The Impact of Human Capital in the American Labor Market Series

Skills and the Earnings of College Graduates

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Preface

In the first report of a series on the impact of human capital investments in the U.S. labor market, authors Neeta Fogg, Paul Harrington, and Ishwar Khatiwada dove into large-scale assessment data on educational attainment and cognitive skills of the full-time labor force. One of their most critical findings in *Skills and Earnings in the Full-Time Labor Market* was that for American workers of prime age (ages 25 to 54) with full-time jobs, the payoff to a college education on average occurs only for those with at least a bachelor's degree. For millions who completed less than a bachelor's degree education and were employed in full-time jobs, there was no statistically significant earnings advantage at all.

But that wasn't all these labor economists from Drexel University's Center for Labor Markets and Policy found in their report. Commissioned by the ETS Center for Research on Human Capital and Education, this report provided analyses of data from the Programme for the International Assessment of Adult Competencies (PIAAC) and showed that in addition to a college degree, the level of one's literacy and numeracy skills also plays a central role in earnings. Strong and consistent gains in earnings were shown at every level of education for those with higher levels of those skills.

These findings led the authors to pursue a follow-up question that focused on those who have earned at least a bachelor's degree. That is, while those who obtain a bachelor's degree have largely clinched a significant earnings payoff, what impact will the skill levels of these graduates have on their earnings?

In this paper, which is the second in the "Impact of Human Capital in the American Labor Market" series, the authors reveal that there are large groups of college graduates who lose out on the seemingly automatic earnings premium from their degree, and that their failure is related to a lack of skills. One of every five bachelor's degree holders among employed college graduates ages 21 to 65 lacks some important skills in literacy. For numeracy, the number is one in three.

Furthermore, the authors determined that access to college labor market, or CLM, occupations is critical. Working in an occupation that utilizes the skills, knowledge, and abilities that are typically developed with a college education reaps large earnings premiums. But those who wind up mal-employed—working in jobs that do not require those types of skills—get no premium at all. In other words, regardless of your college degree, if you end up working in a noncollege level occupation, you will wind up earning no more than the average high school graduate.

This report amplifies a crucial message emanating from a wider series of reports by the ETS Center for Research on Human Capital and Education: the importance of human capital and the cost to a large number of individuals—and to society itself—when levels of it are lacking. What is human capital? It is the stock of productive capabilities of individuals and is the currency of today's society. Investments in human capital ideally pay off through higher earnings, improved health, increases in civic engagement, and more.

Since the "high tech" revolution that began in the 1970s, much attention has been focused in particular on bolstering numeracy proficiencies of students in preparation for STEM (science, technology, engineering, and math) careers, although employers value reading and writing skills as well. The result has been an emphasis on "college for all." For the last decade, upward of 70 percent of graduating seniors have gone directly to postsecondary programs. Within three years of high school, more than 85 percent of all high school graduates will have taken classes at a postsecondary educational institution.

In this "college for all" environment, the discussion on human capital has fallen into a trap. Since data on educational attainment are readily available at the national, state, and local levels from several different household surveys, it has been heavily relied on in making an easy comparison of the earnings of college vs. high school graduates.

Through use of data now available from PIAAC, the ETS Center has sought to broaden and sharpen the earnings discussion. In 2015 and 2018, the Center released papers that looked at the skills of millennials and showed increases in educational attainment belied by low overall performance. In *Too Big to Fail: Millennials on the Margins*, Sands and Goodman showed that approximately 36 million of America's young adults ages 16-34 were not adequately equipped to thrive in today's world in terms of their human capital, including about 6 million essentially "disconnected" from society: neither employed nor engaged in formal education. The pattern was even more troubling when comparing U.S. millennials to international peers, especially in numeracy, where they outperformed only 4 out of 30 countries.

This new report on the earnings of college graduates bolsters the case for literacy and numeracy skills. Among its findings is that, holding all other human-capital traits constant, the difference in earnings associated with one standard deviation unit change on the PIAAC proficiency scales was 11.3 percent on the literacy assessment and 9.4 percent on numeracy. Further, having these skills increases the likelihood of gaining a CLM job. The authors showed the stark cost of failing to attain such employment: The average monthly earnings of college graduates in CLM jobs were double those of mal-employed graduates ($7,200 per month versus $3,630). In other words, while earning a college degree does increase the likelihood of living a middle class lifestyle, it is far from a guarantee. Skills are a must to increase chances of attaining that lifestyle.

There are, no doubt, macroeconomic issues and geographic issues at play, but when the evidence points to the fact that employers are good at recognizing and rewarding literacy and numeracy skills, it is incumbent upon us to increase awareness of those skills' importance in an effort to move us to act toward helping all individuals acquire the human capital they will need for full participation in our society. Through this series on "The Impact of Human Capital in the American Labor Market," these authors and our Center will continue to examine those issues in future reports.

Irwin Kirsch

Anita Sands

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Lastly, we'd like to give a special thanks to our friend and colleague Dr. Jack Warner. Jack has a long and distinguished career as a leader of higher education systems, serving in many senior roles, including Commissioner of Higher Education in Rhode Island and South Dakota. Jack's focus on the role that institutions of higher learning could and should play on creating opportunities for students to prosper after graduation has always served as a touchstone of his leadership. Jack provided support and encouragement to the authors in our research on many aspects of the connection between higher education and the labor market; he always asked for unvarnished findings—to report the good and the bad to him and his colleagues. He has a laser-like focus on improving access to opportunities for young people and continues to explore ways to make the higher education system better at creating these opportunities. We remain grateful to Jack for his support and intellectual curiosity that have guided our college labor market research.

Executive Summary

"College for all" has become the mantra for education policy in the United States during the last decade. In that time, the nation's high schools have succeeded in enrolling about 7 out of 10 graduating seniors in a postsecondary program in the fall after high school graduation.

The college-for-all policy has been the product of a simple but compelling measure of the earnings of college graduates compared to those of high school graduates. The mean annual earnings of young (20- to 29-year-old) college graduates, which exceeded the earnings of high school graduates by just 20 percent in the mid-1970s, shot up to 70 percent by 2000 and reached 74 percent in 2015. Though the Great Recession prompted questions about the value of a college degree, in truth it remains high. Average college-educated workers are more likely than average non-college-educated workers to participate in the labor market, find a job, and have higher earnings.

But the labor market experiences of college graduates vary substantially. A sizable percent of college graduates—particularly recent ones—do not reap the labor market advantages traditionally associated with a college education.

In our analyses for this paper, we found three key factors affecting how much a college graduate will earn:

1. Gaining access to what we call college labor market (CLM) occupations is critical. Those who work in occupations that utilize the skills, knowledge, and abilities that are typically developed with a college education get large earnings premiums. The mal-employed—those who work in a job that does not require the proficiencies associated with a college degree to obtain employment in the occupation—do not get those premiums.
2. In addition to having a CLM job, one's skills in literacy and numeracy are a determinant of future earnings.
3. Regardless of whether you have a CLM job, the stronger your skills, the better you will tend to perform earnings-wise.

Findings are based on analysis of the Survey of Adult Skills of the Programme for the International Assessment of Adult Competencies (PIAAC), an assessment measuring achievement for countries across the world.

Our regression analysis demonstrates in clear terms the importance of having the human capital (e.g., literacy and numeracy) needed to provide the best chance of gaining CLM employment:

- The average monthly earnings of college graduates in CLM jobs were double those of mal-employed graduates ($7,200 per month versus $3,630).
- Similarly, the mean earnings of all college graduate workers were double those of high school graduates.

- The premium was 125 percent when comparing CLM-employed college graduate workers versus high school counterparts.

Our analyses examined various factors beyond skills that are related to earnings for employed college graduates. We found differences were evident by levels of college degree, fields of study, work experience, gender, and more. But we found that advantage primarily comes down to skills. Employers seeking workers discover that a four-year college diploma is no guarantee of strong literacy or numeracy skills. And individuals without skills are at risk of losing out on the financial rewards of high earnings and a CLM position and winding up mal-employed.

Among the other key findings regarding literacy and numeracy:

- One out of every five bachelor's degree holders among employed college graduates ages 21 to 65 lacks minimum skills in literacy. For numeracy, the number is one in three.
- Holding all other human-capital traits constant, the earnings difference associated with one standard deviation unit change in the PIAAC proficiency test score was 11.3 percent on the literacy test and 9.4 percent on numeracy.
- The share of employed college graduates with scores below the minimum level required for proficiency (level 3) in literacy varied by the level of college degree: 21 percent of workers with a bachelor's degree, and 15 percent of those with a master's degree. But even at the highest levels of educational attainment—doctoral and professional degrees—we still found that one in eight graduates scored below level 3.
- In numeracy, the scores were even worse. Nearly one-third of workers with a bachelor's degree, one-quarter of those with a master's degree, one-fifth of those with a professional degree, and 12 percent of doctoral degree workers scored below level 3.
- About two-thirds of those with proficiency below level 3, just over three-quarters of those with level 3 proficiencies, and 83-85 percent of those with the highest levels of literacy and numeracy proficiencies were employed in CLM occupations at the time of the PIAAC survey.

One noteworthy finding was that there was no statistically significant difference between the monthly earnings of workers with a master's degree and the earnings of those with just a bachelor's degree. This does not necessarily mean that there are no job market advantages to completing a master's degree program, but that these advantages are largely derived from other factors included in the regression such as higher skill levels, a sharply reduced chance of mal-employment, major field of study, and so on.

Major field of study also influenced the earnings of college graduates. The regression-adjusted earnings premiums to major fields of study (compared to the base group—humanities majors) ranged from 33 percent higher earnings among biological and health science majors and 25 percent among business-related majors to 16-18 percent among STEM (science, technology, engineering, and math)-related majors and 17 percent among social science majors, and no statistically significant earnings difference between education majors and the base group—humanities majors.

Regarding the male-female wage gap, our analysis of the PIAAC data found very large earnings gaps between employed men and women with college degrees. The mean earnings of male college graduates were 48 percent higher than those of female counterparts ($7,675 versus $5,188).

This paper is the second in a series of papers that explores the impact of human capital, building on the foundation established by *Skills and Earnings in the Full-Time Labor Market*, which examined the determinants of earnings among full-time, prime age workers in the United States. It was in that paper that we first described that the earnings premium of college graduates relative to high school graduates is overstated and that there are earnings gains associated with both literacy and numeracy skills at every level of educational attainment.

Introduction

For a large and growing number of high school students, college is the Holy Grail. With a college enrollment rate of nearly 70 percent in the United States, college applications and all matters related to college are the focus of a large majority of high school students.[1] This preoccupation with college is hardly surprising given the rising demand for college graduates in the U.S. labor market and the accompanying rise in the earnings premium associated with a college degree. The earnings advantage of college graduates relative to high school graduates has been growing steadily through recent decades. In the mid-1970s, the mean annual earnings of young (20- to 29-year-old) college graduates exceeded that of their high school graduate counterparts by 20 percent. By 2000, that earnings premium had reached 70 percent, and although the earnings of college graduates stagnated during the Great Recession, the premium continued to grow because of the sharp decline in the earnings of high school graduates, hitting 74 percent in 2015.[2]

This sharp rise is largely attributable to structural change in the U.S. labor market. Beyond the cyclical vicissitudes in job growth and decline, there has been a steady movement of employment away from goods- to services-producing sectors. Goods-producing sectors like construction and manufacturing are largely staffed by workers in blue-collar occupations that do not require a college level education and were typically considered primary sources of employment—and a middle class standard of living—even to those without a high school education. But those sectors have been in decline, at least with respect to employment. Meanwhile, services-producing sectors such as professional, technical, financial, educational, and high-level health services, largely staffed by workers with relatively higher levels of skills and educational attainment, have seen large and sustained employment gains.[3]

As employment across sectors has been shifting, the patterns within industries have been changing as well. Technological change and its effect on the production processes have increased the complexity of the tasks performed by workers and increased the demand for sophisticated skills.[4] As a result, the staffing pattern within industries now tends to favor higher-level occupations that are largely staffed with highly skilled and educated workers, further reducing the demand for workers with low levels of education and skills—even in goods-producing sectors.

