recession, they will grow back rapidly as the recovery proceeds. The industry should go from 3 million jobs in 2008 to almost 4 million by 2018.

The share of postsecondary workers in Financial Services has increased from 48 percent in 1983 to 76 percent in 2008 and is projected to increase to 82 percent by 2018. Financial Services had the third-highest share of workers with postsecondary education or training in 2008, with 76 percent attaining at least some college or better. It will hold onto that ranking in 2018, we project, increasing to 82 percent. Postsecondary workers are overrepresented in the Financial Services workforce. In 2008, Financial Services employed 7 percent of the nation's workers but 8 percent of its postsecondary workers.

Of the industry's 3.1 million job openings 2008 and 2018, some 2.6 million will require at least some college education. Financial Services will have openings for:

- 60,000 high school dropouts;
- 495,000 high school graduates;
- 617,000 workers with some college, but no degree;
- 327,000 workers with Associate's degrees;
- 1.3 million workers with Bachelor's degrees;
- 401,000 workers with Master's degrees or better.

The Financial Services industry, like Information Services, once relied on significant employment for workers with no postsecondary education. In 1983, 42 percent of employment in these jobs required no postsecondary education, but this share will shrink drastically to 18 percent in 2018 (Figure 4.18).

Professional and Business Services

- For example, legal, accounting, tax preparation, bookkeeping and payroll, advertising and related services, professional consulting, architectural, and engineering

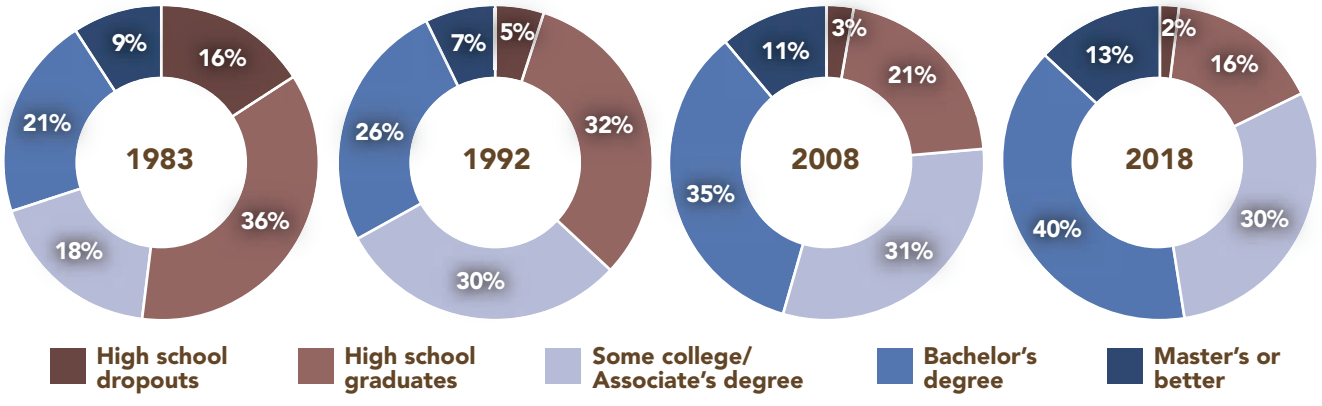
This sector employs workers who provide consulting, temporary help, technical support, and network computing and communications support to the complex organizational networks that typify the postindustrial economy.

The industry employed 19.7 million workers in 2008—13 percent of the workforce. We project it will add 1.4 million new jobs by 2018, making it second only to Wholesale and Retail Trade Services as the largest growth industry. Professional and Business Services is the nation's third-largest industry, producing more than $2.5 billion in economic output in 2008 and projected to increase by another $1 billion by 2018.

FIGURE 4.18

Educational Attainment in Financial Services (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



Between 2008 and 2018, Professional and Business Services will generate 7.9 million job openings, including 3.4 million net new jobs and 4.5 million to replace retiring workers.

Growth in this industry is a result of the increasing pace of change as employers struggle to retain and expand market shares in rapidly shifting environments.

The Professional and Business Services industry has grown apace with the increasing complexity of far-flung institutional networks that rely on multiple companies or institutions to produce final products or services. Such networks have become commonplace in the postindustrial economy. Workers in Professional and Business Services enable such networks by providing highly skilled professional and managerial expertise—skills that tend to cut across traditional industry, geographic, and occupational boundaries.

Consulting and contracting for basic services and expert work accounts for a growing share of Professional and Business Services employment. Strong growth in the future will be driven by the need for consultants and contractors to help companies with everything from running cafeterias to ensuring regulatory compliance to providing marketing, design, and logistics help.

Computer systems design is another fast growth area in this sector. Growth here is driven by a variety of factors, including demand for Internet and intranet design; the need for integration of fixed and mobile technologies; movement toward electronic records in healthcare and other industries; and the need for information security.

Increased use of temporary help and human resources firms will increase demand in employment services. The ongoing shift to temporary help services is projected to continue, especially in high-demand and specialized services such as healthcare. In addition, companies will increasingly shift human resource management functions to contractors in order to reduce costs and risk as they operate in complex regulatory and benefits environments.

Professional and Business Services had the fourth-highest share of postsecondary workers in 2008, with 76 percent attaining at least some college education or better. The share of postsecondary workers in the industry increased from 43 percent in 1983 to 71 percent in 2008 and is projected to hit 81 percent by 2018. Postsecondary workers are overrepresented in the Professional and Business Services workforce. In 2008, the industry employed 13 percent of the nation's workers, but 16 percent of its postsecondary workers. The industry will provide 7.9 million job openings between 2008 and 2018, with 6.4 million requiring at least some college education.

Professional and Business Services will have openings for:

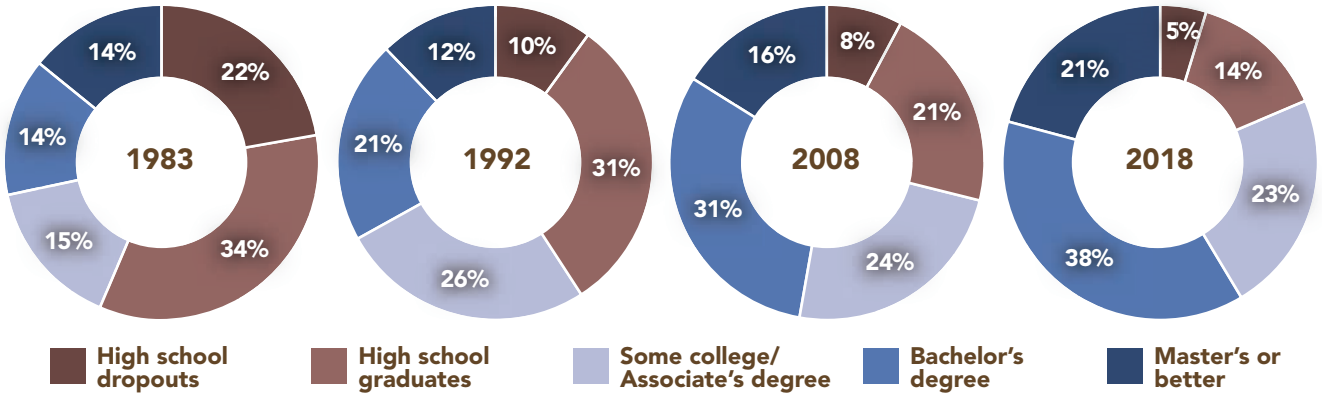
- 401,000 high school dropouts;
- 1.1 million high school graduates;
- 1 million workers with some college but no degree;
- 775,000 workers with Associate's degrees;
- 3 million workers with Bachelor's degrees;
- 1.6 million workers with Master's degrees or better.

The growth of the Professional and Business Services industry includes a shift toward increasing postsecondary requirements. In 1983, 56 percent of employment in the sector required no postsecondary education, but that will drop to 19 percent in 2018 (Figure 4.19).

FIGURE 4.19

Educational Attainment in Professional and Business Services (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



Education Services

- For example, elementary and secondary schools, colleges and universities, business and technical schools and professional services training institutions

Education Services is the core institution for providing entry-level workforce development in the postindustrial economy. Not surprisingly, education is the most postsecondary-intensive industry. The increasing importance of education in workforce preparation begins with a deep-seated education bias in technology change.

Because technology change requires workers with more skill, it naturally increases the demand for learning on the job and ultimately fuels increasing educational requirements in three respects:

- The flow of new skill requirements increases entry-level qualifications and these often require postsecondary education or training.
- Because technology automates repetitive functions, it increases the value of general skills required to perform nonrepetitive tasks and activities. Higher skill levels are necessary because employees are constantly dealing with a flow of unique problems to be solved. In addition, as technology takes on routine tasks, people in every industry spend more time interacting with coworkers, customers, and others. This is especially true in service industries, where human interactions are most pervasive and intense.
- The rate of change that has come with the new computer technology in its various guises means that employers want workers who can learn fast and innovate on the job. This further intensifies the need for more robust entry-level skills and increases demand for postsecondary learning.

This is why, combined, Public and Private Education Services have risen to become the nation's seventh-largest industry and will surpass Manufacturing to become our sixth-largest industry in 2018. We forecast that employment growth in these combined industries will increase from 13.4 million to 15.1 million over the period.

While Education Services have grown dramatically, they have not kept up with the demand for workers with postsecondary education. The result has been a rising wage premium for college-educated workers and increasing inequality between postsecondary-haves and postsecondary have-nots (Goldin and Katz, 2008). As we discussed in Part 2, our projections suggest that demand will continue to outstrip postsecondary education supply in the future, maintaining wage premiums for college-educated workers and increasing inequality.

Education Services divide into two distinct industry groupings: Private Education Services and Public Education. Public Education is by far the larger of the two. Altogether, Public and Private Education Services accounted for almost 14 million jobs in 2008 and will add more than 1.5 million more by 2018, with the public share growing most and the private share slipping slightly.

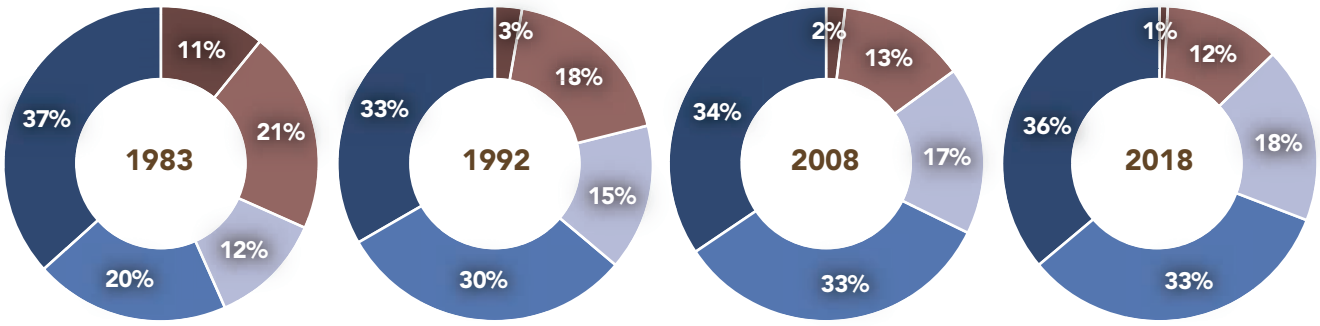
Private Education Services, which we will examine first, is the smallest industry in our projections. It produced $166 billion in output in 2008 and is projected to produce another $28 billion in output by 2018. The industry generated 2.8 million jobs in 2008—2 percent of the workforce. We project it will grow to 3.5 million jobs by 2018, an increase of nearly 700,000 jobs. Between 2008 and 2018, Private Education Services will generate 3.4 million job openings, including 683,000 new jobs and 2.7 million replacement jobs.

A significant part of this industry's growth will be due to increasing numbers of 18–24-year-olds, and older adults, who

FIGURE 4.20

Educational Attainment in Private Education Services (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



seek training and education to qualify for entry-level jobs and to upgrade their skills to adapt to changing job requirements. In addition, because many jobs that required high school diplomas or less were permanently lost in the recession, experienced workers will need to be retrained for new jobs.

Growth in Private Education Services will be fastest at the postsecondary level. Private elementary schools will add more than 200,000 jobs, increasing their workforce to over 1 million workers. But private community colleges, universities, and professional schools will add more than 250,000 jobs, increasing their total employment to more than 1.9 million workers. And private educational institutions that specialize in business, computer, and management training, as well as technical and trade schools, will add more than 300,000 jobs.

Postsecondary workers are overrepresented in the Private Education Services workforce. In 2008, the industry employed 2 percent of the nations' workers but 3 percent of its postsecondary workers. The industry will provide 3.4 million job openings between 2008 and 2018, with 3 million requiring at least some college education.

Private Education Services will have openings for:

- 39,000 high school dropouts;
- 427,000 high school graduates;
- 362,000 workers with some college but no degree;
- 260,000 workers with Associate's degrees;
- 1.1 million workers with Bachelor's degrees;
- 1.2 million workers with Master's degrees or better.

Even though the Private Education Services Industry historically has had high educational requirements, there was room for workers without postsecondary education. In the economy of 2018, this will not be the case. In 1983, 33 percent of the jobs in the industry required no postsecondary education, but by 2018 that figure will be 13 percent (Figure 4.20).

Government and Public Education Services

- For example, public school systems, plus government executive offices and legislative bodies; public finance activities; and public administration

Government and Public Education Services generates $2.3 trillion in economic output—$760 billion from the federal government and $1.5 trillion from the state and local governments. Taken together, the federal, state, and local governments generate the fourth-largest share of output.

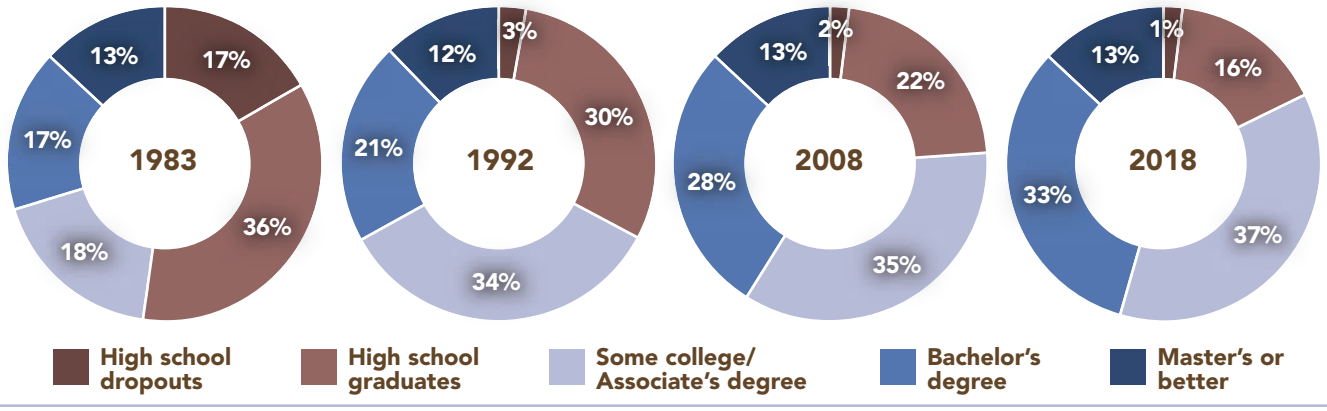
Government and Public Education generated 22 million jobs in 2008, making Government the nation's second-largest employer with 15 percent of the workforce. The Government and Public Education Services industry will grow by 125,000 jobs between 2008 and 2018, reducing its share of the workforce from 15 percent to 14 percent. In 2018, Government and Public Education Services will fall from the second-largest industry employer to third, behind Wholesale and Retail Trade and Professional and Business Services. Between 2008 and 2018, the Government and Public Education Services industry will generate 2.4 million job openings, including 125,000 net new jobs and 2.3 million to replace retiring workers.

In 1983, 48 percent of workers in Government and Public Education Services had at least some postsecondary education or training. That share increased to 69 percent in 1992. By 2008, Government and Public Education Services, along with Financial Services, had the third-highest concentration of postsecondary workers. Both industry workforces included 76 percent of workers with at least some postsecondary education or training.

FIGURE 4.21

Educational Attainment in Government and Public Education Services (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



Postsecondary workers are overrepresented in the Government and Public Education Services workforce. In 2008, Government and Public Education Services employed 15 percent of the nation's workers but 18 percent of its postsecondary workers. The industry will produce 2.4 million job openings between 2008 and 2018, with 1.9 million requiring at least some college.

Government and Public Education Services will have openings for:

- 38,000 high school dropouts;
- 380,000 high school graduates;
- 451,000 workers with some college but no degree;
- 427,000 workers with Associate's degrees;
- 792,000 workers with Bachelor's degrees;
- 302,000 workers with Master's degrees or better.

Government and Public Education Services is just like the other service industries. Jobs requiring less than a high school education virtually disappear, those requiring high school diplomas are reduced by half, and all of the gains in employment share go to jobs requiring some college education or better (Figure 4.21)

Healthcare Services

- For example, doctors' offices to hospitals to nursing and residential care facilities

We project that Healthcare Services will increase its economic output from $1.3 trillion to $1.9 trillion between 2008 and 2018, making it the fifth-largest industry as measured by economic output. Over that same period, it will increase its employment levels from 16.4 million workers to 20.6 million, an increase of 4.2 million jobs. Healthcare will remain the nation's fourth-largest industry as measured by employment, although its share of workers will increase from 11 percent to 13 percent.

Healthcare Services ranks fifth in its concentration of workers with postsecondary education or training. Growth in Healthcare Services is driven by an aging population and the rapid advance of health technologies. The number of people over age 65 will increase by 13 million between 2008 and 2018, driven by the aging Baby Boom generation. New technologies and drugs will allow people to live into advanced ages where care needs are higher than normal. Technology advances will also ensure increased survival rates from major diseases but will trigger increased costs of critical recovery care. Indeed, such cost pressures will affect growth—as well as the distribution of growth—shifting treatment from hospitals to less expensive outpatient settings in practitioners' offices, home healthcare, and nursing and residential facilities.

Healthcare Services has grown steadily in its use of workers with postsecondary education and training. In 1983, 52 percent of workers in Healthcare Services had at least some postsecondary education or training. The share had increased to 72 percent by 2008, and we project it will increase slightly more by 2018. Postsecondary workers are overrepresented in the Healthcare Services workforce. In 2008, Healthcare Services employed 11 percent of the nation's total workers, but 13 percent of its postsecondary workers. Healthcare Services will produce 7.4 million job openings between 2008 and 2018, with 4.4 million requiring at least some college (Figure 4.22).

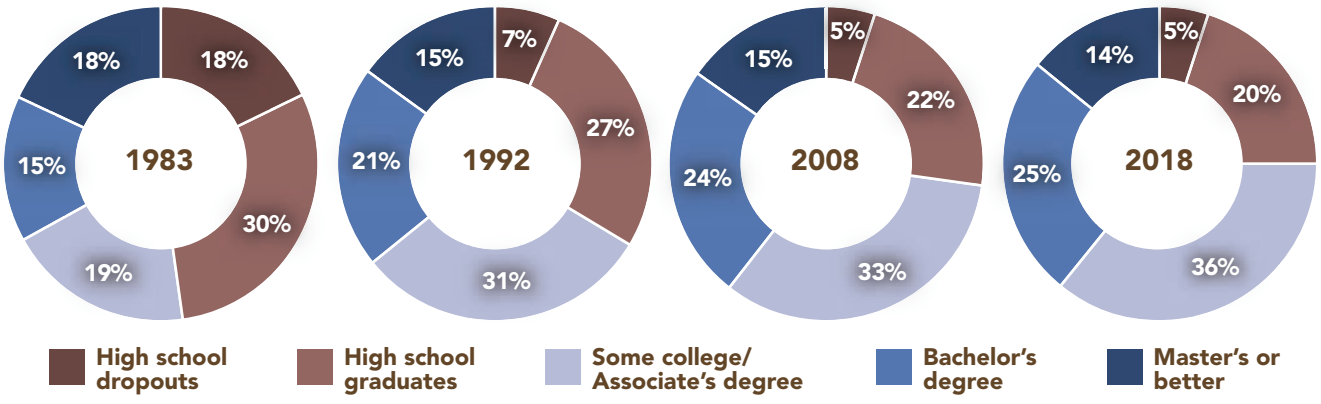
Healthcare Services will have openings for:

- 357,000 high school dropouts;
- 1.5 million high school graduates;
- 1.3 million workers with some college but no degree;
- 1.4 million workers with Associate's degrees;
- 1.8 million workers with Bachelor's degrees;
- 1 million workers with Master's Degrees or better.

FIGURE 4.22

Educational Attainment in Healthcare Services (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



Wholesale and Retail Trade Services

This is an industry that sits at the intersection between the producers of goods and services and their customers. It has already been powerfully affected by computer-based technology. Among the revolutionary developments: technology that allows complex data interchange, radio tracking of products, and electronic commerce that cuts out wholesale and retail establishments and likely will force more consolidation.

The industry also is under enormous pressure from the nation's economic situation. The unusual draw-down on home equity and the free-spending psychology, fueled by inflated housing values and 401(k) balances in the 1990s, were decimated by the recession. As a result, there is likely to be a decline in consumer spending in favor of savings and debt retirement, especially as the Baby Boom ages. A general decline in consumer spending will affect demand and job creation in Wholesale and Retail Trade Services. In spite of pressures for restructuring and a curb on consumer demand—which are assumed in the forecasting model—the industry will grow with the economic recovery.

Our projections show Wholesale and Retail Trade Services growing from $2.3 trillion to $3.7 trillion over the decade, an increase of $1.4 trillion. This makes Wholesale and Retail Trade one of the nation's four largest industries. Wholesale and Retail Trade Services remains the largest industry in overall employment throughout the decade. In 2008 Wholesale and Retail Trade Services employed 15 percent of the workforce, or 22.4 million workers. In 2018 it will still employ 15 percent at 24.1 million workers, an increase of 1.7 million employees.

The industry has grown steadily in its use of workers with postsecondary education and training. In 1983, 32 percent of workers in Wholesale and Retail Trade had at least some higher education. That share increased to 53 percent in 2008, and we project that it will increase to 60 percent by 2018. Postsecondary workers are underrepresented in the industry's workforce. In 2008, Wholesale and Retail Trade employed 15 percent of the nation's workers, but 13 percent of its workers with higher education (Figure 4.23). Wholesale and Retail Trade will provide 7.4 million job openings between 2008 and 2018, with 2.8 million of those requiring at least some college.

Wholesale and Retail Trade Services will provide openings for:

- 626,000 high school dropouts;
- 2.4 million high school graduates;
- 2.6 million workers with some college but no degree;
- 801,000 workers with Associate's degrees;
- 1.6 million workers with Bachelor's degrees;
- 332,000 workers with Master's degrees or better.

Transportation and Utilities Services

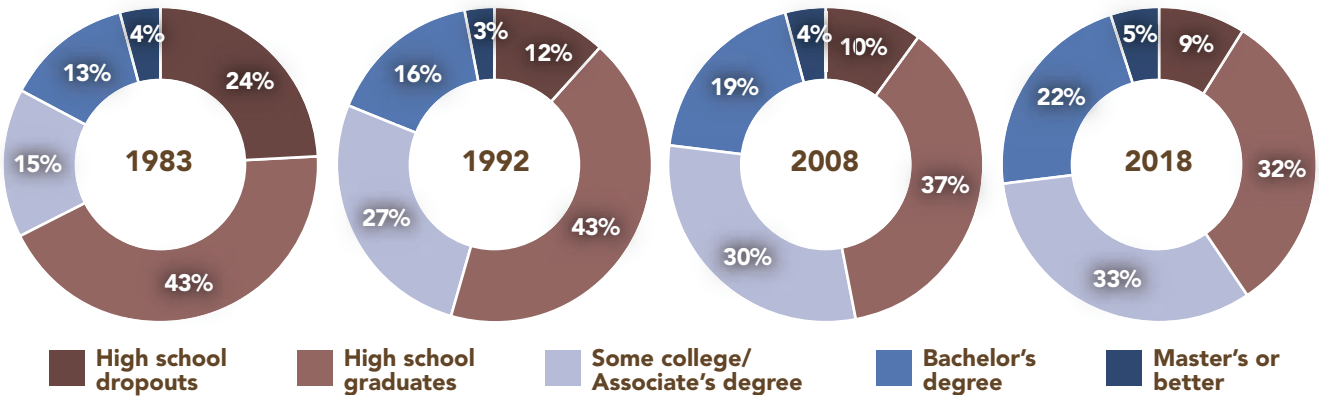
Transportation and Utilities Services produced almost $1 trillion in economic output in 2008, and our forecast shows it will grow to more than $1.3 trillion by 2018. This was our 12th-largest industry as measured by output, and will remain so in 2018. The industry employed 6.2 million workers in 2008 and will employ 6.7 million workers in 2018, with all the increases coming in Transportation Services. At that level, Transportation and Utilities Services will remain our ninth largest industry employer.

Over the next decade, the industry will generate 1.7 million job openings: 520,000 new jobs and 1.2 million job openings necessary to replace retiring workers. Transportation and Utilities Services ranks 11th in job openings.

FIGURE 4.23

Educational Attainment in Wholesale and Retail Trade Services (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



An overall decline in Utilities employment, much like the decline in many Goods-producing industries, is occurring despite increased production. The largest projected decline is in electric power generation—despite almost $50 billion in increased output. Technology changes and deregulation have spurred industry consolidation and other trends that have affected the use of personnel.

The share of postsecondary workers in Transportation and Utilities Services has increased from 28 percent in 1983 to almost 50 percent in 2008, where it is projected to remain until 2018 (Figure 4.24). Transportation and Utilities Services had the seventh-highest concentration of postsecondary workers in 2008. The industry will produce 1.7 million job openings between 2008 and 2018, with 826,000 requiring at least some college education.

Transportation and Utilities Services will have openings for:

- 140,000 high school dropouts;
- 728,000 high school graduates;
- 320,000 workers with some college but no degree;
- 195,000 workers with Associate's degrees;
- 266,000 workers with Bachelor's degrees;
- 46,000 workers with Master's degrees or better.

Leisure and Hospitality Services

This industry is projected to grow from $748 billion in output to $884 billion between 2008 and 2018, an increase of $136 billion. Over the same period, it is expected to grow from 14.2 to 16.2 million jobs, and will continue to employ 10 percent of all U.S. workers. Over half the increase in jobs comes from expanded demand for food services, which is principally driven by population growth—especially growth in the elderly population. The remainder of the growth will come in arts, entertainment, and accommodations. Over the next decade, Leisure and Hospitality Services will generate 6.1 million job openings—2 million net new jobs, and 4.1 million openings necessary to replace retiring workers.

FIGURE 4.24

Educational Attainment in Transportation and Utilities Services (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018

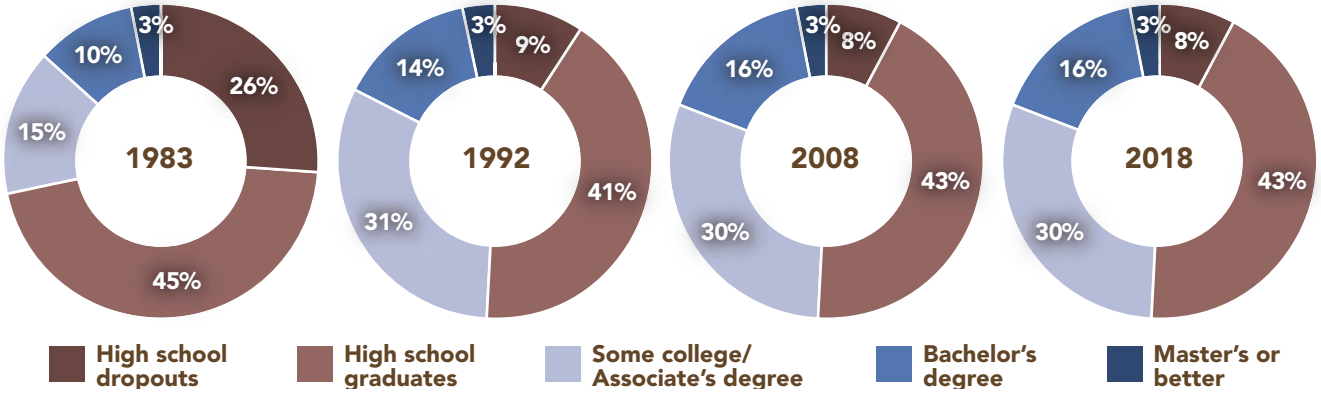
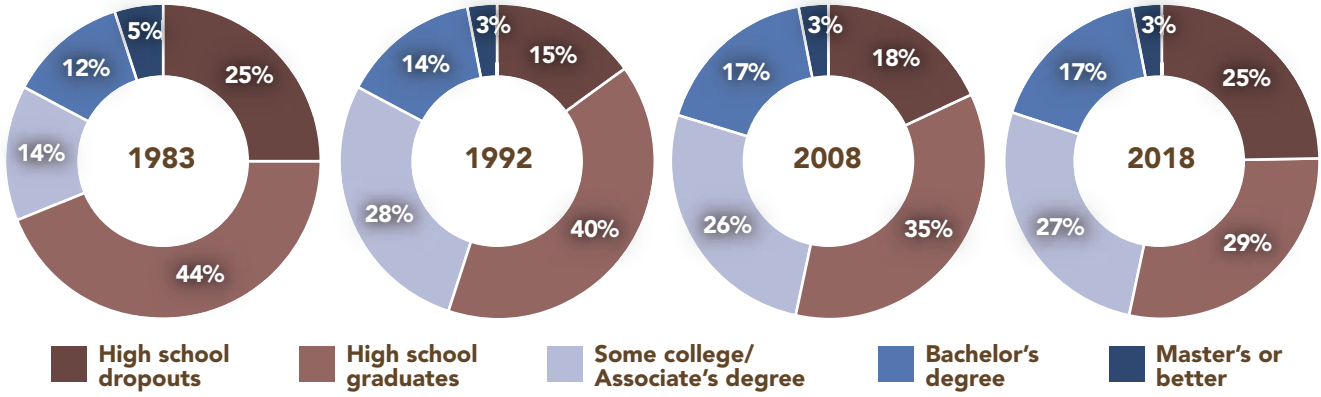


FIGURE 4.25

Educational Attainment in Leisure and Hospitality Services (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



The share of postsecondary workers in Leisure and Hospitality Services has increased from 31 percent in 1983 to 46 percent in 2007, where it is projected to remain until 2018 (Figure 4.25). Leisure and Hospitality Services ranked 10th in the concentration of postsecondary workers in 2008, but it will move up to seventh by 2018. The industry will produce 6.1 million job openings between 2008 and 2018, with 3 million requiring at least some college. The industry will rank fourth in overall job openings.

Leisure and Hospitality Services will include openings for:

- 1.5 million high school dropouts;
- 1.7 million high school graduates;
- 1.1 million workers with some college but no degree;
- 509,000 workers with Associate's degrees;
- 1 million workers with Bachelor's degrees;
- 192,000 workers with Master's degrees or better.

Personal Services

- For example, automotive repair and maintenance, car washes, nail salons and other grooming services, labor unions, and religious organizations

The sector produced almost $1 trillion in economic output in 2008, and our forecast shows it will grow to more than $1.3 trillion by 2018. Personal Services ranked 11th among our 13 industry groups as measured by output and will rank there in 2018, as well.

The industry employed 5.6 million workers in 2008 and will grow to 6.2 million by 2018. The Personal Services industry was our 10th-largest employer in 2008 and will keep that ranking in 2018.

Over the next decade, Personal Services will generate 2 million job openings: 564,000 net new jobs and 1.4 million openings necessary to replace retiring workers. This industry ranks ninth in its volume of job openings through 2018. The share of postsecondary workers in Personal Services has grown from 36 percent in 1983 to almost 47 percent in 2008 and will nudge up to 48 percent by 2018 (Figure 4.26). Personal Services had the 11th-highest concentration of postsecondary workers in 2008. About half of the industry's job openings between now and 2018 will require at least some college education.

Personal Services will have openings for:

- 317,000 high school dropouts;
- 673,000 high school graduates;
- 347,000 workers with some college but no degree;
- 298,000 workers with Associate's degrees;
- 244,000 workers with Bachelor's degrees;
- 146,000 workers with Master's or other graduate degrees.

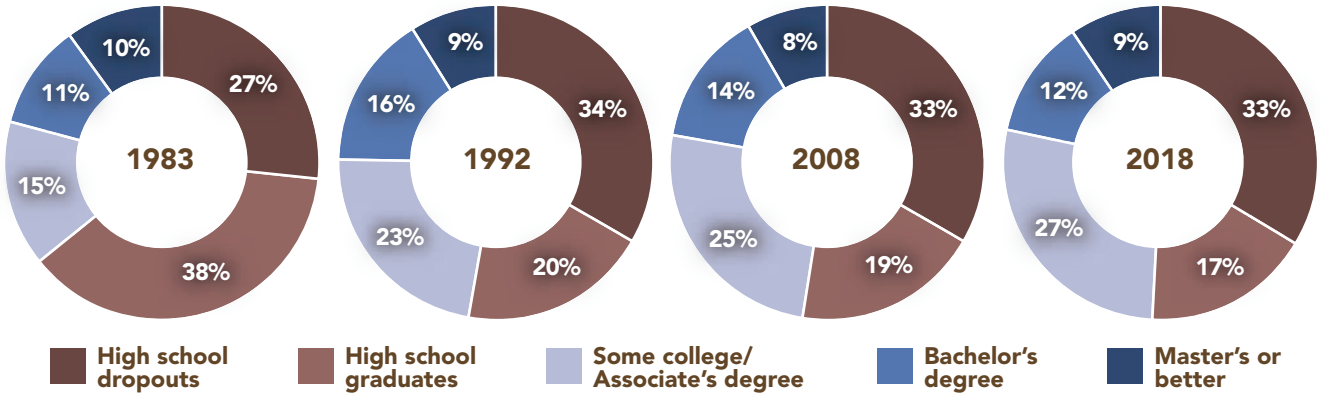
[18] Autor, Katz, and Kearney, 2006

[19] Replacement jobs include openings due to retirement, death, or cases when someone leaves an industry altogether. Retirements are the single largest source of replacement needs. The high rate at which people leave lower-wage and lower-skill jobs, as well as high levels of part-time employment biases the count of job openings toward lower-wage, lower-skill jobs in industries such as Wholesale and Retail Trade Services. These biases in the data lead to an understatement of the demand for postsecondary education.

FIGURE 4.26

Educational Attainment in Personal Services (1983–2018).

Source: Authors' analysis of March CPS data, various years; Center on Education and the Workforce forecast of educational demand through 2018



Part 5

Education and Earning Power.

The best thing workers who want job security in the U.S. economy can do for themselves is to get an education: earn a high school diploma, and go on to college. But there is one more critical advantage we have not yet touched on: earning power. Simply put, education helps workers find, keep, and advance in good-paying jobs.

Research shows there is a direct correlation between formal education levels and annual wages, which reflect what employers are willing to pay for the knowledge, skills, and abilities that workers attain at every consecutive education level. Figure 5.1 clearly illustrates that point. By obtaining a high school diploma, a worker contributes the greatest percentage jump to his or her earning power—82 percent over high school dropouts. For the great majority of Americans, it is necessary to obtain at least some college—a postsecondary certificate or an Associate's degree—to earn wages above the median for the entire country.

WAGES AS AN INDICATOR OF RELATIVE DEMAND FOR SKILLED LABOR.

Wages reflect the interaction between relative supply and demand for labor. Employers may pay higher wages to guarantee a worker's tenure or as a premium for special skills or training in tight labor markets. Rising wages can indicate excess demand or a short-term inability of supply to meet demand for a particular skill. To illustrate this concept, think of the labor market as consisting of two big, largely independent categories of workers: those with a Bachelor's degree or better and those without a Bachelor's degree. Workers in each

FIGURE 5.1

On average, people with higher educational attainment have higher earnings.

Source: Authors' analysis of March CPS data, various years

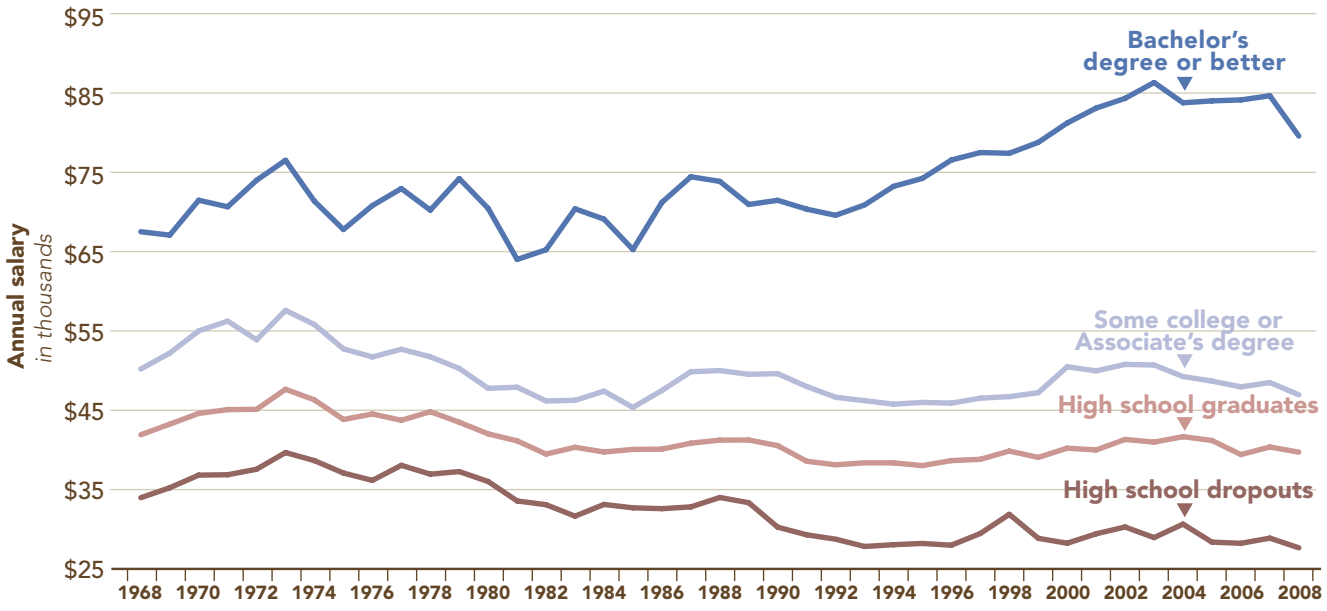
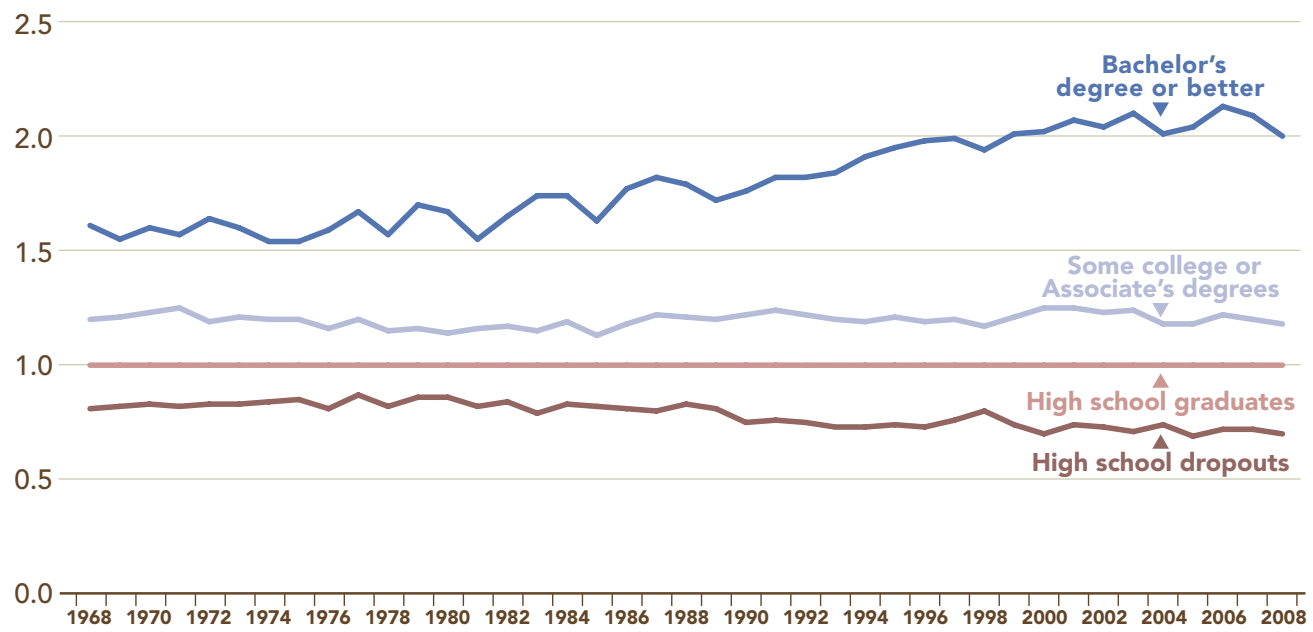


FIGURE 5.2

Wage differentials by education level relative to high school graduates.

Source: Authors' analysis of March CPS data, various years



category are not generally good substitutes for each other because of their differing knowledge and skill sets. Even within specific occupations increases in attainment commonly lead to significantly higher earnings. This means that employers who want workers with college-level skill sets are willing to pay extra to get them. Higher wages for workers with a Bachelor's degree or better, then, suggest they are in relatively greater demand than workers with less education.

We have examined the average earnings of prime-age (25–54 years old)[20] Americans with Bachelor's degrees or better in recent decades and focused on the premium paid to college graduates relative to those workers without a degree.[21] Those earnings fell from the early 1970s up to the 1980s and then rose dramatically through most of the 1990s (Figure 5.2). Since 2000, the wages for workers with Bachelor's degrees or better have declined, but the relative wage differentials over workers with lower levels of education have remained stable. The value of "some college" and Associate's degrees over high school diplomas has also been relatively stable, while the relative wage status of high school dropouts has continued to decline.

On average, high school graduates earned 68 percent more than high school dropouts, while workers who attended some college or attained an Associate's degree earned 26 percent more than high school graduates. Bachelor's degree holders earned 45 percent more than Associate's; and Master's degree holders earned 37 percent more than Bachelor's. Figure 5.2 shows that holders of college degrees, on average, earned twice as much as high school graduates in 2008—even while the real wages of college degree holders declined over several years. That is because wages for high school graduates and dropouts either stagnated or fell during the same period.

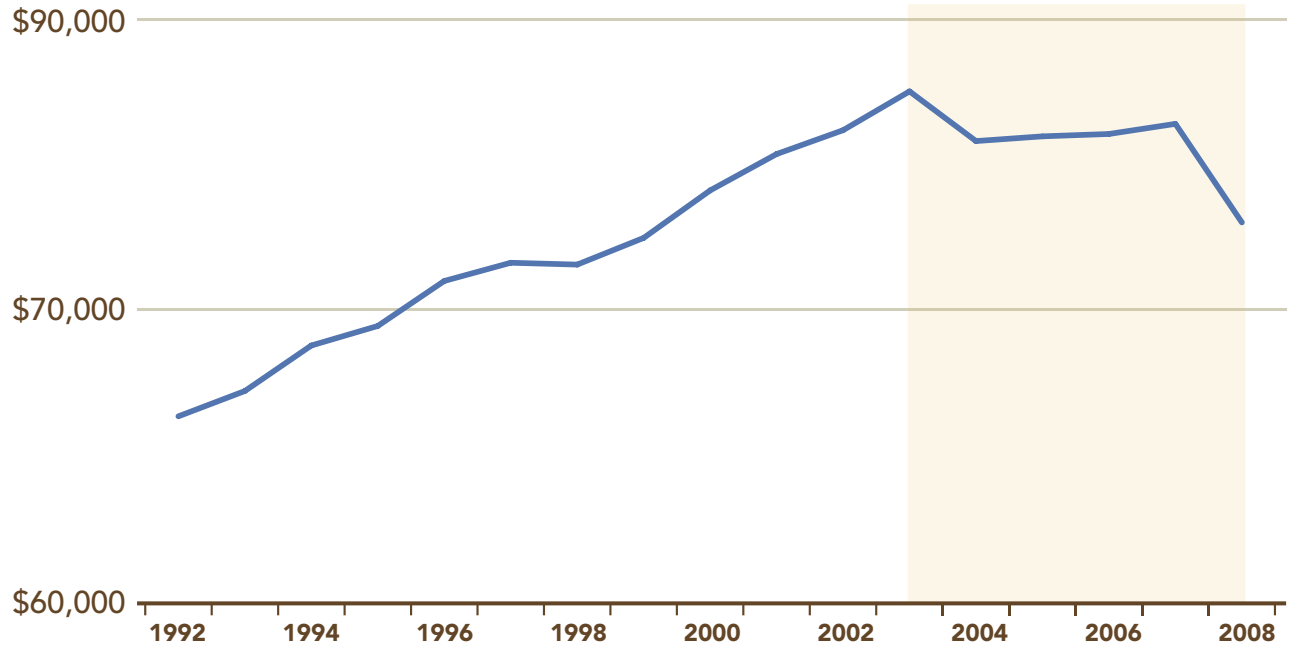
We use this relative wage premium as an indicator of the relative demand for workers with Bachelor's degrees and better versus non-degree holders.[22] Wages by education level traditionally behave as human capital theory predicts: higher education levels correlate with higher wages, a pattern that has remained unchanged over the past eight years.

In the 1970s, the relative premium for college-educated workers declined as the supply of these workers grew dramatically with a surge in college attainment; this resulted in the supply exceeding the demand for college-educated workers. The pattern was quickly reversed in the 1980s as information technology began to transform the economy from industrial to services-based. Skills-biased technological change increased the demand for more educated workers, leading employers to bid up the price. This trend peaked in the 1990s as the real wage premium for college-educated workers spiked dramatically; it has been decreasing since roughly 2002.

FIGURE 5.3

Real wages of prime-age, college-educated American workers since 2002. (in 2008 dollars)

Source: Authors' analysis of March CPS data, various years



WHAT DOES THE DECLINE IN REAL WAGES REALLY MEAN?

Much emphasis has been placed on the dip in real wages; some have argued, incorrectly we believe, that this implies the advantages of earning a college degree are also in decline. Understanding the difference between supply and demand for college workers and wage premiums for college degrees helps to clarify why college education is valuable. Demand for college-educated workers can be rising dramatically, but if supply keeps up, "college wages" will not increase. The real issue for individuals trying to decide whether to attend college is not whether college wages are going up or down. The real issue is not the wage level, but rather the relative wage advantage of college degrees over lower attainment levels. As we show later, while the absolute real wages of college-educated workers have declined since 2002, such fluctuations are not unusual. Overall, the relative advantages of college degrees have grown dramatically since the 1980s and declined only slightly since 2002.

Figure 5.3 shows the average real wages of American prime-age college-educated workers from 1992 to 2008.[23] Note that college wages peaked in 2002, then declined through 2003. They began rising again after 2003—but declined dramatically with the 2007 recession.

Inspection of the wage differential for workers with Bachelor's degrees or better reveals three turning points in the data that correspond to the time periods 1968–1981, 1982–2003, and 2004–2008. In Figure 5.4, we more closely examine the wage premium for college-educated Americans during these time periods.

WHAT DOES THIS MEAN FOR RECENT COLLEGE GRADUATES?

When we limit our observations to recent college graduates between the ages of 25–34, real wages of males and females fluctuated between 2001 to 2008, but ended up roughly where they began.

But both young women and young men are still better off than their less-educated counterparts. Although young women earn less, on average, than young men, they earned 1.6 times as much as young women without college degrees. Young college-educated men, meanwhile, earned 1.7 times as much as young high school-educated men.

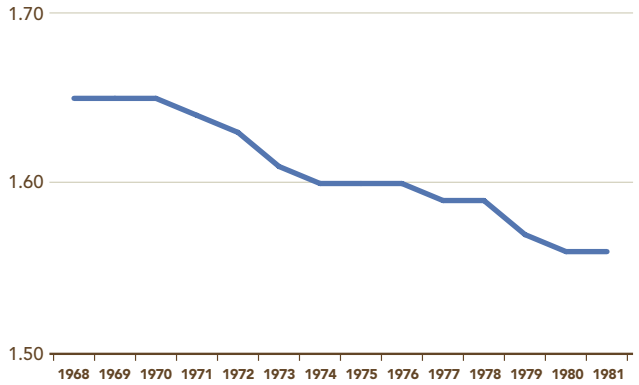
Given trends in wage premiums over the last three decades, we believe it is irresponsible to argue against the pursuit of a college degree solely because real returns have fallen

FIGURE 5.4

A closer look at the college wage premium.

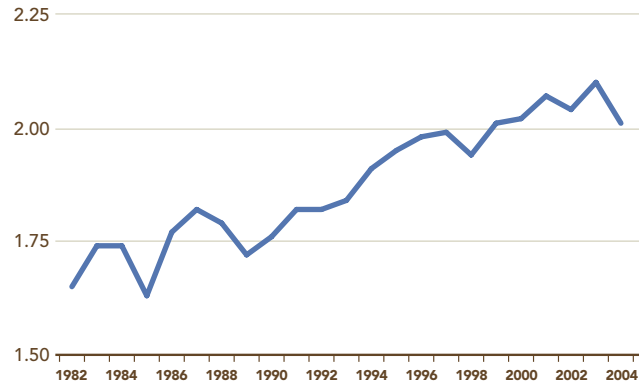
Source: Authors' analysis of March CPS data, various years

PANEL 1 (College wage premium, 1968 to 1981)



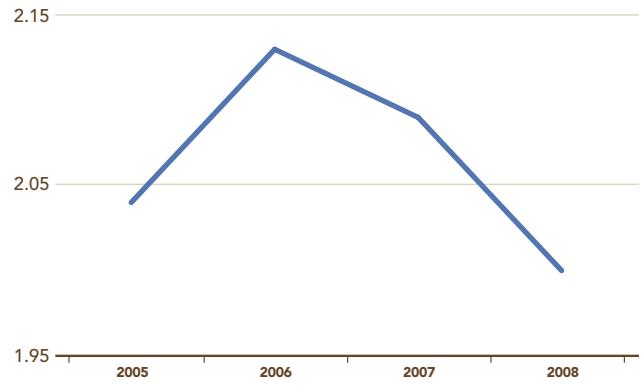
Panel 1 shows a decline in the relative real wage premium for holders of college degrees through most of the 1970s. Goldin and Katz (2008) explain this by the sudden surge in college-educated Baby Boomers that created a temporary oversupply of college graduates and reduced the wage premium. They find that the demand for college graduates grew at an average rate of 2.14 to 2.16 percent per year, while the supply grew at a faster rate of 3.19 percent per year, resulting in an oversupply of college workers and a resultant decline in their wage premium relative to high school graduates.

PANEL 2 (College wage premium, 1982 to 2004)



Panel 2 shows a steep increase in the relative real wage premium for college degrees from the 1980s up to the early 2000s. Here, Goldin and Katz (2008) show that a supply slow-down in college graduates dramatically increased the wage premium of workers with Bachelor's degrees and better compared to high school graduates. The supply of college graduates increased by 3.19 percent per year in the 1970s but fell to 2.00 percent per year in the 1980s and 1990s. In the 1970s, demand increased by an average of 2.15 percent, but accelerated in the 1980s to between 3.27 and 3.66 percent per year. Therefore, increasing demand and declining supply guaranteed a rise in the college wage premium. The relative increase in the wage premium during this period was quite remarkable and increased at far greater rates than the premium had declined during the previous decade. At its peak, college graduates earned more than twice as much, on average, as high school graduates.

PANEL 3 (College wage premium, 2005 to 2008)



Panel 3 shows the most recent period of earnings fluctuation. While this period of decline in the wage premium for higher education is apparent, college graduates of all ages still earned twice as much in 2008 as high school graduates, down from a peak of 2.13 in 2006. The explanation for the dip is straightforward: the economy is in a recession and everyone bears some of the burden. Less-educated workers, however, shoulder a relatively greater share. In April 2010, 4.9 percent of the unemployed had a Bachelor's degree or better; 10.6 percent were high school graduates; and 14.7 percent were high school dropouts.[24]

compared to the most recent past. This is especially true when, even given that decline, college graduates can still expect to earn almost twice as much as their non-college-educated competitors. Furthermore, as this report has already demonstrated, college-level jobs continue to grow at faster rates than middle- or lower-skill-level jobs. Our forecast of educational demand through 2018 estimates that 63 percent of new and replacement jobs in the future will require some college or better, while 72 percent of this subset will require a Bachelor's degree or better.

Ultimately, if we continue to incorrectly downplay the value of postsecondary attainment—and discourage young Americans from pursuing college degrees because real wages have dipped in this decade—this discouragement will lead to low-skill, low-wage work over the next 10 years. Further, while the American system is more forgiving than most, young students who decide not to attend college are unlikely to get a second chance. Enrollment and graduation rates in postsecondary institutions decline geometrically with age, dropping from 70 percent (for those under age 23) to 16 percent (for those over 30) in four-year institutions.[25] Bottom line: a decision to forgo or postpone a college degree now will make it significantly tougher to get one later.

ESTIMATING THE VALUE OF A COLLEGE DEGREE

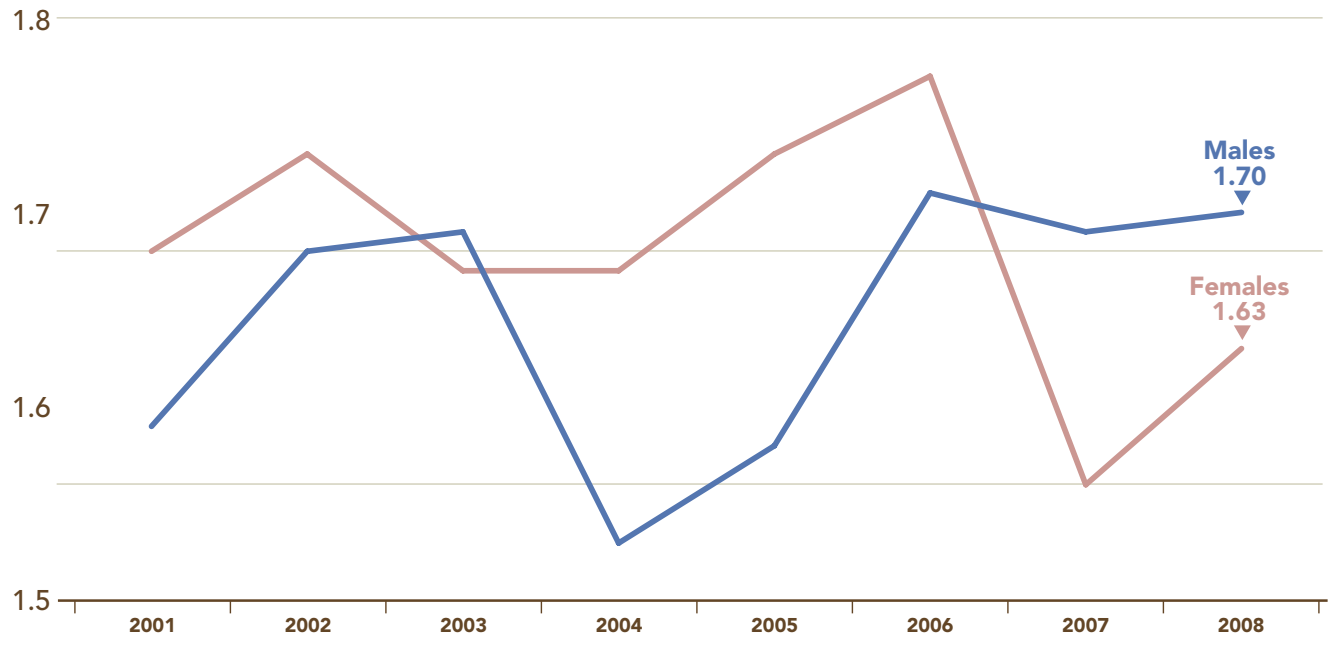
What is a degree worth over a lifetime? In the spirit of the Census Bureau's 2002 report on the value of a college education, we calculate that the average value of a college degree—compared to a high school diploma—is about $1.6 million in additional earnings.[26] This figure is based on 2008 earnings projected over a typical work life (25 through 64 year olds) for full-time, full-year workers.

The real payoff today of this total benefit over 40 years would be lower. So, to adjust for that, we calculate the net present value (NPV) and present a hypothetical cost benefit analysis of attending college in light of recent reductions in the wage premium. If we start today and look forward to earning $1.6 million in additional pay over 40 years, then the present value tells us today how much money is required at an assumed interest rate to yield that amount in the future. Assuming an interest rate of 1 percent (average Federal Funds rate in 2008), then a conservative estimate of the net present value of the lifetime average marginal return from a Bachelor's degree over a high school diploma is $1 million. To determine if a college degree is worth it, we must simply ensure that the discounted cost of the degree is at most $1 million expressed in today's dollars.[27]

FIGURE 5.5

Wage premiums by sex for recent college graduates.

Source: Authors' analysis of March CPS data, various years



The economic costs of attending college should include the indirect cost of forgone income while students are in school, plus the direct costs of tuition, books, and other necessities.[28] According to the College Board, "about 56 percent of students enrolled at four-year colleges or universities attend institutions that charge tuition and fees of less than $9,000 per year." The average annual tuition at public four-year colleges and universities was about $5,685 for in-state residents during 2006–2007 according to the National Center for Education Statistics, U.S. Department of Education. For argument's sake, we have taken the larger of those estimates into consideration for our calculations. Our conclusion: over the length of a four-year degree, the estimated cost is around $50,000.

Is a degree worth it? If one does the math, there is just one answer: a resounding yes.

DEBATING THE DISAPPEARANCE OF THE MIDDLE CLASS

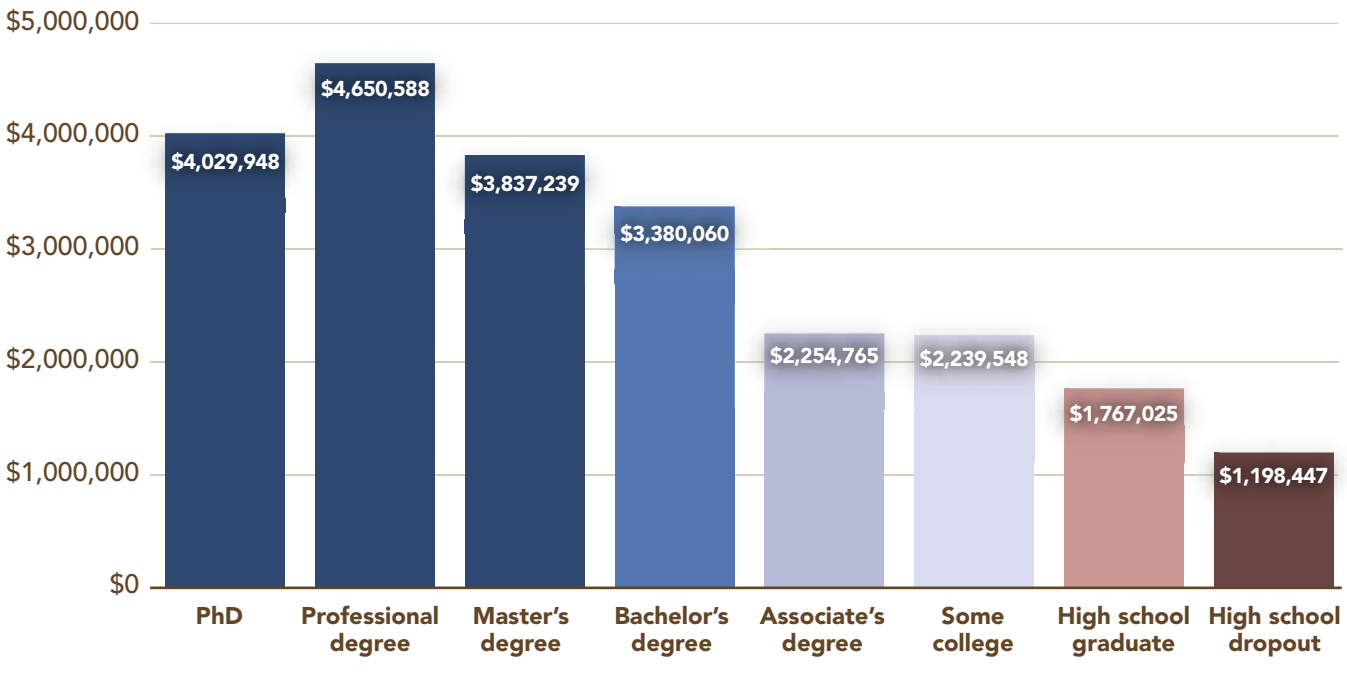
Another debate swirling through economic circles today is whether middle-income jobs are disappearing from the American economy, signaling the decline of the middle class. This idea first surfaced in the 1980s. Theorists cited the increasing movement of wealth toward the top 10 percent of wage earners relative to those at the bottom as an indication that the middle class was beginning to dwindle. During the prosperous 1990s, analysis of the movement of people from one social class to another pointed to upward mobility—people moving from the middle into the wealthier income categories, which was interpreted as a positive. Now, though, we are closing this decade with the most severe economic decline since the Great Depression, and people are sliding from the middle onto the lower-wage rungs. Speculations about an hourglass economy—concentrations of people at the top and bottom of wage categories with a slender middle—are rampant.

The concepts of declining middle class, declining middle-wage jobs, and an hourglass economy are related—and relevant in this report for what they mean for the jobs that will be created as part of the recovery. Will the jobs of the next decade lead to middle-class wages? Is there, indeed, polarization of the job market toward the top and bottom with a decline in middle-wage or middle-skill jobs? Are middle-wage and middle-skill jobs the same? We approach these questions by analyzing the available literature on wage growth in America

FIGURE 5.6

Estimated average lifetime earnings by educational level. (in 2008 dollars)

Source: Authors' analysis of March CPS data, 2008



and presenting the evidence on historical wage changes by education and occupation.

There is a growing body of literature that discusses the polarization of American jobs into high-wage and low-wage opportunities, with a consequent decline in the number of jobs offering middle wages. A 2003 study by Autor, Levy, and Murnane notes that this phenomenon results in a U-shaped growth pattern—with jobs increasing at either end of the pay scale and dipping in the middle. The study found that one factor driving this phenomenon is the computerization of routine tasks.

> The first-order impact of computerization is to displace "middle skilled," routine cognitive and manual tasks, such as bookkeeping and repetitive production work.

This phenomenon affects the demand for workers who do such work and, of course, the wages they earn.

Two decades of experience with such U-shaped growth does suggest that middle-income jobs are indeed becoming scarcer—and significantly harder to land without a postsecondary education.

DISTRIBUTION OF WORKERS BY WAGE AND EDUCATION CATEGORIES

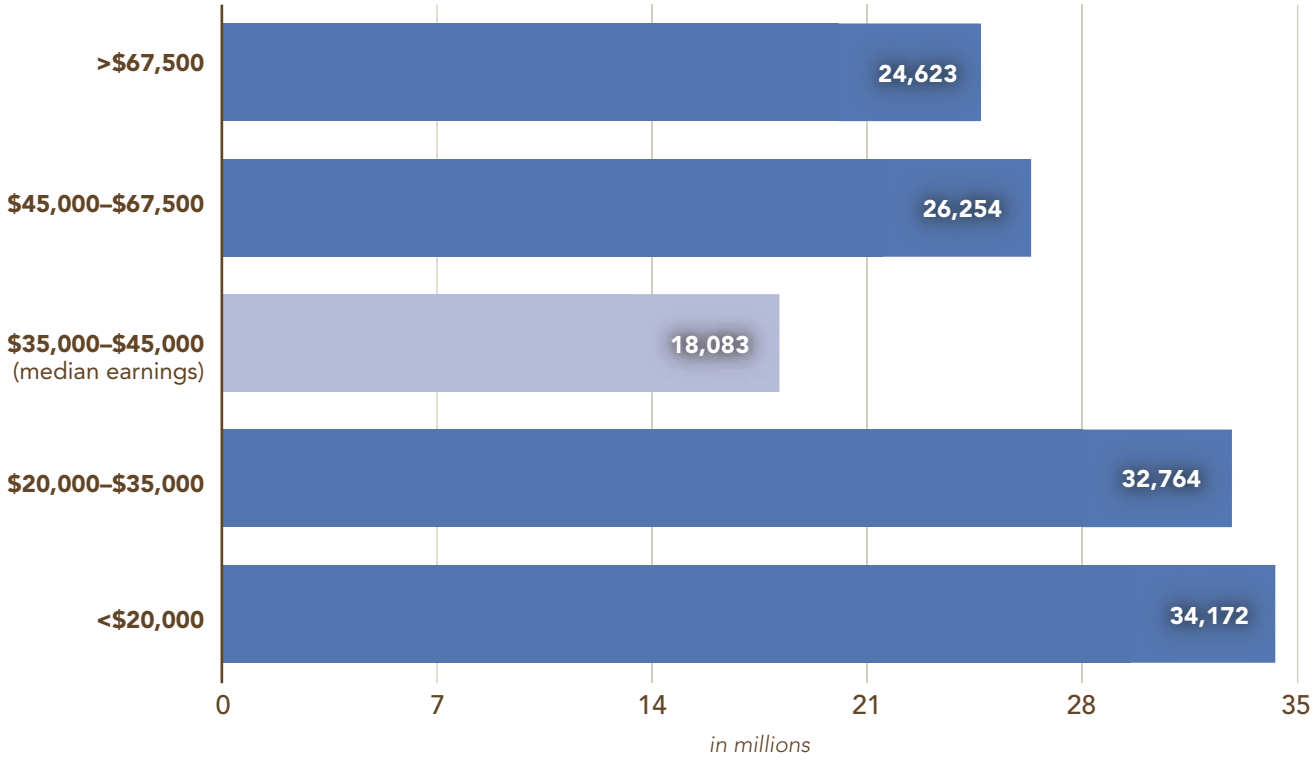
Analysis of the U.S. workforce by educational attainment shows a clear and predictable bias: higher education levels are associated with higher income levels. In Figure 5.8, we sort each of the income classifications according to the average educational attainment of the workers and demonstrate the relative sizes of five income groupings for the U.S. population in 2008. The quintiles were based on a definition of wages drawn from national poverty measurements. The lowest income category is essentially the average weighted poverty threshold for a family of four. Thus, one in four American workers (over 34 million) has a job that pays poverty level wages. Fifty percent make less than $35,000 per year, or 175 percent of the poverty level.

Middle America earns between $35,000 and $68,000, which represents one-third of the working population (18 million workers). Upper-income Americans earn more than $68,000, which is close to 20 percent of the population. Of course, there are many assumptions that cloud these definitions. For example, location in a metropolitan area might imply that larger wages are required to

FIGURE 5.7

More workers are at the top and bottom of the wage spectrum than in the middle. (in 2008 dollars)

Source: Authors' analysis of March CPS data, 2008



meet one's basic needs, meaning someone earning upper-income wages might not be living an upper-income lifestyle.

Reading Figure 5.8 horizontally

The lowest-income categories have the highest proportions of high school dropouts and high school graduates (more than 54 percent). The second earnings category has a similar pattern of attainment, where close to 50 percent of its workers have high school diplomas or less. The upper-income category, meanwhile, has the greatest proportion of highly educated workers—32 percent have a Master's degree or better. Overall, workers with Bachelor's degrees or better have a higher probability of working in the highest-income categories.

Reading Figure 5.8 vertically

Here, we can see the proportions of Americans within each educational category. About 34 percent of Americans have a Bachelor's degree or better, and more than 60 percent of these highly educated workers have wages in the upper two income categories. About 28 percent of workers (38 million) have some college or an Associate's degree.[29] About 51 percent of these middle-skills people are in the lower two income categories, while 33 percent are in the upper two. Thus, if we look at the subgroup of some college workers only, there are greater numbers in the lower two earnings categories than in the upper two. The odds worsen for high school dropouts and holders of high school diplomas: 67 percent of Americans with a high school diploma or less earn wages in the lowest two categories, while only 20 percent are in the upper two. As expected, just 9 percent of high school dropouts earn $45,000 or more, while 23 percent of high school graduates earn $45,000 or more. Overall, then, there is a hierarchical relationship between mean wages earned and educational attainment.

WAGES BY OCCUPATION

The previous section outlined average wages of prime-age workers for the entire economy, broken down by formal education level. While average education is a useful tool for

FIGURE 5.8

Those with the most postsecondary attainment have the highest wages. (in 2008 dollars)

Source: U.S. Census Bureau, Current Population Survey, 2009 Annual Social and Economic Supplement

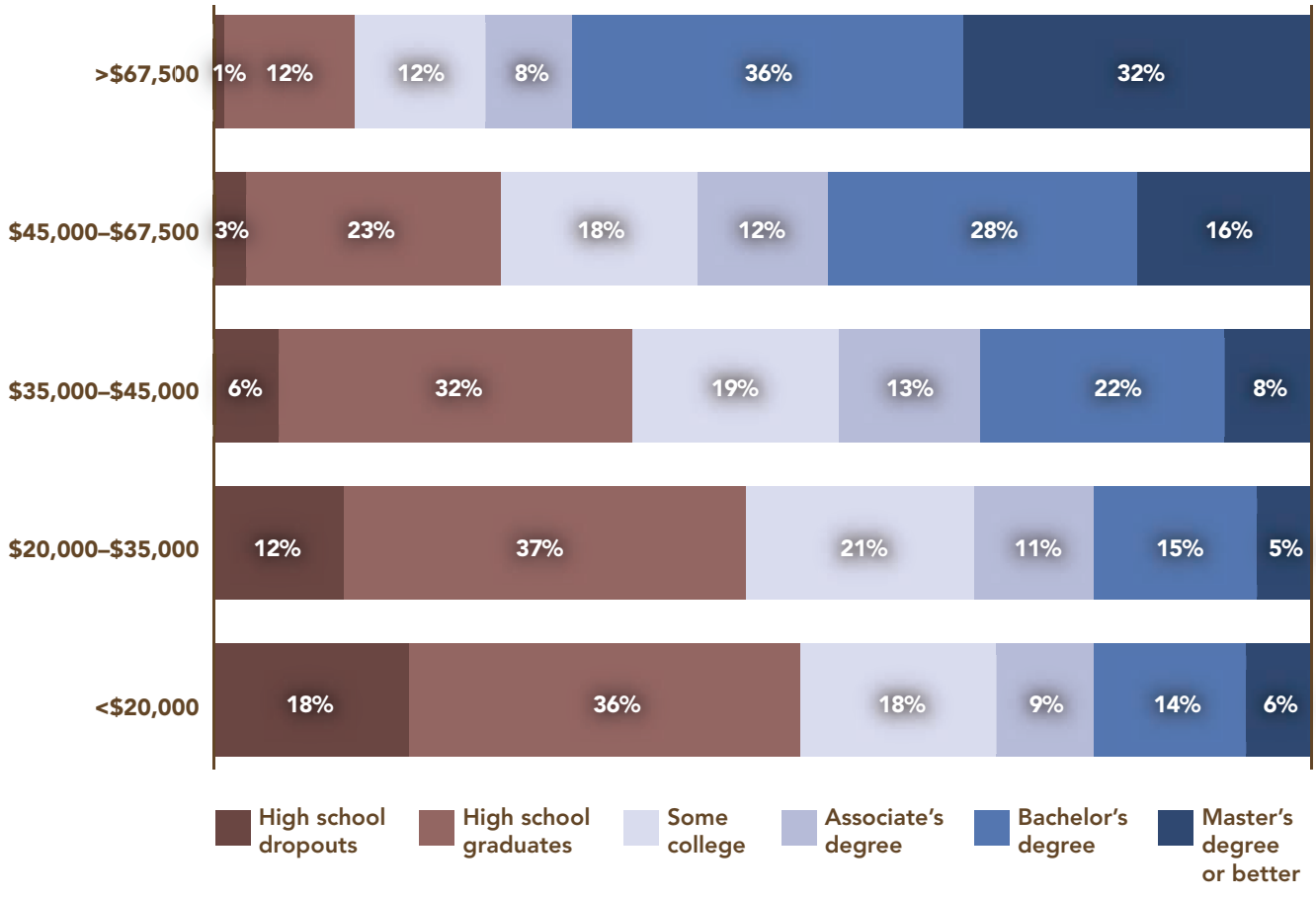
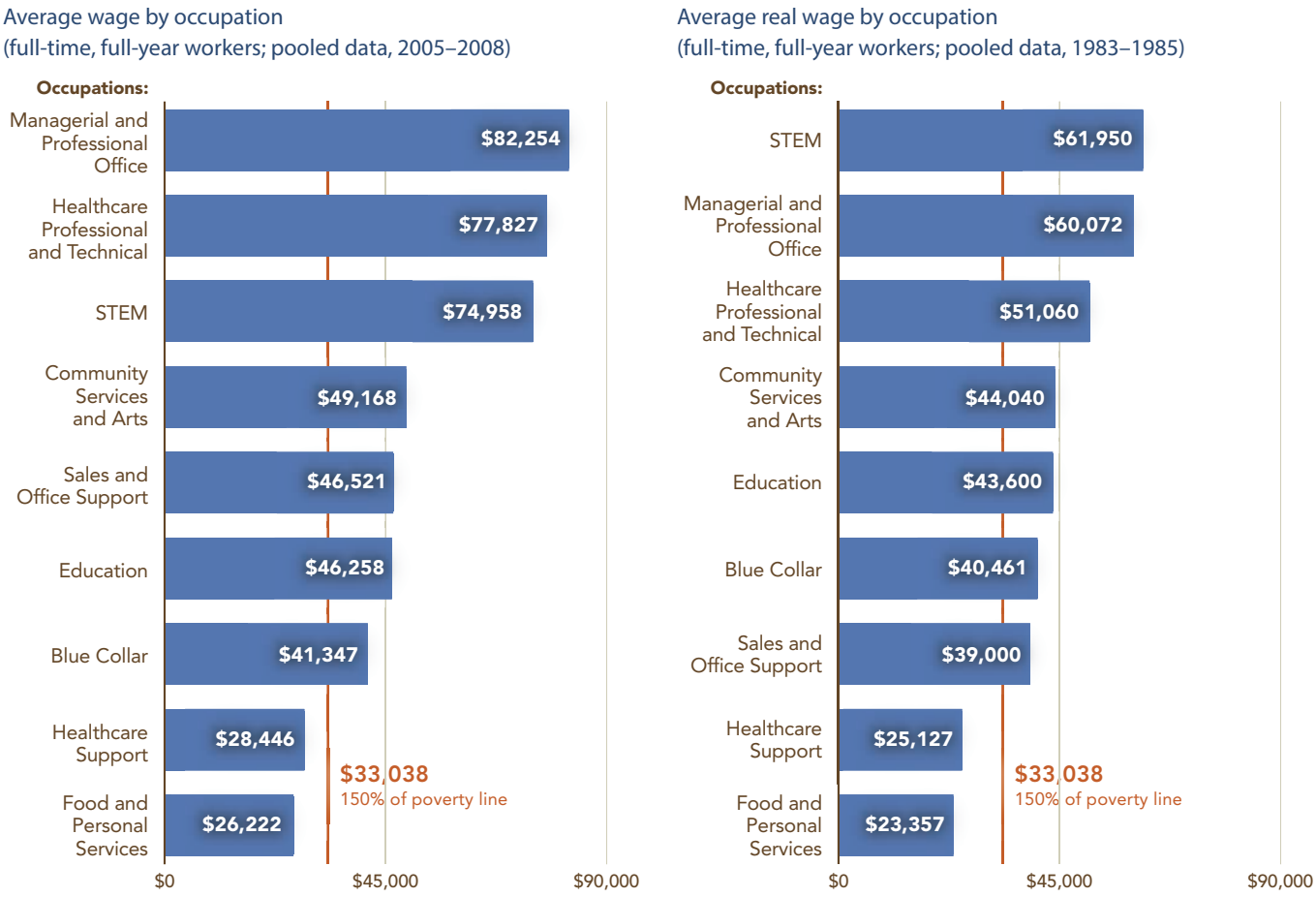


FIGURE 5.9

On average, Healthcare Support and Food and Personal Services jobs provide insufficient annual earnings to support a family of four at 150% of the poverty line.

Source: Authors' analysis of March CPS data, various years



gauging one's location on the payroll totem pole, average wages conceal complex relationships between wages and degree choice or wages and occupational choice. In other words, while education level is highly associated with one's earnings, other factors are gaining importance, too: the type of degree one selects, the occupation one pursues within a particular industry; and a variety of personal traits also influence the average wages one can expect. In this section, we discuss average wage trends by occupation and education level.