Given those shifting employment patterns, average labor market outcomes, as one might expect, of those with a college education are better than those without. In fact, the earnings advantage of college-educated workers achieved nearly universal acceptance, only for the Great Recession to change that for some. As newly minted college graduates faced rising college costs and a hostile labor market, many began to question the value of a college education.

In truth, the value of a college degree remains high.[5] On every labor market outcome, average college-educated workers are more likely than average non-college-educated workers to have positive outcomes. They are more likely to participate in the labor market, find a job, and have higher earnings.[6]

But the labor market experiences of college graduates vary substantially. While a comparison of average outcomes of college graduates with those of workers without a college education consistently finds large advantages for college graduates, a sizable percent of college graduates—particularly recent ones—do not reap the labor market advantages traditionally associated with a college education.[7] That's because college graduates are not a homogeneous group and are characterized by sharp differences on a number of measures.

Findings are based on analysis of the Survey of Adult Skills of the Programme for the International Assessment of Adult Competencies (PIAAC), an assessment measuring achievement for countries across the world.

College graduates have different levels of college education/degrees, earn degrees from different institutions in different fields of study, vary in academic performance and proficiency, have different levels of labor market experience, have different rates of access to jobs in high-level college labor market occupations, and have different levels of literacy and numeracy proficiencies. Indeed, in a previous report, we found that among prime-age, full-time employed U.S. workers, 18 percent of college graduates with a bachelor's and 13 percent of those with a master's or higher degree scored below the minimum required proficiency level (level 3) on the PIAAC literacy scale. The percent of college graduates scoring below level 3 on the PIAAC numeracy scale was even higher: 29 percent among workers with a bachelor's degree and 21 percent among those with a graduate or advanced degree.[8]

Differences among 21- to 65-year old college graduates on several of the measures listed above are examined in detail in this report. But the main focus is to examine the level of earnings and differences in earnings among various subgroups of college graduates in the United States and to identify factors that explain the earnings differentials of college graduates. In particular, the focus of this report is to examine the connection between the human capital of college graduates and their earnings.

In doing so, we have found three key factors affecting how much a college graduate will earn.

1. Gaining access to what we call college labor market (CLM) occupations is critical. Those who work in occupations that utilize the skills, knowledge, and abilities that are typically developed with a college education get large earnings premiums. Those who don't work in CLM occupations, also known as the mal-employed, do not. In fact, there is no earnings premium for a mal-employed college graduate over a high school graduate. A mal-employed individual defined for this report is an employed college graduate who works in a job that does not require the proficiencies associated with a college degree to obtain employment in the occupation.
2. In addition to having a CLM job, one's skills in literacy and numeracy are a determinant of future earnings.
3. Regardless of whether you have a CLM job, the stronger your skills, the better you will tend to perform earnings-wise.

Of course, these are not fixed rules. There are instances of high school dropouts going on to become CEOs, while some with advanced degrees and high levels of skills never find their way. It's all about risk—or more specifically, mitigating risk. The more we can do to ensure college graduates acquire the skills they need, and the more we can do to connect them to jobs commensurate with their education, the better their chances of having a high level of earnings.

These findings are based on a detailed analysis of human capital and earnings in this report. Before we go further, let us define human capital. Human capital represents the productive capabilities of individuals. It can be thought of as ability; knowledge; skills such as literacy, numeracy, problem solving and so on; and many different character traits and social/communications proficiencies developed by an individual over time. Individuals invest in developing productive capabilities valued in the labor market in a wide variety of ways. The most important are formal schooling and work experience. These investments yield gains in many dimensions of life such as employment, earnings, health, civic engagement, and social behavior. Human capital is similar to physical capital in that its development entails investment with the expectation of future streams of benefits; in this case, the benefits include enhanced employment and earnings experiences. Human capital investments primarily lead to gains in the cognitive and behavioral capacities of individuals in ways that make them more productive in the labor market.[9] While the gains to these investments are most often measured in the labor market, the benefits of developing human capital of individuals can be found in many dimensions of economic and social activities.[10]

Educational attainment is the most commonly used measure of human capital. Educational attainment is typically measured by educational credentials (or years of schooling completed) and is classified from elementary and secondary schooling to high school diploma or GED®, and from attending some college without gaining a credential to the highest level of college credentials—doctoral or professional degrees. Because analysis in this report is restricted to college graduates with a bachelor's degree or higher level of education, the variation in the educational human capital of workers included in this report is more limited than usual. But even among college graduates, the level of education differs among those with a bachelor's degree, master's degree, doctorate, or professional degree. In recent years, large numbers of bachelor's degree recipients have flooded into seemingly ever-expanding master's, doctoral, and professional degree programs.

In addition to education, the human capital stock of workers also includes skills, knowledge, abilities, and behavioral and other traits that affect productivity in the labor market. While the PIAAC database does not have measures of behavioral and other traits that affect the productivity of workers, it does provide measures of a very important component of human capital of individuals: literacy and numeracy proficiencies. These proficiencies are our measure of skills. The PIAAC database also provides a direct measure of work experience, a measure that is usually not available in household surveys. Thus, PIAAC data provide a unique opportunity to explore the earnings of college graduates by level of educational attainment using measures of literacy and numeracy proficiencies and work experience.

The report examines the relationship between PIAAC measures of human capital traits and the earnings of 21- to 65-year-old employed college graduates in the United States.[11] It begins with an examination of the basic demographic characteristics of employed college graduates, level of college degree completion, college major field of study, literacy and numeracy proficiencies, access to college level jobs, and intensity of employment (weekly hours of work). The next section contains a descriptive analysis of the mean earnings of college graduates by key characteristics including college degree and major, literacy and numeracy proficiencies, and access to employment in CLM occupations. Following the descriptive analysis, the report presents findings from human capital earnings functions designed to estimate the independent effect of human capital traits and other covariates on the earnings of employed college graduates in the United States.

A Word about the Data

Results reported here are based on the PIAAC 2012-2014 Restricted Use File data provided to us by Educational Testing Service.[12] Results are restricted to employed college graduates with a bachelor's or higher degree between the ages of 21 and 65 who had reported positive monthly earnings. We have excluded workers with foreign degrees, workers in military occupations, workers with unknown occupations, and those under 25 years of age who were enrolled in school and working part time (less than 35 hours per week). Our analysis is based on a sample of 1,350 workers in the PIAAC database representing 41.016 million employed American college graduates in the United States. For further information, see Appendix A.

Educational Characteristics of Employed College Graduates

Degree Level

Our first look into demographics involves examining the educational characteristics of these employed college graduates to ascertain information on their background. First, we focus on degree level. According to the data, the sample of 1,350 represents approximately 41 million employed American college graduates in the general population: about 35 percent of the entire set of 118.5 million workers between the ages of 21 and 65. While the 41 million have a college degree, their level of attainment varied widely. Sixty percent of employed college graduates had a bachelor's degree as their highest degree. The remaining 40 percent had earned an advanced degree: 28 percent had a master's degree and 12 percent had a doctoral or professional degree such as M.D., J.D., D.M.D., and so on (Table 1).

Table 1: Percentage Distribution of 21- to 65-Year-Old Employed College Graduates, by College Degree Level, by Gender, 2012-2014

COLLEGE DEGREE LEVEL	PERCENT-TOTAL GRADUATES	STANDARD ERROR-TOTAL GRADUATES	PERCENT-MALE	STANDARD ERROR-MALE	PERCENT-FEMALE	STANDARD ERROR-FEMALE
BACHELOR'S DEGREE	60.5%	1.7	60.8%	2.3	60.2%	2.1
MASTER'S DEGREE	27.8%	1.2	25.5%	1.9	30.0%	1.4
PROFESSIONAL OR DOCTORAL DEGREE	11.6%	1.3	13.7%	1.8	9.8%	1.4
TOTAL	100.0%		100.0%		100.0%	

Major Field of Study

Next we look at major field of study. The PIAAC survey asks respondents with a college education to report the major field of study of their highest college degree. Based on the U.S. Department of Education's National Center for Educational Statistics (NCES) CIP (Classification of Instructional Programs) major coding taxonomy, there were more than 600 majors in the U.S. PIAAC data file.[13] Using the CIP taxonomy, we have classified college graduates in this study into six broad groups of college majors and an additional group for all other fields of study.[14]

The single major group with the most representation among working college graduates was business. Over one-fifth (22 percent) of 21- to 65-year-old employed college graduates had earned their college degree in a business major (Table 2). Humanities

majors comprised the second largest group with 18.5 percent. About 15 percent had majored in social sciences and 14 percent had a college degree in the field of education. Biological and health sciences was the major field of study of 14 percent, and about 13 percent had earned their highest college degree in STEM-related fields of engineering, math, and physical science.[15]

Table 2: Percentage Distribution of 21- to 65-Year-Old Employed College Graduates, by Major Field of Study, 2012-2014

MAJOR FIELD OF STUDY	PERCENT	STANDARD ERROR
BUSINESS	22.3%	1.3
HUMANITIES	18.5%	1.2
SOCIAL SCIENCES	14.8%	1.2
EDUCATION AND TRAINING	14.1%	1.4
BIOLOGICAL AND HEALTH SCIENCES	13.8%	1.1
ENGINEERING, MATH, AND PHYSICAL SCIENCES	13.2%	1.4

Note: Percentage distribution does not add to 100 due to exclusion of cases with missing major field of study and major fields that could not be classified in one of the listed broad categories.

Later in this report, we will find that the mean earnings of college graduate workers vary widely by their major field of study. Mean earnings of college graduates with degrees in business and STEM disciplines are considerably higher than the mean earnings of workers with a college degree in education.

Characteristics of the Jobs of Employed College Graduates

This section examines two important job-related traits of employed college graduates that are known to be closely related to their earnings: access to employment in college labor market (CLM) occupations and the intensity of employment (weekly hours of work). As noted above, CLM occupations utilize the skills, knowledge, and abilities that are typically developed with a college education. We have used two measures of employment intensity: mean weekly hours of employment and the proportion of workers employed in full-time positions.[16]

Access to Employment in CLM Occupations

A college education on average provides some insulation against the worst effects of economic downturns. During the Great Recession, for example, college graduates were considerably less likely to be unemployed than those without a college education.[17] Between 2007 and 2010, the unemployment rate of the adult population (25 years and over) increased from 7.1 percent to 14.9 percent among high school dropouts, from 4.4 percent to 10.3 percent among high school graduates without any college education, and from only 2 percent to 4.7 percent among college graduates with a bachelor's or higher degree. At the trough of the recession, the unemployment rate of college graduates was one-third as high as high school dropouts and half as high as high school graduates.[18]

But while college graduates are much more likely than those without a college education to avoid unemployment, college graduates endure a different kind of economic hardship—underemployment. During economic downturns, as opportunities decline, many college graduates remain employed by taking jobs from those who are at lower levels of the labor market queue—high school graduates and dropouts—who in turn are forced into unemployment or end up quitting the labor force. In these situations, many college graduates remain employed by working in occupations that do not utilize college level skills, knowledge, and abilities. This type of underemployment, also called mal-employment, is endured by many college graduates, particularly during a recession, and by many young college graduates when entering the labor market.[19]

While mal-employment increased sharply during the Great Recession, the problem of underemployment among college graduates had been steadily rising even beforehand—since the 2001 recession.[20] Mal-employment rates among U.S. college graduates with just a bachelor's degree stood at 28 percent in 2010 (the labor market trough of the Great Recession), up from 25 percent in 2000. For young college graduates with just a bachelor's degree, the mal-employment rate was 39 percent in 2010, up from 29 percent in 2000.[21]

One of the key determinants of the earnings of college graduates is their ability to secure employment in occupations that utilize the skills, knowledge, and abilities typically developed with a college education. In 2009, the mean annual earnings of

college graduates with a bachelor's or higher degree who were employed in CLM occupations were nearly twice as high (95 percent higher) as the mean annual earnings of those who were mal-employed.[22]

We used the O*NET's® occupational requirements data and linked it with the 2012-2014 PIAAC database to define CLM and non-CLM occupations.[23] We found that three-quarters of employed college graduates included in this study were employed in a CLM occupation and the remaining one-quarter were mal-employed.