Figure 5.9 shows average real earnings by broad occupational categories for two time periods: the mid-1980s and the late 2000s. Over time, the hierarchical distribution of earnings has changed. Managerial and Professional Office jobs have overtaken STEM jobs for the highest current real average earnings, and Healthcare Professional and Technical Occupations are now the second highest-paying category. The wage increase for Healthcare Professionals is more than $26,000 per year over the time period, an impressive 52 percent increase. Managerial and Professional Office jobs have grown by more than $22,000, while STEM jobs have grown by more than $13,000 in real terms over the time period.

Blue Collar jobs had the lowest increase—less than $1,000 in real earnings—followed by Education jobs and low-skill Food and Personal Services. Wages of Blue Collar workers have grown by a meager 2 percent, while those of Education workers grew by 6 percent. Wages for Healthcare Support and Food and Personal Services, meanwhile, have grown by 13 and 12 percent, respectively. Despite this increase, however, Healthcare Support and Food and Personal Services jobs still, on average, fail to earn employees at least 150 percent of the poverty threshold for a family of four.

Figure 5.10 takes each of the broadly defined occupations and plots their average earnings across time. A flat graph across time for Blue Collar, Healthcare Support, and Food

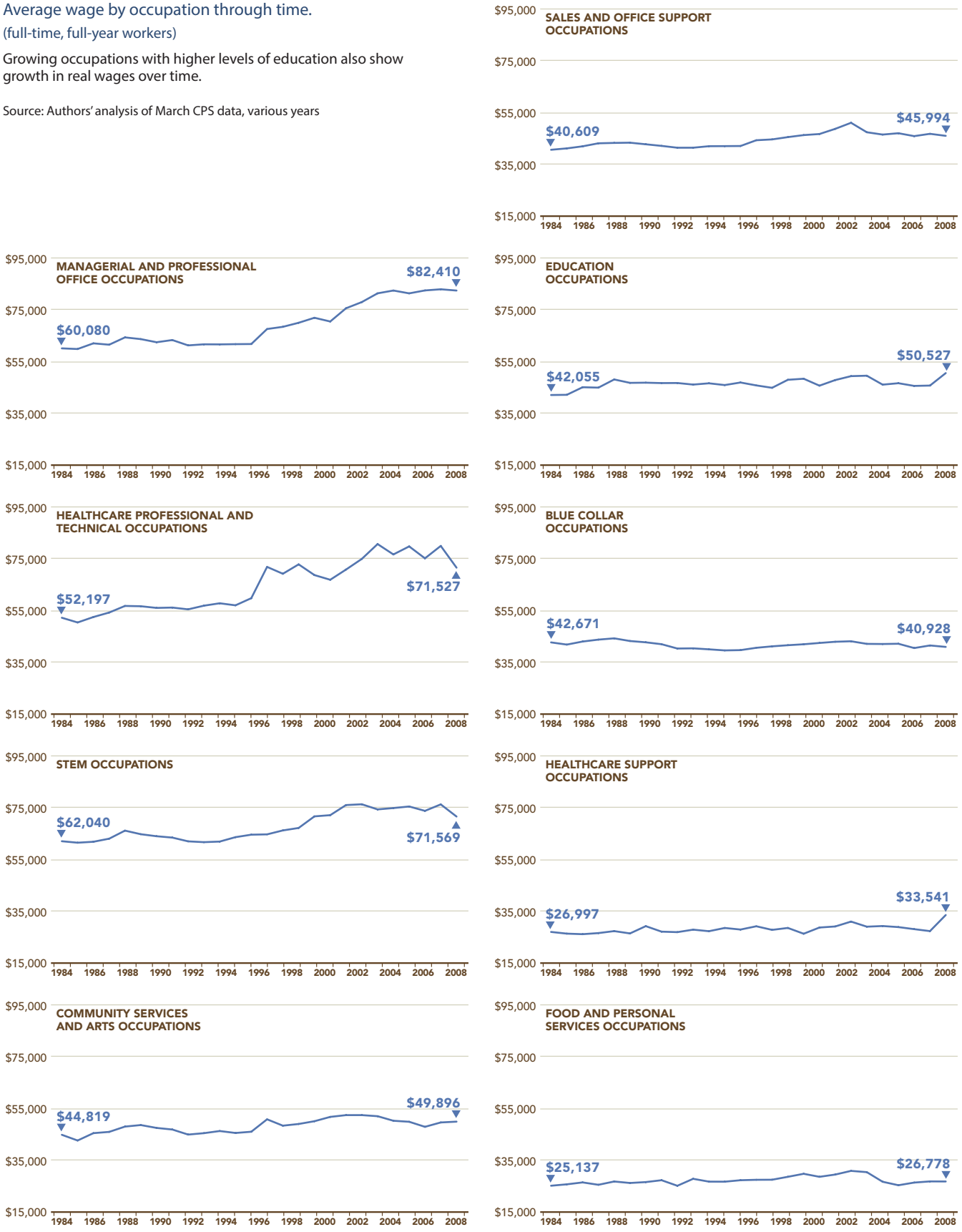
FIGURE 5.10

Average wage by occupation through time.

(full-time, full-year workers)

Growing occupations with higher levels of education also show growth in real wages over time.

Source: Authors' analysis of March CPS data, various years



and Personal Services jobs emphasizes the low-wage growth capacity of these occupations. Indeed, the fact that these occupations are in predominantly declining industries may contribute to this particular trend. Blue Collar Occupations, for example, are found in Manufacturing and Natural Resources industries, both of which are in decline.

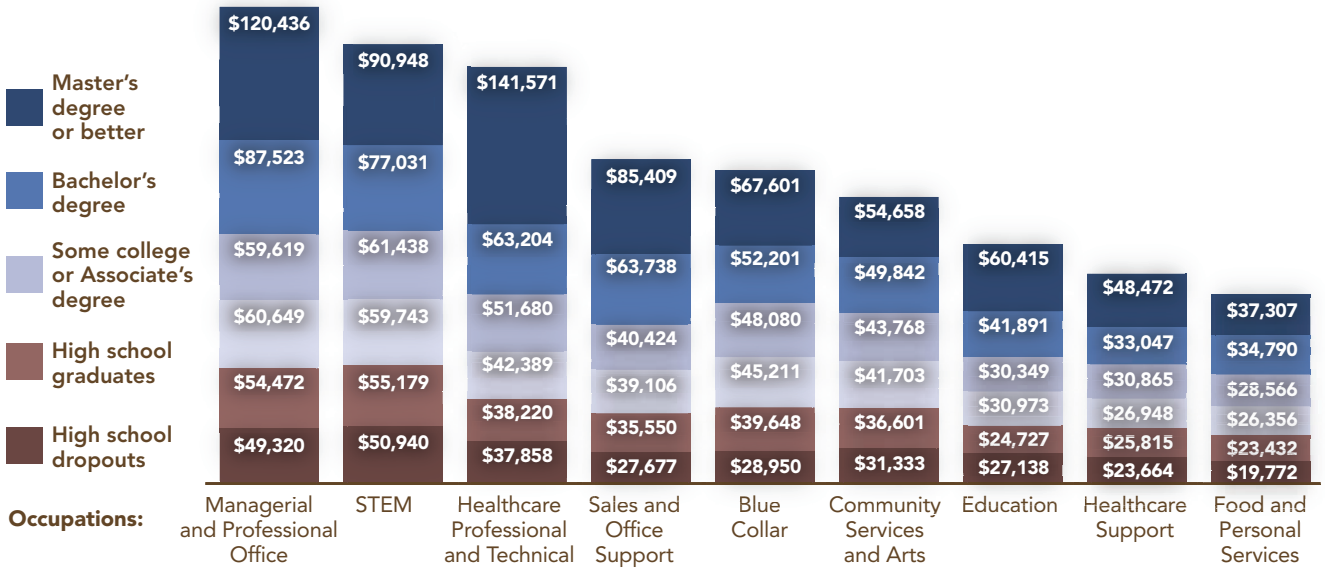
In Figure 5.11, we show average wages for broad education levels in each of our nine occupational groupings for two periods, the 1980s and the 2000s, to see whether there have been any substantial changes over time. The tallest bars are in jobs that pay well at every level of the educational food chain. For example, in 2005–2008, holders of a Bachelor's degree or better working in Managerial and Professional Office Occupations earned, on average, at least $87,000, while high school dropouts and graduates earned at least $49,000—a figure far above the national mean and median wages at the time of $35,000 and $40,000, respectively. The best-paying

FIGURE 5.11

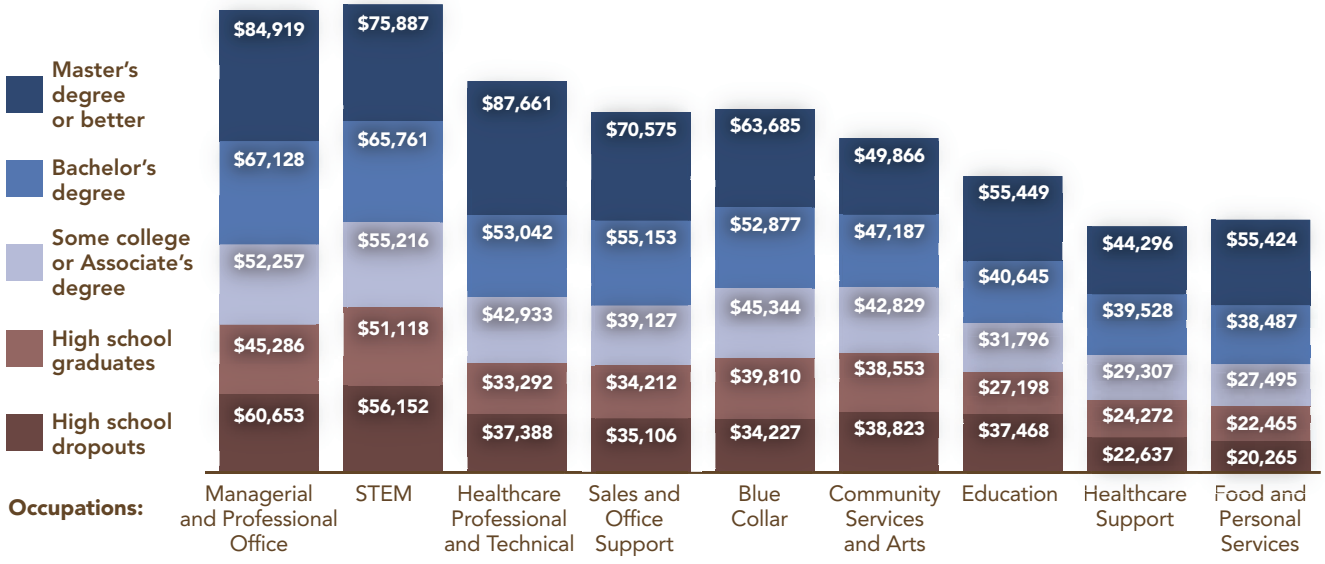
People with the same educational attainment levels can have different wages depending on their occupation. (in 2008 dollars)

Source: Authors' analysis of March CPS data, various years

2005–2008 pooled data



1983–1986 pooled data



jobs at the top of the educational distribution overall are still doctors and nurses in the Healthcare Professional and Technical occupations, while managers and CEOs in Managerial and Professional Office jobs rank second for the size of their wage premiums. STEM jobs also pay well at every level of the educational distribution, a trend that remains consistent across time.

Although middle-skills jobs correlate with middle wages, the relationship is not absolute—there is also a distribution of earnings associated with education levels. If we define middle skills as some college or an Associate's degree (knowing that the "some college" category includes postsecondary certificates, certifications, and college dropouts), then the best jobs for these workers are in Managerial and Professional Office, STEM, and Blue Collar Occupations.

While better education correlates to better pay across the board, this dynamic is especially significant in low-earning jobs. Workers with some college, for instance, receive a 13 percent bump in salary over high school graduates in Food and Personal Services occupations and a 10 percent increase in Healthcare Support occupations. Occupations that require the least amount of education for its workers still pay low wages, however—even at the top of that educational distribution. For example, college graduates earn only about $33,000 in Healthcare Support and $35,000 in Food and Personal Services occupations. Although there are benefits to more training in these occupational groupings, there are still wage ceilings that make it impossible to climb comfortably into the middle class.The average wages of the lowest-educated workers in Food and Personal Services actually declined in real terms over the time period.

Occupational choice also matters at the highest education levels. A graduate degree in Healthcare Professional, Managerial, and STEM Occupations gives workers a vastly superior wage premium than a comparable degree for workers in Food and Personal Services Occupations. Ultimately, occupation-specific human capital ties people to their occupations and can result in substantial wage premiums for specialized tasks. Occupational choice is highly correlated to earnings, regardless of educational attainment levels. High school dropouts in Managerial and Professional Office and STEM jobs, for instance, still earned twice as much as high school dropouts in Healthcare Support or Food and Personal Services jobs.

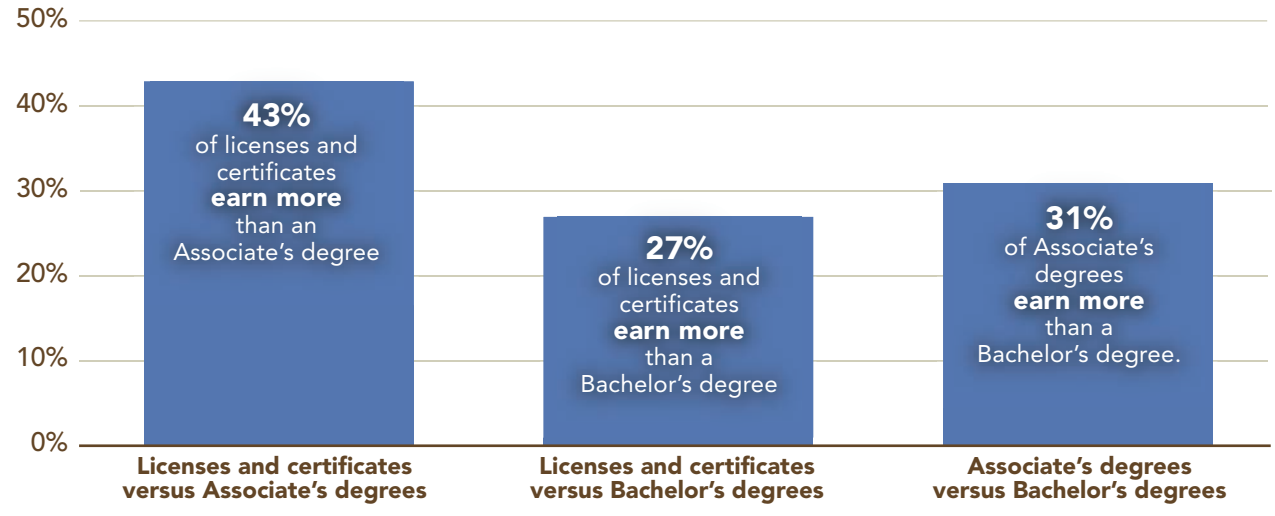
Further, workers with Bachelor's degrees in Managerial and Professional Office or STEM Occupations earned more than employees with graduate degrees in Blue Collar, Community Services and Arts, Education, Healthcare Support, and Personal Services Occupations, on average. In general, there are greater rewards to higher education levels in the STEM, Managerial, and Healthcare Professional Occupations than there are in the Education, Healthcare Support, and Food and Personal Services Occupations.

Figure 5.12 demonstrates that, depending on industry and occupational choice, the link between education and higher wages can sometimes break down. For instance, 43 percent of workers with licenses and certificates earn more than their colleagues with an Associate's degree. About 27 percent of workers with licenses and certificates earn more than employees with a Bachelor's degree, and 31 percent of those with Associate's degrees earn more than their counterparts with a Bachelor's degree.

FIGURE 5.12

Earnings are not just a function of postsecondary attainment. Occupational choice also influences earnings potential.

Source: National Education Longitudinal Study 2000



[20] Prime-age workers have most commonly left the education system and have had enough time in the labor market to be on a career track and are entering the prime of their earnings years, which makes this group the most appropriate for the study of the relationship between earnings and education.

[21] Essentially, relative demand and changes in relative demand is best understood viewed through this lens.

[22] This argument is fully developed in Goldin and Katz (2008).

[23] For privacy purposes, anyone today who earns an annual salary of $200,000 and above is recorded as having earned the mean amount of persons with similar socioeconomic characteristics in the CPS public use file. This practice is called topcoding and amounts to a censoring of information on wage data for the small portion of people at this level of the earnings distribution. How we treat topcoded data is particularly important for relative earnings analysis between disparate groups of people. About 1–2 percent of Americans are topcoded in the CPS surveys: 83 percent are male, 45 years old on average, and predominantly White, while 73 percent have a Bachelor's degree and above. According to the Internal Revenue Service (IRS), the top 1 percent of earners in the nation made $388,806 on average, and the top 10 percent made $108,904 in 2006.

[24] The unemployment rate overall was 9.8 percent at the time of this writing.

[25] Enrollment by students under 23 years old and over 30 years old was 70 percent and 16 percent, respectively, in 2004. Source: U.S. Department of Education, National Center for Education Statistics, 2003–04 National Postsecondary Student Aid Study (NPSAS:04).

[26] We've updated the original Census data and limit our sample to prime-age, full-time, full-year workers (25–54). The Census Bureau's 2002 report on the average value of a college degree over one's lifetime estimates that high school graduates can expect to earn $1.2 million; holders of Bachelor's degrees, $2.1 million; and holders of Master's degrees, $2.5 million. This implies that the average value of a four-year degree is increased earnings income of $900,000 over a period of about 40 years.

[27] At the following interest rates, the NPV of $1.6 million today, 40 years into the future, is $1 million (1 percent), $725,000 (2 percent) or $490,000 (3 percent).

[28] Tuition and fees, $9,000 per year; books, $1,500 per year; trips and extra costs, $1,500 per year. Rent and food are excluded from these calculations since these are costs that one would have incurred regardless of whether one was attending college or working.

[29] This is usually a difficult group of workers to connect human capital and earnings to, since the group contains some college dropouts as well as those with a recognizable degree.

Summary and Conclusions

Recession and economic change are reshaping the U.S. job and education landscapes.

The recession that began in December of 2007 is already 30 months old, but the U.S. economy will not recover its pre-recession employment levels for at least another two years. From there, it will take an additional three years to make up for lost growth and create a job market strong enough to employ both the casualties of the recession and the millions of new workers who will stream into the workforce from schools across the country.

In the preceding chapters we have looked at the current state of the economy, assessed the prospects for job creation through 2018, and detailed what employers will be looking for once hiring resumes.

Among other things, we found that:

- There is a growing mismatch between the jobs that will be created over the next decade and the education and training of our adult workers. More than 60 million of our prime-age workforce who are 25–54 years old are still working in jobs that require high school or less. That economy is receding fast and those workers will be left behind: unemployed, underemployed, or likely stuck in jobs that don't provide middle-class wages.
- The postsecondary education and training system will fall short by 3 million or more postsecondary degrees. Economic demand will not be met, denying numerous Americans access to middle-class career pathways.
- Hundreds of thousands of Manufacturing and Natural Resources jobs in farming, fishing, and forestry have been destroyed in the recession and will not be coming back. And we will lose another 1.4 million jobs in these industries over the next decade. The new jobs that replace them will look nothing like the old ones and will require employees with postsecondary skills and preparation.
- The U.S. economy will create 46.8 million job openings by 2018, including 13.8 newly created jobs and 33 million "replacement" positions produced when workers retire.
- Employers filling these jobs, overwhelmingly, will require college degrees or other postsecondary preparation of 63 percent of their new hires.
- Postsecondary education and training is quickly becoming the only viable path to the American middle class.
- Education and training connects directly to occupations and less directly to industries, which can complicate economic development efforts.

In the immediate future we likely will see months of "jobless recovery," such as we experienced during the recessions of 1990 and 2001. That means economic output will grow but will not immediately generate job growth. Instead of hiring new workers, businesses will ask current employees to work longer hours to meet rising demand. Evidence suggests this is already happening. Gross Domestic Product grew by 3.5 percent in the third quarter and 5.7 percent in the fourth quarter of 2009—the fastest pace in six years—but job losses continued, averaging 260,000 and 110,000 respectively over that period.

By then, GDP growth will pick up more steam and the economy will finally start creating more jobs than it loses. That does not mean everything will be back to normal, however. Here's why: The recession eliminated 7.8 million jobs and also stymied job growth, which typically adds an additional 100,000 positions per month to the economy. Once growth resumes next year, it will take until 2015 for the economy's job creation engine to catch up to where it should have been.

TECHNOLOGY FUELS A RESTRUCTURING ECONOMY.

For many, though, that will be a hollow accomplishment. Hundreds of thousands of low-skill jobs in manufacturing, farming, fishing, and forestry have been permanently destroyed because the recession has prompted employers to either automate those positions or ship them offshore to reduce labor costs.

They are casualties of more than just the recession, though, for such jobs have been steadily disappearing for years as part of a fundamental restructuring of the American economy. And the forces behind that restructuring have not been slowed by the recession—if anything, they have sped up.

Foremost among those forces: technology. In the 19th and 20th centuries, electricity and the internal combustion engine drove the rise of manufacturing and America's shift away from an agrarian economy. In the 21st century, computers and related inventions are transforming the U.S. economic landscape—boosting productivity so companies can produce more with less and spurring an economic shift from Manufacturing to Services. That is why, when old-line Manufacturing and Natural Resources jobs disappear, they often don't come back.

Their replacements tend to be very different kinds of jobs, requiring very different kinds of employees—and very different kinds of preparation. Just as the industrial revolution was critical to building a mass K–12 educational system to feed workers into the Manufacturing industries, the information revolution is spurring the development of a mass postsecondary system to fill the needs of sophisticated new industries, such as Computer Systems Design or Financial Services.

Integral to this trend is skill-biased technological change. This simply means that technological development and the organizational changes that come with it favor workers with more education, because they have the expertise needed to handle more intricate tasks. Demand for these workers, in turn, grows across the board as the technology spreads throughout the economy.

Education and training requirements change, too. Instead of looking for narrow, industry-specific skills in their new hires, employers instead tend to look for employees with advanced general education and skills. Once employed, then, the new workers receive more specialized on-the-job training.

POSTSECONDARY EDUCATION AND TRAINING IS THE ROAD TO THE MIDDLE CLASS.

And so, the jobs report finds, the future of employment in the United States comes down to this: success will require postsecondary education, in one form or another. By 2018, our forecasts show the economy will create 46.8 million openings—13.8 million brand new jobs and 33 million replacement jobs, positions vacated by workers who have retired. Nearly two-thirds of these 46.8 million jobs—some 63 percent—will require workers with at least some college education. About 34 percent will require a Bachelor's degree or better, while 30 percent will require at least some college or a two-year Associate's degree. Only 36 percent of total jobs will require workers with just a high school diploma or less, and those will be clustered toward the low end of the wage scale.

The implications of this shift represent a sea of change in American society. Essentially, postsecondary education or training has become the threshold requirement for access to middle-class status and earnings in good times and bad. It is no longer the preferred pathway to middle-class jobs—it is, increasingly, the only pathway.

Obtaining a good job—one capable of providing a family-sustaining wage—has become the ultimate standard for educational adequacy. The mass postsecondary educational system has arrived, leaving academics the debate over "college for all." Experts might contest whether everyone needs some college education—but the labor market clearly has linked middle-class employability to postsecondary education and training.

The reasons are not hard to understand. College education is critical not only to the initial hire, but also to better wages and access to on-the-job training. There is a clear relationship between formal education level and annual earnings. Consider that, in 2008, high school dropouts earned an average of $14,318 per year, according to Department of Labor statistics. High school graduates earned $26,001; Bachelor's degree holders earned $49,435; and advanced degree holders earned $71,895.

That college graduates earn more than high school graduates or dropouts is an indication that they are in relatively greater demand in the labor force. Essentially, employers are paying a premium to hire workers with more education and have been for decades. Recently, some emphasis has been placed on a decline in the growth rate of real wages for holders of Bach-

elor's degrees and better since 2002. But the relative wage premium for workers with postsecondary degrees over those with high school educations or worse has essentially held steady—which means there are still overwhelming advantages for college degrees in the workplace.

Among them: access to further training. College graduates are almost twice as likely as high school graduates to receive formal training from their employers, which can increase employee wages by 3 to 11 percent.

TODAY'S CAREER PATHWAYS ARE IN OCCUPATIONS, NOT WITHIN INDUSTRIES.

All of this leads to some dilemmas for federal, state, and local governments as they try to formulate economic development strategies.The emphasis on postsecondary preparation for new hires means that workers will tend to be attached more to the occupations they will be filling than to the specialized industries in which they work. The day when people left high school to go to work in the local industry and then worked their way up is disappearing. Starting out, straight from high school, on the loading dock or in the mail room and climbing to the CEO's corner office is no longer an option. People do not go work in industries any more. They get educated or trained, go to work in occupations, and progress in an occupational hierarchy. Some occupations are tied tightly to particular industries, Healthcare occupations for example, but more and more occupations are dispersed broadly across industries. And industries vary widely in how many jobs they create: old-line Manufacturing, clearly, is in decline. But even some new industries, such as Information Services, have only limited hiring potential because they are tech-heavy and can achieve high levels of productivity with relatively few workers. This means governments will need to be selective about how they approach industries and where they deploy scarce development resources.

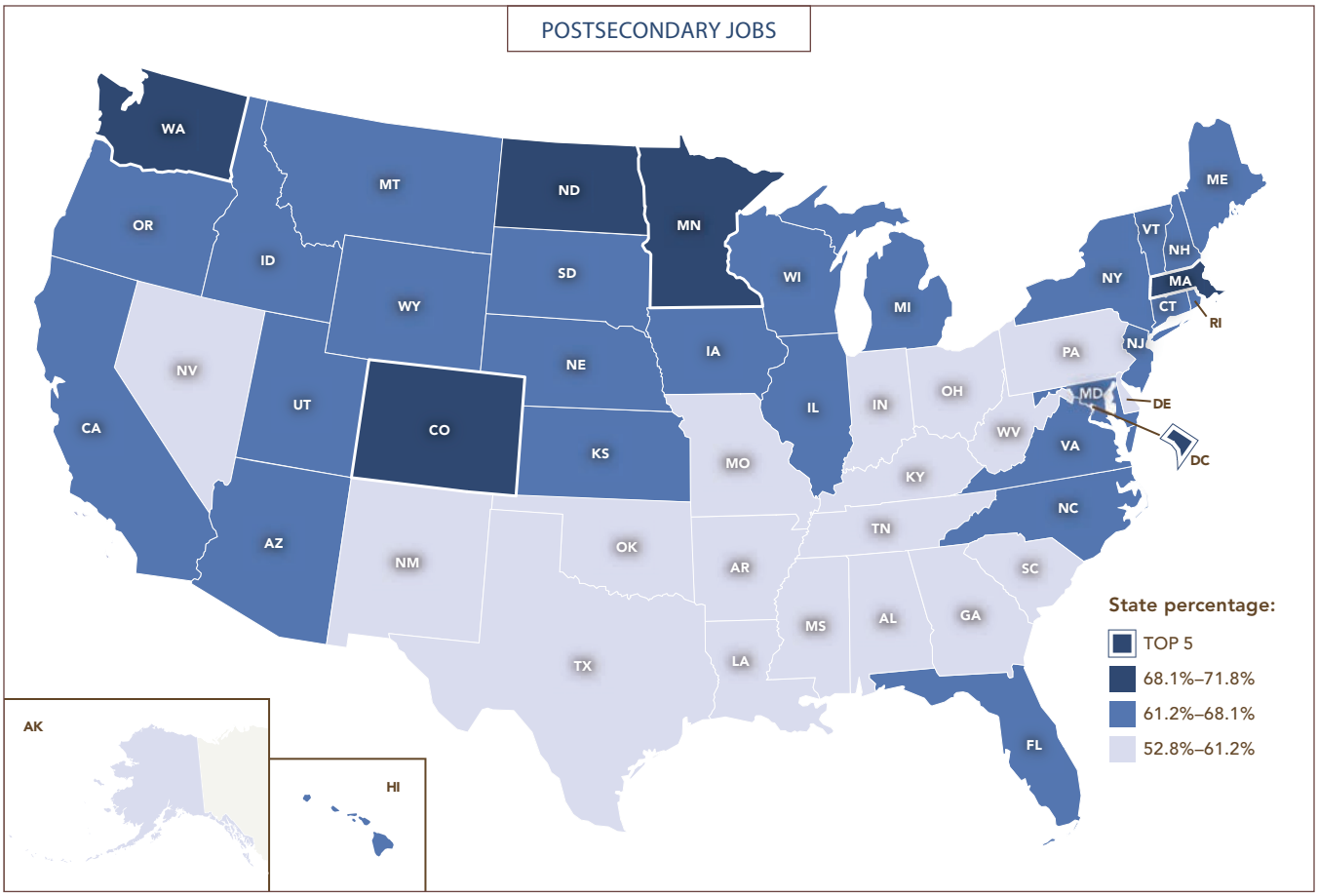
In addition, education and training must be made available to individuals outside the usual college-age population to serve workers whose old-economy jobs have disappeared. To do otherwise risks leaving hundreds of thousands of workers behind as the economy recovers and builds for the future.

And that would be a dismal recovery, indeed.

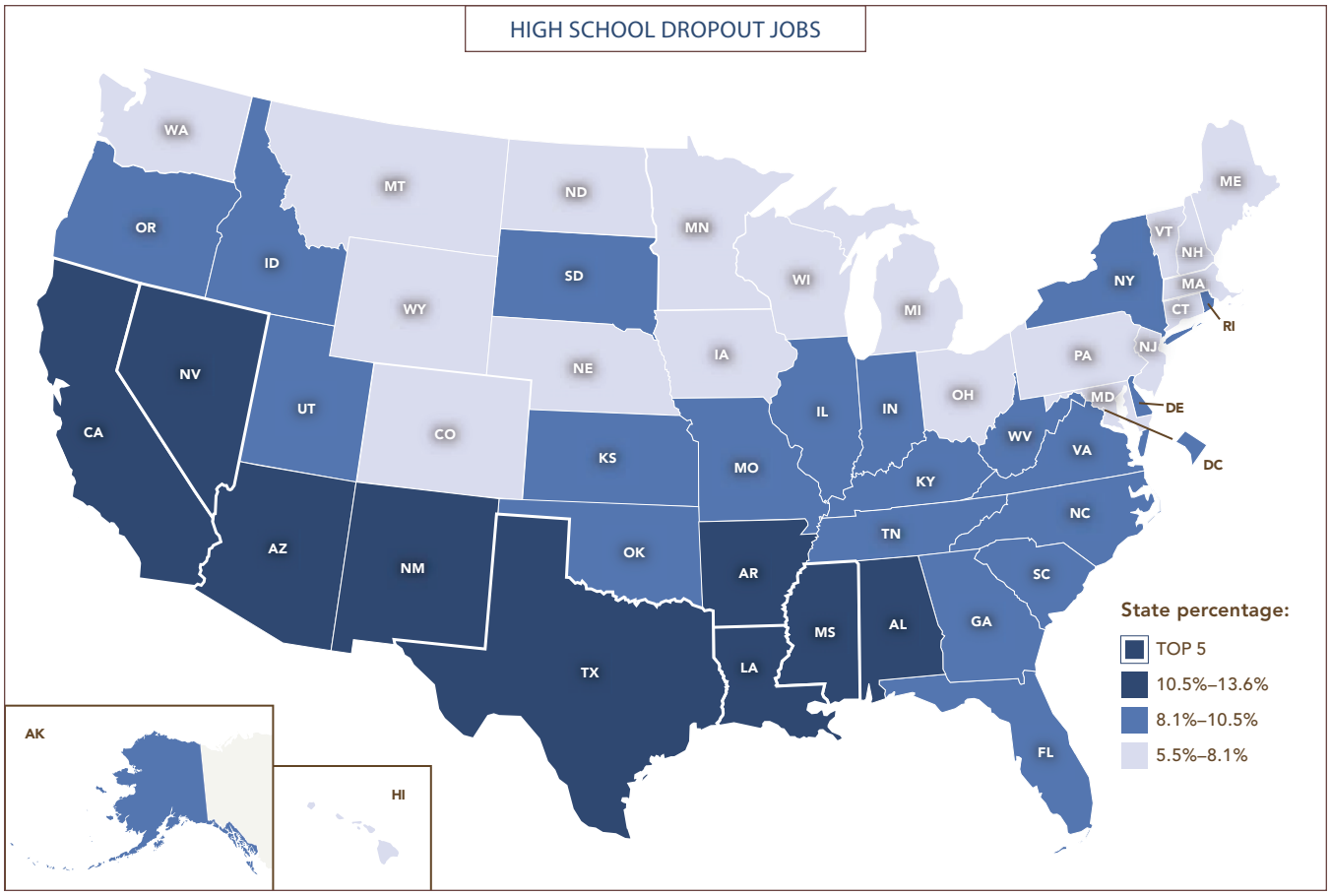
Appendix 1

U.S. Maps: Educational concentrations of job openings by state though 2018.

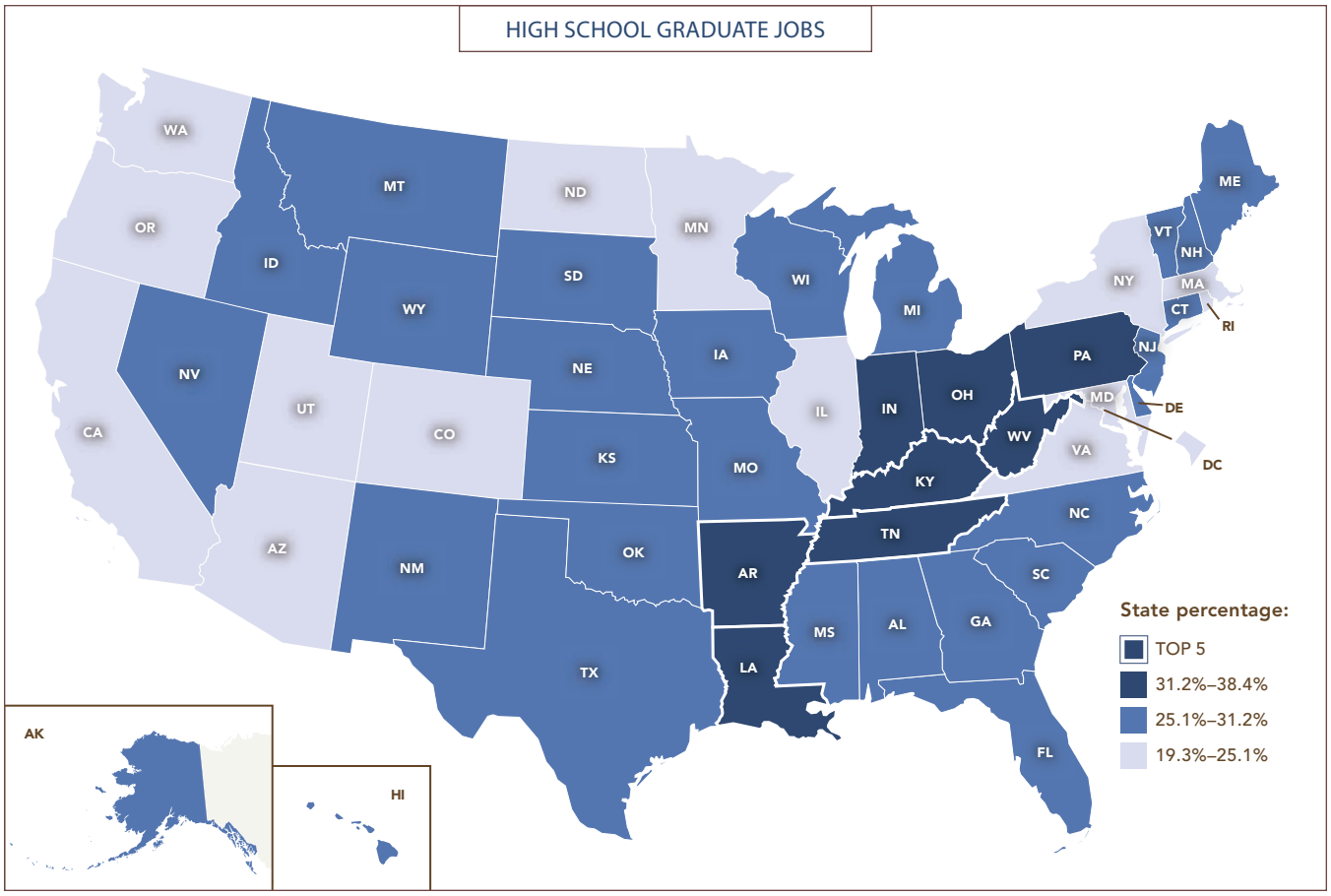
DISTRICT OF COLUMBIA, MASSACHUSETTS, COLORADO, MINNESOTA, AND WASHINGTON WILL LEAD THE NATION IN JOB OPENINGS REQUIRING POSTSECONDARY EDUCATION BY 2018.