An examination of CLM occupation employment among college graduates by level of college degree found that only two-thirds with just a bachelor's degree were employed in a CLM occupation, yielding a mal-employment rate of 33 percent (Table 3). The mal-employment rate was lower among college graduates with an advanced degree: 9 percent among workers with a master's degree and 7 percent among those with a professional or doctoral degree. The higher level of occupation-specific skills, knowledge, and specialization among workers with a post-baccalaureate degree is likely to increase their access to college level occupations, thereby reducing risk of mal-employment.

Table 3: Percent of 21- to 65-Year-Old College Graduate Workers Employed in College Labor Market Occupations, by Gender and College Degree Level, 2012-2014

GENDER AND COLLEGE DEGREE LEVEL	PERCENT EMPLOYED IN CLM OCCUPATIONS	STANDARD ERROR
ALL	76.5%	1.6
GENDER		
MALE	77.1%	1.9
FEMALE	75.9%	2.1
COLLEGE DEGREE LEVEL		
BACHELOR'S DEGREE	66.6%	2.0
MASTER'S DEGREE	91.2%	1.5
PROFESSIONAL OR DOCTORAL DEGREE	92.5%	2.2

These findings matched closely to our earlier (2009) examination of the mal-employment rate among U.S. college graduates, when we found that 31 percent of workers with a bachelor's degree were mal-employed; we had found a lower rate of mal-employment for those with advanced degrees—13 percent among workers with a master's degree—and a similar 7 percent rate among those with a professional degree or a doctorate.[24] Abel and Deitz examined the probability of mal-employment among recent college graduates (22 to 27 years old) and found that workers with graduate degrees were 25 percentage points less likely to be mal-employed than their counterparts without a graduate degree.[25]

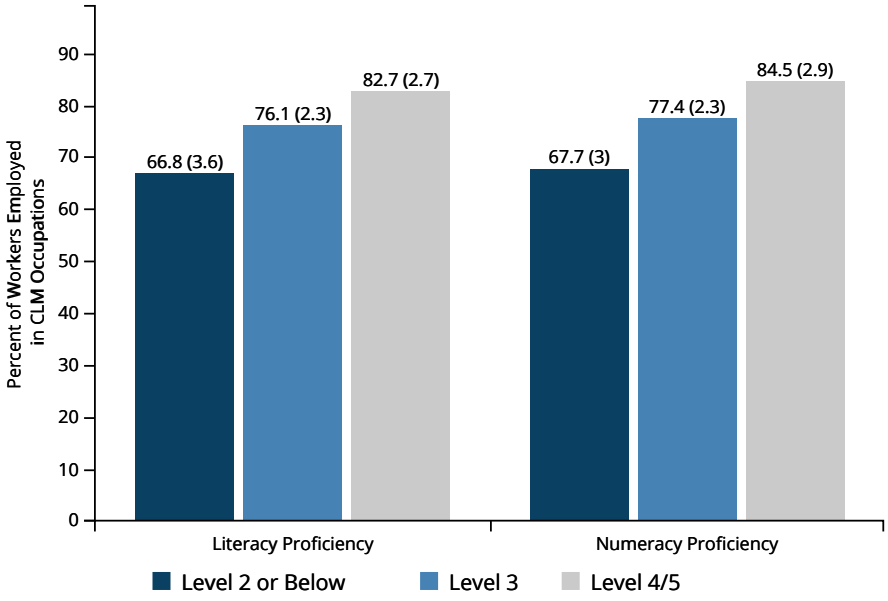
An examination of the access to a CLM occupation among employed college graduates by major field of study presented in Table 4 reveals significant advantages for certain majors. Workers with a college degree in STEM-related majors (engineering, math, and physical sciences) had the highest percent of CLM employment at 85 percent. Those who had majored in an education and humanities fields also were highly likely to work in CLM occupations, 79 and 78 percent, respectively. Employment in CLM occupations was somewhat lower among graduates with degrees in the remaining major fields of study. About three-quarters of college graduates in two fields—biological and health sciences and business—were employed in CLM occupations. The lowest rate was among social science graduates.

Table 4: Percent of 21- to 65-Year-Old College Graduate Workers Employed in College Labor Market Occupations, by Major Field of Study, 2012-2014

MAJOR FIELD OF STUDY	PERCENT EMPLOYED IN CLM OCCUPATIONS	STANDARD ERROR
ENGINEERING, MATH, AND PHYSICAL SCIENCES	84.6%	3.2
BIOLOGICAL AND HEALTH SCIENCES	76.0%	4.3
HUMANITIES	78.2%	2.8
SOCIAL SCIENCES	69.0%	4.4
BUSINESS	73.9%	3.2
EDUCATION AND TRAINING	78.9%	3.4
TOTAL (BACHELOR'S DEGREE OR HIGHER)	76.5%	1.6

College graduates with higher levels of literacy and numeracy proficiency also had a higher likelihood of working in a CLM occupation. Literacy and numeracy proficiencies of college graduates by degree level and major field, which we will detail in subsequent sections of the report, reveal that college graduates with advanced degrees and those with degrees in engineering, math, and physical sciences had higher literacy and numeracy proficiencies; these same groups of college graduate workers were most likely to be employed in a CLM occupation. Between 83 and 84 percent of college graduate workers with the highest levels of literacy and numeracy proficiencies (level 4/5) were employed in CLM occupations. The percent dropped to three-quarters for those scoring at level 3, and to just two-thirds for those below level 3 (Figure 1).

Figure 1: Percent of 21- to 65-Year-Old College Graduate Workers Employed in CLM Occupations, by Level of Literacy and Numeracy Proficiencies, 2012-2014 (Standard Errors in Parentheses)



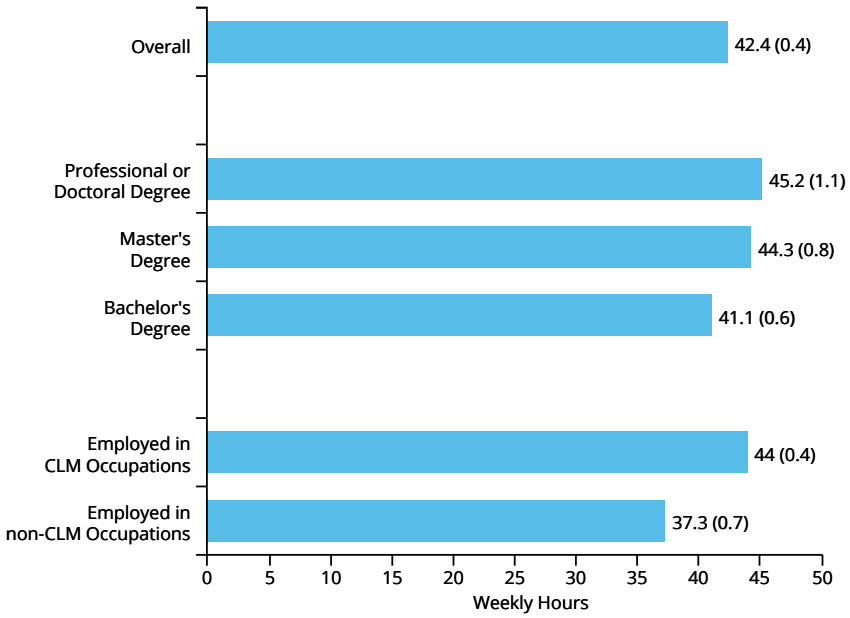
Intensity of Employment: Weekly Hours of Work and Full-Time Employment

Earnings of workers are directly related to their intensity of engagement in the labor market. By definition, more hours equals more earnings. But workers in full-time positions often have a higher earnings rate per hour than part-time workers. Furthermore, nonmonetary compensation, in the form of health insurance and other benefits such as employer retirement contributions and employer-provided training, are more likely to be provided to full-time workers. Analysis of nonmonetary compensation is beyond the scope of this study. However, the percent of workers employed in full-time positions is presented in this section to illustrate variation in full-time employment across different subgroups of college graduates.

On average, college graduates worked a 42.4-hour workweek (Figure 2). The mean weekly hours of work varied by college degree level from 41 hours among bachelor's degree graduates to 44 and 45 hours, respectively, among those with a master's degree and professional or doctoral degrees.

College graduates in CLM occupations worked considerably more hours per week than those in non-CLM occupations. College graduates in a CLM occupation on average worked 7 hours more per week: 44 hours versus 37 (Figure 2). Mean weekly hours of work among college graduates in CLM occupations were nearly one-fifth higher.

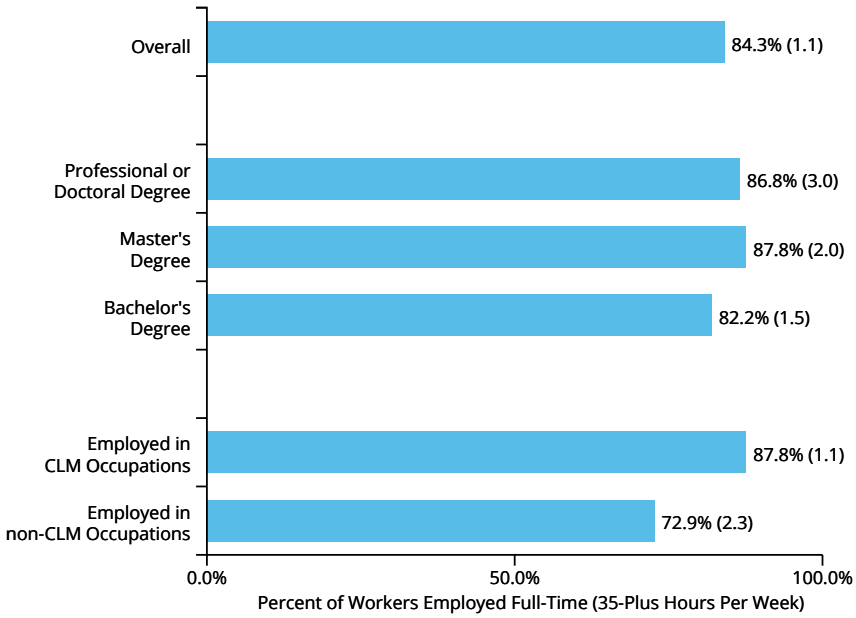
Figure 2: Mean Weekly Hours of Employment of 21- to 65-Year-Old Employed College Graduates, by Degree and Employment in College Labor Market Occupations, 2012-2014 (Standard Errors in Parentheses)



Given an average of 42 weekly hours of work among employed college graduates, it is not surprising to find that a large majority of them were in full-time positions. The share of all college graduates who were working 35 or more hours per week (full time) was 84 percent (Figure 3), ranging from 82 percent among those with a bachelor's degree to 87 to 88 percent among those with a professional or doctoral degree.