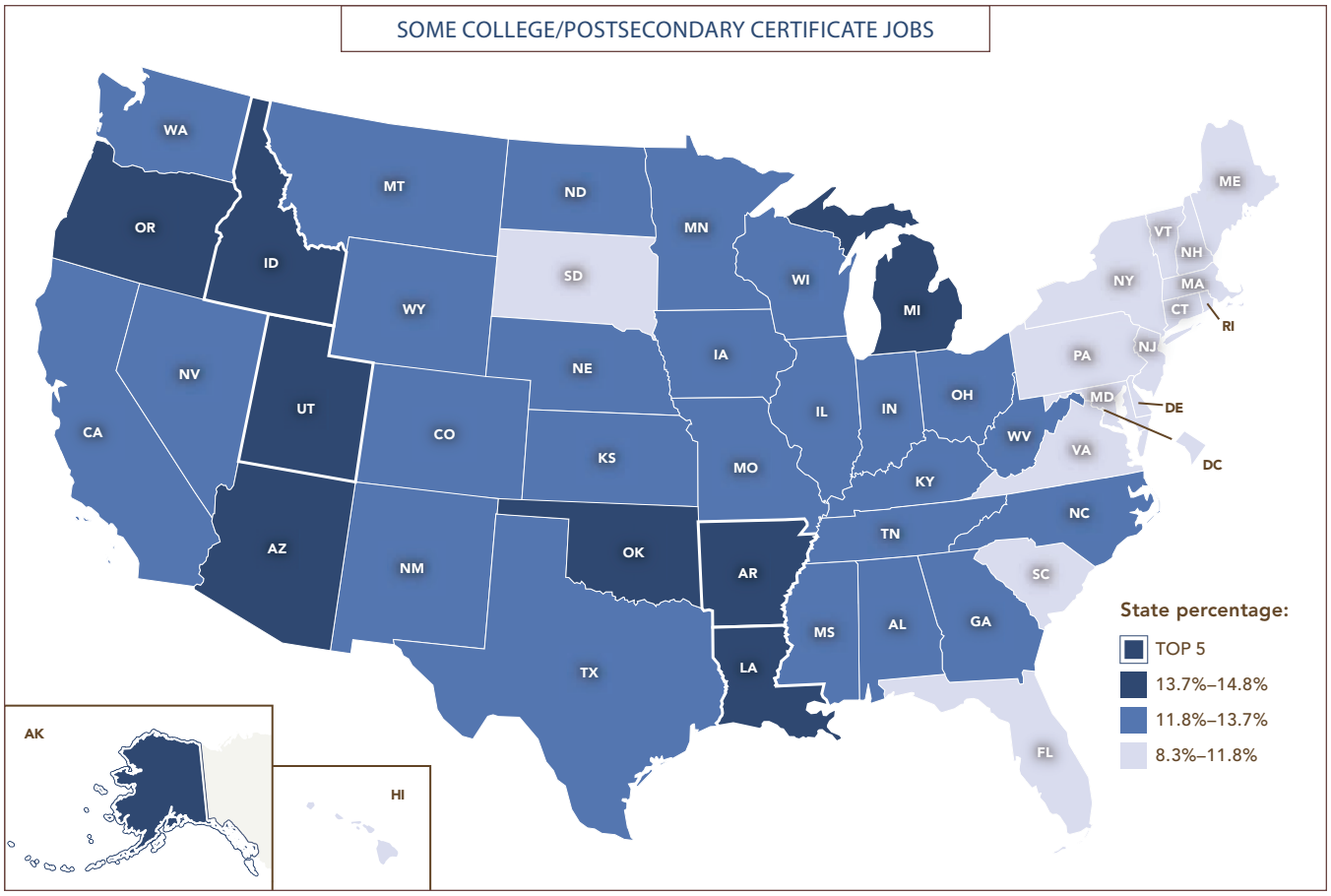
TEXAS, LOUISIANA, MISSISSIPPI, NEVADA, AND CALIFORNIA WILL LEAD THE NATION IN JOB OPENINGS REQUIRING LESS THAN HIGH SCHOOL BY 2018.



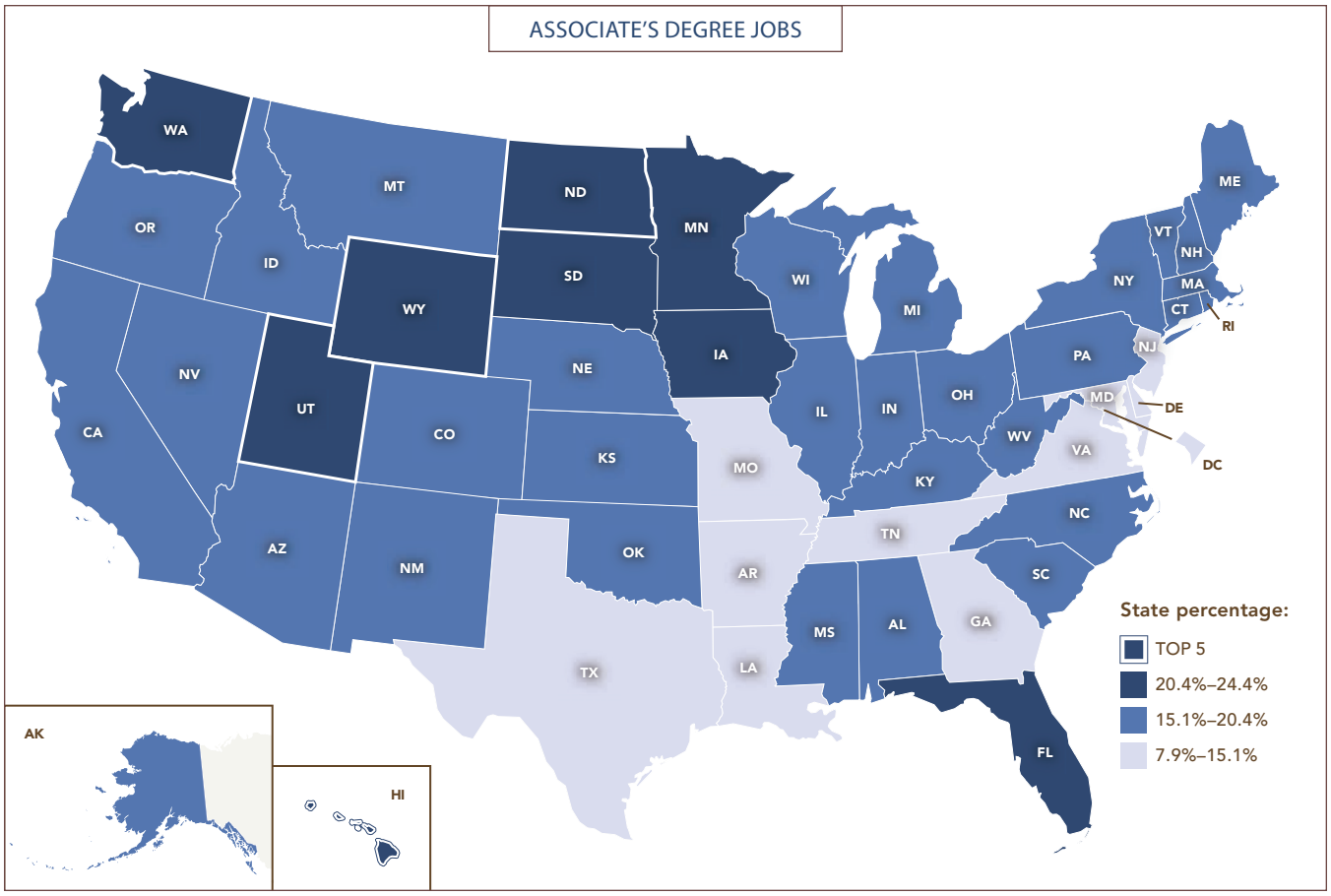
WEST VIRGINIA, LOUISIANA, ARKANSAS, TENNESSEE, AND KENTUCKY WILL LEAD THE NATION IN JOB OPENINGS REQUIRING HIGH SCHOOL BY 2018.



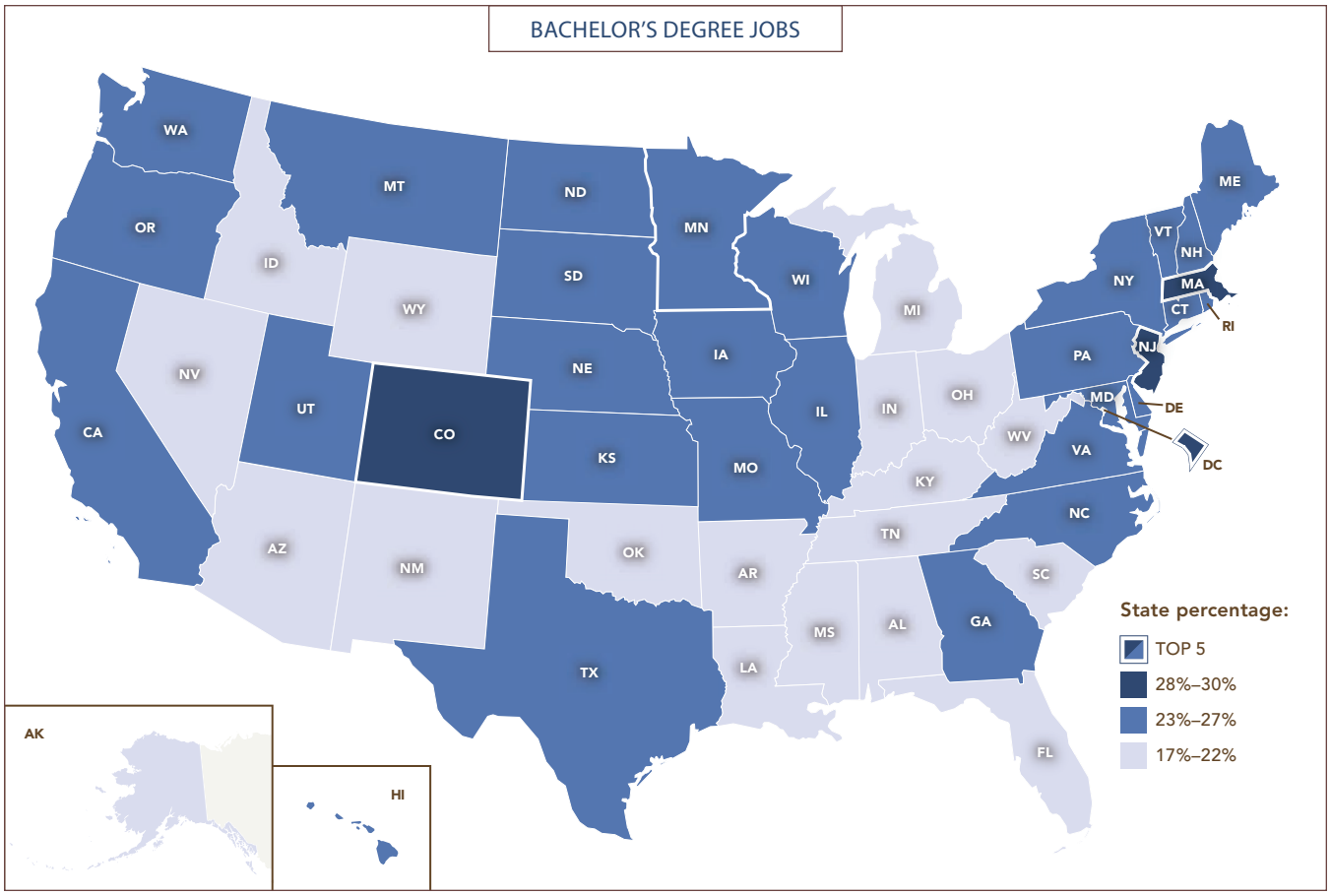
ALASKA, IDAHO, UTAH, LOUISIANA, AND ARKANSAS WILL LEAD THE NATION IN JOB OPENINGS REQUIRING SOME COLLEGE BY 2018.



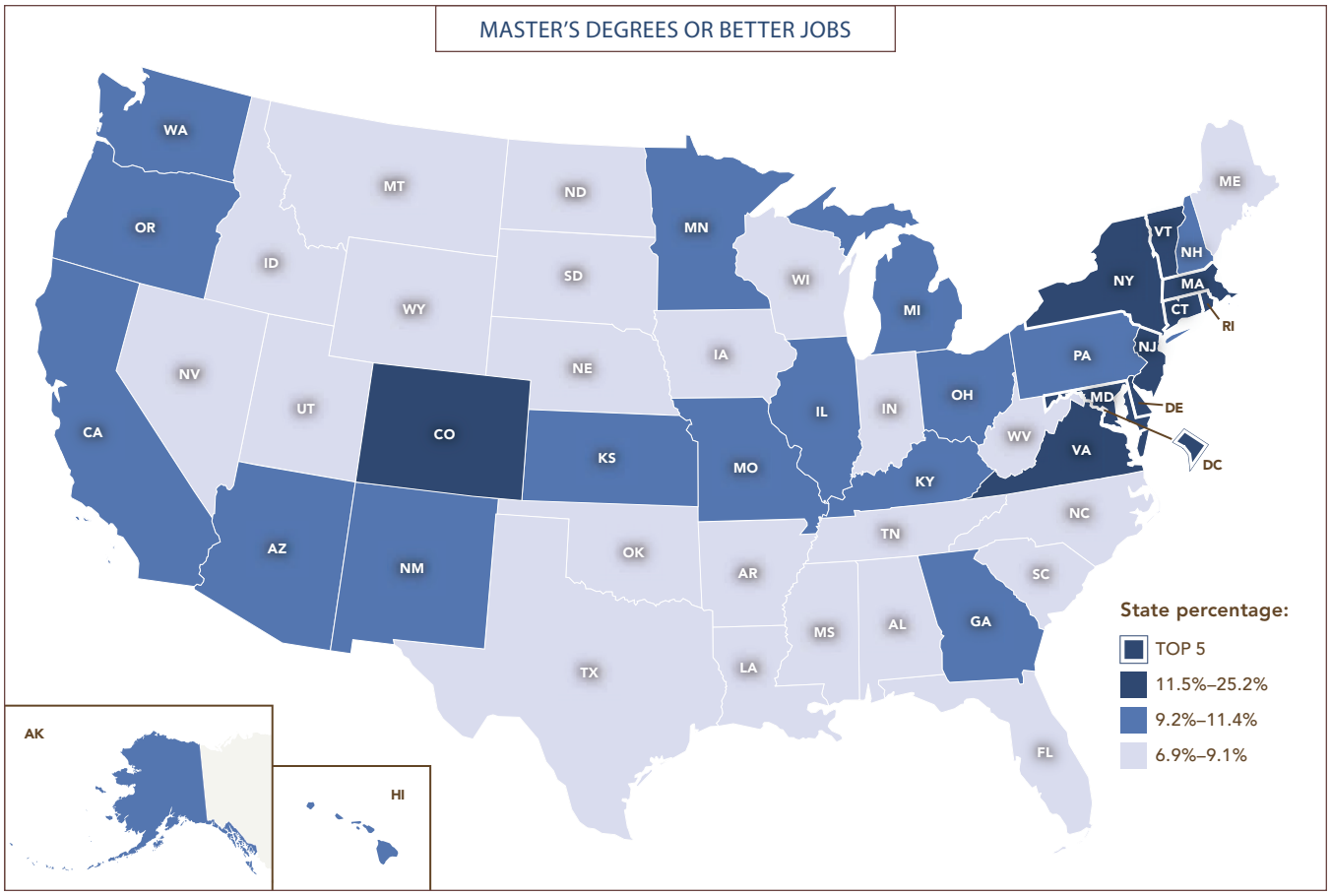
NORTH DAKOTA, WASHINGTON, UTAH, WYOMING, AND HAWAII WILL LEAD THE NATION IN JOB OPENINGS REQUIRING ASSOCIATE'S DEGREE BY 2018.



DISTRICT OF COLUMBIA, MINNESOTA, NEW JERSEY, MASSACHUSETTS, AND COLORADO WILL LEAD THE NATION IN JOB OPENINGS REQUIRING BACHELOR'S DEGREES BY 2018.



DISTRICT OF COLUMBIA, CONNECTICUT, NEW YORK, MASSACHUSETTS, AND MARYLAND WILL LEAD THE NATION IN JOB OPENINGS REQUIRING MASTER'S DEGREES OR BETTER BY 2018.



Appendix 2

Tables with state-level analysis and rankings of job openings and educational demand through 2018.

Percentage distribution of education requirements among all job openings/opportunities at the state level by 2018

(Source data for U.S. maps in Appendix 1)

State	Less than high school	High school graduate	Some college, no degree	Associate's degree	Bachelor's degree	Master's degree or better	Total postsecondary education
US TOTAL	9%	27%	12%	17%	24%	10%	63%
AK	9%	29%	15%	16%	21%	10%	62%
AL	11%	31%	14%	16%	20%	9%	58%
AR	11%	35%	14%	14%	19%	7%	54%
AZ	11%	24%	14%	19%	22%	10%	64%
CA	12%	21%	12%	18%	26%	11%	67%
CO	8%	22%	12%	17%	30%	12%	70%
CT	7%	26%	11%	16%	26%	15%	67%
DC	9%	19	8%	8%	30%	25%	72%
DE	9%	30	11%	16%	22%	11%	61%
FL	9%	27	11%	21%	22%	9%	63%
GA	10%	28	12%	15%	24%	10%	61%
HI	6%	26	11%	23%	25%	9%	68%
IA	7%	29	13%	21%	23%	8%	64%
ID	10%	27	15%	19%	22%	8%	63%
IL	8%	25	12%	18%	25%	11%	67%
IN	10%	33	13%	16%	20%	8%	58%
KS	9%	26	14%	17%	25%	10%	66%
KY	10%	33	13%	16%	19%	9%	57%
LA	12%	35	14%	11%	21%	8%	53%
MA	7%	23	10%	16%	28%	16%	70%
MD	8%	25	11%	14%	26%	16%	67%
ME	7%	31	11%	19%	23%	9%	62%
MI	8%	28	14%	19%	22%	10%	65%
MN	6%	23	13%	21%	27%	9%	70%
MO	9%	30	13%	15%	23%	9%	60%
MS	12%	31	13%	19%	18%	7%	57%
MT	8%	29	13%	17%	24%	8%	63%
NC	10%	27	12%	19%	23%	9%	63%
ND	7%	24%	13%	24%	25%	7%	69%
NE	8%	26%	14%	20%	24%	8%	66%
NH	7%	26%	11%	19%	26%	11%	67%
NJ	8%	26%	10%	14%	29%	13%	66%
NM	12%	28%	14%	16%	20%	11%	61%
NV	12%	30%	13%	17%	20%	7%	58%
NY	8%	24%	9%	20%	25%	14%	67%

Percentage distribution of education requirements among all job openings/opportunities at the state level by 2018, continued

State	Less than high school	High school graduate	Some college, no degree	Associate's degree	Bachelor's degree	Master's degree or better	Total postsecondary education
OH	8%	32%	13%	16%	21%	9%	59%
OK	10%	31%	14%	16%	21%	8%	59%
OR	9%	24%	14%	18%	24%	10%	67%
PA	7%	32%	10%	17%	23%	11%	60%
RI	9%	25%	11%	19%	25%	11%	66%
SC	10%	30%	12%	18%	21%	9%	60%
SD	8%	29%	11%	21%	23%	7%	63%
TN	11%	33%	13%	14%	21%	9%	56%
TX	14%	27%	13%	14%	23%	9%	60%
UT	8%	24%	15%	22%	23%	8%	68%
VA	9%	25%	12%	15%	26%	14%	66%
VT	6%	28%	10%	19%	25%	12%	66%
WA	7%	22%	13%	22%	25%	11%	70%
WI	7%	29%	12%	20%	23%	9%	64%
WV	9%	38%	12%	15%	17%	8%	53%
WY	7%	28%	14%	24%	20%	7%	65%

Ranking of education requirements for job openings within states by 2018

Highest (#1) Middle (#25) Lowest (#51)

State	High school dropout rank	High school graduate rank	Some college, no degree rank	Associate's degree rank	Bachelor's degree rank	Graduate degree rank	Total postsecondary rank
AK	22	18	3	36	37	22	33
AL	8	12	13	40	44	30	43
AR	7	2	4	48	48	49	49
AZ	9	41	7	19	34	23	24
CA	5	50	32	24	10	14	14
CO	33	49	33	30	2	8	3
CT	46	36	45	38	7	4	9
DC	23	51	51	51	1	1	1
DE	19	16	38	35	33	11	35
FL	20	27	40	8	32	32	28
GA	11	22	34	42	21	20	34
HI	51	31	44	3	14	28	7
IA	40	21	27	7	28	45	25
ID	16	29	2	13	35	44	27
IL	28	40	29	25	12	12	13
IN	17	6	23	33	43	37	45
KS	27	34	10	29	15	21	21
KY	12	5	21	39	49	25	47
LA	2	3	5	50	42	42	50
MA	47	47	49	31	4	2	4
MD	34	39	41	47	8	3	11
ME	45	9	42	14	31	29	32
MI	37	24	8	17	36	19	23
MN	49	46	25	6	5	26	5

Ranking of education requirements for job openings within states by 2018, continued

State	High school dropout rank	High school graduate rank	Some college, no degree rank	Associate's degree rank	Bachelor's degree rank	Graduate degree rank	Total postsecondary rank
MO	18	14	15	44	29	24	37
MS	3	11	19	18	50	48	46
MT	38	17	20	26	19	40	29
NC	14	28	30	20	24	33	30
ND	48	44	16	1	18	50	6
NE	35	35	12	10	22	38	18
NH	44	32	43	16	9	15	15
NJ	36	33	48	46	3	7	19
NM	6	25	11	34	47	13	36
NV	4	13	17	27	45	47	44
NY	31	42	50	12	16	5	10
OH	32	7	26	32	39	27	41
OK	15	10	6	37	38	43	42
OR	25	43	9	22	20	18	12
PA	41	8	46	28	30	17	38
RI	21	37	39	21	17	10	20
SC	13	15	35	23	41	36	40
SD	29	20	37	9	23	51	31
TN	10	4	22	49	40	34	48
TX	1	30	18	45	25	31	39
UT	30	45	1	5	26	39	8
VA	26	38	36	43	6	6	17
VT	50	26	47	15	11	9	16
WA	39	48	24	4	13	16	2
WI	43	19	31	11	27	35	26
WV	24	1	28	41	51	41	51
WY	42	23	14	2	46	46	22

Appendix 3

Educational distribution by occupational and industrial categories in 2018.

Educational distribution of total jobs (by occupation) in 2008.

Source: Center on Education and the Workforce forecast of educational demand through 2018

OCCUPATIONS:	High school dropouts	High school graduates	Some college, no degree	Associate's degree	Bachelor's degree	Master's degree or better	TOTAL
Healthcare Support	387,235	1,417,936	998,100	658,680	366,921	50,020	3,878,892
Community Services and Arts	61,796	431,138	564,586	391,502	2,071,337	1,031,480	4,551,839
STEM	96,165	662,494	846,029	880,248	2,969,453	1,865,471	7,319,860
Healthcare Professional and Technical	25,331	495,843	640,033	1,811,124	2,264,523	2,115,531	7,352,385
Education	58,551	595,452	698,378	492,905	3,513,397	3,597,444	8,956,127
Managerial and Professional Office	289,812	2,507,576	2,394,892	1,479,072	6,200,806	3,313,721	16,185,879
Food and Personal Services	4,771,974	9,747,825	4,673,030	2,070,159	2,869,005	420,100	24,552,093
Blue Collar	6,757,699	15,605,801	6,070,335	2,909,005	2,104,260	352,696	33,799,796
Sales and Office Support	2,151,558	13,359,641	10,198,153	4,675,240	8,679,104	1,439,430	40,503,126
TOTAL*	14,600,121	44,823,706	27,083,536	15,367,935	31,038,806	14,185,893	147,099,997

Educational distribution of total jobs (by occupation) in 2018.

Source: Center on Education and the Workforce forecast of educational demand through 2018

OCCUPATIONS:	High school dropouts	High school graduates	Some college, no degree	Associate's degree	Bachelor's degree	Master's degree or better	TOTAL
Healthcare Support	316,220	1,650,170	1,316,377	1,015,012	433,370	95,088	4,826,237
Community Services and Arts	41,044	411,231	583,516	526,375	2,520,524	1,126,326	5,209,016
STEM	27,717	729,443	865,555	1,054,172	3,614,642	2,261,768	8,553,297
Healthcare Professional and Technical	-	450,038	610,671	2,161,139	2,924,180	2,667,125	8,813,153
Education	60,302	654,477	825,721	674,515	3,906,200	4,112,993	10,234,208
Managerial and Professional Office	253,580	2,033,003	2,340,385	1,766,664	7,518,784	3,771,595	17,684,011
Food and Personal Services	5,311,606	10,375,799	5,176,370	2,953,944	3,705,516	472,328	27,995,563
Blue Collar	7,122,598	15,322,808	5,805,475	3,664,944	2,387,683	337,899	34,641,407
Sales and Office Support	2,326,477	12,838,226	10,908,550	5,901,593	10,069,661	1,498,611	43,543,118
TOTAL*	15,459,544	44,465,195	28,432,620	19,718,358	37,080,560	16,343,733	161,500,010

*The education totals for education categories do not match totally between occupation and industry due to methodological differences. A discussion of the methodology used to generate all forecasts in this document is available at The Center's website at cew.georgetown.edu.

Educational distribution of total jobs (by industry) in 2008.

Source: Center on Education and the Workforce forecast of educational demand through 2018

INDUSTRIES:	High school dropouts	High school graduates	Some college, no degree	Associate's degree	Bachelor's degree	Master's degree or better	TOTAL
Wholesale and Retail Trade Services	2,547,739	8,129,461	5,191,831	1,891,198	3,984,063	661,023	22,405,315
Professional and Business Services	1,326,466	4,296,253	2,839,896	1,897,200	5,829,364	3,493,289	19,682,469
Government and Public Education Services	769,337	4,463,893	3,748,887	3,909,709	6,458,953	2,384,075	21,734,853
Healthcare Services	935,647	3,696,546	2,940,135	2,800,364	3,785,342	2,282,387	16,440,421
Leisure and Hospitality Services	3,883,192	3,857,654	3,396,551	953,418	1,736,583	358,950	14,186,347
Manufacturing	1,136,625	5,849,593	2,090,408	1,247,149	2,236,409	1,086,139	13,646,322
Financial Services	219,068	2,289,615	2,062,471	821,758	3,410,194	1,293,209	10,096,315
Construction	1,013,746	3,793,425	1,635,965	727,818	822,856	129,967	8,123,777
Transportation and Utilities Services	405,808	2,859,775	1,184,738	649,416	899,809	167,134	6,166,679
Personal Services	837,471	1,925,675	1,091,028	668,621	690,645	433,136	5,646,576
Private Education Services	56,521	434,821	376,061	170,403	812,002	947,988	2,797,796
Information Services	123,898	648,346	662,460	187,572	1,073,362	441,013	3,136,650
Natural Resources	710,233	1,323,899	290,590	224,440	307,423	96,568	2,953,153
TOTAL*	13,965,751	43,568,955	27,511,022	16,149,065	32,047,004	13,774,878	147,016,675

Educational distribution of total jobs (by industry) in 2018.

Source: Center on Education and the Workforce forecast of educational demand through 2018

INDUSTRIES:	High school dropouts	High school graduates	Some college, no degree	Associate's degree	Bachelor's degree	Master's degree or better	TOTAL
Wholesale and Retail Trade Services	2,054,180	7,747,315	5,240,566	2,628,735	5,384,497	1,089,876	24,145,169
Professional and Business Services	1,172,360	3,181,083	2,995,082	2,264,671	8,649,452	4,795,087	23,057,735
Government and Public Education Services	347,226	3,465,799	4,127,209	3,909,128	7,246,199	2,764,115	21,859,676
Healthcare Services	991,378	4,124,082	3,519,395	3,936,313	5,116,397	2,866,496	20,554,061
Leisure and Hospitality Services	4,029,596	4,635,877	2,937,440	1,351,427	2,690,571	509,823	16,154,733
Manufacturing	1,262,440	4,646,339	1,984,204	1,458,667	2,612,356	1,116,125	13,080,131
Financial Services	217,869	1,780,750	2,220,391	1,177,103	4,506,022	1,441,828	11,343,964
Construction	1,809,463	3,554,175	1,387,382	878,205	837,183	162,861	8,629,269
Transportation and Utilities Services	553,317	2,871,578	1,262,668	768,033	1,049,958	181,151	6,686,704
Personal Services	970,426	2,065,142	1,064,372	914,406	750,046	447,987	6,212,379
Private Education Services	40,041	432,463	366,395	263,122	1,141,766	1,237,942	3,481,728
Information Services	-	291,555	736,215	381,689	1,547,880	503,713	3,461,051
Natural Resources	817,562	1,158,793	281,276	257,506	275,567	92,117	2,882,822
TOTAL*	14,265,858	39,954,951	28,122,595	20,189,005	41,807,893	17,209,121	161,549,423

*The education totals for education categories do not match totally between occupation and industry due to methodological differences. A discussion of the methodology used to generate all forecasts in this document is available at The Center's website at cew.georgetown.edu.

Appendix 4

Comparison of the Center on Education and the Workforce's projections of educational demand and Bureau of Labor Statistics' educational and training requirements.

The Bureau of Labor Statistics (BLS) and the Georgetown University Center on Education and the Workforce (Center) use fundamentally different methodologies to forecast education data that can be boiled down to two issues:

1. The Center uses historical data to inform its projections, while BLS holds educational demand constant. This means that BLS assumes if 10% of jobs in an occupation in 2008 require postsecondary education, then 10% of jobs in the same occupation in 2018 will require postsecondary education. As a result, educational demand in the Bureau's numbers changes only as a result of fluctuations in the mix of occupations in the economy, not because requirements in an occupation have changed.
2. The Center uses all valid data on education requirements to build its projections, while the BLS assigns a single educational or training requirement to each of the 755 occupations in its projections. Rather than rely on trends in educational demand, BLS uses a mix of available data and subjective judgments by BLS analysts and informal industry contacts.

This is important because BLS' educational and training requirement data undercount postsecondary degrees by 22 million in 2008. This implies that 22 million workers are overeducated. The overwhelming consensus in the literature contradicts this.

As a result of our core methodology, our projections account for changing educational requirements within occupations as well as changes in educational demand resulting from changes in employment composition. The methodological differences between the Center and the BLS produce vastly different results. Specifically, we have found that the BLS undercounts postsecondary degrees in the workforce by about 47 percent while our method overshoots by only 4 percent. Based on such results, we believe that our technique has produced the first genuine forecast of detailed educational demand to be made widely available in the United States.

It is important to recognize that education requirements continuously change and are updated within each occupation. In fact, educational demand is mostly driven by such changes (Exhibit A).

1. About one-third of the increase in education requirements comes from shifts in economic growth toward industries and occupations that tend to require more education; and
2. Changes in requirements in existing occupational categories—a phenomenon known as "upskilling"—accounts for about two-thirds of the growth in educational demand.

The BLS projections of industry and occupation do not take the second point into consideration and, as a result, miss as much as two-thirds of the upskilling in the economy.

In the following section, we will expand on this point and look in more detail at what drives educational demand.

WHY DO EMPLOYERS WANT WORKERS WITH MORE EDUCATION?

The historic increase in educational demand in recent years is driven by a simple equation: more education leads to greater productivity. That, in turn, encourages employers to pay higher wages to employees with more education, which provides incentive for students to get that education.

From an employment demand perspective, the need for education is driven by two central trends:

1. The mix of occupations in the economy has been shifting away from those that do not require substantial formal education. For instance, since 1900, Agriculture has gone from the single most important sector of the U.S. economy to one that today commands less than 3 percent of all employment.
2. In the majority of occupations, skill requirements have increased over time—and this is holding the specific occupation constant. For instance, the predominant image of the

EXHIBIT A Distribution of education among auto mechanics in three eras.[2]

	1968–1971	1988–1991	2004–2007
High school dropouts	58%	29%	19%
High school graduates	34%	52%	47%
Some college/Associate's degree	6%	16%	30%
Bachelor's degree or better	1%	3%	4%

Author's analysis of March CPS data, various years

EXHIBIT B Comparison of estimates holding education constant with real demand. [2]

	(A) Educational demand, 1983	(B) 1983 education requirements applied to 2001 employment	(C) Educational demand 2001 labor force (reveals upskilling and change in occupational mix)
High school dropouts	15%	14%	9%
High school graduates	40%	38%	31%
Some college/ Associate's degree	19%	19%	29%
Bachelor's degree	25%	29%	31%

Author's analysis of March CPS data, various years

> mechanic in 1960 was one of wrenches and greasy overalls. Today, the image has become one of a nearly sterile garage and car engines so complex that only computer technicians can tune them. The need for more formal skills for mechanics is reflected in the way the job title has evolved. In 1968, mechanics were officially designated as "Mechanics and repairmen, Auto"; in 2007, mechanics were officially known as "Auto service technicians and mechanics."

Exhibit B, meanwhile, shows that holding education constant—as BLS does in its projections—misses the contribution of upskilling. This exhibit shows education distribution in 1983, and how it changes by 2001 when factoring in only the change in occupational mix. Finally, the table shows actual education distribution among prime-age workers in the labor force for 2001, factoring in both upskilling and changes in the mix of occupations across the economy.

UNDERSTANDING WHAT BLS DOES.

Starting in the 1990s, BLS decided to publish future education requirements as a by-product of its employment projections. Current and future education and training requirements were introduced using its new assignment method, which assigns a single education category to each occupation in the Bureau's 1996–2006 projection series as a way to give individuals a sense of what kind of preparation various careers required.

BLS explains the assignment method as follows:

> BLS economists assign occupations to categories on the basis of analyses of qualitative and quantitative information. Sources of quantitative data include educational attainment data from the American Community Survey[3] and data on occupational skills, knowledge, work activities, and education and job training from the Occupational Information Network[4] (O*NET). In addition, economists evaluate qualitative information obtained from educators, employers, workers in the occupation, training experts, and representatives of professional and trade associations and unions. [BLS, 2009][5]

In its technical detail on the assignment method, the BLS does not claim that assigning education requirements by occupations is the same as measuring current or projected educational demand. But the distinction between requirements and demand is lost on all but the most devoted methodologists. Moreover, BLS has done little, if anything, to clarify the point. And since BLS produced the only set of numbers that showed future attainment levels, it is not surprising that the data have been interpreted as both current and projected educational demand. The notion that the assignment data are actually projections is further encouraged by the fact that the education assignment data are released with BLS industry and occupation projections data.

It is not surprising that both researchers and policy makers began using the BLS assignment data as projections of educational demand immediately and consistently since they were first released in 1996—a serious mistake, because these data are not intended to fulfill that purpose. As BLS itself points out, assigning a single point of entry to a career is different than measuring educational demand or the full extent of education requirements in real jobs in the real economy:

> Because of the variability of job functions within a given occupation, and because different employers have many different requirements of education and training, workers in the same occupation can have substantially different education and training backgrounds. [BLS, 2009][6]

By assigning the entry-level requirement to a single education or training level, BLS reduces complexity and by doing so loses lots of valuable information. At any given point in time, there are a variety of ways to get into most occupations. For example, in the computer boom of the 1990s, many new entrants to computer-based occupations did not have formal education or training in their field. As the boom slowed, though, more and more workers had certificates, certifications, and degrees.

The computer boom is a recent and spectacular example of the general trend toward upskilling in the vast majority of occupa-

tions. Even when the share of incumbents with postsecondary education or training represent a minority of workers in an occupation, those workers tend to reflect the growing segment of that occupation—and they tend to be paid higher wages.

Using the BLS assignment method, with no empirical examination of skill or wage trends, accumulates unavoidable errors as an education requirement is assigned to each of the Bureau's 755 occupations. Those errors are then amplified in the projection process when they are tied to the millions of new jobs and replacement job openings 10 years into the future. Because the assignment method focuses on the preferred or modal requirement for entering an occupation, it emphasizes where the occupation and the wages it pays are in the present, and downplays upskilling and wage trends that show where the occupation is headed over the decade covered by the projections.

In sum, we provide our alternative projections as an alternative to the official BLS data because:

- The BLS numbers do not take into account the fact that education requirements are widely varied, even within a single occupation.
- BLS often assigns a lower education category to an occupation even when workers with more advanced degrees actually dominate that occupation. This contributes to the undercounting of postsecondary degrees.
- BLS' education and training requirements fail to emphasize that all of the on-the-job training (OJT) experience in related occupations—short, medium, and long-term training—varies greatly by education level. Case in point: on average, 21.2 percent of the jobs where BLS assigns "work experience in a related occupation" as the occupation's education and training requirement also, in addition, require Bachelor's degrees. In other words, the "work experience" may be the crucial qualification, but a Bachelor's degree is the portal for access to that "work experience."
- BLS education and training requirements are not really forecasts at all. BLS simply assumes that current period requirements will not change and applies these fixed values to its employment projections. Changes in total education and training requirements result, then, only because the mix of industries and occupations changes. However, research shows that increasing education requirements within jobs is the rule and not the exception.

The discrepancies caused by these shortcomings can be significant. For example:

- The BLS 1996–2006 projections data list 25 percent of jobs as requiring postsecondary degrees and awards; however, 34.3 percent of the labor force actually had postsecondary degrees and awards, according to Census data. This 9.3 percentage point differential represents 12.3 million workers (Table 1).[7]
- The BLS data assert that requirements for postsecondary education are actually declining, not increasing. For example, the 1996–2006 education and training data projected that jobs requiring Bachelor's degrees in 2006 would be 13.1 percent of the total (excluding Bachelor's degree plus work experience), and yet the Bureau's 2008–2018 projections dropped the Bachelor's degree requirement for its 2008 baseline to 12.3 percent (Table 1).
- The difference between the BLS projections and actual levels of postsecondary education keep growing.[8] The BLS 1998–2008 projections data list 25.1 percent of jobs, or 37.8 million workers, as requiring postsecondary degrees and awards. But in actuality, 40.1 percent of the labor market, or 60.5 million people, actually had postsecondary degrees and awards in 2008. This 15 percentage point differential represents an undercount of 22.6 million workers with postsecondary credentials (Table 1).[9]

Just how the Bureau arrives at its "single most significant" education and training designation for an occupation is something of a mystery. BLS uses a hybrid qualitative/quantitative assignment method, which it has not made public.

The reality of education requirements for occupations is simple: requirements vary for each job. That becomes obvious when comparing BLS designations with the credentials of employees who are actually working in a given occupation. A closer look at the background data (Table 3) used in the assignment method demonstrates that there are, indeed, employees with a wide variety of educational credentials in each occupation, regardless of what designation BLS assigns. For example:[10]

- The greatest discrepancy between reality and BLS projections made with the assignment method can be found in the number of Associate's degrees. Here, 22 out of 42 occupations designated by the BLS as Associate's degree occupations actually have more workers with Bachelor's than Associate's degrees currently working in these fields.
- The assignment method is more consistent[11] for Bachelor's degrees, where only 12 occupations actually have higher graduate-level concentrations.
- Doctoral degree assignments are off 6 out of 11 times, and Master's degrees are consistent roughly half of the time.
- Jobs listed as requiring a Doctoral degree actually have a workforce of 28.4 percent Bachelor's degrees; 29.3 percent Master's degrees; and 32.6 percent Doctoral or first professional degrees.

- Jobs listed as requiring Master's degrees actually consist of 30.8 percent Bachelor's degrees; 39.6 percent Master's degrees; and 14.9 percent Doctoral or first professional degrees.
- Jobs listed as requiring Bachelor's degrees (no work experience) actually consist of 7.8 percent Associate's degrees; 42.9 percent Bachelor's degrees; 20.9 percent Master's degrees; and 5.3 percent Doctoral or first professional degrees.

CONCLUSION.