Full-time work was considerably more prevalent among college graduates in CLM occupations than those in non-CLM occupations. Nearly 88 percent of college graduates in a CLM occupation were in a full-time position compared to less than 73 percent of those in a non-CLM occupation—a 15-percentage-point differential (Figure 3).

Figure 3: Percent of 21- to 65-Year-Old Employed College Graduates in Full-Time Positions (35-Plus Hours per Week), by Degree and Employment in College Labor Market Occupations, 2012-2014 (Standard Errors in Parentheses)



The intensity of employment also varied widely by gender (Table 5). Male college graduate workers worked 45 hours per week on average, while their female counterparts worked an average of 40, representing an 11 percent longer workweek. Men were also considerably more likely to work in full-time positions. Nearly 91 percent of male college graduate workers were working in full-time positions, compared to just 79 percent of their female counterparts—a difference of 12 percentage points.

Table 5: Mean Weekly Hours of Work and Percent of Workers in Full-Time Positions (35-plus Weekly Hours) among 21- to 65-Year-Old Employed College Graduates, by Gender, 2012-2014

GENDER	MEAN HOURS	STANDARD ERROR	PERCENT EMPLOYED FULL-TIME (35-PLUS HOURS PER WEEK)	STANDARD ERROR
MALE	44.8	0.6	90.8%	1.3
FEMALE	40.3	0.4	78.5%	1.4
ABSOLUTE DIFFERENCE (MALE MINUS FEMALE)	4.5***	0.6	12.3%***	1.6
DIFFERENCE RELATIVE TO FEMALE WORKERS	11.2%		15.7%	

Statistical significance: *** sig. at .01 level.

Literacy and Numeracy Proficiencies of College Graduates

The literacy and numeracy skills of adults in the United States are lower than in many of the world's developed nations. The 272 mean score (on a scale of 0 to 500) of all 16- to 65-year old U.S. adults on the PIAAC literacy scale was significantly lower than average scores in 7 participating countries, higher than average in 6, and not statistically different from 8 countries or the overall PIAAC international average. The mean U.S. score of 257 in numeracy was at the lower end of the international comparison. It was significantly lower than the average score in 16 countries and the PIAAC international average, higher than average in 3, and not statistically different from the other 3.[26]

Looking just at prime-age (25- to 54-year-old), full-time employed workers, within the United States, literacy and numeracy scores rose steadily with educational attainment.[27] For college graduates, they are considerably higher than those of workers who do not have a bachelor's degree. However, even among college graduates, there are considerable subgroup differences.

Scores

This report focuses on literacy and numeracy proficiencies scores of employed college graduates in the United States of ages 21 to 65. The mean score was 308 on the PIAAC literacy scale and 298 in numeracy (see Table 6). These average proficiency scores correspond to level 3 on the PIAAC literacy and numeracy scale, the minimum required proficiency for effective engagement in many dimensions of adult social, economic, and civic life.[28] An examination of the literacy and numeracy scores by gender reveals higher average proficiency scores among male college graduate workers. The mean literacy score of male workers was 5 points higher than that of females (310 versus 305) and the mean numeracy score of male workers was 19 points higher (308 versus 289).

Table 6: Mean Scores of 21- to 65-Year-Old Employed College Graduates on the PIAAC Literacy and Numeracy Scales, by Gender, 2012-2014

GENDER	LITERACY MEAN PROFICIENCY SCORE	LITERACY STANDARD ERROR	NUMERACY MEAN PROFICIENCY SCORE	NUMERACY STANDARD ERROR
ALL	308	1.7	298	1.9
MALE	310	2.4	308	2.5
FEMALE	305	1.8	289	2.3
DIFFERENCE (MALE MINUS FEMALE)	5**	2.7	19***	2.7

Statistical significance: *** sig. at .01 level; **sig. at .05 level.

Although skills of college graduates were higher than for those who had not completed a college education, within the group of college graduates, skills varied (Table 7). Mean scores on the PIAAC literacy and proficiency scales increased with the level of college education. With a mean score of 304 on the literacy scale, college graduates with just a bachelor's degree had the lowest score compared to those with a master's (311) or a professional or doctoral degree (321). An examination of the mean scores on the PIAAC numeracy scale reveals a similar pattern.

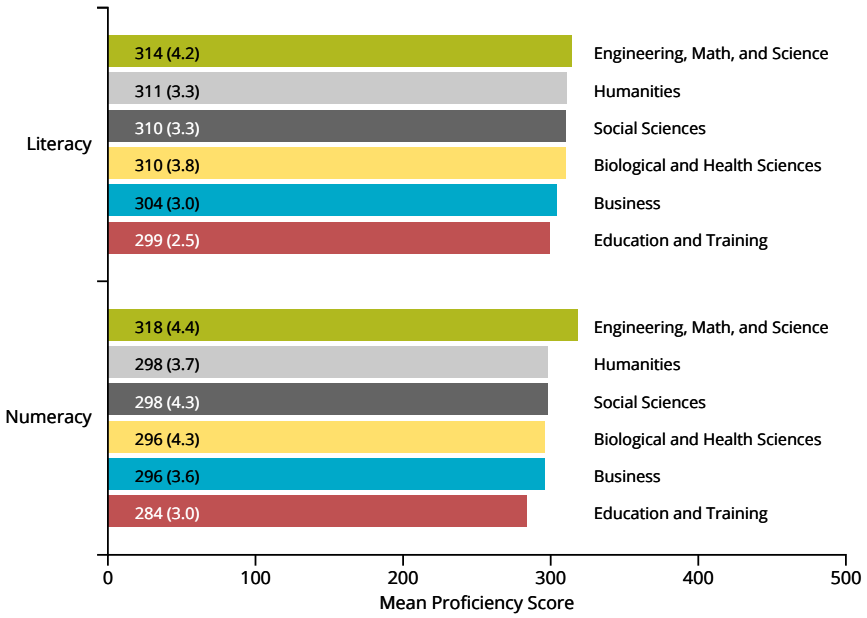
Table 7: Mean Scores of 21- to 65-Year-Old Employed College Graduates on the PIAAC Literacy and Numeracy Scales, by College Degree Level, 2012-2014

COLLEGE DEGREE LEVEL	LITERACY MEAN PROFICIENCY SCORE	LITERACY STANDARD ERROR	NUMERACY MEAN PROFICIENCY SCORE	NUMERACY STANDARD ERROR
ALL	308	1.7	298	1.2
BACHELOR'S DEGREE	304	1.6	293	2.4
MASTER'S DEGREE	311	2.5	303	2.9
PROFESSIONAL/ DOCTORAL DEGREE	321	4.2	312	4.3

Those with higher levels of literacy and numeracy skills are more likely to earn an advanced degree. Furthermore, not only do the advanced degrees add to their stock of educational human capital, but the process of acquiring the additional education in turn likely adds to their literacy and numeracy skills and their overall knowledge related to their major field of study.

Findings from our analysis of the mean scores on the PIAAC literacy scale by major field of study are presented in Figure 4. Gaps between the mean literacy proficiency scores of college graduates from different major fields are modest. Employed college graduates with a degree in STEM or humanities had mean literacy scores of 314 and 311, respectively, and their counterparts in social sciences or biological and health sciences had a mean literacy score of 310, while education majors scored a mean of 299 points on the literacy scale.

Figure 4: Mean Scores of 21- to 65-Year-Old Employed College Graduates on the PIAAC Literacy and Numeracy Scales, by Major Field of Study, 2012-2014 (Standard Errors in Parentheses)



But the mean numeracy score of STEM majors was 318 points, exceeding the remaining five college majors by 20 to 34 points. The mean numeracy score among college graduates with degrees in social sciences, biological and health sciences, humanities, and business fields was between 296 and 298 points, while counterparts with an education degree scored much lower: 284 points (Figure 4).

Literacy and numeracy proficiencies of college-educated workers also varied by access to CLM occupations. On average, college graduates who were employed in CLM occupations had much higher literacy and numeracy scores than college graduates in non-CLM occupations. Employment in CLM occupations requires workers to have college-level skills, knowledge, and abilities, so the ability to effectively work in CLM occupations likely requires higher levels of literacy and numeracy skills.

A comparison of the mean scores on the PIAAC literacy scale of college graduates employed in CLM and non-CLM occupations is presented in Table 8. On the literacy scale, the 311-point mean score of college graduates employed in a CLM occupation was 14 points higher than that of their mal-employed counterparts (297). The mean numeracy proficiency scores of the two groups were 17 points apart: 302 among CLM-employed college graduates and 285 among non-CLM employed college graduates.

Table 8: Mean Scores of 21- to 65-Year-Old Employed College Graduates on the PIAAC Literacy and Numeracy Scales, by Employment in College Labor Market Occupations, 2012-2014

SCALE BY CLM STATUS	MEAN	STANDARD ERROR
LITERACY		
NON-COLLEGE LABOR MARKET OCCUPATION	297	2.8
COLLEGE LABOR MARKET OCCUPATION	311	1.8
DIFFERENCE	14***	3.2
NUMERACY		
NON-COLLEGE LABOR MARKET OCCUPATION	285	3.6
COLLEGE LABOR MARKET OCCUPATION	302	2.0
DIFFERENCE	17***	3.9

Statistical significance: *** sig. at .01 level.

Levels

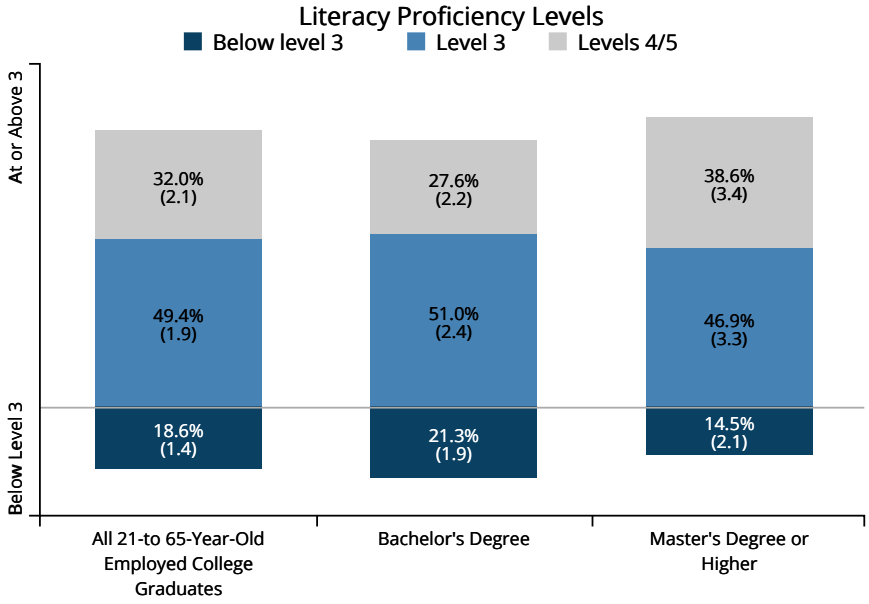
Literacy and numeracy proficiencies of workers can also be assessed by examining the distribution of workers across proficiency levels that are defined with specific thresholds or cut scores. Each proficiency level is associated with a range of literacy and numeracy tasks. A description of the proficiency achievement levels, score boundaries, and task descriptions for each level for literacy and numeracy proficiencies are presented in Appendix D.