The Georgetown University Center on Education and the Workforce has developed an approach to projecting educational demand that differs fundamentally from the BLS approach. A detailed methodology paper can be found online at cew.georgetown.edu. In short, our method:

- Builds on the occupational projections data provided by BLS;
- Uses existing labor market data for each year between 1983 and 2008 to analyze increases and decreases in each occupational group;
- Uses occupationally specific data on increases in education and training required by an occupation;
- Assumes that the present distribution of education among the employed prime-age population is the best single indicator of present demand for education. This model does not start with a deficit of some 20 million postsecondary degrees, as the BLS model does;
- Has proven itself to be robust across a number of statistical tests. The most intuitive of these shows that by using data between 1983 and 2002 the projections method forecasts educational demand for 2008 reasonably well.

[1] There are some who will argue that BLS is, in fact, not undercounting postsecondary degrees, but that many millions of American workers are overqualified for their jobs and that American employers are not smart about hiring. As discussed below, BLS starts in 2008 with 22 million fewer postsecondary degrees in their requirements table than existed in the employed labor force at that time. We cannot take seriously the argument that there is that much "overqualification" in the economy. While there will always be some mismatch in the labor market, we do not believe that employers would continue to pay high wages and not obtain the commensurate worker productivity. We investigated the possibility that overqualification might be a reality by testing whether increased education leads to increased earnings, holding occupation constant. The results clearly demonstrate that in the overwhelming majority of cases, overqualification is not an issue. Analysis is available upon request.

[2] Some upskilling could be attributed to apprentices moving toward obtaining degrees in community colleges.

[3] http://www.bls.gov/emp/ep_education_tech.htm

[4] http://www.census.gov/acs/www/ (ACS)

[5] http://online.onetcenter.org/

[6] Lacey and Wright, 2009.

[7] The fact that BLS reports that 12.3 million workers had postsecondary education that was not required to work in their jobs disagrees in concept with the general research finding that the U.S. has been under-producing postsecondary talent since the mid-80s, resulting in a substantial wage premium for postsecondary educated workers over those with high school or less (Goldin and Katz, 2008).

[8] Our projections show 43 million more postsecondary workers in 2018 than the BLS assignment method projects.

[9] The BLS assignment method understates the actual number of workers with higher education by 47 percent in its 1998–2008 data. In a robustness test of our method applied retrospectively to the 1998–2008 projections, our method came much closer. It overstates the actual number of postsecondary workers in the census data (ACS) by just 4 percent.

[10] Authors' calculations based on BLS Table 1.11, data not shown. Spreadsheet is available upon request.

[11] Authors' calculations based on BLS Table 1.11

TABLE 1 Comparison of BLS education and training requirements and education among employed workers in 1996 and 2008.

Sources: Silvestri, G. (1997), "Occupational employment projections to 2006," Monthly Labor Review, Table 6, p. 82, Nov. 1997. BLS; CPS March Supplement, various years; Lacey, A. and B. Wright (2009),"Occupational employment projections to 2018," Monthly Labor Review, Table 3, p. 88, Nov. 2009

	BLS 1996		Labor Market 1996		BLS 2008		Labor Market 2008	
	%	#	%	#	%	#	%	#
Postsecondary degrees	25%	33,008	34.3%	45,397	25.1%	37,884	40.1%	60,524
1st professional degree	1.3%	1,707	1.6%	2,118	1.3%	2,001	1.7%	2,566
Doctoral degree	0.8%	1,016	1.1%	1,456	1.4%	2,085	1.4%	2,113
Master's degree	1%	1,371	5.9%	7,809	1.7%	2,531	7.3%	11,018
Bachelor's degree or better, with work experience	6.8%	8,971	NA	NA	4.3%	6,516	NA	NA
Bachelor's degree	12%	15,821	17.6%	23,294	12.3%	18,584	20.4%	30,790
Associate's degree	3.1%	4,122	8.1%	10,721	4.1%	6,129	9.3%	14,037
Post 2nd vocational training	6.1%	8,091	NA		5.8%	8,787		
Work experience in a related occupation	7.5%	9,966			9.6%	14,517		
Long-term on-the-job-training	9.3%	12,373			7.2%	10,815		
Moderate-term on-the-job-training	12.7%	16,792			16.3%	24,569		
Short-term on-the-job-training	39.4%	52,125			36%	54,396		

Note: BLS has 132.4 million jobs listed in 1996. A 9.3 percentage point difference between the BLS estimate and the actual labor force equates to 12.3 million workers. In 2008, employment is given as 150,932 and the 15 percentage point difference between the BLS estimate and the actual labor force equates to a 22.6 million difference. All calculations have used BLS employment numbers multiplied by shares calculated in the labor market.

TABLE 2 Subset of BLS table 1.11 allowing comparison of education and training categories and distribution among the employed.

Source: BLS table 1.11. Education and training requirements by detailed occupation. http://www.bls.gov/emp/ep_table_111.htm. Accessed May 26, 2010.

Occupation title	Most significant source of education or training	Educational attainment percent distributions						
		Less than high school diploma	High school diploma or equivalent	Some college, no degree	Associate's degree	Bachelor's degree	Master's degree	Doctoral or professional degree
Accountants and auditors	Bachelor's degree	0.3	5.3	8.9	10.5	55.6	17.0	2.4
Actors	Long-term on-the-job training	3.3	11.1	21.5	6.6	44.8	11.2	1.5
Actuaries	Bachelor's or higher degree, plus work experience	0.1	0.4	1.5	1.0	62.0	22.2	12.9
Administrative law judges, adjudicators, and hearing officers	Bachelor's or higher degree, plus work experience	0.1	0.5	0.8	0.3	2.5	3.0	92.8
Administrative services managers	Bachelor's or higher degree, plus work experience	2.2	19.3	28.6	12.2	27.5	8.6	1.6
Adult literacy, remedial education, and GED teachers and instructors	Bachelor's degree	2.1	12.2	19.2	8.0	35.0	20.1	3.4
Advertising and promotions managers	Bachelor's or higher degree, plus work experience	1.0	7.7	12.5	5.9	59.9	12.1	1.0
Advertising sales agents	Moderate-term on-the-job training	2.1	13.7	22.5	8.6	46.0	6.6	0.6
Aerospace engineering and operations technicians	Associate degree	3.7	23.5	33.1	22.7	14.1	2.3	0.5
Aerospace engineers	Bachelor's degree	0.1	2.5	7.4	6.8	49.2	28.2	5.8
Agents and business managers of artists, performers, and athletes	Bachelor's or higher degree, plus work experience	2.7	14.5	19.8	6.5	42.4	9.8	4.3
Agricultural and food science technicians	Associate degree	5.5	31.4	25.3	11.0	22.6	2.8	1.3
Agricultural engineers	Bachelor's degree	0.0	2.5	8.9	14.1	47.2	20.2	7.1
Agricultural inspectors	Work experience in a related occupation	8.1	29.1	25.0	8.1	24.1	4.2	1.4
Air traffic controllers	Long-term on-the-job training	0.4	16.2	36.6	15.2	27.7	3.2	0.6
Aircraft cargo handling supervisors	Work experience in a related occupation	8.5	35.5	29.8	9.1	14.5	2.3	0.3
Aircraft mechanics and service technicians	Postsecondary vocational award	2.9	28.6	35.3	21.2	10.6	1.0	0.4

TABLE 3 Average education distribution within each of BLS's education and training categories.

Source: Georgetown University Center on Education and the Workforce calculations using (http://www.bls.gov/emp/ep_table_111.htm) Table 1.11, Education and training measurements by detailed occupation

	Less than high school diploma	High school diploma or equivalent	Some college, no degree	Associate's degree	Bachelor's degree	Master's degree	Doctoral or professional degree
1st professional degree	0.1%	0.7%	0.7%	0.5%	5.2%	6.4%	86.5%
Doctoral degree	0.2%	1.6%	4.7%	3.3%	28.4%	29.3%	32.6%
Master's degree	0.6%	3.2%	6.7%	4.3%	30.8%	39.6%	14.9%
Bachelor's degree or better, with work experience	1.6%	8.7%	13.7%	5.8%	35.3%	21.2%	13.6%
Bachelor's degree	1.2%	8.1%	13.8%	7.8%	42.9%	20.9%	5.3%
Associate's degree	2.4%	16.3%	23.7%	24.0%	25.2%	5.9%	2.4%
Post 2nd vocational training	7.3%	29.6%	29.1%	14.3%	15.9%	2.9%	0.9%
Work experience in a related occupation	9.1%	27.5%	26.1%	9.9%	21.2%	5.3%	1.0%
Long-term on-the-job-training	13.8%	35.0%	23.9%	9.3%	14.1%	3.2%	0.7%
Moderate-term on-the-job-training	18.1%	41.9%	22.2%	7.0%	8.8%	1.6%	0.4%
Short-term on-the-job-training	17.8%	37.8%	23.5%	8.0%	10.4%	1.9%	0.5%

Appendix 5

Wages of workers by occupation and education level—detailed (2008).

MANAGERIAL AND PROFESSIONAL OFFICE OCCUPATIONS

	HSDO	HSGR	SC/A	BA	GRAD
Chief executives		$103,347	$92,021	$160,957	$189,574
General and operations managers		$69,456	$66,759	$84,946	$131,904
Marketing and sales managers		$58,545	$67,603	$99,199	$113,022
Administrative services managers		$46,330	$53,971		
Computer and information systems managers		$72,986	$72,828	$98,075	$127,564
Financial managers		$50,353	$59,061	$91,897	$134,231
Human resources managers		$60,978	$54,228	$76,502	$111,193
Industrial production managers		$58,082	$62,820	$84,077	$100,087
Purchasing managers		$41,979	$57,065	$73,025	
Transportation, storage, and distribution managers		$44,219	$48,631	$59,885	
Farm, ranch, and other agricultural managers		$40,397	$64,026	$50,864	
Farmers and ranchers		$13,915	$18,031	$24,486	
Construction managers	$44,755	$65,578	$74,699	$78,229	$99,873
Education administrators			$38,577	$47,335	$70,820
Engineering managers				$131,339	$109,497
Food service managers	$31,228	$33,833	$38,884	$55,055	
Lodging managers		$37,165	$43,410	$51,799	
Medical and health services managers		$39,760	$52,396	$81,158	$114,329
Property, real estate, and community association managers		$41,372	$48,438	$64,853	$154,149
Social and community service managers			$37,641	$56,190	$64,518
Managers, all other	$34,889	$54,811	$59,779	$86,801	$99,795
Wholesale and retail buyers, except farm products		$38,059	$57,940	$61,326	
Purchasing agents, exc. wholesale, retail, and farm products		$40,312	$49,854	$53,284	
Claims adjusters, appraisers, examiners, and investigators		$41,446	$48,844	$50,350	
Compliance officers, exc. agriculture, construction, health and safety, and transportation			$45,876	$57,388	$86,205
Cost estimators			$71,122	$56,726	
Human resources, training, and labor relations specialists		$43,291	$45,030	$64,071	$63,631
Management analysts		$50,315	$51,596	$72,496	$93,627
Other business operations specialists		$34,292	$44,476	$49,425	$66,283
Accountants and auditors		$34,874	$42,571	$68,293	$79,141
Appraisers and assessors of real estate		$57,720	$49,346	$86,564	$66,648
Financial analysts				$58,708	$140,400
Personal financial advisors		$49,933	$61,162	$120,181	$176,346
Insurance underwriters		$46,964	$48,287	$66,352	
Loan counselors and officers		$46,943	$48,756	$70,958	$78,935
Tax preparers					
Lawyers, judges, magistrates, and other judicial workers					$151,764
Paralegals and legal assistants		$36,434	$41,373	$45,004	
Miscellaneous legal support workers		$35,129	$45,899	$32,377	$45,672

STEM OCCUPATIONS

	HSDO	HSGR	SC/A	BA	GRAD
Computer scientists and systems analysts		$51,539	$62,788	$72,930	$81,832
Computer programmers		$63,910	$62,035	$73,992	$74,914
Computer software engineers		$66,648	$73,988	$84,667	$90,634
Computer support specialists		$44,069	$45,556	$65,342	
Database administrators				$71,327	
Network and computer systems administrators			$55,927	$63,432	
Network systems and data communications analysts		$79,658	$56,438	$67,266	$73,526
Operations research analysts				$68,832	$93,611
Architects, except naval				$73,101	$73,903
Aerospace engineers				$77,324	
Civil engineers			$67,225	$82,259	$97,242
Computer hardware engineers				$83,974	
Electrical and electronic engineers			$72,009	$78,769	$107,147
Industrial engineers, including health and safety			$64,046	$70,042	$100,794
Mechanical engineers			$62,931	$81,211	$87,327

HIGH SCHOOL DROPOUT (HSDO) | HIGH SCHOOL GRADUATE (HSGR) | SOME COLLEGE/ASSOCIATE'S DEGREE (SC/A) | BACHELOR'S DEGREE (BA) | GRADUATE DEGREE (GRAD)

STEM OCCUPATIONS, cont.

	HSDO	HSGR	SC/A	BA	GRAD
Engineers, all other			$72,595	$81,925	$95,850
Drafters			$51,026		
Engineering technicians, except drafters		$50,923	$51,858	$49,943	
Surveying and mapping technicians			$38,231		
Biological scientists				$50,297	$59,522
Medical scientists				$54,173	$69,112
Chemists and materials scientists				$71,634	$74,514
Environmental scientists and geoscientists				$83,946	$112,045
Physical scientists, all other				$57,450	$92,735
Market and survey researchers				$54,786	$93,509
Psychologists					$66,201
Other life, physical, and social science technicians		$41,353	$34,179	$29,562	

COMMUNITY SERVICES AND ARTS OCCUPATIONS

	HSDO	HSGR	SC/A	BA	GRAD
Counselors		$29,835	$29,265	$35,618	$43,899
Social workers		$31,929	$38,323	$38,472	$51,698
Miscellaneous community and social service specialists		$27,380	$33,948	$41,421	$64,220
Clergy			$32,032	$38,167	$45,396
Artists and related workers			$53,778	$58,102	
Designers		$38,400	$45,650	$48,697	$57,351
Producers and directors			$62,071	$60,893	
Athletes, coaches, umpires, and related workers			$21,852	$72,723	
Musicians, singers, and related work				$44,884	
Public relations specialists				$59,883	
Editors				$47,227	
Writers and authors				$42,534	$56,448
Photographers			$27,054		

EDUCATION OCCUPATIONS

	HSDO	HSGR	SC/A	BA	GRAD
Postsecondary teachers			$32,389	$26,835	$54,057
Preschool and kindergarten teachers		$15,545	$17,516	$28,507	$42,395
Elementary and middle school teachers		$16,307	$17,814	$35,920	$49,556
Secondary school teachers			$27,020	$39,929	$54,151
Special education teachers			$23,491	$39,816	$48,404
Other teachers and instructors		$36,327	$33,099	$33,518	$37,571
Librarians				$33,480	$40,265
Teacher assistants		$17,091	$18,259	$19,129	$14,318

HEALTHCARE PROFESSIONAL AND TECHNICAL OCCUPATIONS

	HSDO	HSGR	SC/A	BA	GRAD
Dentists					$173,482
Dietitians and nutritionists				$47,446	
Pharmacists				$80,839	$98,008
Physicians and surgeons					$187,123
Physician assistants				$56,634	$78,245
Registered nurses			$50,100	$54,566	$65,531
Occupational therapists				$48,800	$53,586
Physical therapists				$68,160	$54,808
Respiratory therapists			$52,663	$56,368	
Speech-language pathologists					$47,040
Therapists, all other				$33,047	$39,434
Clinical laboratory technologists and technicians		$33,797	$38,160	$48,680	$46,115
Dental hygienists			$39,420	$43,323	
Diagnostic related technologists and technicians			$49,395	$46,746	
Emergency medical technicians and paramedics		$44,326	$37,539	$39,919	
Health diagnosing & treating practitioner support techs		$27,451	$31,975	$32,298	
Licensed practical and licensed vocational nurses		$31,585	$38,184	$40,523	
Medical records and health information technicians		$25,424	$23,207		
Miscellaneous health technologists and technicians			$33,476	$56,700	

HEALTHCARE SUPPORT OCCUPATIONS

	HSDO	HSGR	SC/A	BA	GRAD
Nursing, psychiatric, and home health aides	$17,980	$21,132	$21,739	$29,158	
Physical therapist assistants and aides			$35,301		
Massage therapists			$28,646		
Dental assistants		$23,443	$25,702	$23,661	
Medical assistants and other healthcare support occupations	$21,025	$23,195	$24,814	$30,185	

FOOD AND PERSONAL SERVICES OCCUPATIONS

	HSDO	HSGR	SC/A	BA	GRAD
First-line supervisors/managers of police and detectives			$67,986	$81,683	
Supervisors, protective service workers, all others			$49,535		
Firefighters		$57,450	$61,032	$72,028	
Bailiffs, correctional officers, and jailers		$41,424	$45,091	$44,398	
Detectives and criminal investigators		$42,415	$60,727	$100,582	
Police and sheriff's patrol officers		$56,611	$56,589	$69,171	$68,440
Private detectives and investigators		$47,913	$36,887	$71,624	
Security guards and gaming surveillance officers	$19,236	$30,459	$33,224	$46,658	
Chefs and head cooks	$20,925	$27,199	$36,607	$39,749	
First-line supervisors/managers of food preparation and serving workers	$23,603	$25,202	$29,935	$44,636	
Cooks	$17,039	$16,918	$18,263	$18,612	
Food preparation workers	$20,532	$14,448	$14,914	$22,022	
Bartenders		$19,341	$28,242	$29,607	
Combined food preparation and serving	$15,969	$17,325	$16,186	$16,958	
Counter attendants, cafeteria, food		$9,742			
Waiters and waitresses	$14,310	$16,041	$17,249	$23,438	
Food servers, nonrestaurant		$17,942			
Dining room and cafeteria attendants	$13,270	$15,783	$19,481		
Dishwashers	$13,962	$12,146			
Hosts and hostesses, restaurant, lounge, and coffee shop		$14,480	$18,906		
First-line supervisors/managers of housekeeping and janitorial workers	$31,466	$35,703	$40,923	$44,628	
First-line supervisors/managers of landscaping lawn service, and groundskeeping workers		$41,821	$47,544	$62,061	
Janitors and building cleaners	$17,640	$23,027	$23,389	$25,168	
Maids and housekeeping cleaners	$13,688	$15,556	$14,664	$16,421	
Grounds maintenance workers	$19,786	$22,376	$24,150	$25,337	
First-line supervisors/managers of gaming workers		$59,041	$39,511	$35,794	
First-line supervisors/managers of personal service workers		$42,137	$37,501		
Gaming services workers		$36,152	$29,053		
Hairdressers, hairstylists, and cosmetologists		$21,788	$24,729		
Miscellaneous personal appearance workers	$21,326	$21,656	$25,751		
Transportation attendants		$25,127	$36,977	$35,760	
Child care workers	$11,604	$13,752	$15,209	$16,845	
Personal and home care aides	$12,833	$17,853	$18,406	$20,806	
Recreation and fitness workers		$22,999	$24,224	$21,675	

SALES AND OFFICE SUPPORT OCCUPATIONS

	HSDO	HSGR	SC/A	BA	GRAD
First-line supervisors/managers of retail sales workers	$32,979	$38,680	$42,903	$59,393	$76,245
First-line supervisors/managers of non-retail sales workers	$42,238	$53,016	$52,501	$95,697	$133,444
Cashiers	$13,558	$16,964	$19,238	$28,753	
Counter and rental clerks		$32,707	$40,986		
Parts salespersons		$37,712	$34,745		
Advertising sales agents		$36,928	$53,232	$66,989	
Insurance sales agents		$41,045	$53,993	$81,788	
Securities, commodities, and financial services sales agents		$54,605	$63,073	$140,717	$193,491
Travel agents			$28,939	$41,774	
Sales representatives, services, all other	$37,556	$48,510	$58,091	$83,058	$106,230
Sales representatives, wholesale and manufacturing	$27,764	$29,768	$34,036	$60,519	$63,422
Real estate brokers and sales agents		$55,710	$52,239	$74,559	$89,161
Telemarketers		$18,065	$21,982		
Door-to-door sales workers, news and street vendors, and related workers		$22,556	$18,973		
Sales and related workers, all other			$47,216	$58,747	
First-line supervisors/managers of office and administrative support workers	$29,766	$38,854	$39,908	$50,683	$66,130
Bill and account collectors		$31,176	$33,301	$61,211	
Billing and posting clerks and machine operators		$30,020	$28,676	$41,598	
Bookkeeping, accounting, and auditing clerks	$26,249	$28,036	$30,816	$30,813	$49,341
Payroll and timekeeping clerks		$42,560	$33,961		
Tellers		$23,027	$22,142		
Court, municipal, and license clerks		$31,887	$31,889		
Customer service representatives	$21,198	$31,109	$31,495	$41,367	$64,427

SALES AND OFFICE SUPPORT OCCUPATIONS, cont.	HSDO	HSGR	SC/A	BA	GRAD
File clerks		$26,117	$28,617	$30,816	
Hotel, motel, and resort desk clerks		$18,413	$19,907		
Interviewers, except eligibility and loan		$22,955	$26,320		
Library assistants, clerical			$19,294		
Loan interviewers and clerks		$38,653	$37,179	$57,480	
Order clerks		$31,658	$32,598		
Receptionists and information clerks	$19,065	$22,442	$22,164	$22,918	
Reservation and transportation ticket agents and travel clerks		$24,636	$34,126	$44,216	
Information and record clerks, all other		$27,962	$26,113		
Couriers and messengers		$37,250	$40,184	$45,081	
Dispatchers		$36,396	$34,476	$35,632	
Postal service clerks		$49,942	$49,043	$44,976	
Postal service mail carriers		$44,579	$48,482	$44,731	
Postal service mail sorters, process, and processing machine operators		$39,404	$44,445		
Production, planning, and expediting clerks		$37,319	$40,429	$60,547	
Shipping, receiving, and traffic clerks	$23,053	$32,167	$32,555	$32,566	
Stock clerks and order fillers	$17,252	$25,391	$27,095	$25,943	
Secretaries and administrative assistants	$28,478	$28,981	$31,251	$32,985	$34,850
Computer operators		$34,026	$40,412	$46,690	
Data entry keyers		$28,232	$27,530	$25,300	
Word processors and typists		$26,397	$28,837	$27,096	
Insurance claims and policy processing clerks		$31,581	$32,205	$32,882	
Mail clerks and mail machine operators, except postal service		$24,811	$25,599		
Office clerks, general	$22,607	$28,116	$30,463	$28,704	
Office and administrative support workers, all other		$33,109	$39,032	$39,432	$69,353

BLUE COLLAR OCCUPATIONS

	HSDO	HSGR	SC/A	BA	GRAD
Graders and sorters, agricultural products	$17,120	$24,386			
Miscellaneous agricultural workers	$16,099	$18,358	$25,606	$32,035	
First-line supervisors/managers of construction trades and extraction workers	$43,933	$55,299	$59,756	$67,155	
Brickmasons, blockmasons, and stonemasons	$26,562	$30,375	$35,002		
Carpenters	$25,921	$34,929	$38,667	$29,700	
Carpet, floor, and tile installers and finishers	$26,641	$31,110			
Cement masons, concrete finishers, and terrazzo workers	$30,789	$31,874			
Construction laborers	$22,591	$31,508	$33,782	$41,367	
Operating engineers and other construction equipment operators	$33,424	$40,895	$45,651		
Drywall installers, ceiling tile installers, and tapers	$24,058	$33,261	$31,891		
Electricians	$36,020	$48,468	$49,250	$42,997	
Painters, construction and maintenance	$25,033	$27,220	$33,435	$54,652	
Pipelayers, plumbers, pipefitters, and steamfitters	$26,974	$44,355	$49,420		
Roofers	$23,543	$35,431			
Sheet metal workers		$46,079	$51,260		
Structural iron and steel workers		$35,966			
Helpers, construction trades	$21,904	$22,587			
Construction and building inspectors			$74,793		
Highway maintenance workers		$35,264	$38,481		
Mining machine operators		$51,178			
First-line supervisors/managers of mechanics, installers, and repairers		$51,772	$61,856	$74,281	
Computer, automated teller, and office machine repairers		$41,256	$45,698	$44,075	
Radio and telecommunications equipment		$55,731	$51,074	$47,300	
Aircraft mechanics and service technicians		$48,004	$52,211		
Automotive body and related repairers		$41,376	$39,119		
Automotive service technicians and mechanics	$29,239	$38,864	$43,058	$42,698	
Bus and truck mechanics and diesel engine specialists	$38,116	$38,303	$45,384		
Heavy vehicle and mobile equipment service technicians and mechanics	$29,962	$57,115	$44,336		
Heating, air conditioning, and refrigeration mechanics and installers		$41,383	$44,255		
Industrial and refractory machinery mechanics	$34,640	$44,392	$50,239		
Maintenance and repair workers, general	$27,073	$39,102	$48,589	$45,389	
Electrical power-line installers and repairers		$50,651	$69,312		
Telecommunications line installers and repairers		$50,360	$62,833		
Other installation, maintenance, and repair workers	$27,207	$34,371	$42,871		
First-line supervisors/managers of production and operating workers	$46,231	$47,249	$55,697	$60,252	
Electrical, electronics, and electromechanical assemblers	$21,085	$31,985	$29,333		
Miscellaneous assemblers and fabricators	$22,237	$32,772	$36,628	$32,102	
Bakers	$21,095	$22,714	$29,211		
Butchers and other meat, poultry, and fish processing workers	$21,093	$35,742	$38,329		
Food batchmakers		$28,747			
Cutting, punching, and press machine setters, operators and tenders, metal and plastic	$25,711	$30,043			
Machinists	$35,898	$40,212	$44,253		
Tool and die makers		$46,344	$61,401		

BLUE COLLAR OCCUPATIONS, CONT.	HSDO	HSGR	SC/A	BA	GRAD
Welding, soldering, and brazing workers	$30,926	$37,712	$39,550		
Metalworkers and plastic workers, all other	$22,942	$33,686	$40,407		
Printing machine operators	$24,540	$35,006	$35,364		
Laundry and dry-cleaning workers	$16,015	$25,975			
Pressers, textile, garment, and related materials	$17,993				
Sewing machine operators	$16,997	$18,771	$18,309		
Cabinetmakers and bench carpenters		$32,542	$33,132		
Sawing machine setters, operators, and tenders, wood		$27,374			
Stationary engineers and boiler operators		$50,932	$62,447		
Water and liquid waste treatment plant and system operators		$44,408			
Crushing, grinding, polishing, mixing, lending workers	$26,646	$33,011			
Cutting workers	$21,770	$29,906			
Inspectors, testers, sorters, samplers, and weighers	$19,966	$35,256	$39,703	$47,742	
Medical, dental, and ophthalmic laboratory technicians		$29,894	$36,610		
Packaging and filling machine operators and tenders	$16,494	$24,921	$30,203		
Painting workers	$24,904	$35,037	$31,211		
Production workers, all other	$26,270	$34,063	$35,147	$41,092	
Supervisors, transportation and material-moving workers		$51,140	$51,784	$57,339	
Aircraft pilots and flight engineers			$81,995	$107,605	
Bus drivers	$24,609	$26,948	$26,217		
Driver/sales workers and truck drivers	$33,658	$43,158	$41,094	$39,571	
Taxi drivers and chauffeurs	$22,914	$28,184	$29,212		
Industrial truck and tractor operators	$26,417	$30,408	$34,170		
Cleaners of vehicles and equipment	$23,122	$28,373			
Laborers and freight, stock, and material movers, hand	$21,428	$25,933	$28,115	$31,921	
Packers and packagers, hand	$14,405	$21,275			

Appendix 6

Postsecondary certificate occupations

BLUE COLLAR OCCUPATIONS—1-DIGIT (9 OCCUPATIONS)

2-DIGIT (25 OCCUPATIONS)	3-DIGIT (800 OCCUPATIONS)	PSC %
Installation, Maintenance, and Repair Workers	Bus and truck mechanics and diesel engine specialists	80.2%
Installation, Maintenance, and Repair Workers	Commercial divers	79.1%
Transportation and Material Moving Occupations	Ship engineers	67.6%
Installation, Maintenance, and Repair Workers	Mobile heavy equipment mechanics, except engines	65.5%
Installation, Maintenance, and Repair Workers	Motorboat mechanics	63.5%
Installation, Maintenance, and Repair Workers	Electronic home entertainment equipment installers and repairers	61.6%
Production Occupations	Patternmakers, metal and plastic	57.7%
Installation, Maintenance, and Repair Workers	Electronic equipment installers and repairers, motor vehicles	56.6%
Installation, Maintenance, and Repair Workers	Aircraft mechanics and service technicians	55.2%
Production Occupations	Tool and die makers	54.5%
Construction and Extraction Occupations	Cement masons and concrete finishers	52.8%
Installation, Maintenance, and Repair Workers	Telecommunications equipment installers and repairers, except line installers	50.9%
Production Occupations	Milling and planing machine setters, operators, and tenders, metal and plastic	49.8%
Transportation and Material Moving Occupations	Crane and tower operators	48.6%
Installation, Maintenance, and Repair Workers	Automotive service technicians and mechanics	48.0%
Construction and Extraction Occupations	Operating engineers and other construction equipment operators	47.9%
Construction and Extraction Occupations	Electricians	47.5%
Transportation and Material Moving Occupations	Motorboat operators	46.7%
Construction and Extraction Occupations	Helpers, pipelayers, plumbers, pipefitters, and steamfitters	46.5%
Production Occupations	Patternmakers, wood	45.9%
Installation, Maintenance, and Repair Workers	Helpers--Installation, maintenance, and repair workers	45.1%
Construction and Extraction Occupations	Carpenters	44.8%
Installation, Maintenance, and Repair Workers	Electrical and electronics installers and repairers, transportation equipment	44.2%
Installation, Maintenance, and Repair Workers	Musical instrument repairers and tuners	43.3%
Installation, Maintenance, and Repair Workers	Medical equipment repairers	42.7%
Installation, Maintenance, and Repair Workers	Control and valve installers and repairers, except mechanical door	40.2%
Installation, Maintenance, and Repair Workers	Electric motor, power tool, and related repairers	39.5%
Production Occupations	Gas plant operators	39.1%
Installation, Maintenance, and Repair Workers	Recreational vehicle service technicians	39.1%
Production Occupations	Lathe and turning machine tool setters, operators, and tenders, metal and plastic	39.0%
Installation, Maintenance, and Repair Workers	Electrical and electronics repairers, powerhouse, substation, and relay	39.0%
Production Occupations	Model makers, metal and plastic	38.6%
Production Occupations	Cutters and trimmers, hand	38.3%
Transportation and Material Moving Occupations	Captains, mates, and pilots of water vessels	37.9%
Construction and Extraction Occupations	Sheet metal workers	37.5%
Installation, Maintenance, and Repair Workers	Security and fire alarm systems installers	37.1%
Installation, Maintenance, and Repair Workers	Industrial machinery mechanics	36.7%
Construction and Extraction Occupations	Elevator installers and repairers	35.6%
Production Occupations	Fabric and apparel patternmakers	34.8%
Production Occupations	Drilling and boring machine tool setters, operators, and tenders, metal and plastic	34.4%
Installation, Maintenance, and Repair Workers	Millwrights	33.4%
Production Occupations	Jewelers and precious stone and metal workers	33.3%
Installation, Maintenance, and Repair Workers	Electrical and electronics repairers, commercial and industrial equipment	32.5%
Production Occupations	Power distributors and dispatchers	32.1%
Production Occupations	Computer-controlled machine tool operators, metal and plastic	32.0%
Installation, Maintenance, and Repair Workers	Maintenance and repair workers, general	31.9%
Production Occupations	Aircraft structure, surfaces, rigging, and systems assemblers	31.8%
Production Occupations	Model makers, wood	31.6%
Installation, Maintenance, and Repair Workers	Signal and track switch repairers	31.6%
Installation, Maintenance, and Repair Workers	First-line supervisors/managers of mechanics, installers, and repairers	31.3%
Installation, Maintenance, and Repair Workers	Heating, air conditioning, and refrigeration mechanics and installers	31.2%
Construction and Extraction Occupations	Construction and related workers, all other	30.9%
Construction and Extraction Occupations	Segmental pavers	30.9%
Installation, Maintenance, and Repair Workers	Electrical power-line installers and repairers	30.8%
Installation, Maintenance, and Repair Workers	Automotive body and related repairers	30.5%
Installation, Maintenance, and Repair Workers	Automotive glass installers and repairers	30.2%
Production Occupations	Electrical and electronic equipment assemblers	30.1%
Production Occupations	Numerical tool and process control programmers	30.0%
Transportation and Material Moving Occupations	Sailors and marine oilers	29.8%
Production Occupations	Sewers, hand	29.6%

BLUE COLLAR OCCUPATIONS—1-DIGIT (9 OCCUPATIONS), cont.

2-DIGIT (25 OCCUPATIONS)	3-DIGIT (800 OCCUPATIONS)	PSC %
Construction and Extraction Occupations	Stonemasons	29.5%
Installation, Maintenance, and Repair Workers	Radio mechanics	29.5%
Production Occupations	Machinists	29.1%
Production Occupations	Cooling and freezing equipment operators and tenders	28.1%
Construction and Extraction Occupations	Boilermakers	27.8%
Production Occupations	Extruding and drawing machine setters, operators, and tenders, metal and plastic	27.3%
Production Occupations	Prepress technicians and workers	27.1%
Production Occupations	Job printers	26.7%
Production Occupations	Welders, cutters, solderers, and brazers	26.6%
Installation, Maintenance, and Repair Workers	Motorcycle mechanics	26.4%
Construction and Extraction Occupations	Hazardous materials removal workers	26.2%
Production Occupations	Engine and other machine assemblers	26.0%
Production Occupations	Upholsterers	25.8%
Production Occupations	Textile, apparel, and furnishings workers, all other	25.8%
Production Occupations	Painters, transportation equipment	25.8%
Installation, Maintenance, and Repair Workers	Maintenance workers, machinery	25.5%
Installation, Maintenance, and Repair Workers	Camera and photographic equipment repairers	25.2%
Transportation and Material Moving Occupations	Commercial pilots	23.8%
Production Occupations	Electromechanical equipment assemblers	23.8%
Transportation and Material Moving Occupations	Excavating and loading machine and dragline operators	23.7%
Transportation and Material Moving Occupations	Hoist and winch operators	23.5%
Production Occupations	Tool grinders, filers, and sharpeners	23.4%
Production Occupations	Metal workers and plastic workers, all other	23.4%
Production Occupations	Stationary engineers and boiler operators	22.9%
Construction and Extraction Occupations	Insulation workers, mechanical	22.6%
Installation, Maintenance, and Repair Workers	Outdoor power equipment and other small engine mechanics	22.4%
Production Occupations	Inspectors, testers, sorters, samplers, and weighers	22.3%
Production Occupations	Multiple machine tool setters, operators, and tenders, metal and plastic	21.8%
Transportation and Material Moving Occupations	Truck drivers, heavy and tractor-trailer	21.7%
Construction and Extraction Occupations	Plumbers, pipefitters, and steamfitters	21.0%
Construction and Extraction Occupations	Explosives workers, ordnance handling experts, and blasters	20.8%
Production Occupations	First-line supervisors/managers of production and operating workers	20.6%
Construction and Extraction Occupations	Helpers, electricians	20.0%

COMMUNITY SERVICES AND ARTS OCCUPATIONS—1-DIGIT (9 OCCUPATIONS)

2-DIGIT (25 OCCUPATIONS)	3-DIGIT (800 OCCUPATIONS)	PSC %
Arts, Design, Entertainment, Sports, and Media Occupations	Sound engineering technicians	66.7%
Community and Social Services Occupations	Directors, religious activities and education	31.3%
Community and Social Services Occupations	Religious workers, all other	31.3%
Arts, Design, Entertainment, Sports, and Media Occupations	Radio operators	26.5%
Arts, Design, Entertainment, Sports, and Media Occupations	Interior designers	22.0%
Arts, Design, Entertainment, Sports, and Media Occupations	Broadcast technicians	21.5%

EDUCATION OCCUPATIONS—1-DIGIT (9 OCCUPATIONS)

2-DIGIT (25 OCCUPATIONS)	3-DIGIT (800 OCCUPATIONS)	PSC %
Education, Training, and Library Occupations	Library technicians	28.1%
Education, Training, and Library Occupations	Curators	21.3%

HEALTHCARE PROFESSIONAL AND TECHNICAL OCCUPATIONS—1-DIGIT (9 OCCUPATIONS)

2-DIGIT (25 OCCUPATIONS)	3-DIGIT (800 OCCUPATIONS)	PSC %
Healthcare Practitioners and Technical Occupations	Surgical technologists	43.8%
Healthcare Practitioners and Technical Occupations	Emergency medical technicians and paramedics	41.1%
Healthcare Practitioners and Technical Occupations	Opticians, dispensing	39.7%
Healthcare Practitioners and Technical Occupations	Respiratory therapy technicians	32.7%
Healthcare Practitioners and Technical Occupations	Pharmacy technicians	32.6%
Healthcare Practitioners and Technical Occupations	Licensed practical and licensed vocational nurses	30.7%
Healthcare Practitioners and Technical Occupations	Medical and clinical laboratory technicians	29.3%
Healthcare Practitioners and Technical Occupations	Radiologic technologists and technicians	26.5%
Healthcare Practitioners and Technical Occupations	Respiratory therapists	26.4%
Healthcare Practitioners and Technical Occupations	Diagnostic medical sonographers	23.4%

HEALTHCARE SUPPORT OCCUPATIONS—1-DIGIT (9 OCCUPATIONS)

2-DIGIT (25 OCCUPATIONS)	3-DIGIT (800 OCCUPATIONS)	PSC %
Healthcare Practitioners and Technical Occupations	Massage therapists	56.6%
Healthcare Practitioners and Technical Occupations	Dental assistants	55.9%
Healthcare Practitioners and Technical Occupations	Nursing aides, orderlies, and attendants	46.0%
Healthcare Practitioners and Technical Occupations	Medical transcriptionists	28.8%
Healthcare Practitioners and Technical Occupations	Medical assistants	22.9%

POSTSECONDARY CERTIFICATE (PSC)

FOOD AND PERSONAL SERVICES OCCUPATIONS—1-DIGIT (9 OCCUPATIONS)

2-DIGIT (25 OCCUPATIONS)	3-DIGIT (800 OCCUPATIONS)	PSC %
Personal Care and Service Occupations	Skin care specialists	74.1%
Personal Care and Service Occupations	Hairdressers, hairstylists, and cosmetologists	73.6%
Personal Care and Service Occupations	Shampooers	67.6%
Food Preparation and Serving-Related Occupations	Cooks, private household	57.1%
Personal Care and Service Occupations	Barbers	55.0%
Personal Care and Service Occupations	Manicurists and pedicurists	42.9%
Personal Care and Service Occupations	Makeup artists, theatrical and performance	36.4%
Protective Services Occupations	Firefighters	29.7%
Building and Grounds Cleaning and Maintenance Occupations	First-line supervisors/managers of housekeeping and janitorial workers	29.6%
Food Preparation and Serving-Related Occupations	Food servers, nonrestaurant	27.5%
Protective Services Occupations	First-line supervisors/managers of firefighting and prevention workers	24.5%
Protective Services Occupations	Fire inspectors and investigators	23.6%
Protective Services Occupations	Private detectives and investigators	22.9%

MANAGERIAL AND PROFESSIONAL OFFICE OCCUPATIONS—1-DIGIT (9 OCCUPATIONS)

2-DIGIT (25 OCCUPATIONS)	3-DIGIT (800 OCCUPATIONS)	PSC %
Management Occupations	Property, real estate, and community association managers	42.0%
Management Occupations	Administrative services managers	36.6%
Financial Specialists	Appraisers and assessors of real estate	28.2%
Financial Specialists	Insurance underwriters	27.9%
Business Operations Specialists	Purchasing agents and buyers, farm products	26.4%
Management Occupations	Transportation, storage, and distribution managers	25.5%
Management Occupations	Industrial production managers	23.7%

SALES AND OFFICE SUPPORT OCCUPATIONS—1-DIGIT (9 OCCUPATIONS)

2-DIGIT (25 OCCUPATIONS)	3-DIGIT (800 OCCUPATIONS)	PSC %
Sales and Related Occupations	Sales representatives, services, all other	45.0%
Sales and Related Occupations	Travel agents	45.0%
Sales and Related Occupations	Real estate sales agents	40.1%
Office and Administrative Support Occupations	Procurement clerks	27.2%
Office and Administrative Support Occupations	Medical secretaries	20.6%

STEM OCCUPATIONS—1-DIGIT (9 OCCUPATIONS)

2-DIGIT (25 OCCUPATIONS)	3-DIGIT (800 OCCUPATIONS)	PSC %
Computer and Mathematical Occupations	Network systems and data communications analysts	33.1%
Architecture and Engineering Occupations	Electromechanical technicians	32.5%
Computer and Mathematical Occupations	Computer systems analysts	31.9%
Architecture and Engineering Occupations	Civil engineering technicians	25.4%
Architecture and Engineering Occupations	Surveying and mapping technicians	21.4%
Architecture and Engineering Occupations	Electrical and electronics drafters	21.4%

Appendix 7

Education distribution of occupations (2018)

MANAGERIAL AND PROFESSIONAL OFFICE OCCUPATIONS*

	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
MANAGEMENT OCCUPATIONS	861,452	747,283	885,834	1,148,789	5,024,315	8,667,672	10%	9%	10%	13%	58%
Chief executives	-	2,854	14,916	485	520,231	538,486	0.0%	0.5%	2.8%	0.1%	96.6%
General and operations managers	152,393	178,508	189,160	547,379	650,464	1,717,905	8.9%	10.4%	11.0%	31.9%	37.9%
Legislators	5,537	6,486	6,873	19,890	23,636	62,423	8.9%	10.4%	11.0%	31.9%	37.9%
Advertising and promotions managers	818	-	4,688	6,429	30,220	42,156	1.9%	0.0%	11.1%	15.3%	71.7%
Marketing managers	7,973	-	7,973	-	183,368	199,313	4.0%	0.0%	4.0%	0.0%	92.0%
Sales managers	17,224	-	51,707	17,224	275,685	361,838	4.8%	0.0%	14.3%	4.8%	76.2%
Public relations managers	34,977	-	1,489	1,120	21,045	58,631	59.7%	0.0%	2.5%	1.9%	35.9%
Administrative services managers	65,954	99,066	9,132	27,260	69,558	270,969	24.3%	36.6%	3.4%	10.1%	25.7%
Computer and information systems managers	-	-	7,856	-	306,403	314,259	0.0%	0.0%	2.5%	0.0%	97.5%
Financial managers	232	1,857	39,293	18,108	520,905	580,396	0.0%	0.3%	6.8%	3.1%	89.8%
Compensation and benefits managers	-	-	2,373	-	47,480	49,853	0.0%	0.0%	4.8%	0.0%	95.2%
Training and development managers	-	-	1,486	2,968	31,178	35,633	0.0%	0.0%	4.2%	8.3%	87.5%
Human resources managers, all other	-	-	2,817	5,628	59,119	67,565	0.0%	0.0%	4.2%	8.3%	87.5%
Industrial production managers	37,416	35,458	27,655	4,096	44,876	149,501	25.0%	23.7%	18.5%	2.7%	30.0%
Purchasing managers	-	3,087	1,537	32,126	32,786	69,536	0.0%	4.4%	2.2%	46.2%	47.2%
Transportation, storage, and distribution managers	51,159	26,773	431	5,529	21,212	105,104	48.7%	25.5%	0.4%	5.3%	20.2%
Farm, ranch, and other agricultural managers	11,591	24,575	51,546	66,424	124,462	278,597	4.2%	8.8%	18.5%	23.8%	44.7%
Farmers and ranchers	265,338	91,733	60,012	-	59,250	476,333	55.7%	19.3%	12.6%	0.0%	12.4%
Construction managers	-	-	58,340	35,034	280,123	373,498	0.0%	0.0%	15.6%	9.4%	75.0%
Education administrators, preschool and child care center/program	6,267	3,622	-	5,169	56,245	71,303	8.8%	5.1%	0.0%	7.2%	78.9%
Education administrators, elementary and secondary school	-	2,303	-	-	250,780	253,084	0.0%	0.9%	0.0%	0.0%	99.1%
Education administrators, postsecondary	947	-	-	1,788	130,666	133,401	0.7%	0.0%	0.0%	1.3%	98.0%
Education administrators, all other	325	-	-	613	44,787	45,724	0.7%	0.0%	0.0%	1.3%	98.0%
Engineering managers	-	-	-	-	199,093	199,093	0.0%	0.0%	0.0%	0.0%	100.0%
Food service managers	166,997	21,488	41,735	25,497	32,707	288,424	57.9%	7.5%	14.5%	8.8%	11.3%
Funeral directors	1,374	4,845	-	14,221	7,651	28,091	4.9%	17.2%	0.0%	50.6%	27.2%
Gaming managers	4,437	35	511	1,366	1,506	7,855	56.5%	0.4%	6.5%	17.4%	19.2%
Lodging managers	14,873	-	8,660	39,987	11,062	74,581	19.9%	0.0%	11.6%	53.6%	14.8%
Medical and health services managers	-	-	-	10,708	299,649	310,357	0.0%	0.0%	0.0%	3.5%	96.5%
Natural sciences managers	-	-	-	-	47,822	47,822	0.0%	0.0%	0.0%	0.0%	100.0%
Postmasters and mail superintendents	15,477	657	1,990	4,654	1,849	24,628	62.8%	2.7%	8.1%	18.9%	7.5%
Property, real estate, and community association managers	53	221,244	166,552	113,971	25,579	527,398	0.0%	42.0%	31.6%	21.6%	4.9%
Social and community service managers	15	3,822	21,410	23,771	103,245	152,263	0.0%	2.5%	14.1%	15.6%	67.8%
Managers, all other	75	18,868	105,693	117,345	509,672	751,654	0.0%	2.5%	14.1%	15.6%	67.8%
BUSINESS OPERATIONS SPECIALISTS	434,801	125,028	519,604	705,983	2,593,128	4,378,545	9.9%	2.9%	11.9%	16.1%	59.2%
Agents and business managers of artists, performers, and athletes	3,120	-	6,325	654	15,561	25,660	12.2%	0.0%	24.7%	2.6%	60.6%
Purchasing agents and buyers, farm products	6,806	4,087	494	994	3,097	15,478	44.0%	26.4%	3.2%	6.4%	20.0%
Wholesale and retail buyers, except farm products	87,780	6,617	21,538	1,881	21,510	139,326	63.0%	4.7%	15.5%	1.3%	15.4%
Purchasing agents, except wholesale, retail, and farm products	32,595	23,012	121,789	7,457	106,467	291,320	11.2%	7.9%	41.8%	2.6%	36.5%
Claims adjusters, examiners, and investigators	31,603	56,990	35,746	58,381	126,473	309,193	10.2%	18.4%	11.6%	18.9%	40.9%
Insurance appraisers, auto damage	7,563	3,122	101	6,445	4,318	21,550	35.1%	14.5%	0.5%	29.9%	20.0%
Compliance officers, except agriculture, construction, health and safety, and transportation	4,492	-	4,492	13,501	234,141	256,626	1.8%	0.0%	1.8%	5.3%	91.2%
Cost estimators	-	8,772	17,544	35,113	184,291	245,721	0.0%	3.6%	7.1%	14.3%	75.0%
Emergency management specialists	1,735	183	5,053	546	8,367	15,885	10.9%	1.2%	31.8%	3.4%	52.7%
Employment, recruitment, and placement specialists	108,763	1,209	21	40,969	61,072	212,034	51.3%	0.6%	0.0%	19.3%	28.8%
Compensation, benefits, and job analysis specialists	1,593	20,889	9,114	20,781	82,664	135,041	1.2%	15.5%	6.7%	15.4%	61.2%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

HIGH SCHOOL OR LESS (HSL) | POSTSECONDARY CERTIFICATE (PSC) | SOME COLLEGE (SC) | ASSOCIATE (A) | BACHELOR'S DEGREE OR BETTER (BA+)

BUSINESS OPERATIONS SPECIALISTS, cont.	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
Training and development specialists	887	148	33,851	60,434	151,023	246,342	0.4%	0.1%	13.7%	24.5%	61.3%
Human resources, training, and labor relations specialists, all other	-	-	8,050	-	249,966	258,016	0.0%	0.0%	3.1%	0.0%	96.9%
Logisticians	-	-	483	11,801	100,011	112,295	0.0%	0.0%	0.4%	10.5%	89.1%
Management analysts	64,976	-	55,565	61,964	570,478	752,983	8.6%	0.0%	7.4%	8.2%	75.8%
Meeting and convention planners	3,952	-	9,508	18,358	32,118	63,936	6.2%	0.0%	14.9%	28.7%	50.2%
Business operation specialists, all other	78,935	-	189,929	366,703	641,571	1,277,138	6.2%	0.0%	14.9%	28.7%	50.2%
FINANCIAL SPECIALISTS	610,673	129,913	250,191	127,971	2,172,132	3,290,879	18.6%	3.9%	7.6%	3.9%	66.0%
Accountants and auditors	57,186	-	147,562	19,541	1,212,536	1,436,824	4.0%	0.0%	10.3%	1.4%	84.4%
Appraisers and assessors of real estate	49,381	55,022	17,449	19,538	53,812	195,202	25.3%	28.2%	8.9%	10.0%	27.6%
Budget analysts	5,539	-	3,997	4,660	57,837	72,033	7.7%	0.0%	5.5%	6.5%	80.3%
Credit analysts	18,969	3,570	-	5,368	36,768	64,675	29.3%	5.5%	0.0%	8.3%	56.9%
Financial analysts	-	-	-	-	341,018	341,018	0.0%	0.0%	0.0%	0.0%	100.0%
Personal financial advisors	57,426	-	36,003	63,366	203,240	360,035	16.0%	0.0%	10.0%	17.6%	56.5%
Insurance underwriters	34,343	28,889	20,168	2,509	17,783	103,692	33.1%	27.9%	19.5%	2.4%	17.2%
Financial examiners	688	-	924	-	30,257	31,870	2.2%	0.0%	2.9%	0.0%	94.9%
Loan counselors	12,230	-	-	2,045	19,916	34,191	35.8%	0.0%	0.0%	6.0%	58.3%
Loan officers	268,392	-	2,688	8,710	78,675	358,465	74.9%	0.0%	0.7%	2.4%	21.9%
Tax examiners, collectors, and revenue agents	20,442	-	20,869	1,374	29,625	72,310	28.3%	0.0%	28.9%	1.9%	41.0%
Tax preparers	26,513	13,070	163	265	27,926	67,937	39.0%	19.2%	0.2%	0.4%	41.1%
Financial specialists, all other	59,565	29,363	366	595	62,739	152,628	39.0%	19.2%	0.2%	0.4%	41.1%
LEGAL OCCUPATIONS	102,944	23,875	121,227	128,278	862,244	1,238,569	8.3%	1.9%	9.8%	10.4%	69.6%
Lawyers	-	-	-	-	701,737	701,737	0.0%	0.0%	0.0%	0.0%	100.0%
Administrative law judges, adjudicators, and hearing officers	3,108	-	3,021	-	12,099	18,228	17.1%	0.0%	16.6%	0.0%	66.4%
Arbitrators, mediators, and conciliators	380	757	1,579	59	7,952	10,728	3.5%	7.1%	14.7%	0.6%	74.1%
Judges, magistrate judges, and magistrates	1,817	-	454	-	28,371	30,642	5.9%	0.0%	1.5%	0.0%	92.6%
Paralegals and legal assistants	32,277	17,037	69,977	89,667	85,806	294,763	11.0%	5.8%	23.7%	30.4%	29.1%
Court reporters	235	5,337	886	22,753	1,252	30,463	0.8%	17.5%	2.9%	74.7%	4.1%
Law clerks	-	743	-	15,152	22,620	38,515	0.0%	1.9%	0.0%	39.3%	58.7%
Title examiners, abstractors, and searchers	38,388	-	26,707	381	1,418	66,894	57.4%	0.0%	39.9%	0.6%	2.1%
Legal support workers, all other	26,740	-	18,604	266	988	46,598	57.4%	0.0%	39.9%	0.6%	2.1%

STEM OCCUPATIONS*

	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
COMPUTER AND MATHEMATICAL OCCUPATIONS	156,569	576,011	339,536	548,870	2,565,181	4,186,169	3.7%	13.8%	8.1%	13.1%	61.3%
Computer and information scientists, research	-	-	-	-	48,416	48,416	0.0%	0.0%	0.0%	0.0%	100.0%
Computer programmers	13,334	-	40,552	18,825	319,437	392,148	3.4%	0.0%	10.3%	4.8%	81.5%
Computer software engineers, applications	-	124,221	58,497	60,605	509,530	752,852	0.0%	16.5%	7.8%	8.1%	67.7%
Computer software engineers, systems software	54,815	4,419	12,082	128,810	269,937	470,063	11.7%	0.9%	2.6%	27.4%	57.4%
Computer support specialists	70,980	90,922	133,777	108,622	201,847	606,147	11.7%	15.0%	22.1%	17.9%	33.3%
Computer systems analysts	7,167	198,616	187	17,761	399,476	623,208	1.2%	31.9%	0.0%	2.9%	64.1%
Database administrators	-	-	30,299	24,264	99,786	154,348	0.0%	0.0%	19.6%	15.7%	64.7%
Network and computer systems administrators	-	35,646	32,527	60,558	276,338	405,069	0.0%	8.8%	8.0%	15.0%	68.2%
Network systems and data communications analysts	-	122,187	21,343	98,629	127,062	369,221	0.0%	33.1%	5.8%	26.7%	34.4%
Computer specialists, all other	10,273	-	10,273	30,797	174,489	225,833	4.5%	0.0%	4.5%	13.6%	77.3%
Actuaries	-	-	-	-	24,483	24,483	0.0%	0.0%	0.0%	0.0%	100.0%
Mathematicians	-	-	-	-	5,862	5,862	0.0%	0.0%	0.0%	0.0%	100.0%
Operations research analysts	-	-	-	-	67,689	67,689	0.0%	0.0%	0.0%	0.0%	100.0%
Statisticians	-	-	-	-	25,431	25,431	0.0%	0.0%	0.0%	0.0%	100.0%
Mathematical technicians	-	-	-	-	3,168	3,168	0.0%	0.0%	0.0%	0.0%	100.0%
Mathematical scientists, all other	-	-	-	-	12,231	12,231	0.0%	0.0%	0.0%	0.0%	100.0%
ARCHITECTURE AND ENGINEERING OCCUPATIONS	174,647	168,767	119,251	440,502	1,903,138	2,806,306	6.2%	6.0%	4.2%	15.7%	67.8%
Architects, except landscape and naval	-	2,676	-	-	127,195	129,871	0.0%	2.1%	0.0%	0.0%	97.9%
Landscape architects	-	-	-	19,205	15,405	34,610	0.0%	0.0%	0.0%	55.5%	44.5%
Cartographers and photogrammetrists	2,439	2,766	2,986	3,345	4,821	16,357	14.9%	16.9%	18.3%	20.4%	29.5%
Surveyors	4,035	10,088	2,018	6,053	44,392	66,585	6.1%	15.2%	3.0%	9.1%	66.7%
Aerospace engineers	-	-	5,737	-	88,931	94,668	0.0%	0.0%	6.1%	0.0%	93.9%
Agricultural engineers	-	-	-	-	6,480	6,480	0.0%	0.0%	0.0%	0.0%	100.0%
Biomedical engineers	-	2,867	96	8,283	10,523	21,769	0.0%	13.2%	0.4%	38.1%	48.3%
Chemical engineers	-	-	-	-	32,921	32,921	0.0%	0.0%	0.0%	0.0%	100.0%
Civil engineers	-	-	-	-	294,225	294,225	0.0%	0.0%	0.0%	0.0%	100.0%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

HIGH SCHOOL OR LESS (HSL) | POSTSECONDARY CERTIFICATE (PSC) | SOME COLLEGE (SC) | ASSOCIATE (A) | BACHELOR'S DEGREE OR BETTER (BA+)

ARCHITECTURE AND ENGINEERING OCCUPATIONS, cont.	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
Computer hardware engineers	3,834	371	371	995	84,858	90,429	4.2%	0.4%	0.4%	1.1%	93.8%
Electrical engineers	-	10,435	-	49,537	100,827	160,799	0.0%	6.5%	0.0%	30.8%	62.7%
Electronics engineers, except computer	-	14,119	-	8,959	121,868	144,946	0.0%	9.7%	0.0%	6.2%	84.1%
Environmental engineers	-	-	219	-	64,242	64,461	0.0%	0.0%	0.3%	0.0%	99.7%
Health and safety engineers, except mining safety engineers and inspectors	-	-	-	-	28,928	28,928	0.0%	0.0%	0.0%	0.0%	100.0%
Industrial engineers	-	876	29,481	1,800	211,108	243,264	0.0%	0.4%	12.1%	0.7%	86.8%
Marine engineers and naval architects	-	384	-	163	9,747	10,294	0.0%	3.7%	0.0%	1.6%	94.7%
Materials engineers	-	-	-	-	25,105	25,105	0.0%	0.0%	0.0%	0.0%	100.0%
Mechanical engineers	26,491	-	6,901	8,127	185,502	227,020	11.7%	0.0%	3.0%	3.6%	81.7%
Mining and geological engineers, including mining safety engineers	-	310	-	770	13,197	14,277	0.0%	2.2%	0.0%	5.4%	92.4%
Nuclear engineers	-	1,769	-	-	21,232	23,000	0.0%	7.7%	0.0%	0.0%	92.3%
Petroleum engineers	-	-	-	-	27,701	27,701	0.0%	0.0%	0.0%	0.0%	100.0%
Engineers, all other	-	-	-	-	183,758	183,758	0.0%	0.0%	0.0%	0.0%	100.0%
Architectural and civil drafters	-	8,662	32,300	40,158	27,551	108,671	0.0%	8.0%	29.7%	37.0%	25.4%
Electrical and electronics drafters	5,125	7,607	972	13,045	8,864	35,613	14.4%	21.4%	2.7%	36.6%	24.9%
Mechanical drafters	-	9,669	4,429	60,220	-	74,318	0.0%	13.0%	6.0%	81.0%	0.0%
Drafters, all other	-	3,558	1,630	22,160	-	27,348	0.0%	13.0%	6.0%	81.0%	0.0%
Aerospace engineering and operations technicians	2,691	186	37	1,378	5,624	9,917	27.1%	1.9%	0.4%	13.9%	56.7%
Civil engineering technicians	31,240	24,119	4,615	16,959	18,023	94,955	32.9%	25.4%	4.9%	17.9%	19.0%
Electrical and electronic engineering technicians	11,004	24,741	-	111,640	21,383	168,768	6.5%	14.7%	0.0%	66.2%	12.7%
Electro-mechanical technicians	4,581	5,737	987	6,348	-	17,652	26.0%	32.5%	5.6%	36.0%	0.0%
Environmental engineering technicians	8,175	-	5,751	3,047	11,614	28,588	28.6%	0.0%	20.1%	10.7%	40.6%
Industrial engineering technicians	15,909	-	13,861	9,406	42,118	81,294	19.6%	0.0%	17.1%	11.6%	51.8%
Mechanical engineering technicians	8,442	7,329	283	11,493	22,135	49,682	17.0%	14.8%	0.6%	23.1%	44.6%
Engineering technicians, except drafters, all other	14,016	12,168	470	19,081	36,752	82,487	17.0%	14.8%	0.6%	23.1%	44.6%
Surveying and mapping technicians	36,665	18,333	6,108	18,333	6,108	85,546	42.9%	21.4%	7.1%	21.4%	7.1%
LIFE AND PHYSICAL SCIENCE OCCUPATIONS	15,366	-	10,412	16,033	574,253	616,064	2.5%	0.0%	1.7%	2.6%	93.2%
Animal scientists	-	-	-	-	6,356	6,356	0.0%	0.0%	0.0%	0.0%	100.0%
Food scientists and technologists	882	-	272	43	11,322	12,519	7.0%	0.0%	2.2%	0.3%	90.4%
Soil and plant Scientists	-	-	-	-	13,238	13,238	0.0%	0.0%	0.0%	0.0%	100.0%
Biochemists and biophysicists	-	-	-	-	24,692	24,692	0.0%	0.0%	0.0%	0.0%	100.0%
Microbiologists	-	-	-	833	17,478	18,311	0.0%	0.0%	0.0%	4.6%	95.5%
Zoologists and wildlife biologists	5,859	-	-	-	16,360	22,219	26.4%	0.0%	0.0%	0.0%	73.6%
Biological scientists, all other	8,314	-	-	-	23,215	31,529	26.4%	0.0%	0.0%	0.0%	73.6%
Conservation scientists	-	-	1,466	-	19,146	20,612	0.0%	0.0%	7.1%	0.0%	92.9%
Foresters	-	-	-	-	13,459	13,459	0.0%	0.0%	0.0%	0.0%	100.0%
Epidemiologists	-	-	-	-	6,320	6,320	0.0%	0.0%	0.0%	0.0%	100.0%
Medical scientists, except epidemiologists	-	-	-	866	111,539	112,405	0.0%	0.0%	0.0%	0.8%	99.2%
Life scientists, all other	-	-	-	120	15,452	15,572	0.0%	0.0%	0.0%	0.8%	99.2%
Astronomers	-	-	-	-	3,434	3,434	0.0%	0.0%	0.0%	0.0%	100.0%
Physicists	283	-	223	550	15,323	16,380	1.7%	0.0%	1.4%	3.4%	93.6%
Atmospheric and space scientists	-	-	-	-	13,191	13,191	0.0%	0.0%	0.0%	0.0%	100.0%
Chemists	-	-	7,904	4,889	71,206	83,999	0.0%	0.0%	9.4%	5.8%	84.8%
Materials scientists	27	-	-	17	12,032	12,075	0.2%	0.0%	0.0%	0.1%	99.6%
Environmental scientists and specialists, including health	-	-	-	8,716	90,675	99,390	0.0%	0.0%	0.0%	8.8%	91.2%
Geoscientists, except hydrologists and geographers	-	-	548	-	45,505	46,053	0.0%	0.0%	1.2%	0.0%	98.8%
Hydrologists	-	-	-	-	14,070	14,070	0.0%	0.0%	0.0%	0.0%	100.0%
Physical scientists, all other	-	-	-	-	30,239	30,239	0.0%	0.0%	0.0%	0.0%	100.0%
SOCIAL SCIENCE OCCUPATIONS	82,411	50,849	120,180	56,798	690,813	1,001,051	8.2%	5.1%	12.0%	5.7%	69.0%
Economists	-	-	-	-	15,481	15,481	0.0%	0.0%	0.0%	0.0%	100.0%
Market research analysts	-	43,267	64,167	-	164,317	271,751	0.0%	15.9%	23.6%	0.0%	60.5%
Survey researchers	379	-	5,683	-	30,366	36,428	1.0%	0.0%	15.6%	0.0%	83.4%
Clinical, counseling, and school psychologists	-	-	-	-	135,328	135,328	0.0%	0.0%	0.0%	0.0%	100.0%
Industrial-organizational psychologists	-	-	-	-	25,282	25,282	0.0%	0.0%	0.0%	0.0%	100.0%
Psychologists, all other	-	-	-	-	33,931	33,931	0.0%	0.0%	0.0%	0.0%	100.0%
Sociologists	-	-	-	-	5,288	5,288	0.0%	0.0%	0.0%	0.0%	100.0%
Urban and regional planners	-	-	15,226	-	26,627	41,854	0.0%	0.0%	36.4%	0.0%	63.6%
Anthropologists and archeologists	-	-	-	-	7,353	7,353	0.0%	0.0%	0.0%	0.0%	100.0%
Geographers	-	-	-	-	2,535	2,535	0.0%	0.0%	0.0%	0.0%	100.0%
Historians	-	-	866	-	3,955	4,821	0.0%	0.0%	18.0%	0.0%	82.0%
Political scientists	-	-	-	-	5,783	5,783	0.0%	0.0%	0.0%	0.0%	100.0%
Social scientists and related workers, all other	-	-	-	-	34,695	34,695	0.0%	0.0%	0.0%	0.0%	100.0%
Agricultural and food science technicians	11,689	-	-	4,141	7,076	22,906	51.0%	0.0%	0.0%	18.1%	30.9%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

HIGH SCHOOL OR LESS (HSL) | POSTSECONDARY CERTIFICATE (PSC) | SOME COLLEGE (SC) | ASSOCIATE (A) | BACHELOR'S DEGREE OR BETTER (BA+)

SOCIAL SCIENCES OCCUPATIONS, cont.	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
Biological technicians	11,775	-	3,922	1,677	64,863	82,238	14.3%	0.0%	4.8%	2.0%	78.9%
Chemical technicians	15,446	-	21,095	8,738	22,623	67,902	22.7%	0.0%	31.1%	12.9%	33.3%
Geological and petroleum technicians	2,701	1,150	975	3,628	11,405	19,859	13.6%	5.8%	4.9%	18.3%	57.4%
Nuclear technicians	697	731	1,951	4,053	502	7,934	8.8%	9.2%	24.6%	51.1%	6.3%
Social science research assistants	-	-	101	3,590	16,546	20,238	0.0%	0.0%	0.5%	17.7%	81.8%
Environmental science and protection technicians, including health	4,550	770	4,572	5,527	27,590	43,009	10.6%	1.8%	10.6%	12.9%	64.2%
Forensic science technicians	2,287	716	1,621	76	13,954	18,655	12.3%	3.8%	8.7%	0.4%	74.8%
Forest and conservation technicians	10,296	1,320	-	7,942	11,056	30,613	33.6%	4.3%	0.0%	25.9%	36.1%
Life, physical, and social science technicians, all other	22,591	2,895	-	17,425	24,256	67,167	33.6%	4.3%	0.0%	25.9%	36.1%

COMMUNITY SERVICES AND ARTS OCCUPATIONS*

	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
COMMUNITY AND SOCIAL SERVICES OCCUPATIONS	329,719	32,769	108,026	131,343	1,821,360	2,423,216	13.6%	1.4%	4.5%	5.4%	75.2%
Substance abuse and behavioral disorder counselors	1,420	-	4,204	16,637	89,557	111,817	1.3%	0.0%	3.8%	14.9%	80.1%
Educational, vocational, and school counselors	-	2,073	4,427	1,625	272,035	280,160	0.0%	0.7%	1.6%	0.6%	97.1%
Marriage and family therapists	-	-	-	-	36,655	36,655	0.0%	0.0%	0.0%	0.0%	100.0%
Mental health counselors	22,397	-	-	9,926	101,632	133,956	16.7%	0.0%	0.0%	7.4%	75.9%
Rehabilitation counselors	84,740	-	-	3,189	67,615	155,544	54.5%	0.0%	0.0%	2.1%	43.5%
Counselors, all other	22,825	-	-	859	18,212	41,896	54.5%	0.0%	0.0%	2.1%	43.5%
Child, family, and school social workers	8,403	-	-	13,789	302,262	324,454	2.6%	0.0%	0.0%	4.3%	93.2%
Medical and public health social workers	-	-	-	-	155,242	155,242	0.0%	0.0%	0.0%	0.0%	100.0%
Mental health and substance abuse social workers	-	-	-	1,531	159,596	161,126	0.0%	0.0%	0.0%	0.9%	99.1%
Social workers, all other	-	-	-	780	81,339	82,119	0.0%	0.0%	0.0%	0.9%	99.1%
Health educators	22,086	82	-	-	59,874	82,041	26.9%	0.1%	0.0%	0.0%	73.0%
Probation officers and correctional treatment specialists	1,379	-	21,484	16,108	67,072	106,043	1.3%	0.0%	20.3%	15.2%	63.3%
Social and human service assistants	111,494	-	50,496	35,407	231,262	428,660	26.0%	0.0%	11.8%	8.3%	54.0%
Community and social service specialists, all other	37,579	-	17,020	11,934	77,947	144,480	26.0%	0.0%	11.8%	8.3%	54.0%
Clergy	15,364	8,717	-	19,538	65,358	108,977	14.1%	8.0%	0.0%	17.9%	60.0%
Directors, religious activities and education	1,377	14,843	7,046	14	24,201	47,481	2.9%	31.3%	14.8%	0.0%	51.0%
Religious workers, all other	654	7,054	3,349	7	11,502	22,566	2.9%	31.3%	14.8%	0.0%	51.0%
ARTS, DESIGN, ENTERTAINMENT, SPORTS, AND MEDIA OCCUPATIONS	673,106	141,262	191,998	288,162	1,459,474	2,754,002	24.4%	5.1%	7.0%	10.5%	53.0%
Art directors	-	-	6,840	41,619	14,936	63,395	0.0%	0.0%	10.8%	65.7%	23.6%
Craft artists	16,961	2,993	2,993	3,991	5,986	32,924	51.5%	9.1%	9.1%	12.1%	18.2%
Fine artists, including painters, sculptors, and illustrators	14,786	1,901	5,997	3,456	12,649	38,789	38.1%	4.9%	15.5%	8.9%	32.6%
Multimedia artists and animators	10,132	613	1,585	17,411	39,192	68,934	14.7%	0.9%	2.3%	25.3%	56.9%
Artists and related workers, all other	5,443	330	852	9,353	21,054	37,032	14.7%	0.9%	2.3%	25.3%	56.9%
Commercial and industrial designers	1,003	4,444	-	9,012	33,318	47,776	2.1%	9.3%	0.0%	18.9%	69.7%
Fashion designers	1,404	319	7,871	11,212	10,196	31,002	4.5%	1.0%	25.4%	36.2%	32.9%
Floral designers	45,595	4,392	1,100	-	14,367	65,454	69.7%	6.7%	1.7%	0.0%	22.0%
Graphic designers	-	-	8,735	26,228	201,089	236,051	0.0%	0.0%	3.7%	11.1%	85.2%
Interior designers	22,709	15,947	-	12,489	21,332	72,477	31.3%	22.0%	0.0%	17.2%	29.4%
Merchandise displayers and window trimmers	72,310	551	10,432	3,041	2,597	88,932	81.3%	0.6%	11.7%	3.4%	2.9%
Set and exhibit designers	-	2,161	484	3,143	17,058	22,847	0.0%	9.5%	2.1%	13.8%	74.7%
Designers, all other	-	2,478	555	3,604	19,559	26,197	0.0%	9.5%	2.1%	13.8%	74.7%
Actors	37,038	-	17,144	-	7,353	61,535	60.2%	0.0%	27.9%	0.0%	12.0%
Producers and directors	11,372	14,079	5,589	3,344	57,999	92,384	12.3%	15.2%	6.1%	3.6%	62.8%
Athletes and sports competitors	24,677	-	-	82	157	24,916	99.0%	0.0%	0.0%	0.3%	0.6%
Coaches and scouts	1,577	-	1,940	15,370	194,283	213,169	0.7%	0.0%	0.9%	7.2%	91.1%
Umpires, referees, and other sports officials	18,227	492	492	986	5,417	25,614	71.2%	1.9%	1.9%	3.9%	21.2%
Dancers	14,397	-	39	489	2,733	17,658	81.5%	0.0%	0.2%	2.8%	15.5%
Choreographers	8,315	831	2,494	831	8,315	20,787	40.0%	4.0%	12.0%	4.0%	40.0%
Music directors and composers	-	898	1,924	7,828	50,035	60,686	0.0%	1.5%	3.2%	12.9%	82.5%
Musicians and singers	90,014	-	1,723	-	20,190	111,927	80.4%	0.0%	1.5%	0.0%	18.0%
Entertainers and performers, sports and related workers, all other	44,061	-	844	-	9,883	54,787	80.4%	0.0%	1.5%	0.0%	18.0%
Radio and television announcers	12,005	3,231	4,771	3,038	14,050	37,096	32.4%	8.7%	12.9%	8.2%	37.9%
Public address system and other announcers	12,057	-	739	735	368	13,900	86.7%	0.0%	5.3%	5.3%	2.7%
Broadcast news analysts	747	-	106	1,523	8,527	10,903	6.9%	0.0%	1.0%	14.0%	78.2%
Reporters and correspondents	1,142	89	4,907	964	45,272	52,374	2.2%	0.2%	9.4%	1.8%	86.4%
Public relations specialists	-	27,108	-	30,232	224,153	281,493	0.0%	9.6%	0.0%	10.7%	79.6%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

HIGH SCHOOL OR LESS (HSL) | POSTSECONDARY CERTIFICATE (PSC) | SOME COLLEGE (SC) | ASSOCIATE (A) | BACHELOR'S DEGREE OR BETTER (BA+)

ARTS, DESIGN, ENTERTAINMENT, SPORTS, AND MEDIA OCCUPATIONS, cont.	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
Editors	1,910	-	10,263	1,921	103,077	117,172	1.6%	0.0%	8.8%	1.6%	88.0%
Technical writers	976	-	470	2,602	55,489	59,537	1.6%	0.0%	0.8%	4.4%	93.2%
Writers and authors	13,132	-	4,546	10,683	112,407	140,769	9.3%	0.0%	3.2%	7.6%	79.9%
Interpreters and translators	8,227	2,927	1,906	17,565	37,927	68,552	12.0%	4.3%	2.8%	25.6%	55.3%
Media and communication workers, all other	6,274	2,232	1,453	13,394	28,922	52,276	12.0%	4.3%	2.8%	25.6%	55.3%
Audio and video equipment technicians	5,292	8,825	10,994	12,803	12,631	50,546	10.5%	17.5%	21.8%	25.3%	25.0%
Broadcast technicians	10,481	8,284	6,843	6,461	6,546	38,616	27.1%	21.5%	17.7%	16.7%	17.0%
Radio operators	1,693	860	372	177	139	3,242	52.2%	26.5%	11.5%	5.5%	4.3%
Sound engineering technicians	2,839	11,002	-	162	2,487	16,489	17.2%	66.7%	0.0%	1.0%	15.1%
Photographers	143,930	22,354	42,032	7,916	8,636	224,868	64.0%	9.9%	18.7%	3.5%	3.8%
Camera operators, television, video, and motion picture	10,191	1,660	3,066	2,961	7,545	25,422	40.1%	6.5%	12.1%	11.6%	29.7%
Film and video editors	1,097	130	9,981	769	10,836	22,813	4.8%	0.6%	43.8%	3.4%	47.5%
Media and communication equipment workers, all other	1,090	129	9,915	764	10,764	22,662	4.8%	0.6%	43.8%	3.4%	47.5%

EDUCATION OCCUPATIONS*

	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
EDUCATION, TRAINING AND LIBRARY OCCUPATIONS	2,379,761	353,151	1,134,522	816,527	5,487,861	10,171,821	23.4%	3.5%	11.2%	8.0%	54.0%
Postsecondary teachers	1,119,554	-	778,888	11,121	41,364	1,950,927	57.4%	0.0%	39.9%	0.6%	2.1%
Preschool teachers, except special education	218,461	9,485	59,244	134,110	85,923	507,222	43.1%	1.9%	11.7%	26.4%	16.9%
Kindergarten teachers, except special education	-	-	-	-	213,417	213,417	0.0%	0.0%	0.0%	0.0%	100.0%
Elementary school teachers, except special education	73,849	59,774	-	14,258	1,680,059	1,827,940	4.0%	3.3%	0.0%	0.8%	91.9%
Middle school teachers, except special and vocational education	13,037	-	-	-	744,880	757,918	1.7%	0.0%	0.0%	0.0%	98.3%
Vocational education teachers, middle school	-	494	-	-	23,723	24,217	0.0%	2.0%	0.0%	0.0%	98.0%
Secondary school teachers, except special and vocational education	-	-	-	-	1,142,514	1,142,514	0.0%	0.0%	0.0%	0.0%	100.0%
Vocational education teachers, secondary school	2,476	12,283	4,864	7,810	70,451	97,885	2.5%	12.5%	5.0%	8.0%	72.0%
Special education teachers, preschool, kindergarten, and elementary school	570	-	733	-	270,346	271,649	0.2%	0.0%	0.3%	0.0%	99.5%
Special education teachers, middle school	-	-	-	-	120,641	120,641	0.0%	0.0%	0.0%	0.0%	100.0%
Special education teachers, secondary school	-	-	-	-	154,752	154,752	0.0%	0.0%	0.0%	0.0%	100.0%
Adult literacy, remedial education, and GED teachers and instructors	2,957	-	-	-	112,560	115,518	2.6%	0.0%	0.0%	0.0%	97.4%
Self-enrichment education teachers	77,323	28,505	16,191	28,213	93,636	243,869	31.7%	11.7%	6.6%	11.6%	38.4%
Teachers and instructors, all other	209,309	77,162	43,829	76,370	253,468	660,138	31.7%	11.7%	6.6%	11.6%	38.4%
Archivists	2,101	-	2,094	817	3,783	8,795	23.9%	0.0%	23.8%	9.3%	43.0%
Curators	-	3,039	3,039	-	8,168	14,246	0.0%	21.3%	21.3%	0.0%	57.3%
Museum Technicians and Conservators	2,648	1,695	1,940	1,386	6,518	14,187	18.7%	11.9%	13.7%	9.8%	45.9%
Librarians	131	-	131	7,440	155,482	163,183	0.1%	0.0%	0.1%	4.6%	95.3%
Library technicians	21,245	36,848	38,328	8,954	25,539	130,913	16.2%	28.1%	29.3%	6.8%	19.5%
Audio-visual collections specialists	-	253	922	1,010	6,678	8,863	0.0%	2.9%	10.4%	11.4%	75.4%
Farm and home management advisors	-	-	-	-	16,998	16,998	0.0%	0.0%	0.0%	0.0%	100.0%
Instructional coordinators	-	-	-	-	157,193	157,193	0.0%	0.0%	0.0%	0.0%	100.0%
Teacher assistants	588,575	114,377	170,549	485,810	92,314	1,451,624	40.5%	7.9%	11.7%	33.5%	6.4%
Education, training, and library workers, all other	47,525	9,235	13,771	39,227	7,454	117,212	40.5%	7.9%	11.7%	33.5%	6.4%