Analyzing the levels of literacy and numeracy proficiency reveals the distribution of college-educated workers across these proficiency scales, shedding light on the variations and on the magnitude of college-educated workers who failed to score at or above level 3.[29]

In literacy, among all working college graduates between the ages of 21 and 65, nearly 19 percent scored below level 3 (below 276), about one-half scored at level 3 (between 276 and 325 points), and the remaining 32 percent scored at levels 4 and 5 (more than 325 points; Figure 5).

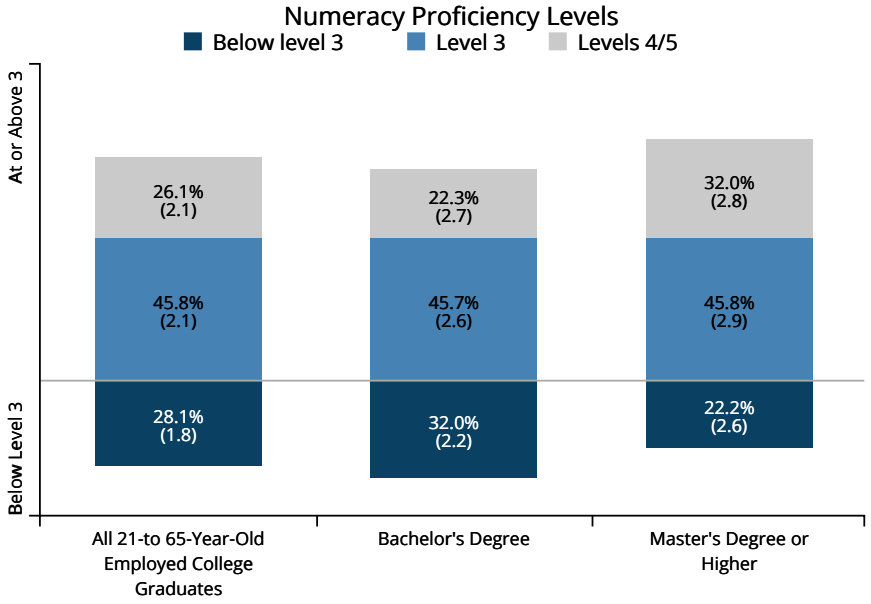
Looking by degree level, 21 percent of graduates with just a bachelor's degree and 15 percent of those with a master's, professional, or doctoral degree scored below level 3 in literacy.[30] Similarly, the percent of graduates with scores in the top two levels (level 4/5) was higher among workers with higher levels of education: 28 percent among workers with a bachelor's degree and 39 percent among those with advanced degrees (master's, professional, or doctoral degree; Figure 5).

Figure 5: Percentage Distribution of 21- to 65-Year-Old Employed College Graduates by PIAAC Literacy Proficiency Levels, by College Degree, 2012-2014 (Standard Errors in Parentheses)



The performance of employed college graduates on the PIAAC numeracy scale was worse than in literacy. Over 28 percent of all college graduates scored below level 3 on the PIAAC numeracy scale, ranging from a high of nearly one-third of workers with just a bachelor's degree to about a fifth (22 percent) of those with a master's or higher level of education. Over one-quarter of all college graduates scored in the highest two levels on the PIAAC numeracy proficiency scale. The share of workers with numeracy proficiency in the top two levels was just 22 percent among workers with a bachelor's degree and 32 percent among workers with a master's or higher degree (Figure 6).

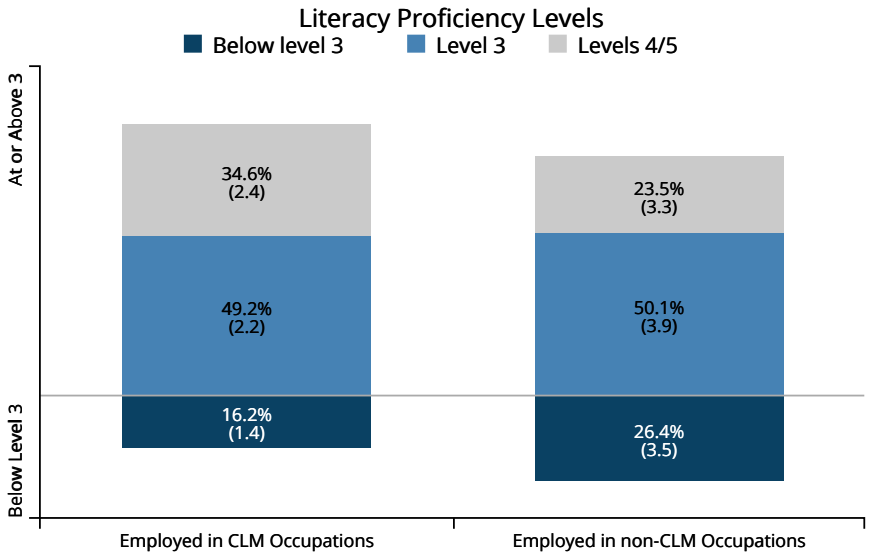
Figure 6: Percentage Distribution of 21- to 65-Year-Old Employed College Graduates by PIAAC Numeracy Proficiency Levels, by College Degree, 2012-2014 (Standard Errors in Parentheses)

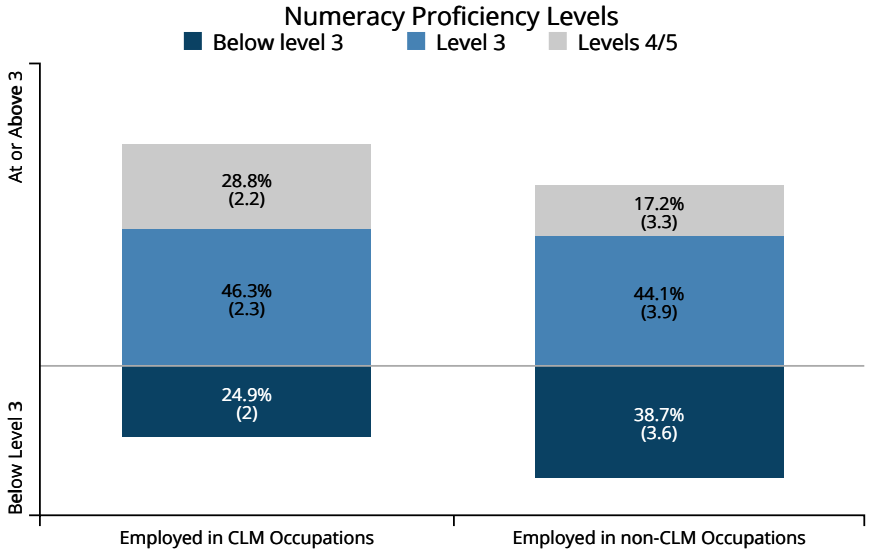


The level of literacy and numeracy skills of college graduates employed in a CLM occupation was much higher than that of those who were mal-employed. There was a 10-percentage-point difference in the percent of college graduate workers with literacy skills below level 3 between those employed in CLM occupations (16 percent) and non-CLM occupations (26 percent). About one-half of both groups scored at level 3. And, at the top of the literacy scale, 35 percent of workers employed in CLM occupations and 24 percent of non-CLM employed counterparts scored in literacy levels 4 or 5 (Figure 7).

Similar to the pattern found for all subgroups of college graduates, a greater proportion of CLM and non-CLM employed college graduates were at lower levels of the PIAAC numeracy scale than the PIAAC literacy scale. One-quarter of workers in a CLM occupation and nearly 39 percent of mal-employed workers scored below level 3 in numeracy. The proportion of workers with level 3 numeracy proficiencies was 46 percent among CLM workers and 44 percent among non-CLM workers; and at the very top of the numeracy proficiency scale, levels 4 or 5, there was a 12-percentage-point gap between those in CLM occupations (29 percent) and the mal-employed (17 percent; Figure 7).

Figure 7: Percentage Distribution of 21- to 65-Year-Old Employed College Graduates by PIAAC Literacy and Numeracy Proficiency Levels, by Employment in CLM Occupations, 2012-2014 (Standard Errors in Parentheses)





Mean Earnings of Employed College Graduates

The discussion in this section focuses on mean earnings of a few key subgroups of college graduates: specifically, subgroups by gender, age, education, major field of study, literacy and numeracy proficiencies, and access to employment in CLM occupations. Data on the mean earnings of detailed subgroups of college graduates are presented in Appendix E.

Gender

The average employed 21- to 65-year old college graduate earned $6,360 per month in 2012-2014, representing annualized earnings of $76,300. An examination of the mean earnings of college graduate workers by gender found a sizable gap between men and women; the mean monthly earnings of male college graduates were about $2,500, or 48 percent, higher than those of women ($7,675 among men versus $5,188 among women; see Table 9). While these workers are all college graduates, as we discussed earlier, there are a number of differences in their characteristics. Although their distribution of college degree attainment was about the same among men and women, there were sizable differences in college major: Women were much more concentrated in the low-paying field of education, while men were considerably more concentrated in high-paying fields of engineering, math, and physical sciences and business.

The percent of employment in CLM occupations did not vary by gender, but the intensity of employment was markedly different. Full-time employment was much more prevalent among male workers than female (91 percent versus 78 percent), resulting in much higher mean weekly hours of work (45 hours for males versus 40 hours for females). Male workers also held an advantage over females in the PIAAC literacy and numeracy scales; the mean score was 310 for males and 305 for females in literacy, and 308 for males and 298 for females in numeracy. It is possible that these literacy and numeracy skills and work intensity differences could account for some of the gender difference in mean earnings. Examination of the findings from multivariate regression analysis presented in a subsequent section of this report will highlight the independent effects of all these variables, including gender, on the earnings of college graduate workers.

Table 9: Mean Monthly Earnings of 21- to 65-Year-Old Employed College Graduates by Gender, 2012-2014

GENDER	MEAN MONTHLY EARNINGS	STANDARD ERROR
ALL	$6,361	374
MALE	$7,675	524
FEMALE	$5,188	316

Note: Earnings in U.S. dollars.

Degree and Major Field of Study

Our earlier discussion found that, even among college graduate workers, the level of human capital varied widely. About 6 of 10 had just a bachelor's degree, while the remaining 4 had a master's, professional, or doctoral degree. Furthermore, they had earned their college degrees across different major fields of study, representing differences in the field of their educational human capital. College graduates also varied in their level of literacy and numeracy proficiencies, with sizable percentages of these college graduates scoring below the minimum level (level 3) on the PIAAC literacy and numeracy proficiency scale: nearly 19 percent on the literacy scale and 28 percent in numeracy.

An examination of the mean monthly earnings of employed college graduates in the United States reveals a close relationship between earnings and each of these measures of human capital. The mean earnings of workers increased with their level of college education. Workers with just a bachelor's degree earned an average of $5,616 per month. Workers with a master's degree earned an average of $7,130 per month, representing an earnings premium of about $1,510, or 27 percent. The mean monthly earnings of workers with an advanced degree (doctoral or professional) was nearly $8,400, representing a monthly earnings premium of $2,780, or 50 percent, compared to those with just a bachelor's degree (Table 10).