HEALTHCARE PROFESSIONAL AND TECHNICAL OCCUPATIONS*

	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
HEALTHCARE PROFESSIONAL AND TECHNICAL OCCUPATIONS	818,121	920,036	448,208	2,864,342	3,708,336	8,759,044	9.3%	10.5%	5.1%	32.7%	42.3%
Chiropractors	-	-	-	-	45,548	45,548	0.0%	0.0%	0.0%	0.0%	100.0%
Dentists, general	7,321	-	-	6,964	82,041	96,326	7.6%	0.0%	0.0%	7.2%	85.2%
Oral and maxillofacial surgeons	-	-	-	-	10,049	10,049	0.0%	0.0%	0.0%	0.0%	100.0%
Orthodontists	-	-	-	-	10,186	10,186	0.0%	0.0%	0.0%	0.0%	100.0%
Prosthodontists	-	-	272	-	5,726	5,999	0.0%	0.0%	4.5%	0.0%	95.5%
Dentists, all other specialists	-	-	428	-	8,996	9,424	0.0%	0.0%	4.5%	0.0%	95.5%
Dietitians and nutritionists	1,790	-	-	5,565	57,501	64,855	2.8%	0.0%	0.0%	8.6%	88.7%
Optometrists	-	-	-	-	38,595	38,595	0.0%	0.0%	0.0%	0.0%	100.0%
Pharmacists	-	-	-	-	336,546	336,546	0.0%	0.0%	0.0%	0.0%	100.0%
Physicians and surgeons	-	-	-	-	732,474	732,474	0.0%	0.0%	0.0%	0.0%	100.0%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

HIGH SCHOOL OR LESS (HSL) | POSTSECONDARY CERTIFICATE (PSC) | SOME COLLEGE (SC) | ASSOCIATE (A) | BACHELOR'S DEGREE OR BETTER (BA+)

HEALTHCARE PROFESSIONAL AND TECHNICAL OCCUPATIONS, cont.	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
Physician assistants	-	-	-	-	90,924	90,924	0.0%	0.0%	0.0%	0.0%	100.0%
Podiatrists	-	-	-	-	18,398	18,398	0.0%	0.0%	0.0%	0.0%	100.0%
Registered nurses	52,037	138,871	-	2,007,200	936,359	3,134,468	1.7%	4.4%	0.0%	64.0%	29.9%
Audiologists	-	-	-	283	15,806	16,089	0.0%	0.0%	0.0%	1.8%	98.2%
Occupational therapists	-	-	-	-	122,582	122,582	0.0%	0.0%	0.0%	0.0%	100.0%
Physical therapists	-	-	-	-	226,121	226,121	0.0%	0.0%	0.0%	0.0%	100.0%
Radiation therapists	-	372	-	12,027	8,170	20,570	0.0%	1.8%	0.0%	58.5%	39.7%
Recreational therapists	-	991	-	-	24,761	25,752	0.0%	3.9%	0.0%	0.0%	96.2%
Respiratory therapists	-	34,005	-	76,116	18,527	128,648	0.0%	26.4%	0.0%	59.2%	14.4%
Speech-language pathologists	-	-	-	-	129,699	129,699	0.0%	0.0%	0.0%	0.0%	100.0%
Therapists, all other	-	-	-	-	29,775	29,775	0.0%	0.0%	0.0%	0.0%	100.0%
Veterinarians	-	-	-	-	77,858	77,858	0.0%	0.0%	0.0%	0.0%	100.0%
Health diagnosing and treating practitioners, all other	-	-	-	-	66,473	66,473	0.0%	0.0%	0.0%	0.0%	100.0%
Medical and clinical laboratory technologists	-	6,640	-	40,933	143,774	191,348	0.0%	3.5%	0.0%	21.4%	75.1%
Medical and clinical laboratory technicians	78,615	51,358	-	9,542	35,870	175,384	44.8%	29.3%	0.0%	5.4%	20.5%
Dental hygienists	-	-	-	173,750	51,870	225,620	0.0%	0.0%	0.0%	77.0%	23.0%
Cardiovascular technologists and technicians	5,608	8,452	5,783	36,411	6,126	62,379	9.0%	13.6%	9.3%	58.4%	9.8%
Diagnostic medical sonographers	-	13,864	704	24,948	19,636	59,152	0.0%	23.4%	1.2%	42.2%	33.2%
Nuclear medicine technologists	1,146	2,897	-	12,616	9,273	25,932	4.4%	11.2%	0.0%	48.7%	35.8%
Radiologic technologists and technicians	12,526	63,130	17,011	110,132	35,788	238,587	5.3%	26.5%	7.1%	46.2%	15.0%
Emergency medical technicians and paramedics	70,347	101,563	34,159	11,527	29,756	247,352	28.4%	41.1%	13.8%	4.7%	12.0%
Dietetic technicians	21,037	1,318	-	3,056	4,815	30,225	69.6%	4.4%	0.0%	10.1%	15.9%
Pharmacy technicians	271,185	133,886	3,906	1,110	1,110	411,198	66.0%	32.6%	1.0%	0.3%	0.3%
Psychiatric technicians	23,936	6,349	13,699	16,751	311	61,047	39.2%	10.4%	22.4%	27.4%	0.5%
Respiratory therapy technicians	714	6,365	-	10,570	1,805	19,454	3.7%	32.7%	0.0%	54.3%	9.3%
Surgical technologists	16,934	48,634	10,334	29,578	5,633	111,114	15.2%	43.8%	9.3%	26.6%	5.1%
Veterinary technologists and technicians	33,458	9,607	10,981	50,837	-	104,883	31.9%	9.2%	10.5%	48.5%	0.0%
Licensed practical and licensed vocational nurses	40,535	253,615	299,021	191,945	40,535	825,651	4.9%	30.7%	36.2%	23.2%	4.9%
Medical records and health information technicians	141,205	3,551	38,269	19,885	-	202,909	69.6%	1.8%	18.9%	9.8%	0.0%
Opticians, dispensing	38,551	29,198	1,286	4,438	-	73,472	52.5%	39.7%	1.8%	6.0%	0.0%
Orthotists and prosthetists	-	534	924	-	9,884	11,343	0.0%	4.7%	8.2%	0.0%	87.1%
Healthcare technologists and technicians, all other	-	4,247	7,349	-	78,576	90,172	0.0%	4.7%	8.2%	0.0%	87.1%
Occupational health and safety specialists	-	-	1,727	3,450	48,309	53,486	0.0%	0.0%	3.2%	6.4%	90.3%
Occupational health and safety technicians	1,177	589	2,355	4,709	5,298	14,127	8.3%	4.2%	16.7%	33.3%	37.5%
Athletic trainers	-	-	-	-	20,652	20,652	0.0%	0.0%	0.0%	0.0%	100.0%
Healthcare practitioners and technical workers, all other	-	-	-	-	66,198	66,198	0.0%	0.0%	0.0%	0.0%	100.0%

HEALTHCARE SUPPORT OCCUPATIONS*

	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
HEALTHCARE SUPPORT OCCUPATIONS	2,556,197	1,331,930	352,119	486,774	69,679	4,796,700	53.3%	27.8%	7.3%	10.1%	1.5%
Home health aides	1,146,408	78,778	7,644	-	-	1,232,829	93.0%	6.4%	0.6%	0.0%	0.0%
Nursing aides, orderlies, and attendants	597,245	782,503	120,673	199,195	-	1,699,615	35.1%	46.0%	7.1%	11.7%	0.0%
Psychiatric aides	44,881	1,606	9,578	10,887	18,043	84,995	52.8%	1.9%	11.3%	12.8%	21.2%
Occupational therapist assistants	4,782	-	-	22,264	7,907	34,953	13.7%	0.0%	0.0%	63.7%	22.6%
Occupational therapist aides	3,571	-	3,375	2,255	2,235	11,436	31.2%	0.0%	29.5%	19.7%	19.5%
Physical therapist assistants	5,912	-	17,142	58,371	1,265	82,689	7.2%	0.0%	20.7%	70.6%	1.5%
Physical therapist aides	38,924	2,578	9,953	6,174	1,508	59,137	65.8%	4.4%	16.8%	10.4%	2.6%
Massage therapists	6,910	38,340	1,137	4,602	16,696	67,685	10.2%	56.6%	1.7%	6.8%	24.7%
Dental assistants	135,334	212,913	11,551	21,425	-	381,223	35.5%	55.9%	3.0%	5.6%	0.0%
Medical assistants	254,220	141,612	85,525	134,795	3,533	619,684	41.0%	22.9%	13.8%	21.8%	0.6%
Medical equipment preparers	44,746	2,755	888	4,263	4,263	56,916	78.6%	4.8%	1.6%	7.5%	7.5%
Medical transcriptionists	35,534	29,871	36,704	1,015	425	103,548	34.3%	28.8%	35.4%	1.0%	0.4%
Pharmacy aides	29,132	5,623	15,833	480	-	51,068	57.0%	11.0%	31.0%	0.9%	0.0%
Veterinary assistants and laboratory animal caretakers	57,570	9,757	8,864	5,809	3,810	85,810	67.1%	11.4%	10.3%	6.8%	4.4%
Healthcare support workers, all other	151,027	25,595	23,254	15,240	9,995	225,112	67.1%	11.4%	10.3%	6.8%	4.4%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

FOOD AND PERSONAL SERVICES OCCUPATIONS*

	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
PROTECTIVE SERVICES OCCUPATIONS	2,375,005	279,949	524,606	329,462	156,592	3,665,613	64.8%	7.6%	14.3%	9.0%	4.3%
First-line supervisors/managers of correctional officers	39,805	4,131	6,510	4,731	423	55,599	71.6%	7.4%	11.7%	8.5%	0.8%
First-line supervisors/managers of police and detectives	35,656	8,875	7,306	28,215	23,871	103,924	34.3%	8.5%	7.0%	27.2%	23.0%
First-line supervisors/managers of fire fighting and prevention workers	16,411	16,532	9,763	21,221	3,628	67,555	24.3%	24.5%	14.5%	31.4%	5.4%
First-line supervisors/managers, protective service workers, all other	49,942	2,848	2,462	75	2,329	57,656	86.6%	4.9%	4.3%	0.1%	4.0%
Fire fighters	102,013	99,893	127,415	7,099	-	336,421	30.3%	29.7%	37.9%	2.1%	0.0%
Fire inspectors and investigators	2,060	4,184	6,001	2,998	2,455	17,698	11.6%	23.6%	33.9%	16.9%	13.9%
Forest fire inspectors and prevention specialists	398	160	160	478	10,819	12,015	3.3%	1.3%	1.3%	4.0%	90.1%
Bailiffs	14,196	815	7,901	500	75	23,487	60.4%	3.5%	33.6%	2.1%	0.3%
Correctional officers and jailers	290,920	76,966	113,801	25,723	-	507,410	57.3%	15.2%	22.4%	5.1%	0.0%
Detectives and criminal investigators	61,051	14,310	21,384	28,646	8,833	134,223	45.5%	10.7%	15.9%	21.3%	6.6%
Fish and game wardens	1,458	971	487	1,458	12,638	17,012	8.6%	5.7%	2.9%	8.6%	74.3%
Parking enforcement workers	6,467	536	1,202	3,798	1,875	13,878	46.6%	3.9%	8.7%	27.4%	13.5%
Police and sheriff's patrol officers	285,008	9,731	149,391	161,110	80,109	685,349	41.6%	1.4%	21.8%	23.5%	11.7%
Transit and railroad police	917	1,349	237	12,881	732	16,115	5.7%	8.4%	1.5%	79.9%	4.5%
Animal control workers	9,173	1,890	8,726	-	-	19,788	46.4%	9.6%	44.1%	0.0%	0.0%
Private detectives and investigators	12,909	13,209	4,595	25,911	1,032	57,657	22.4%	22.9%	8.0%	44.9%	1.8%
Gaming surveillance officers and gaming investigators	27,395	-	1,527	-	-	28,922	94.7%	0.0%	5.3%	0.0%	0.0%
Security guards	1,139,195	21,017	43,614	4,617	6,439	1,214,882	93.8%	1.7%	3.6%	0.4%	0.5%
Crossing guards	67,473	-	2,542	-	-	70,014	96.4%	0.0%	3.6%	0.0%	0.0%
Lifeguards, ski patrol, and other recreational protective service workers	121,352	1,445	5,471	-	761	129,030	94.1%	1.1%	4.2%	0.0%	0.6%
Protective service workers, all other	91,207	1,086	4,112	-	572	96,977	94.1%	1.1%	4.2%	0.0%	0.6%
FOOD PREPARATION AND SERVING RELATED OCCUPATIONS	11,504,218	524,528	665,325	189,280	249,119	13,132,471	87.6%	4.0%	5.1%	1.4%	1.9%
Chefs and head cooks	68,730	411	11,083	31,641	5,530	117,395	58.5%	0.4%	9.4%	27.0%	4.7%
First-line supervisors/managers of food preparation and serving workers	730,021	57,331	71,594	13,144	60,128	932,219	78.3%	6.2%	7.7%	1.4%	6.5%
Cooks, fast food	521,976	63	-	-	111,657	633,697	82.4%	0.0%	0.0%	0.0%	17.6%
Cooks, institution and cafeteria	346,148	40,871	38,277	-	-	425,295	81.4%	9.6%	9.0%	0.0%	0.0%
Cooks, private household	3,056	5,433	339	339	339	9,508	32.1%	57.1%	3.6%	3.6%	3.6%
Cooks, restaurant	816,241	88,447	61,257	58,384	1,847	1,026,175	79.5%	8.6%	6.0%	5.7%	0.2%
Cooks, short order	192,005	115	-	-	-	192,120	99.9%	0.1%	0.0%	0.0%	0.0%
Cooks, all other	21,234	13	-	-	-	21,247	99.9%	0.1%	0.0%	0.0%	0.0%
Food preparation workers	971,338	30,585	2,601	8,635	27,152	1,040,310	93.4%	2.9%	0.3%	0.8%	2.6%
Bartenders	428,057	11,647	72,003	59,495	2,524	573,727	74.6%	2.0%	12.6%	10.4%	0.4%
Combined food preparation and serving workers, including fast food	2,894,323	-	245,340	-	9,763	3,149,426	91.9%	0.0%	7.8%	0.0%	0.3%
Counter attendants, cafeteria, food concession, and coffee shop	592,946	1,310	1,191	-	-	595,447	99.6%	0.2%	0.2%	0.0%	0.0%
Waiters and waitresses	2,319,650	228,016	155,797	-	1,352	2,704,816	85.8%	8.4%	5.8%	0.0%	0.1%
Food servers, nonrestaurant	151,180	58,358	2,309	-	-	211,847	71.4%	27.5%	1.1%	0.0%	0.0%
Dining room and cafeteria attendants and bartender helpers	427,648	-	-	16,127	17,003	460,778	92.8%	0.0%	0.0%	3.5%	3.7%
Dishwashers	567,780	-	-	-	11,823	579,603	98.0%	0.0%	0.0%	0.0%	2.0%
Hosts and hostesses, restaurant, lounge, and coffee shop	390,648	1,666	3,055	1,309	-	396,679	98.5%	0.4%	0.8%	0.3%	0.0%
Food preparation and serving related workers, all other	61,237	261	479	205	-	62,182	98.5%	0.4%	0.8%	0.3%	0.0%
BUILDING AND GROUNDS CLEANING AND MAINTENANCE OCCUPATIONS	4,964,471	517,448	148,025	86,777	316,634	6,033,354	82.3%	8.6%	2.5%	1.4%	5.2%
First-line supervisors/managers of housekeeping and janitorial workers	141,607	79,630	215	2,180	45,453	269,085	52.6%	29.6%	0.1%	0.8%	16.9%
First-line supervisors/managers of landscaping, lawn service, and groundskeeping workers	77,201	4,245	10,837	45,416	1,969	139,668	55.3%	3.0%	7.8%	32.5%	1.4%
Janitors and cleaners, except maids and housekeeping cleaners	2,211,194	22,990	76,137	-	161,668	2,471,989	89.5%	0.9%	3.1%	0.0%	6.5%
Maids and housekeeping cleaners	1,310,659	200,072	46,047	-	47,491	1,604,269	81.7%	12.5%	2.9%	0.0%	3.0%
Building cleaning workers, all other	150,290	22,942	5,280	-	5,446	183,958	81.7%	12.5%	2.9%	0.0%	3.0%
Pest control workers	76,336	4,146	276	406	122	81,286	93.9%	5.1%	0.3%	0.5%	0.2%
Landscaping and groundskeeping workers	881,998	176,919	2,482	17,263	49,646	1,128,308	78.2%	15.7%	0.2%	1.5%	4.4%
Pesticide handlers, sprayers, and applicators, vegetation	26,268	5,004	3,700	14,522	3,978	53,472	49.1%	9.4%	6.9%	27.2%	7.4%
Tree trimmers and pruners	50,010	843	1,715	3,932	484	56,985	87.8%	1.5%	3.0%	6.9%	0.8%
Grounds maintenance workers, all other	38,907	656	1,334	3,059	377	44,333	87.8%	1.5%	3.0%	6.9%	0.8%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

HIGH SCHOOL OR LESS (HSL) | POSTSECONDARY CERTIFICATE (PSC) | SOME COLLEGE (SC) | ASSOCIATE (A) | BACHELOR'S DEGREE OR BETTER (BA+)

	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
PERSONAL CARE AND SERVICE OCCUPATIONS	3,100,494	633,209	389,940	266,985	602,487	4,993,115	62.1%	12.7%	7.8%	5.3%	12.1%
Gaming supervisors	29,003	2,367	6,353	138	2,806	40,668	71.3%	5.8%	15.6%	0.3%	6.9%
Slot key persons	18,772	97	2,106	70	982	22,027	85.2%	0.4%	9.6%	0.3%	4.5%
First-line supervisors/managers of personal service workers	58,450	14,621	17,089	14,090	67,175	171,425	34.1%	8.5%	10.0%	8.2%	39.2%
Animal trainers	19,778	4,643	4,050	307	1,607	30,386	65.1%	15.3%	13.3%	1.0%	5.3%
Nonfarm animal caretakers	170,922	6,990	1,779	-	-	179,691	95.1%	3.9%	1.0%	0.0%	0.0%
Gaming dealers	93,530	8,052	5,336	-	-	106,917	87.5%	7.5%	5.0%	0.0%	0.0%
Gaming and sports book writers and runners	20,142	2,816	-	-	2,281	25,240	79.8%	11.2%	0.0%	0.0%	9.0%
Gaming service workers, all other	17,010	2,379	-	-	1,927	21,315	79.8%	11.2%	0.0%	0.0%	9.0%
Motion picture projectionists	10,251	-	-	-	342	10,593	96.8%	0.0%	0.0%	0.0%	3.2%
Ushers, lobby attendants, and ticket takers	85,327	491	24,751	3,634	80	114,284	74.7%	0.4%	21.7%	3.2%	0.1%
Amusement and recreation attendants	276,402	678	-	-	5,395	282,475	97.9%	0.2%	0.0%	0.0%	1.9%
Costume attendants	6,347	541	30	190	2,009	9,116	69.6%	5.9%	0.3%	2.1%	22.0%
Locker room, coatroom, and dressing room attendants	22,736	-	-	46	-	22,782	99.8%	0.0%	0.0%	0.2%	0.0%
Entertainment attendants and related workers, all other	48,428	-	-	97	-	48,525	99.8%	0.0%	0.0%	0.2%	0.0%
Embalmers	0	1	1	5	3	9	2.7%	6.7%	6.1%	55.1%	29.5%
Funeral attendants	24,888	2,731	3,625	5,112	1,373	37,729	66.0%	7.2%	9.6%	13.5%	3.6%
Barbers	4,330	8,795	2,863	-	-	15,988	27.1%	55.0%	17.9%	0.0%	0.0%
Hairdressers, hairstylists, and cosmetologists	25,555	312,872	86,786	-	-	425,214	6.0%	73.6%	20.4%	0.0%	0.0%
Makeup artists, theatrical and performance	4,056	2,950	737	-	369	8,113	50.0%	36.4%	9.1%	0.0%	4.6%
Manicurists and pedicurists	39,987	30,039	35	-	-	70,062	57.1%	42.9%	0.0%	0.0%	0.0%
Shampooers	7,027	15,117	235	-	-	22,378	31.4%	67.6%	1.1%	0.0%	0.0%
Skin care specialists	8,063	29,638	-	2,313	-	40,013	20.2%	74.1%	0.0%	5.8%	0.0%
Baggage porters and bellhops	48,380	-	2,466	-	204	51,050	94.8%	0.0%	4.8%	0.0%	0.4%
Concierges	18,557	777	1,312	980	845	22,471	82.6%	3.5%	5.8%	4.4%	3.8%
Tour guides and escorts	16,276	2,020	13,914	12	7,530	39,752	40.9%	5.1%	35.0%	0.0%	18.9%
Travel guides	2,990	-	3,657	1,040	1,375	9,062	33.0%	0.0%	40.4%	11.5%	15.2%
Flight attendants	50,758	2,737	22,742	11,329	17,720	105,285	48.2%	2.6%	21.6%	10.8%	16.8%
Transportation attendants, except flight attendants and baggage porters	19,994	3,120	2,822	217	934	27,087	73.8%	11.5%	10.4%	0.8%	3.4%
Child care workers	774,132	20,786	120,658	129,883	184,493	1,229,952	62.9%	1.7%	9.8%	10.6%	15.0%
Personal and home care aides	906,953	125,166	-	25,922	-	1,058,041	85.7%	11.8%	0.0%	2.5%	0.0%
Fitness trainers and aerobics instructors	167,635	32,585	17,343	2,044	64,261	283,867	59.1%	11.5%	6.1%	0.7%	22.6%
Recreation workers	102,886	200	10,890	59,293	160,809	334,078	30.8%	0.1%	3.3%	17.7%	48.1%
Residential advisors	457	-	18,836	5,041	38,285	62,619	0.7%	0.0%	30.1%	8.1%	61.1%
Personal care and service workers, all other	474	-	19,522	5,225	39,681	64,902	0.7%	0.0%	30.1%	8.1%	61.1%

SALES AND OFFICE SUPPORT OCCUPATIONS*

	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
SALES AND RELATED OCCUPATIONS	12,157,382	1,085,343	1,666,034	593,524	2,514,678	18,016,960	67.5%	6.0%	9.2%	3.3%	14.0%
First-line supervisors/managers of retail sales workers	1,426,878	15,624	25,122	23,437	40,899	1,531,960	93.1%	1.0%	1.6%	1.5%	2.7%
First-line supervisors/managers of non-retail sales workers	113,113	8,512	26,907	5,675	318,675	472,882	23.9%	1.8%	5.7%	1.2%	67.4%
Cashiers, except gaming	3,589,662	13,394	17,014	-	-	3,620,071	99.2%	0.4%	0.5%	0.0%	0.0%
Gaming change persons and booth cashiers	36,632	-	2,804	-	-	39,435	92.9%	0.0%	7.1%	0.0%	0.0%
Counter and rental clerks	539,660	-	-	-	-	539,660	100.0%	0.0%	0.0%	0.0%	0.0%
Parts salespersons	159,633	22,937	25,896	1,385	-	209,851	76.1%	10.9%	12.3%	0.7%	0.0%
Retail salespersons	3,782,830	205,611	426,242	-	764,438	5,179,121	73.0%	4.0%	8.2%	0.0%	14.8%
Advertising sales agents	102,045	24,121	31,703	27,963	16,357	202,189	50.5%	11.9%	15.7%	13.8%	8.1%
Insurance sales agents	166,565	80,188	115,405	79,484	27,339	468,980	35.5%	17.1%	24.6%	16.9%	5.8%
Securities, commodities, and financial services sales agents	2,191	-	21,304	-	382,260	405,756	0.5%	0.0%	5.3%	0.0%	94.2%
Travel agents	46,508	42,420	3,165	-	2,100	94,193	49.4%	45.0%	3.4%	0.0%	2.2%
Sales representatives, services, all other	372,327	339,603	25,335	-	16,814	754,079	49.4%	45.0%	3.4%	0.0%	2.2%
Sales representatives, wholesale and manufacturing, technical and scientific products	49,960	3,814	64,604	101,662	250,834	470,874	10.6%	0.8%	13.7%	21.6%	53.3%
Sales representatives, wholesale and manufacturing, except technical and scientific products	462,806	-	524,611	239,682	412,312	1,639,411	28.2%	0.0%	32.0%	14.6%	25.2%
Demonstrators and product promoters	84,994	514	21,449	-	4,701	111,658	76.1%	0.5%	19.2%	0.0%	4.2%
Models	15,523	140	-	1,155	-	16,818	92.3%	0.8%	0.0%	6.9%	0.0%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

HIGH SCHOOL OR LESS (HSL) | POSTSECONDARY CERTIFICATE (PSC) | SOME COLLEGE (SC) | ASSOCIATE (A) | BACHELOR'S DEGREE OR BETTER (BA+)

SALES AND RELATED OCCUPATIONS, cont.	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
Real estate brokers	107,832	25,159	253,213	36,862	202,771	625,836	17.2%	4.0%	40.5%	5.9%	32.4%
Real estate sales agents	342,223	303,306	34,222	56,860	20,518	757,130	45.2%	40.1%	4.5%	7.5%	2.7%
Sales engineers	-	-	13,226	19,359	54,658	87,243	0.0%	0.0%	15.2%	22.2%	62.7%
Telemarketers	271,083	-	33,813	-	-	304,896	88.9%	0.0%	11.1%	0.0%	0.0%
Door-to-door sales workers, news and street vendors, and related workers	270,234	-	-	-	-	270,234	100.0%	0.0%	0.0%	0.0%	0.0%
Sales and related workers, all other	214,684	-	-	-	-	214,684	100.0%	0.0%	0.0%	0.0%	0.0%
OFFICE AND ADMINISTRATIVE SUPPORT OCCUPATIONS	12,891,008	1,979,010	4,930,724	3,345,135	2,114,493	25,260,369	51.0%	7.8%	19.5%	13.2%	8.4%
First-line supervisors/managers of office and administrative support workers	415,698	65,181	237,456	178,540	594,834	1,491,709	27.9%	4.4%	15.9%	12.0%	39.9%
Switchboard operators, including answering service	93,598	7,453	23,577	7,722	9,337	141,687	66.1%	5.3%	16.6%	5.5%	6.6%
Telephone operators	16,020	124	-	-	-	16,144	99.2%	0.8%	0.0%	0.0%	0.0%
Communications equipment operators, all other	8,750	68	-	-	-	8,818	99.2%	0.8%	0.0%	0.0%	0.0%
Bill and account collectors	152,738	66,658	140,505	139,007	449	499,357	30.6%	13.3%	28.1%	27.8%	0.1%
Billing and posting clerks and machine operators	160,694	-	207,548	171,544	-	539,786	29.8%	0.0%	38.5%	31.8%	0.0%
Bookkeeping, accounting, and auditing clerks	471,912	126,252	727,486	472,351	394,101	2,192,102	21.5%	5.8%	33.2%	21.5%	18.0%
Gaming cage workers	21,401	1,603	785	-	-	23,790	90.0%	6.7%	3.3%	0.0%	0.0%
Payroll and timekeeping clerks	86,312	34,635	58,351	7,674	17,103	204,076	42.3%	17.0%	28.6%	3.8%	8.4%
Procurement clerks	25,830	21,217	8,758	12,271	9,984	78,061	33.1%	27.2%	11.2%	15.7%	12.8%
Tellers	462,084	-	230,488	-	-	692,572	66.7%	0.0%	33.3%	0.0%	0.0%
Brokerage clerks	16,478	-	22,880	10,120	23,856	73,334	22.5%	0.0%	31.2%	13.8%	32.5%
Correspondence clerks	18,618	-	307	1,378	297	20,600	90.4%	0.0%	1.5%	6.7%	1.4%
Court, municipal, and license clerks	113,723	1,765	1,507	784	4,768	122,547	92.8%	1.4%	1.2%	0.6%	3.9%
Credit authorizers, checkers, and clerks	15,017	963	1,297	12,751	25,652	55,681	27.0%	1.7%	2.3%	22.9%	46.1%
Customer service representatives	1,582,864	230,464	284,385	348,159	290,954	2,736,825	57.8%	8.4%	10.4%	12.7%	10.6%
Eligibility interviewers, government programs	59,546	15,812	1,495	25,123	11,293	113,270	52.6%	14.0%	1.3%	22.2%	10.0%
File clerks	57,312	10,193	3,807	46,931	-	118,243	48.5%	8.6%	3.2%	39.7%	0.0%
Hotel, motel, and resort desk clerks	197,480	-	47,269	3,148	-	247,897	79.7%	0.0%	19.1%	1.3%	0.0%
Interviewers, except eligibility and loan	59,484	52,464	74,328	18,769	71,398	276,442	21.5%	19.0%	26.9%	6.8%	25.8%
Library assistants, clerical	67,085	12,845	15,755	6,823	24,560	127,068	52.8%	10.1%	12.4%	5.4%	19.3%
Loan interviewers and clerks	58,398	28,626	30,354	82,694	8,140	208,213	28.0%	13.7%	14.6%	39.7%	3.9%
New accounts clerks	51,848	-	17,941	1,704	100	71,594	72.4%	0.0%	25.1%	2.4%	0.1%
Order clerks	168,741	112	17,390	729	-	186,972	90.2%	0.1%	9.3%	0.4%	0.0%
Human resources assistants, except payroll and timekeeping	60,254	3,593	42,878	20,674	56,882	184,282	32.7%	1.9%	23.3%	11.2%	30.9%
Receptionists and information clerks	895,365	55,464	64,057	276,929	10,286	1,302,100	68.8%	4.3%	4.9%	21.3%	0.8%
Reservation and transportation ticket agents and travel clerks	148,746	2,063	11,234	8,421	-	170,463	87.3%	1.2%	6.6%	4.9%	0.0%
Information and record clerks, all other	173,743	2,409	13,121	9,836	-	199,110	87.3%	1.2%	6.6%	4.9%	0.0%
Cargo and freight agents	53,654	-	2,831	2,221	33,826	92,532	58.0%	0.0%	3.1%	2.4%	36.6%
Couriers and messengers	136,400	-	16,609	433	1,347	154,789	88.1%	0.0%	10.7%	0.3%	0.9%
Police, fire, and ambulance dispatchers	83,533	7,895	13,111	1,548	3,712	109,800	76.1%	7.2%	11.9%	1.4%	3.4%
Dispatchers, except police, fire, and ambulance	144,006	186	40,252	597	1,398	186,440	77.2%	0.1%	21.6%	0.3%	0.8%
Meter readers, utilities	44,732	176	294	-	-	45,202	99.0%	0.4%	0.6%	0.0%	0.0%
Postal service clerks	66,768	3,106	2,648	3,793	-	76,316	87.5%	4.1%	3.5%	5.0%	0.0%
Postal service mail carriers	305,352	-	27,348	-	-	332,700	91.8%	0.0%	8.2%	0.0%	0.0%
Postal service mail sorters, processors, and processing machine operators	164,572	7,414	1,434	-	1,434	174,853	94.1%	4.2%	0.8%	0.0%	0.8%
Production, planning, and expediting clerks	131,135	23,276	31,085	61,246	51,292	298,033	44.0%	7.8%	10.4%	20.6%	17.2%
Shipping, receiving, and traffic clerks	433,240	99,805	105,566	139,898	-	778,509	55.7%	12.8%	13.6%	18.0%	0.0%
Stock clerks and order fillers	1,346,275	-	178,319	183,443	-	1,708,037	78.8%	0.0%	10.4%	10.7%	0.0%
Weighers, measurers, checkers, and samplers, recordkeeping	41,110	4,316	15,679	6,332	-	67,438	61.0%	6.4%	23.3%	9.4%	0.0%
Executive secretaries and administrative assistants	794,870	103,144	418,099	292,687	172,620	1,781,420	44.6%	5.8%	23.5%	16.4%	9.7%
Legal secretaries	49,613	22,082	94,610	154,190	-	320,494	15.5%	6.9%	29.5%	48.1%	0.0%
Medical secretaries	287,915	110,377	91,695	46,867	-	536,855	53.6%	20.6%	17.1%	8.7%	0.0%
Secretaries, except legal, medical, and executive	750,382	307,990	681,855	81,588	71,176	1,892,991	39.6%	16.3%	36.0%	4.3%	3.8%
Computer operators	13,242	312	25,843	16,086	28,915	84,399	15.7%	0.4%	30.6%	19.1%	34.3%
Data entry keyers	206,447	25,985	24,524	6,961	1,780	265,697	77.7%	9.8%	9.2%	2.6%	0.7%
Word processors and typists	94,598	1,305	21,473	17,168	-	134,544	70.3%	1.0%	16.0%	12.8%	0.0%
Desktop publishers	21,297	6,919	11,022	-	1,996	41,233	51.7%	16.8%	26.7%	0.0%	4.8%
Insurance claims and policy processing clerks	120,488	14,068	72,252	11,884	6,370	225,062	53.5%	6.3%	32.1%	5.3%	2.8%
Mail clerks and mail machine operators, except postal service	112,302	1,344	8,515	-	-	122,161	91.9%	1.1%	7.0%	0.0%	0.0%
Office clerks, general	1,749,562	477,214	712,635	413,832	-	3,353,243	52.2%	14.2%	21.3%	12.3%	0.0%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

HIGH SCHOOL OR LESS (HSL) | POSTSECONDARY CERTIFICATE (PSC) | SOME COLLEGE (SC) | ASSOCIATE (A) | BACHELOR'S DEGREE OR BETTER (BA+)

OFFICE AND ADMINISTRATIVE SUPPORT OCCUPATIONS, cont.	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
Office machine operators, except computer	72,881	-	6,108	6,794	-	85,783	85.0%	0.0%	7.1%	7.9%	0.0%
Proofreaders and copy markers	1,036	420	954	33	17,946	20,389	5.1%	2.1%	4.7%	0.2%	88.0%
Statistical assistants	541	2,006	3,789	3,092	15,406	24,835	2.2%	8.1%	15.3%	12.4%	62.0%
Office and administrative support workers, all other	5,316	19,703	37,211	30,359	151,282	243,871	2.2%	8.1%	15.3%	12.4%	62.0%