Table 10: Mean Monthly Earnings of 21- to 65-Year-Old Employed College Graduates, By College Degree Level and Major Field of Study, 2012-2014

COLLEGE DEGREE LEVEL AND MAJOR FIELD OF STUDY	MEAN MONTHLY EARNINGS	STANDARD ERROR
ALL	$6,361	374
COLLEGE DEGREE LEVEL		
BACHELOR'S DEGREE	$5,616	389
MASTER'S DEGREE	$7,130	546
PROFESSIONAL/PH.D. DEGREE	$8,394	779
MAJOR FIELD OF STUDY		
EDUCATION AND TRAINING	$4,230	271
HUMANITIES	$6,037	573
BIOLOGICAL AND HEALTH SCIENCES	$6,524	475
ENGINEERING, MATH AND PHYSICAL SCIENCES	$6,644	356
SOCIAL SCIENCES	$6,943	1,115
BUSINESS	$7,215	498

Note: Earnings in U.S. dollars.

Earnings of college educated workers also varied by their college major. Workers with degrees in business, social science, and the STEM fields of engineering, math, and physical sciences had the highest mean monthly earnings, followed closely by those with degrees in biological and health sciences, while workers with college degrees in the fields of education and humanities had the lowest mean monthly earnings (Table 10).

Literacy and Numeracy Proficiencies

An important measure of the human capital of workers is literacy and numeracy proficiencies. Workers with higher skills are expected to have higher earnings. In their study of the links between earnings and literacy, numeracy, and problem-solving skills, Hanushek, Schwerdt, Wiederhold, and Woessmann found positive earnings premiums associated with skills in each of the 22 countries included in their study. Their estimates of the size of the earnings premium varied across those countries, with the highest premium among U.S. workers.[31] As the modern economy continues to advance technologically, the demand for workers with higher levels of literacy, numeracy and technical skills has sharply increased, while at the same time the demand for workers with lower levels of skills has declined, resulting in higher wages for high-skill workers and rising wage gaps between high- and low-skill workers.[32]

A comparison of the mean monthly earnings of 21- to 65-year-old college graduates in the United States by level of literacy and numeracy proficiencies presented in Table 11 also reveals that college graduates with lower skills earned less than counterparts with higher skills. However, differences between earnings of workers with different levels of proficiencies were somewhat larger on the numeracy scale than the literacy scale.

The mean monthly earnings were $5,330 per month among employed college graduates with literacy proficiency below level 3, $6,120 in literacy level 3, and $7,340 in literacy levels 4 and 5. Relative to college graduate workers with literacy proficiency below level 3, the difference in earnings of those at level 3 was not statistically significant, but the earnings premium of $2,000, or 38 percent, for workers in literacy levels 4 and 5 was (Table 11).

A comparison of mean monthly earnings by numeracy proficiencies (Table 11) reveals that mean monthly earnings increased from $5,300 among workers with numeracy proficiency below level 3, to $6,280 among those in level 3, and $7,640 among workers in levels 4 or 5 of the PIAAC numeracy proficiency scale, yielding earnings premiums (relative to the earnings of workers below level 3) of 44 percent for workers in numeracy levels 4 or 5; there was no statistically significant difference between the earnings of workers with numeracy proficiencies in level 3 and below level 3 (Table 11).

Table 11: Mean Monthly Earnings of 21- to 65-Year-Old Employed College Graduates, By Level of PIAAC Literacy and Numeracy Proficiencies, 2012-2014

LITERACY AND NUMERACY PROFICIENCY LEVEL	MEAN EARNINGS	STANDARD ERROR	ABSOLUTE DIFFERENCE (COMPARED TO BELOW LEVEL 3)	STANDARD ERROR	RELATIVE DIFFERENCE (COMPARED TO BELOW LEVEL 3)
LITERACY					
BELOW LEVEL 3	$5,333	582	na		
LEVEL 3	$6,117	499	784	779	14.7%
LEVEL 4/5	$7,337	466	$2,004***	581	37.6%***
NUMERACY					
BELOW LEVEL 3	$5,307	510	na		
LEVEL 3	$6,280	453	973	596	18.3%
LEVEL 4/5	$7,644	587	$2,337***	700	44.0%***

Statistical significance: *** sig. at .01 level.
Note: Earnings in U.S. dollars.

Access to College Labor Market Occupations

Employed college graduates on average have higher earnings than workers without a college degree. However, within the group of workers with a college degree, the level of earnings is closely linked to their access to quality jobs. One measure of job quality is the education and skill requirements of the job. Access to employment in CLM occupations is associated with a sizable earnings premium among college graduates. For example, in 2009, the mean annual earnings of workers with a bachelor's or higher college degree who were employed in CLM occupations were 95 percent higher than counterparts who were mal-employed.[33]

Our examination found a similarly large gap in 2012-2014, with college graduates in CLM occupations doubling the earnings of those in non-CLM occupations. The mean earnings of college graduates in a CLM occupation were $7,200, 98 percent higher ($3,568) than the $3,632 mean monthly earnings of mal-employed college graduate workers (Table 12).

Table 12: Difference between the Mean Monthly Earnings of 21- to 65-Year-Old College Graduates Employed in CLM Occupations and Non-CLM Occupations, 2012-2014

COLLEGE GRADUATES IN CLM OCCUPATIONS VS. COLLEGE GRADUATES IN NON-CLM OCCUPATIONS	MEAN MONTHLY EARNINGS	STANDARD ERROR
COLLEGE GRADUATES IN CLM OCCUPATIONS	$7,200	442
COLLEGE GRADUATES IN NON-CLM OCCUPATIONS	$3,632	254
ABSOLUTE DIFFERENCE	$3,568***	498
RELATIVE DIFFERENCE	98.2%***	

Statistical significance: *** sig. at .01 level.
Note: Earnings in U.S. dollars.

Although high school graduates are not within the universe of workers included in this study, we present some striking comparisons between the earnings of high school graduates with those of college graduates, particularly mal-employed college graduates.[34] In 2012-2014, workers who graduated college doubled the earnings of those who graduated only high school and proceeded no further. Employed high school graduates without any post-high school education earned on average $3,190 per month. In comparison, college graduate workers earned an average of $6,360, yielding a college earnings premium of $3,170, or 99 percent (Table 13).

Table 13: Difference between the Mean Monthly Earnings of 21- to 65-Year-Old Employed College Graduates and High School Graduates, 2012-2014

COLLEGE GRADUATES VS. HIGH SCHOOL GRADUATES	MEAN MONTHLY EARNINGS	STANDARD ERROR
ALL EMPLOYED COLLEGE GRADUATES	$6,361	374
ALL EMPLOYED HIGH SCHOOL GRADUATES	$3,191	123
ABSOLUTE DIFFERENCE	$3,170***	401
RELATIVE DIFFERENCE	99.3%***	

Statistical significance: *** sig. at .01 level.
Note: Earnings in U.S. dollars.

Separate comparisons of the mean monthly earnings of high school graduates with CLM employment and mal-employed college graduates (Table 14) provide strong evidence of zero returns to a college degree for mal-employed college graduates. The mean monthly earnings of college graduates employed in CLM occupations was $7,200, while mal-employed counterparts (those in non-CLM occupations) earned $3,630 per month. The $7,200 mean monthly earnings of CLM-employed college graduates were more than $4,000, or 125 percent higher, than the $3,190 mean monthly earnings of high school

graduates. Mal-employed college graduates, in contrast, earned only $441, or 14 percent, more than high school graduates ($3,630 versus $3,190), a difference that was not statistically significant (Table 14).

Table 14: Differences between the Mean Monthly Earnings of 21- to 65-Year-Olds: College Graduates Employed in CLM Occupations and High School Graduates, and College Graduates Employed in Non-CLM Occupations and High School Graduates, 2012-2014

	MEAN MONTHLY EARNINGS	STANDARD ERROR
CLM OCCUPATIONS		
COLLEGE GRADUATES IN CLM OCCUPATIONS	$ 7,200	442
ALL EMPLOYED HIGH SCHOOL GRADUATES	$ 3,191	123
ABSOLUTE DIFFERENCE	$ 4,009***	459
RELATIVE DIFFERENCE	125.6%***	
NON-CLM OCCUPATIONS		
COLLEGE GRADUATES IN NON-CLM OCCUPATIONS	$ 3,632	254
ALL EMPLOYED HIGH SCHOOL GRADUATES	$ 3,191	123
ABSOLUTE DIFFERENCE	$ 441	320
RELATIVE DIFFERENCE	13.8%	

Statistical significance: *** sig. at .01 level.
class="subhead"Note: Earnings in U.S. dollars.

Access to employment in CLM occupations is critical for college graduates to reap an earnings premium. Without employment in a CLM occupation, there is no statistically significant earnings gain for a college graduate relative to a high school graduate. Although average skills and human capital stock of college graduates are higher than that of high school graduates, college graduates employed in non-CLM occupations are unable to gain an earnings advantage over high school graduates. The higher cognitive and noncognitive skills (soft skills) of college graduates might make them better employees, even in a non-CLM job like a barista, but they will still earn what is closer to the mean barista wage than the wage of a typical CLM job.

Some studies have found that college graduates' inability to access employment in CLM occupations, particularly at the time of their labor market entry after graduation, is likely to have longer-term effects on their employment and earnings outcomes. Lisa Kahn offers the following skill-based explanation for the longer-term negative wage effect: College graduates who enter the labor market in a non-college-level job are not likely to develop high-level skills from on-the-job learning that they can utilize when they transition into college-level jobs. Instead, they end up learning lower-level skills that are mostly wasted when they transition into college-level jobs, resulting in setbacks to their

career progress and earnings growth. In contrast, peers who enter the workforce in college-level occupations gain an early start in the development of higher-level skills from on-the-job learning.[35] Nunley, Pugh, Romero, and Seals found that *under*employment was more likely than *un*employment to reduce future employment opportunities for college graduates. They contend that postgraduation employment of college graduates in a non-college-level occupation leads to skills depreciation and is seen by employers as a signal of lower productivity.[36]

Multivariate Regression Analysis of Earnings

To this point, we have shown findings revealing a strong link between human capital and earnings of employed college graduates. The mean monthly earnings of college graduate workers moved according to the following patterns:

- sharply up with higher levels of literacy and numeracy proficiencies
- higher based on degree level (bachelor's, graduate, advanced degree)
- considerably higher for degrees in STEM-related and business fields than for degrees in education and the humanities
- dramatically higher for college graduates in CLM occupations than those in non-CLM occupations

As far as gaining access to CLM occupations, we saw it was:

- more likely for those with graduate or advanced college degrees
- much greater for those with higher levels of literacy and numeracy proficiencies

But descriptive analysis cannot disentangle the independent effects of different measures of human capital traits of workers. Earnings regressions allow us to do so, for example, letting us see the independent effects of literacy and numeracy proficiencies when examining college educated workers with varying college degree levels.

We have estimated several multivariate earnings regression models to measure the independent effects of the different measures of human capital on the earnings of college graduate workers, statistically controlling the effects of other variables that are known to affect the earnings of college graduates. These are included in the regressions as explanatory variables. This method is detailed in Appendix F.

There are seven models of earning regressions using PIAAC proficiency scores as the base explanatory variable, once each for literacy and numeracy (see Box 1). A detailed description of the dependent variable and all independent variables included in these regression models is presented in Appendix G.

Box 1: Multivariate Earnings Regression Models

Seven Earnings Regression Models

The explanatory variable blocks in each of the seven regression models are listed below:

Human Capital Traits

Model 1: Literacy/numeracy proficiency

Model 2: Model 1 plus educational attainment

Model 3: Model 2 plus major field of study

Model 4: Model 3 plus paid work experience

Job Characteristics and Employment-Related Traits of Workers

Model 5: Model 4 plus employment in a college labor market occupation

Model 6: Model 5 plus economic sector, weekly hours of work, school enrollment status, and place of residence

Demographic Traits of Workers

Model 7: Model 6 plus gender, race-ethnicity, foreign-born status, and disability status

Two Sets of Seven Earnings Regression Models

Two sets of earnings regressions were estimated, each consisting of the seven regression models listed above. The two sets of regressions differ on the following two measures of the explanatory variable measuring skills

Set A: Standardized score on the literacy scale

Set B: Standardized score on the numeracy scale

Effects of Literacy and Numeracy Proficiencies on Earnings

As noted above, the primary focus in these regressions is the effect of skills on the earnings of college graduate workers. In this section, we present a summary of regression-based estimates of the effects of literacy and numeracy proficiencies on the monthly earnings of 21- to 65-year old employed college graduates.

Findings on the effect of standardized literacy and numeracy scores of 21- to 65-year old employed college graduates on their monthly earnings estimated from set A (skills specified as standardized score on the PIAAC literacy scale) and set B (numeracy) of the seven regression models are presented in Figures 8 and 9. According to set A-model 1, which has the standardized literacy scale score as the sole explanatory variable, an increase of one standard deviation unit in the literacy scale score is expected to increase monthly earnings by 21 percent (significant at the .01 level).[37] But the explanatory power (adjusted R-squared) of this model (was only .027), meaning the literacy score by itself explained less than 3 percent of the earnings variation.

Regression-adjusted effects measure the "independent" effect of an explanatory variable on the dependent variable after statistically controlling for the effects of other explanatory variables included in the regression. Therefore the addition of more explanatory variables in the earnings regression models was expected to reduce the

regression-adjusted effect of skills on earnings since the additional explanatory variables (which measure other human capital traits, access to college labor market occupations, and job-related and demographic traits) are known to affect earnings. That was indeed the case.

For literacy, adding the level of college degree (educational attainment measure; set A-model 2) and the major field of study (set A-model 3) each resulted in the estimated earnings effect from a one standard deviation unit change in literacy score to decrease and the explanatory power (R-squared) to increase. Adding work experience (set A-model 4) increased only the explanatory power from set A-model 3, with a jump from 10 percent to 17 percent. Each of these models left the estimated literacy impact on the percentage change in monthly earnings in the 16 to 17 percent range.

Unsurprisingly, Set A-model 5, which added an explanatory variable representing access of college graduate workers to CLM occupations, resulted in the most noteworthy change. The R-squared of the model rose to .258, meaning all of these traits together explained close to 26 percent of the variation in earnings. And there was a sizable reduction in the percentage earnings change (11.3 percent, a 5-point drop) resulting from a one standard deviation unit change in workers' literacy scores. Still, even after adding education, major field of study, paid work experience, and access to CLM occupations—traits that are strongly related to earnings—the effect of literacy skills of workers on their earnings remained sizable and statistically significant.

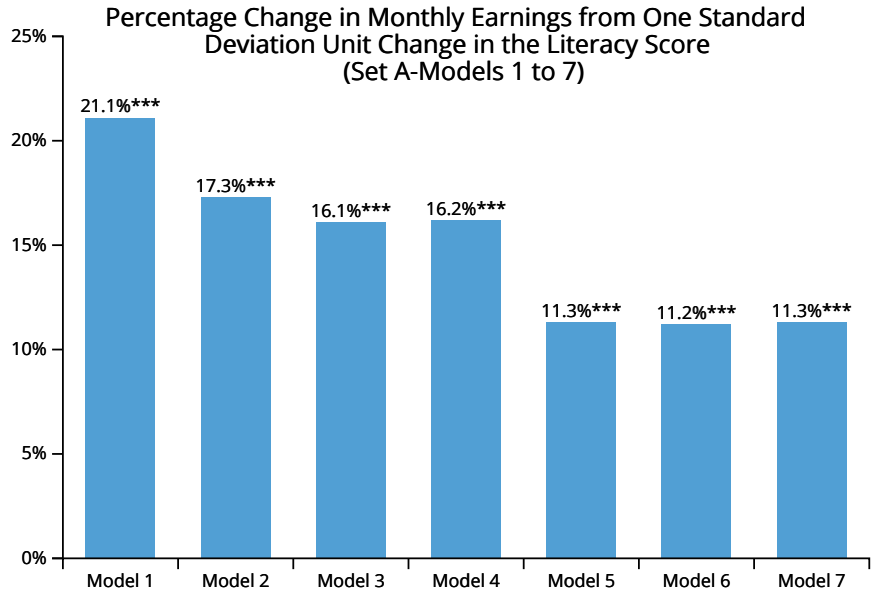
Set A-model 6 added four explanatory variables representing one job trait (economic sector of employment) and three employment-related traits of workers (weekly hours of work, school enrollment status, and region of residence). A close relationship between these employment-related traits of workers and earnings was revealed as the R-squared jumped from .258 to .484. This ties in with the descriptive analysis presented earlier, showing a strong link between earnings of college graduates and their employment-related traits, particularly the number of hours worked per week (a positive relationship) and whether they are enrolled in school, as the commitment to the labor market may be weak for those pursuing education, particularly if enrolled full time.[38]

The addition of explanatory variables measuring the demographic traits of college graduate workers in set A-model 7 resulted in a very small increase in the R-squared (.493, up from .484 in set A-model 6).

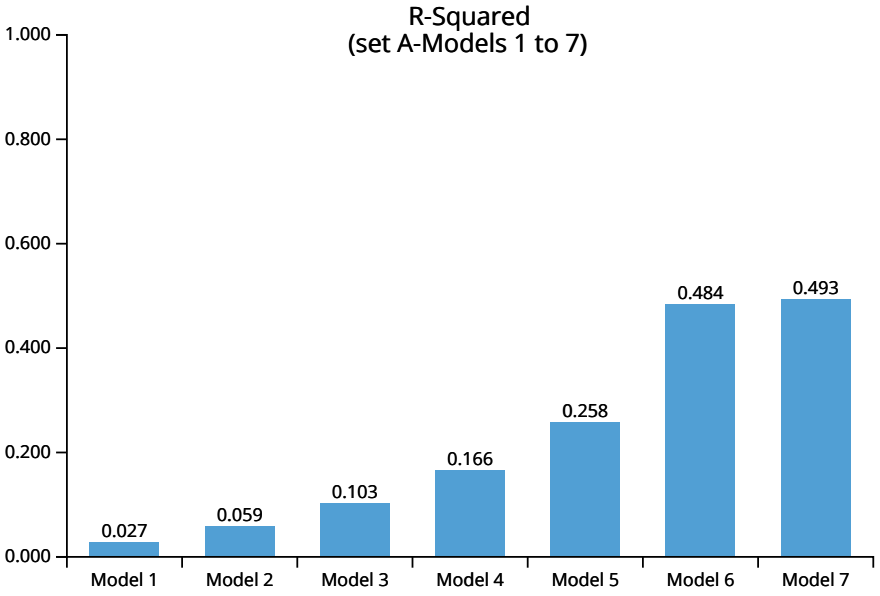
These final two models left the estimated effect of literacy on earnings unchanged at 11.3 percent. The effect of a standard deviation unit change in the literacy proficiency of college graduate workers on their earnings, then, is estimated to be 11.3 percent (Figure 8). That is 3 percentage points higher than our previous report,[39] which estimated an 8.4 percent regression-adjusted effect on earnings from one standard deviation unit change in the literacy score of prime-aged full-time workers, even after controlling for the level of educational attainment (Figure 8).

The .493 R-squared of the full earnings regression model in set A-model 7 means that this model explains nearly one-half of the variation in the log of monthly earnings of 21- to 65-year-old employed college graduates with a bachelor's or higher level of education (Figure 8).

Figure 8: Estimated Percentage Change on the Monthly Earnings of 21- to 65-Year-Old Employed College Graduates (with a Bachelor's Degree or More) from One Standard Deviation Unit Change in the Literacy Score, 2012-2014 (Estimated from Earnings Regression Models (Set A-Models 1-7))



Statistical significance: *** sig. at .01 level.



Explanatory variables in regression models: **Model 1**: standardized literacy score; **Model 2:** Model 1 plus educational attainment (college degree level); **Model 3**: Model 2 plus major field of study of college degree; **Model 4:** Model 3 plus paid work experience, **Model 5**: Model 4 plus employment in a college-level occupation; **Model 6**: Model 5 plus sector of employment, weekly hours of work, school enrollment status, place of residence; **Model 7**: Model 6 plus gender, race-ethnicity, foreign-born status, and disability status.

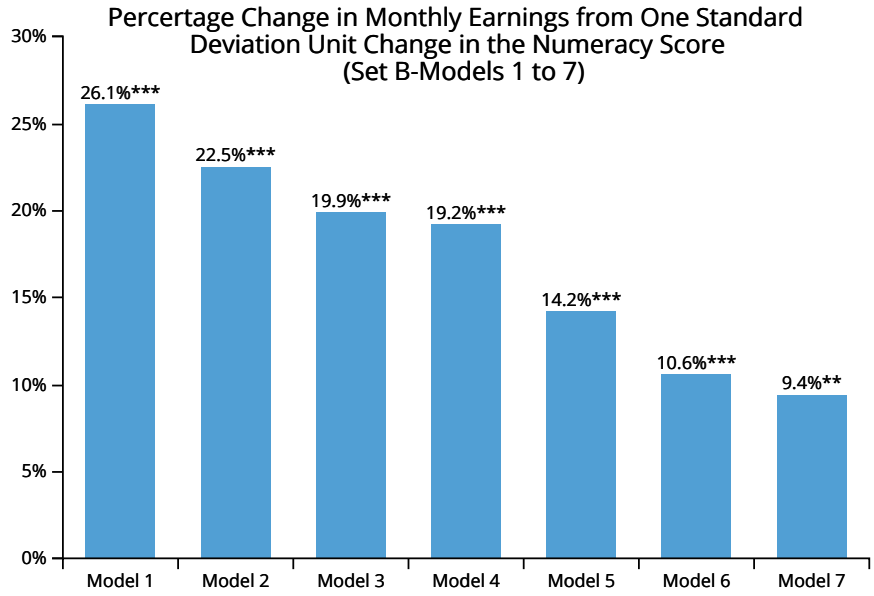
As presented in Figure 9, similar to the findings on literacy proficiencies, estimates of the regression-adjusted effect of numeracy proficiency of college graduates on their earnings declined as blocks of explanatory variables (Box 1) were added to the earnings regression models.