BLUE COLLAR OCCUPATIONS*

	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
FARMING, FISHING, AND FORESTRY OCCUPATIONS	816,510	21,636	46,997	8,014	114,542	1,007,699	81.0%	2.1%	4.7%	0.8%	11.4%
Supervisors, farming, fishing, and forestry workers	27,729	1,290	1,632	1,454	11,338	43,443	63.8%	3.0%	3.8%	3.3%	26.1%
Agricultural inspectors	6,695	-	2,008	2,008	6,025	16,736	40.0%	0.0%	12.0%	12.0%	36.0%
Animal breeders	2,601	287	1,323	-	1,243	5,453	47.7%	5.3%	24.3%	0.0%	22.8%
Graders and sorters, agricultural products	46,066	85	894	-	-	47,045	97.9%	0.2%	1.9%	0.0%	0.0%
Agricultural equipment operators	57,617	3,620	-	-	738	61,974	93.0%	5.8%	0.0%	0.0%	1.2%
Farmworkers and laborers, crop, nursery, and greenhouse	502,279	7,560	34,649	-	85,425	629,912	79.7%	1.2%	5.5%	0.0%	13.6%
Farmworkers, farm and ranch animals	92,131	3,327	-	-	431	95,889	96.1%	3.5%	0.0%	0.0%	0.4%
Agricultural workers, all other	18,349	663	-	-	86	19,097	96.1%	3.5%	0.0%	0.0%	0.4%
Fishers and related fishing workers	16,192	2,170	1,333	85	1,963	21,743	74.5%	10.0%	6.1%	0.4%	9.0%
Forest and conservation workers	4,224	235	-	3,173	6,958	14,589	29.0%	1.6%	0.0%	21.8%	47.7%
Fallers	8,519	-	-	-	-	8,519	100.0%	0.0%	0.0%	0.0%	0.0%
Logging equipment operators	26,292	-	2,892	-	-	29,184	90.1%	0.0%	9.9%	0.0%	0.0%
Log graders and scalers	3,484	1,070	1,010	577	150	6,291	55.4%	17.0%	16.1%	9.2%	2.4%
Logging workers, all other	4,332	1,331	1,256	717	186	7,823	55.4%	17.0%	16.1%	9.2%	2.4%
CONSTRUCTION AND EXTRACTION OCCUPATIONS	4,715,872	1,808,350	271,295	282,127	476,301	7,553,947	62.4%	23.9%	3.6%	3.7%	6.3%
First-line supervisors/managers of construction trades and extraction workers	438,237	71,564	59,900	83,443	66,812	719,955	60.9%	9.9%	8.3%	11.6%	9.3%
Boilermakers	14,522	6,121	-	1,360	-	22,004	66.0%	27.8%	0.0%	6.2%	0.0%
Brickmasons and blockmasons	103,670	13,923	-	-	-	117,593	88.2%	11.8%	0.0%	0.0%	0.0%
Stonemasons	19,895	8,337	-	-	-	28,232	70.5%	29.5%	0.0%	0.0%	0.0%
Carpenters	599,098	501,674	19,037	-	-	1,119,809	53.5%	44.8%	1.7%	0.0%	0.0%
Carpet installers	38,520	19	-	-	-	38,540	100.0%	0.1%	0.0%	0.0%	0.0%
Floor layers, except carpet, wood, and hard tiles	18,046	834	66	-	-	18,946	95.2%	4.4%	0.4%	0.0%	0.0%
Floor sanders and finishers	15,144	123	-	49	-	15,316	98.9%	0.8%	0.0%	0.3%	0.0%
Tile and marble setters	41,251	5,530	972	15,801	-	63,554	64.9%	8.7%	1.5%	24.9%	0.0%
Cement masons and concrete finishers	99,102	110,682	-	-	-	209,784	47.2%	52.8%	0.0%	0.0%	0.0%
Terrazzo workers and finishers	8,037	324	355	-	-	8,716	92.2%	3.7%	4.1%	0.0%	0.0%
Construction laborers	724,280	138,127	60,563	-	257,601	1,180,571	61.4%	11.7%	5.1%	0.0%	21.8%
Paving, surfacing, and tamping equipment operators	55,802	9,709	-	-	-	65,511	85.2%	14.8%	0.0%	0.0%	0.0%
Pile-driver operators	8,145	2,176	2,312	-	-	12,632	64.5%	17.2%	18.3%	0.0%	0.0%
Operating engineers and other construction equipment operators	227,919	209,126	-	-	-	437,045	52.2%	47.9%	0.0%	0.0%	0.0%
Drywall and ceiling tile installers	110,125	27,328	83	-	-	137,535	80.1%	19.9%	0.1%	0.0%	0.0%
Tapers	41,765	1,736	-	-	-	43,501	96.0%	4.0%	0.0%	0.0%	0.0%
Electricians	190,282	317,093	55,930	103,050	1,135	667,490	28.5%	47.5%	8.4%	15.4%	0.2%
Glaziers	47,660	801	-	-	6,396	54,858	86.9%	1.5%	0.0%	0.0%	11.7%
Insulation workers, floor, ceiling, and wall	30,303	427	217	-	-	30,947	97.9%	1.4%	0.7%	0.0%	0.0%
Insulation workers, mechanical	24,119	7,100	239	-	-	31,459	76.7%	22.6%	0.8%	0.0%	0.0%
Painters, construction and maintenance	210,420	12,414	-	53,214	53,214	329,262	63.9%	3.8%	0.0%	16.2%	16.2%
Paperhangers	6,898	297	1,632	-	-	8,827	78.2%	3.4%	18.5%	0.0%	0.0%
Pipelayers	71,697	1,362	1,572	594	-	75,225	95.3%	1.8%	2.1%	0.8%	0.0%
Plumbers, pipefitters, and steamfitters	357,727	98,326	13,282	-	-	469,335	76.2%	21.0%	2.8%	0.0%	0.0%
Plasterers and stucco masons	46,475	408	-	-	-	46,883	99.1%	0.9%	0.0%	0.0%	0.0%
Reinforcing iron and rebar workers	27,765	2,636	-	-	-	30,401	91.3%	8.7%	0.0%	0.0%	0.0%
Roofers	120,442	19,296	-	-	-	139,738	86.2%	13.8%	0.0%	0.0%	0.0%
Sheet metal workers	104,515	63,022	403	-	-	167,940	62.2%	37.5%	0.2%	0.0%	0.0%
Structural iron and steel workers	47,116	9,209	11,629	-	825	68,779	68.5%	13.4%	16.9%	0.0%	1.2%
Helpers, brickmasons, blockmasons, stonemasons, and tile and marble setters	42,042	10,673	-	-	3,877	56,592	74.3%	18.9%	0.0%	0.0%	6.9%
Helpers, carpenters	84,730	1,059	-	5,515	-	91,304	92.8%	1.2%	0.0%	6.0%	0.0%
Helpers, electricians	77,277	19,977	2,432	-	-	99,686	77.5%	20.0%	2.4%	0.0%	0.0%
Helpers, painters, paperhangers, plasterers, and stucco masons	19,366	755	100	287	-	20,508	94.4%	3.7%	0.5%	1.4%	0.0%
Helpers, pipelayers, plumbers, pipefitters, and steamfitters	47,221	41,001	-	-	-	88,221	53.5%	46.5%	0.0%	0.0%	0.0%
Helpers, roofers	16,208	-	1,685	-	3,411	21,305	76.1%	0.0%	7.9%	0.0%	16.0%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

CONSTRUCTION AND EXTRACTION OCCUPATIONS, cont.	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
Helpers, construction trades, all other	25,964	-	2,700	-	5,464	34,128	76.1%	0.0%	7.9%	0.0%	16.0%
Construction and building inspectors	19,617	23,533	3,928	11,772	62,778	121,627	16.1%	19.3%	3.2%	9.7%	51.6%
Elevator installers and repairers	10,117	8,982	1,131	2,032	2,975	25,236	40.1%	35.6%	4.5%	8.1%	11.8%
Fence erectors	26,405	-	786	-	1,810	29,001	91.0%	0.0%	2.7%	0.0%	6.2%
Hazardous materials removal workers	30,999	11,246	678	-	-	42,922	72.2%	26.2%	1.6%	0.0%	0.0%
Highway maintenance workers	144,249	193	2,344	1,588	-	148,373	97.2%	0.1%	1.6%	1.1%	0.0%
Rail-track laying and maintenance equipment operators	12,235	1,386	1,937	-	-	15,558	78.6%	8.9%	12.5%	0.0%	0.0%
Septic tank servicers and sewer pipe cleaners	22,991	4,431	358	-	-	27,780	82.8%	16.0%	1.3%	0.0%	0.0%
Segmental pavers	2,207	1,041	95	27	-	3,370	65.5%	30.9%	2.8%	0.8%	0.0%
Construction and related workers, all other	35,688	16,836	1,542	436	-	54,502	65.5%	30.9%	2.8%	0.8%	0.0%
Derrick operators, oil and gas	26,860	1,451	-	1,057	-	29,369	91.5%	4.9%	0.0%	3.6%	0.0%
Rotary drill operators, oil and gas	20,157	3,058	7,460	-	3,001	33,677	59.9%	9.1%	22.2%	0.0%	8.9%
Service unit operators, oil, gas, and mining	34,278	3,414	7,081	-	211	44,984	76.2%	7.6%	15.7%	0.0%	0.5%
Earth drillers, except oil and gas	17,949	3,526	1,650	1,026	-	24,151	74.3%	14.6%	6.8%	4.3%	0.0%
Explosives workers, ordnance handling experts, and blasters	5,068	1,583	633	317	-	7,602	66.7%	20.8%	8.3%	4.2%	0.0%
Continuous mining machine operators	11,841	447	-	-	-	12,288	96.4%	3.6%	0.0%	0.0%	0.0%
Mine cutting and channeling machine operators	8,815	531	706	-	-	10,051	87.7%	5.3%	7.0%	0.0%	0.0%
Mining machine operators, all other	5,121	308	410	-	-	5,839	87.7%	5.3%	7.0%	0.0%	0.0%
Rock splitters, quarry	6,435	-	-	-	1,508	7,943	81.0%	0.0%	0.0%	0.0%	19.0%
Roof bolters, mining	6,830	429	-	559	-	7,818	87.4%	5.5%	0.0%	7.1%	0.0%
Roustabouts, oil and gas	68,533	12,047	-	-	-	80,579	85.1%	15.0%	0.0%	0.0%	0.0%
Helpers, extraction workers	26,689	512	3,856	-	3,741	34,798	76.7%	1.5%	11.1%	0.0%	10.8%
Extraction workers, all other	11,001	211	1,589	-	1,542	14,344	76.7%	1.5%	11.1%	0.0%	10.8%
INSTALLATION, MAINTENANCE, AND REPAIR WORKERS	2,450,513	2,157,971	635,628	481,227	148,302	5,873,641	41.7%	36.7%	10.8%	8.2%	2.5%
First-line supervisors/managers of mechanics, installers, and repairers	198,760	147,156	43,245	43,856	36,531	469,548	42.3%	31.3%	9.2%	9.3%	7.8%
Computer, automated teller, and office machine repairers	18,774	20,777	51,434	41,597	12,507	145,088	12.9%	14.3%	35.5%	28.7%	8.6%
Radio mechanics	896	2,299	916	2,591	1,103	7,805	11.5%	29.5%	11.7%	33.2%	14.1%
Telecommunications equipment installers and repairers, except line installers	29,730	101,485	25,346	42,702	-	199,264	14.9%	50.9%	12.7%	21.4%	0.0%
Avionics technicians	3,172	2,190	1,322	12,410	236	19,329	16.4%	11.3%	6.8%	64.2%	1.2%
Electric motor, power tool, and related repairers	11,975	8,779	136	1,336	-	22,225	53.9%	39.5%	0.6%	6.0%	0.0%
Electrical and electronics installers and repairers, transportation equipment	6,036	8,237	2,475	1,873	-	18,621	32.4%	44.2%	13.3%	10.1%	0.0%
Electrical and electronics repairers, commercial and industrial equipment	31,338	28,006	16,788	9,952	-	86,085	36.4%	32.5%	19.5%	11.6%	0.0%
Electrical and electronics repairers, powerhouse, substation, and relay	2,687	9,473	3,431	8,602	122	24,314	11.1%	39.0%	14.1%	35.4%	0.5%
Electronic equipment installers and repairers, motor vehicles	5,856	12,364	899	847	1,862	21,827	26.8%	56.6%	4.1%	3.9%	8.5%
Electronic home entertainment equipment installers and repairers	7,179	27,751	960	3,484	5,696	45,069	15.9%	61.6%	2.1%	7.7%	12.6%
Security and fire alarm systems installers	38,394	27,809	3,833	4,981	-	75,017	51.2%	37.1%	5.1%	6.6%	0.0%
Aircraft mechanics and service technicians	17,342	72,952	6,503	35,372	-	132,170	13.1%	55.2%	4.9%	26.8%	0.0%
Automotive body and related repairers	106,916	50,221	7,330	231	-	164,698	64.9%	30.5%	4.5%	0.1%	0.0%
Automotive glass installers and repairers	14,570	6,292	-	-	-	20,862	69.8%	30.2%	0.0%	0.0%	0.0%
Automotive service technicians and mechanics	383,223	357,863	4,624	224	-	745,934	51.4%	48.0%	0.6%	0.0%	0.0%
Bus and truck mechanics and diesel engine specialists	52,877	222,143	-	1,967	-	276,986	19.1%	80.2%	0.0%	0.7%	0.0%
Farm equipment mechanics	18,312	5,849	6,113	1,827	-	32,101	57.0%	18.2%	19.0%	5.7%	0.0%
Mobile heavy equipment mechanics, except engines	42,821	94,785	4,065	2,995	-	144,665	29.6%	65.5%	2.8%	2.1%	0.0%
Rail car repairers	23,073	407	-	-	1,035	24,515	94.1%	1.7%	0.0%	0.0%	4.2%
Motorboat mechanics	9,847	17,682	64	251	-	27,844	35.4%	63.5%	0.2%	0.9%	0.0%
Motorcycle mechanics	10,106	6,085	6,089	-	803	23,083	43.8%	26.4%	26.4%	0.0%	3.5%
Outdoor power equipment and other small engine mechanics	21,437	7,152	3,271	26	-	31,886	67.2%	22.4%	10.3%	0.1%	0.0%
Bicycle repairers	11,812	99	140	-	-	12,050	98.0%	0.8%	1.2%	0.0%	0.0%
Recreational vehicle service technicians	9,856	6,823	-	759	-	17,438	56.5%	39.1%	0.0%	4.4%	0.0%
Tire repairers and changers	73,988	-	43,584	-	-	117,571	62.9%	0.0%	37.1%	0.0%	0.0%
Mechanical door repairers	19,153	424	1,314	-	-	20,891	91.7%	2.0%	6.3%	0.0%	0.0%
Control and valve installers and repairers, except mechanical door	22,342	19,241	2,474	2,527	1,278	47,862	46.7%	40.2%	5.2%	5.3%	2.7%
Heating, air conditioning, and refrigeration mechanics and installers	100,181	90,407	16,271	39,591	43,623	290,072	34.5%	31.2%	5.6%	13.6%	15.0%
Home appliance repairers	21,675	8,210	268	22,406	-	52,559	41.2%	15.6%	0.5%	42.6%	0.0%

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HIGH SCHOOL OR LESS (HSL) | POSTSECONDARY CERTIFICATE (PSC) | SOME COLLEGE (SC) | ASSOCIATE (A) | BACHELOR'S DEGREE OR BETTER (BA+)

INSTALLATION, MAINTENANCE, AND REPAIR WORKERS, cont.	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
Industrial machinery mechanics	127,175	112,361	36,270	5,938	24,302	306,046	41.6%	36.7%	11.9%	1.9%	7.9%
Maintenance and repair workers, general	545,670	462,111	310,053	122,226	8,110	1,448,170	37.7%	31.9%	21.4%	8.4%	0.6%
Maintenance workers, machinery	52,176	20,655	5,425	462	2,243	80,960	64.4%	25.5%	6.7%	0.6%	2.8%
Millwrights	33,818	17,226	547	-	-	51,591	65.6%	33.4%	1.1%	0.0%	0.0%
Refractory materials repairers, except brickmasons	4,883	1,115	457	-	-	6,455	75.7%	17.3%	7.1%	0.0%	0.0%
Electrical power-line installers and repairers	70,454	37,273	-	12,352	1,029	121,108	58.2%	30.8%	0.0%	10.2%	0.8%
Telecommunications line installers and repairers	112,046	18,089	16,215	19,116	332	165,798	67.6%	10.9%	9.8%	11.5%	0.2%
Camera and photographic equipment repairers	2,079	2,003	317	3,100	464	7,964	26.1%	25.2%	4.0%	38.9%	5.8%
Medical equipment repairers	7,933	19,071	884	16,156	594	44,638	17.8%	42.7%	2.0%	36.2%	1.3%
Musical instrument repairers and tuners	4,084	4,083	942	314	-	9,424	43.3%	43.3%	10.0%	3.3%	0.0%
Watch repairers	4,866	1,116	547	-	248	6,778	71.8%	16.5%	8.1%	0.0%	3.7%
Coin, vending, and amusement machine servicers and repairers	40,399	5,145	722	-	-	46,265	87.3%	11.1%	1.6%	0.0%	0.0%
Commercial divers	252	10,426	2,496	-	-	13,174	1.9%	79.1%	19.0%	0.0%	0.0%
Fabric menders, except garment	5,889	1,458	1,041	-	2,826	11,214	52.5%	13.0%	9.3%	0.0%	25.2%
Locksmiths and safe repairers	26,107	2,513	521	-	3,238	32,379	80.6%	7.8%	1.6%	0.0%	10.0%
Manufactured building and mobile home installers	10,689	134	-	-	-	10,823	98.8%	1.2%	0.0%	0.0%	0.0%
Riggers	12,010	1,278	442	-	45	13,776	87.2%	9.3%	3.2%	0.0%	0.3%
Signal and track switch repairers	1,917	4,721	1,602	6,638	76	14,955	12.8%	31.6%	10.7%	44.4%	0.5%
Helpers--Installation, maintenance, and repair workers	73,740	74,234	4,250	12,521	-	164,746	44.8%	45.1%	2.6%	7.6%	0.0%
PRODUCTION OCCUPATIONS	7,107,836	1,310,776	562,029	356,546	193,764	9,530,952	74.6%	13.8%	5.9%	3.7%	2.0%
First-line supervisors/managers of production and operating workers	192,583	135,117	112,105	118,220	99,415	657,440	29.3%	20.6%	17.1%	18.0%	15.1%
Aircraft structure, surfaces, rigging, and systems assemblers	24,154	12,260	1,595	412	100	38,522	62.7%	31.8%	4.1%	1.1%	0.3%
Coil winders, tapers, and finishers	17,920	522	-	-	-	18,442	97.2%	2.8%	0.0%	0.0%	0.0%
Electrical and electronic equipment assemblers	104,886	48,238	7,350	-	-	160,474	65.4%	30.1%	4.6%	0.0%	0.0%
Electromechanical equipment assemblers	40,226	14,933	-	163	7,423	62,746	64.1%	23.8%	0.0%	0.3%	11.8%
Engine and other machine assemblers	27,662	10,040	35	912	-	38,649	71.6%	26.0%	0.1%	2.4%	0.0%
Structural metal fabricators and fitters	88,213	18,938	3,921	-	-	111,072	79.4%	17.1%	3.5%	0.0%	0.0%
Fiberglass laminators and fabricators	26,856	2,548	3,927	1,056	-	34,386	78.1%	7.4%	11.4%	3.1%	0.0%
Team assemblers	952,298	129,256	21,322	-	1,878	1,104,754	86.2%	11.7%	1.9%	0.0%	0.2%
Timing device assemblers, adjusters, and calibrators	6,652	82	72	-	295	7,103	93.7%	1.2%	1.0%	0.0%	4.2%
Bakers	107,994	26,107	25,459	1,361	1,134	162,056	66.6%	16.1%	15.7%	0.8%	0.7%
Butchers and meat cutters	124,864	3,628	8,932	-	-	137,423	90.9%	2.6%	6.5%	0.0%	0.0%
Meat, poultry, and fish cutters and trimmers	160,573	-	-	-	-	160,573	100.0%	0.0%	0.0%	0.0%	0.0%
Slaughterers and meat packers	122,834	-	-	-	-	122,834	100.0%	0.0%	0.0%	0.0%	0.0%
Food and tobacco roasting, baking, and drying machine operators and tenders	23,083	46	-	-	-	23,129	99.8%	0.2%	0.0%	0.0%	0.0%
Food batchmakers	116,673	-	-	-	-	116,673	100.0%	0.0%	0.0%	0.0%	0.0%
Food cooking machine operators and tenders	38,958	980	-	959	822	41,719	93.4%	2.3%	0.0%	2.3%	2.0%
Computer-controlled machine tool operators, metal and plastic	91,412	45,415	-	3,550	1,647	142,025	64.4%	32.0%	0.0%	2.5%	1.2%
Numerical tool and process control programmers	1,789	5,455	1,820	6,461	2,658	18,183	9.8%	30.0%	10.0%	35.5%	14.6%
Extruding and drawing machine setters, operators, and tenders, metal and plastic	64,150	24,138	-	-	-	88,289	72.7%	27.3%	0.0%	0.0%	0.0%
Forging machine setters, operators, and tenders, metal and plastic	21,933	305	62	-	-	22,301	98.4%	1.4%	0.3%	0.0%	0.0%
Rolling machine setters, operators, and tenders, metal and plastic	33,087	3,603	-	-	-	36,690	90.2%	9.8%	0.0%	0.0%	0.0%
Cutting, punching, and press machine setters, operators, and tenders, metal and plastic	201,094	3,645	-	1,153	-	205,892	97.7%	1.8%	0.0%	0.6%	0.0%
Drilling and boring machine tool setters, operators, and tenders, metal and plastic	11,009	10,576	5,979	2,172	1,031	30,767	35.8%	34.4%	19.4%	7.1%	3.4%
Grinding, lapping, polishing, and buffing machine tool setters, operators, and tenders, metal and plastic	73,069	7,422	4,138	-	-	84,630	86.3%	8.8%	4.9%	0.0%	0.0%
Lathe and turning machine tool setters, operators, and tenders, metal and plastic	27,009	19,571	2,481	999	166	50,226	53.8%	39.0%	4.9%	2.0%	0.3%
Milling and planing machine setters, operators, and tenders, metal and plastic	11,353	11,477	226	-	-	23,056	49.2%	49.8%	1.0%	0.0%	0.0%
Machinists	219,190	117,755	51,303	15,755	-	404,003	54.3%	29.1%	12.7%	3.9%	0.0%

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PRODUCTION OCCUPATIONS, cont.	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
Metal-refining furnace operators and tenders	16,512	814	-	2,649	78	20,054	82.3%	4.1%	0.0%	13.2%	0.4%
Pourers and casters, metal	16,106	-	149	-	308	16,564	97.2%	0.0%	0.9%	0.0%	1.9%
Model makers, metal and plastic	5,375	3,973	26	129	780	10,282	52.3%	38.6%	0.3%	1.3%	7.6%
Patternmakers, metal and plastic	2,456	5,552	1,378	139	98	9,622	25.5%	57.7%	14.3%	1.4%	1.0%
Foundry mold and coremakers	15,067	-	-	-	-	15,067	100.0%	0.0%	0.0%	0.0%	0.0%
Molding, coremaking, and casting machine setters, operators, and tenders, metal and plastic	107,203	18,036	-	-	-	125,239	85.6%	14.4%	0.0%	0.0%	0.0%
Multiple machine tool setters, operators, and tenders, metal and plastic	67,653	19,724	625	2,600	-	90,603	74.7%	21.8%	0.7%	2.9%	0.0%
Tool and die makers	12,021	45,463	23,708	2,287	-	83,479	14.4%	54.5%	28.4%	2.7%	0.0%
Welders, cutters, solderers, and brazers	273,594	111,523	33,671	-	-	418,788	65.3%	26.6%	8.0%	0.0%	0.0%
Welding, soldering, and brazing machine setters, operators, and tenders	39,640	6,675	-	6,723	7,321	60,360	65.7%	11.1%	0.0%	11.1%	12.1%
Heat-treating equipment setters, operators, and tenders, metal and plastic	18,643	3,506	2,134	-	-	24,283	76.8%	14.4%	8.8%	0.0%	0.0%
Lay-out workers, metal and plastic	7,836	1,255	254	-	-	9,345	83.9%	13.4%	2.7%	0.0%	0.0%
Plating and coating machine setters, operators, and tenders, metal and plastic	39,180	1,868	-	-	-	41,048	95.4%	4.6%	0.0%	0.0%	0.0%
Tool grinders, filers, and sharpeners	11,714	3,596	42	46	-	15,398	76.1%	23.4%	0.3%	0.3%	0.0%
Metal workers and plastic workers, all other	25,271	7,757	90	100	-	33,217	76.1%	23.4%	0.3%	0.3%	0.0%
Bindery workers	50,788	149	-	-	307	51,244	99.1%	0.3%	0.0%	0.0%	0.6%
Bookbinders	5,789	271	1,029	254	-	7,343	78.8%	3.7%	14.0%	3.5%	0.0%
Job printers	21,915	11,364	4,174	919	4,174	42,546	51.5%	26.7%	9.8%	2.2%	9.8%
Prepress technicians and workers	13,656	14,529	12,499	12,735	129	53,548	25.5%	27.1%	23.3%	23.8%	0.2%
Printing machine operators	170,240	16,558	9,852	-	-	196,650	86.6%	8.4%	5.0%	0.0%	0.0%
Laundry and dry-cleaning workers	249,159	3,692	-	-	-	252,851	98.5%	1.5%	0.0%	0.0%	0.0%
Pressers, textile, garment, and related materials	65,271	39	-	-	203	65,514	99.6%	0.1%	0.0%	0.0%	0.3%
Sewing machine operators	146,937	4,454	14,608	-	4,659	170,659	86.1%	2.6%	8.6%	0.0%	2.7%
Shoe and leather workers and repairers	11,215	50	3,286	366	281	15,198	73.8%	0.3%	21.6%	2.4%	1.9%
Shoe machine operators and tenders	6,321	-	335	-	-	6,656	95.0%	0.0%	5.0%	0.0%	0.0%
Sewers, hand	14,056	8,033	2,009	2,009	1,003	27,110	51.9%	29.6%	7.4%	7.4%	3.7%
Tailors, dressmakers, and custom sewers	36,842	5,987	4,361	4,913	-	52,104	70.7%	11.5%	8.4%	9.4%	0.0%
Textile bleaching and dyeing machine operators and tenders	12,634	-	58	-	2,519	15,210	83.1%	0.0%	0.4%	0.0%	16.6%
Textile cutting machine setters, operators, and tenders	12,057	1,619	5,131	-	60	18,868	63.9%	8.6%	27.2%	0.0%	0.3%
Textile knitting and weaving machine setters, operators, and tenders	25,577	-	-	1,367	446	27,390	93.4%	0.0%	0.0%	5.0%	1.6%
Textile winding, twisting, and drawing out machine setters, operators, and tenders	29,476	534	-	-	-	30,010	98.2%	1.8%	0.0%	0.0%	0.0%
Extruding and forming machine setters, operators, and tenders, synthetic and glass fibers	13,146	1,166	-	-	-	14,313	91.9%	8.2%	0.0%	0.0%	0.0%
Fabric and apparel patternmakers	2,124	3,161	1,162	2,631	-	9,077	23.4%	34.8%	12.8%	29.0%	0.0%
Upholsterers	32,549	12,942	1,937	2,755	-	50,183	64.9%	25.8%	3.9%	5.5%	0.0%
Textile, apparel, and furnishings workers, all other	11,407	4,536	679	966	-	17,587	64.9%	25.8%	3.9%	5.5%	0.0%
Cabinetmakers and bench carpenters	62,371	13,052	43,993	-	-	119,416	52.2%	10.9%	36.8%	0.0%	0.0%
Furniture finishers	27,941	-	-	-	-	27,941	100.0%	0.0%	0.0%	0.0%	0.0%
Model makers, wood	1,791	887	128	-	-	2,806	63.8%	31.6%	4.6%	0.0%	0.0%
Patternmakers, wood	1,235	1,445	325	141	-	3,146	39.3%	45.9%	10.3%	4.5%	0.0%
Sawing machine setters, operators, and tenders, wood	48,721	5,507	731	-	-	54,959	88.7%	10.0%	1.3%	0.0%	0.0%
Woodworking machine setters, operators, and tenders, except sawing	70,255	2,977	133	7,491	7,491	88,346	79.5%	3.4%	0.1%	8.5%	8.5%
Woodworkers, all other	9,735	412	18	1,038	1,038	12,241	79.5%	3.4%	0.1%	8.5%	8.5%
Nuclear power reactor operators	2,504	1,389	2,321	940	945	8,100	30.9%	17.2%	28.7%	11.6%	11.7%
Power distributors and dispatchers	2,402	3,891	473	4,597	743	12,107	19.8%	32.1%	3.9%	38.0%	6.1%
Power plant operators	10,693	1,447	12,168	15,340	-	39,648	27.0%	3.7%	30.7%	38.7%	0.0%
Stationary engineers and boiler operators	16,907	10,248	3,849	9,872	3,930	44,807	37.7%	22.9%	8.6%	22.0%	8.8%
Water and liquid waste treatment plant and system operators	69,580	7,862	34,454	-	17,195	129,091	53.9%	6.1%	26.7%	0.0%	13.3%
Chemical plant and system operators	27,296	5,161	908	8,251	4,222	45,837	59.6%	11.3%	2.0%	18.0%	9.2%
Gas plant operators	8,321	6,710	1,800	-	314	17,145	48.5%	39.1%	10.5%	0.0%	1.8%
Petroleum pump system operators, refinery operators, and gaugers	38,516	234	3,081	9,102	-	50,933	75.6%	0.5%	6.1%	17.9%	0.0%
Plant and system operators, all other	12,120	74	970	2,864	-	16,027	75.6%	0.5%	6.1%	17.9%	0.0%
Chemical equipment operators and tenders	45,488	5,492	775	1,722	-	53,478	85.1%	10.3%	1.5%	3.2%	0.0%
Separating, filtering, clarifying, precipitating, and still machine setters, operators, and tenders	37,911	-	3,604	5,274	940	47,729	79.4%	0.0%	7.6%	11.1%	2.0%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

HIGH SCHOOL OR LESS (HSL) | POSTSECONDARY CERTIFICATE (PSC) | SOME COLLEGE (SC) | ASSOCIATE (A) | BACHELOR'S DEGREE OR BETTER (BA+)

PRODUCTION OCCUPATIONS, cont.	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
Crushing, grinding, and polishing machine setters, operators, and tenders	25,211	5,516	4,672	2,644	-	38,043	66.3%	14.5%	12.3%	7.0%	0.0%
Grinding and polishing workers, hand	33,010	-	-	-	7,849	40,858	80.8%	0.0%	0.0%	0.0%	19.2%
Mixing and blending machine setters, operators, and tenders	107,620	2,493	15,094	7,067	1,067	133,341	80.7%	1.9%	11.3%	5.3%	0.8%
Cutters and trimmers, hand	16,422	10,210	51	-	-	26,682	61.5%	38.3%	0.2%	0.0%	0.0%
Cutting and slicing machine setters, operators, and tenders	65,262	829	7,918	-	-	74,009	88.2%	1.1%	10.7%	0.0%	0.0%
Extruding, forming, pressing, and compacting machine setters, operators, and tenders	71,575	7,269	-	-	-	78,845	90.8%	9.2%	0.0%	0.0%	0.0%
Furnace, kiln, oven, drier, and kettle operators and tenders	21,587	702	-	-	-	22,289	96.9%	3.2%	0.0%	0.0%	0.0%
Inspectors, testers, sorters, samplers, and weighers	298,494	96,806	23,616	14,109	1,129	434,153	68.8%	22.3%	5.4%	3.2%	0.3%
Jewelers and precious stone and metal workers	19,686	13,123	3,280	1,642	1,642	39,372	50.0%	33.3%	8.3%	4.2%	4.2%
Dental laboratory technicians	33,411	8,979	1,574	7,144	-	51,108	65.4%	17.6%	3.1%	14.0%	0.0%
Medical appliance technicians	2,999	1,584	7,707	462	3,872	16,625	18.0%	9.5%	46.4%	2.8%	23.3%
Ophthalmic laboratory technicians	29,298	1,776	1,776	3,313	-	36,162	81.0%	4.9%	4.9%	9.2%	0.0%
Packaging and filling machine operators and tenders	285,307	-	-	49,325	-	334,631	85.3%	0.0%	0.0%	14.7%	0.0%
Coating, painting, and spraying machine setters, operators, and tenders	74,905	14,416	-	-	-	89,321	83.9%	16.1%	0.0%	0.0%	0.0%
Painters, transportation equipment	39,237	13,778	444	-	-	53,458	73.4%	25.8%	0.8%	0.0%	0.0%
Painting, coating, and decorating workers	31,161	1,014	40	752	152	33,119	94.1%	3.1%	0.1%	2.3%	0.5%
Photographic process workers	8,764	1,021	3,315	43	2,053	15,196	57.7%	6.7%	21.8%	0.3%	13.5%
Photographic processing machine operators	21,649	2,889	195	-	-	24,734	87.5%	11.7%	0.8%	0.0%	0.0%
Semiconductor processors	36,280	501	171	888	121	37,961	95.6%	1.3%	0.5%	2.3%	0.3%
Cementing and gluing machine operators and tenders	20,875	-	-	-	-	20,875	100.0%	0.0%	0.0%	0.0%	0.0%
Cleaning, washing, and metal pickling equipment operators and tenders	16,185	274	1,088	-	-	17,547	92.2%	1.6%	6.2%	0.0%	0.0%
Cooling and freezing equipment operators and tenders	7,479	3,628	775	1,037	-	12,920	57.9%	28.1%	6.0%	8.0%	0.0%
Etchers and engravers	9,991	-	3,311	-	124	13,425	74.4%	0.0%	24.7%	0.0%	0.9%
Molders, shapers, and casters, except metal and plastic	36,823	1,674	3,348	-	-	41,844	88.0%	4.0%	8.0%	0.0%	0.0%
Paper goods machine setters, operators, and tenders	97,007	733	-	-	-	97,740	99.3%	0.8%	0.0%	0.0%	0.0%
Tire builders	20,970	63	-	-	-	21,033	99.7%	0.3%	0.0%	0.0%	0.0%
Helpers—Production workers	432,672	54,795	-	3,091	-	490,557	88.2%	11.2%	0.0%	0.6%	0.0%
Production workers, all other	229,214	29,029	-	1,637	-	259,880	88.2%	11.2%	0.0%	0.6%	0.0%
TRANSPORTATION AND MATERIAL MOVING OCCUPATIONS	8,373,373	803,383	224,587	275,070	350,406	10,026,819	83.5%	8.0%	2.2%	2.7%	3.5%
Aircraft cargo handling supervisors	6,861	203	2,358	-	673	10,095	68.0%	2.0%	23.4%	0.0%	6.7%
First-line supervisors/managers of helpers, laborers, and material movers, hand	98,767	9,165	5,552	11,518	81,408	206,409	47.9%	4.4%	2.7%	5.6%	39.4%
First-line supervisors/managers of transportation and material-moving machine and vehicle operators	116,507	30,381	46,287	6,692	42,602	242,470	48.1%	12.5%	19.1%	2.8%	17.6%
Airline pilots, copilots, and flight engineers	10,814	5,061	4,447	11,684	53,344	85,350	12.7%	5.9%	5.2%	13.7%	62.5%
Commercial pilots	5,289	8,803	8,020	2,724	12,077	36,913	14.3%	23.8%	21.7%	7.4%	32.7%
Air traffic controllers	15,138	3,793	5,406	4,800	4,547	33,685	44.9%	11.3%	16.1%	14.3%	13.5%
Airfield operations specialists	5,941	358	1,971	750	2,596	11,617	51.1%	3.1%	17.0%	6.5%	22.4%
Ambulance drivers and attendants, except emergency medical technicians	24,476	2,410	280	-	-	27,166	90.1%	8.9%	1.0%	0.0%	0.0%
Bus drivers, transit and intercity	169,284	37,700	6,954	-	-	213,937	79.1%	17.6%	3.3%	0.0%	0.0%
Bus drivers, school	439,559	49,691	6,098	8,618	-	503,966	87.2%	9.9%	1.2%	1.7%	0.0%
Driver/sales workers	414,563	1,670	-	-	11,946	428,179	96.8%	0.4%	0.0%	0.0%	2.8%
Truck drivers, heavy and tractor-trailer	1,389,377	399,759	56,476	-	-	1,845,612	75.3%	21.7%	3.1%	0.0%	0.0%
Truck drivers, light or delivery services	1,039,633	2,966	16,628	-	-	1,059,227	98.2%	0.3%	1.6%	0.0%	0.0%
Taxi drivers and chauffeurs	230,419	3,011	-	-	-	233,430	98.7%	1.3%	0.0%	0.0%	0.0%
Motor vehicle operators, all other	80,656	1,054	-	-	-	81,710	98.7%	1.3%	0.0%	0.0%	0.0%
Locomotive engineers and operators	52,857	691	-	-	-	53,548	98.7%	1.3%	0.0%	0.0%	0.0%
Railroad brake, signal, and switch operators	18,972	1,123	-	-	-	20,095	94.4%	5.6%	0.0%	0.0%	0.0%
Railroad conductors and yardmasters	33,394	1,428	-	-	-	34,821	95.9%	4.1%	0.0%	0.0%	0.0%
Subway and streetcar operators	5,843	676	2,332	647	177	9,676	60.4%	7.0%	24.1%	6.7%	1.8%
Rail transportation workers, all other	2,919	338	1,165	323	88	4,833	60.4%	7.0%	24.1%	6.7%	1.8%
Sailors and marine oilers	26,493	11,360	305	-	-	38,158	69.4%	29.8%	0.8%	0.0%	0.0%
Captains, mates, and pilots of water vessels	9,096	14,247	1,097	9,276	3,851	37,566	24.2%	37.9%	2.9%	24.7%	10.3%

*These percentages represent the total for each occupation. Row percentages sum to 100%.

TRANSPORTATION AND MATERIAL MOVING OCCUPATIONS, cont.	HSL	PSC	SC	A	BA+	TOTAL	HSL (%)	PSC (%)	SC (%)	A (%)	BA+ (%)
Motorboat operators	1,894	3,337	1,894	16	-	7,141	26.5%	46.7%	26.5%	0.2%	0.0%
Ship engineers	2,302	12,307	1,776	-	1,825	18,209	12.6%	67.6%	9.8%	0.0%	10.0%
Bridge and lock tenders	6,296	252	503	-	-	7,051	89.3%	3.6%	7.1%	0.0%	0.0%
Parking lot attendants	143,112	832	-	-	1,970	145,914	98.1%	0.6%	0.0%	0.0%	1.4%
Service station attendants	85,688	14,088	-	-	-	99,777	85.9%	14.1%	0.0%	0.0%	0.0%
Traffic technicians	761	583	1,003	101	7,321	9,769	7.8%	6.0%	10.3%	1.0%	74.9%
Transportation inspectors	850	1,503	2,416	10,199	13,451	28,419	3.0%	5.3%	8.5%	35.9%	47.3%
Transportation workers, all other	30,089	3,127	2,745	3,911	13,097	52,969	56.8%	5.9%	5.2%	7.4%	24.7%
Conveyor operators and tenders	16,556	522	22,953	-	400	40,431	41.0%	1.3%	56.8%	0.0%	1.0%
Crane and tower operators	23,286	22,539	-	566	-	46,392	50.2%	48.6%	0.0%	1.2%	0.0%
Dredge operators	5,968	588	292	-	-	6,848	87.2%	8.6%	4.3%	0.0%	0.0%
Excavating and loading machine and dragline operators	54,015	16,731	-	-	-	70,746	76.4%	23.7%	0.0%	0.0%	0.0%
Loading machine operators, underground mining	8,089	-	-	-	-	8,089	100.0%	0.0%	0.0%	0.0%	0.0%
Hoist and winch operators	4,121	1,426	519	-	-	6,067	67.9%	23.5%	8.6%	0.0%	0.0%
Industrial truck and tractor operators	521,396	79,014	-	-	-	600,410	86.8%	13.2%	0.0%	0.0%	0.0%
Cleaners of vehicles and equipment	257,338	19,318	4,455	75,312	-	356,424	72.2%	5.4%	1.3%	21.1%	0.0%
Laborers and freight, stock, and material movers, hand	2,033,882	8,835	14,725	115,309	92,882	2,265,633	89.8%	0.4%	0.6%	5.1%	4.1%
Machine feeders and offbearers	91,817	9,047	429	7,793	846	109,932	83.5%	8.2%	0.4%	7.1%	0.8%
Packers and packagers, hand	657,817	-	-	-	5,305	663,122	99.2%	0.0%	0.0%	0.0%	0.8%
Gas compressor and gas pumping station operators	10,965	1,614	-	1,504	-	14,083	77.9%	11.5%	0.0%	10.7%	0.0%
Pump operators, except wellhead pumpers	16,227	461	170	1,804	-	18,662	87.0%	2.5%	0.9%	9.7%	0.0%
Wellhead pumpers	20,213	2,202	1,316	1,520	-	25,251	80.0%	8.7%	5.2%	6.0%	0.0%
Refuse and recyclable material collectors	129,458	11,518	-	-	-	140,976	91.8%	8.2%	0.0%	0.0%	0.0%
Shuttle car operators	3,910	649	-	-	-	4,559	85.8%	14.2%	0.0%	0.0%	0.0%
Tank car, truck, and ship loaders	15,167	2,105	1,207	-	-	18,478	82.1%	11.4%	6.5%	0.0%	0.0%
Material moving workers, all other	35,298	4,898	2,808	-	-	43,005	82.1%	11.4%	6.5%	0.0%	0.0%

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