According to findings from the earnings regression in set B-model 1, an increase of one standard deviation unit in the numeracy scale score of college graduate workers is expected to increase monthly earnings by nearly 26 percent. The declines in the percent effect of numeracy proficiency on earnings tracked similarly to literacy. Even after controlling for all variables included in the full model (set B-model 7), the independent effect of one standard deviation unit change in the numeracy proficiency score of workers on their monthly earnings remained high at 9.4 percent (Figure 9);

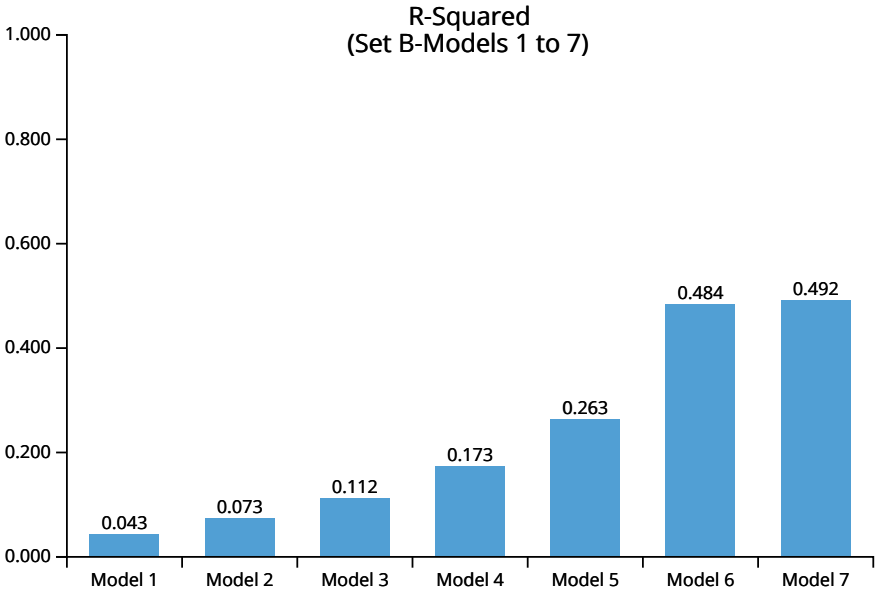
The R-squared of the full numeracy model was .492 (Figure 9), almost the same as for literacy (.493). There was very little difference between the R-squared for each of the seven regression models in set B compared to those in set A.

All in all, these findings reveal that for college graduates, literacy and numeracy proficiencies are estimated to have a sizable effect on earnings even after statistically controlling for a wide array of covariates that are known to affect the earnings of college graduates.

Figure 9: Estimated Percentage Change on the Monthly Earnings of 21- to 65-Year-Old Employed College Graduates (with a Bachelor's Degree or More) from One Standard Deviation Unit Change in the Numeracy Score, 2012-2014 (Estimated from Earnings Regression Models (Set B-Models 1-7))



Statistical significance: *** sig. at .01 level; **sig. at .05 level.



Explanatory variables in regression models: **Model 1**: standardized literacy score; **Model 2:** Model 1 plus educational attainment (college degree level); **Model 3**: Model 2 plus major field of study of college degree; **Model 4:** Model 3 plus paid work experience, **Model 5**: Model 4 plus employment in a college-level occupation; **Model 6**: Model 5 plus sector of employment, weekly hours of work, school enrollment status, place of residence; **Model 7**: Model 6 plus gender, race-ethnicity, foreign-born status, and disability status.

The coefficients, percent effects, and statistical significance of all explanatory variables in each of the seven earnings regression models in the two sets are presented in Appendix H. A detailed discussion of the findings from the full earnings regression model (model 7) of sets A and B is presented below.

Effects of Key Variables on Employed College Graduates on Earnings

In this section we present regression-based estimates from the full earnings regression model (model 7 for sets A and B) of the independent effect of other explanatory variables on the monthly earnings of employed college graduates. There is very little difference in the estimates of the effect of each of the explanatory variables across the two sets of full model earnings regressions, which means that the specification of skills as literacy or numeracy proficiencies has little effect on the size of the coefficients of the remaining explanatory variables. A discussion is presented below.

Human Capital Traits of Workers

Looking at level of education for employed college graduates, we find a beneficial effect from a professional or doctoral degree, but little or none from a master's in comparison to bachelor's degree holders. Findings on education's independent effect on earnings reveal that after controlling for all other variables, the regression-adjusted earnings of a college graduate with a professional or doctoral degree are expected to be between 18 and 19 percent higher than the earnings of their bachelor's degree counterparts (Table 15). The coefficient of professional/doctoral degree was statistically significant at the .05 level. But the master's degree coefficient was not statistically significant in the full earnings regression for literacy and only marginally significant (at the .10 level) for numeracy.

The choice of college major is an integral part of the decision to acquire educational human capital. While years of schooling and schooling credentials are a quantitative measure of human capital, major field of study is an indicator of the quality of human capital. The choice of college major is closely related to earnings.[40] Descriptive analysis of the mean earnings of employed college graduates by their college major reveals wide gaps in earnings by major field of study. Mean monthly earnings of college graduates with a business degree were $7,215, whereas education majors earned $4,230 per month, representing an earnings advantage of nearly $3,000, or 70 percent in favor of business majors. In fact, gaps between the earnings of some college majors are nearly as large as the gap between the earnings of college graduates and high school graduates.[41]

The full earning regression includes explanatory variables representing seven broad areas of college majors. The seven college majors include STEM fields of engineering, math, and physical sciences; biological and health sciences; social sciences; business; education and training; humanities; and a group labeled "other majors" representing miscellaneous majors that do not belong to any of the other areas of study. Workers with college degree in humanities majors represent the base or reference group against which the earnings of the remaining areas of study are assessed in the regression.

Our study shows clear earnings advantages for certain fields of study. Findings reveal that compared to humanities majors, regression-adjusted earnings were lower among education majors and higher among the remaining four college majors. The regression-adjusted earnings premium compared to humanities majors was 33 percent among biological and health science majors, 25 percent among business majors, 16-18 percent among STEM majors, and nearly 17 percent among social science majors. The regression-adjusted earnings of education majors are expected to be 14-15 percent lower than humanities majors. The coefficient of the education major field of study was statistically significant at the marginal level of .10 in both regressions. The coefficients of the remaining major fields were statistically significant at the .01 or .05 levels except for the coefficient of the STEM major for numeracy (.10 level).

Despite the advantages of certain majors, college graduates do not all flock to them because the choice is determined by more than earnings after graduation, particularly the ability to complete the required coursework and interest in the field of study.

Another form of human capital is accumulated by workers from paid work experience. As workers gain labor market experience, they learn new skills and knowledge and improve what they already know and can do. Additional work experience also provides workers with seniority that is sometimes accompanied by higher pay. Paid work experience is expected to have a strong positive effect on the earnings of workers. And, among college graduates, the earnings gains from additional work experience are higher than among workers without a college education, evident in the steeper age-earnings profile of college graduates compared to high school graduates.[42]

Earnings have been shown to rise with additional work experience but at a diminishing rate,[43] going up sharply for the first few years, followed by a more gradual rate of increase. Indeed, findings from our earnings regression analysis support this relationship. An additional year of paid work experience is expected to raise monthly earnings of employed college graduates by 4.5 percent, representing a considerably higher return to work experience compared to the 3.1 to 3.3 percent estimated for all prime-age, full-time workers we found in our previous PIAAC-based study.[44]

We also see the diminishing returns to additional years of experience, meaning that at a certain level of paid work experience, monthly earnings will be maximized: about 31.1 years based on the average estimates of the two work experience variables in the two regression models (Table 15). The negative and statistically significant coefficient on the experience-squared variable points to this pattern.

Table 15: Percent Change in Expected Monthly Earnings from a Change in Predictor Variables: Estimates from Full Earnings Regression Models (Sets A and B) for 21- to 65-Year-Old Employed College Graduates (Findings for a Subset of Explanatory Variables Measuring Human Capital)

EXPLANATORY VARIABLES	(A) SET A-FULL MODEL (7) WITH SKILLS MEASURED BY STANDARDIZED LITERACY PROFICIENCY SCORE	(B) SET B-FULL MODEL (7) WITH SKILLS MEASURED BY STANDARDIZED NUMERACY PROFICIENCY SCORE
STANDARDIZED PROFICIENCY SCORE—PLAUSIBLE VALUES (PVS)		
PVLITERACY OR PVNUMERACY	11.3***	9.4**
EDUCATIONAL ATTAINMENT (BASE GROUP IS JUST A BACHELOR'S DEGREE)		
MASTER'S DEGREE	7.2	7.8*
PROFESSIONAL DEGREE OR DOCTORAL DEGREE	18.0**	19.1**
COLLEGE MAJOR FIELD OF STUDY (BASE GROUP IS HUMANITIES)		
ENGINEERING, MATH AND PHYSICAL SCIENCES	17.8**	16.0*
BIOLOGICAL AND HEALTH SCIENCES	33.0***	32.9***
SOCIAL SCIENCES	16.7**	16.5**
BUSINESS	25.0***	23.9***
EDUCATION AND TRAINING	-13.8*	-14.7*

Statistical significance: *** sig. at .01 level, ** sig. at .05 level, * sig. at .10 level.
Explanatory variables in full regression model (Model 7): Literacy/numeracy proficiencies; educational attainment; college major field of study, paid work experience, college labor market occupation, sector of employment, weekly hours of work, school enrollment status, region of residence, gender, race-ethnicity, foreign-born status, and disability status.
Note: Regression coefficients on literacy and numeracy proficiencies are measured separately and are *not additive.* For example the coefficients for literacy proficiency score was 11.3 percent in set A-model 7 (Col. A) and 9.4 percent for numeracy proficiency score in set B-model 7 (Col. B). Readers should *not* interpret these findings as additive. For example, we *cannot infer* from these findings that the regression-adjusted effect of literacy and numeracy proficiency on earnings is 20.7 percent, i.e., the sum of the coefficients from the two separate regressions (11.3% + 9.4%).

EXPLANATORY VARIABLES	(A) SET A-FULL MODEL (7) WITH SKILLS MEASURED BY STANDARDIZED LITERACY PROFICIENCY SCORE	(B) SET B-FULL MODEL (7) WITH SKILLS MEASURED BY STANDARDIZED NUMERACY PROFICIENCY SCORE
YEARS OF WORK EXPERIENCE (CONTINUOUS VARIABLE, RANGE: 0-47)		
EXPERIENCE	4.5***	4.6***
EXPERIENCE SQUARED	-0.1***	-0.1***
R-SQUARED	0.493	0.492

Statistical significance: *** sig. at .01 level, ** sig. at .05 level, * sig. at .10 level.
Explanatory variables in full regression model (Model 7): Literacy/numeracy proficiencies; educational attainment; college major field of study, paid work experience, college labor market occupation, sector of employment, weekly hours of work, school enrollment status, region of residence, gender, race-ethnicity, foreign-born status, and disability status.
Note: Regression coefficients on literacy and numeracy proficiencies are measured separately and are *not additive.* For example the coefficients for literacy proficiency score was 11.3 percent in set A-model 7 (Col. A) and 9.4 percent for numeracy proficiency score in set B-model 7 (Col. B). Readers should *not* interpret these findings as additive. For example, we *cannot infer* from these findings that the regression-adjusted effect of literacy and numeracy proficiency on earnings is 20.7 percent, i.e., the sum of the coefficients from the two separate regressions (11.3% + 9.4%).

Job Traits: College Labor Market Occupations and Economic Sector of Employment

Earnings of workers are also affected by characteristics of the job in which they are employed. Occupations represent what workers do on the job and so are closely related to the knowledge, ability, social skills and behavioral traits to be a productive contributor to the firm. Occupations that require high levels of skills can be staffed with only highly skilled and educated workers who can perform the tasks required. These occupations pay high wages to attract and adequately compensate workers with high levels of human capital in the form of skills and educational attainment.

According to the human capital theory, earnings rise with human capital because human capital increases the productive potential of workers. Therefore, jobs that do not require a college education and college-level skills, knowledge, and abilities are likely to pay lower wages. Indeed, our descriptive analysis of mean earnings revealed that the mean earnings of college graduates employed in CLM jobs were double those in non-CLM jobs.

The full earnings regression model included an explanatory variable representing college labor market (CLM) occupations. Findings from both full regression models (model 7-sets A and B) reveal sizable regression-adjusted earnings premiums for college graduates who were employed in a CLM occupation. After statistically controlling for all the variables included in the full regression model, the earnings of workers employed in a CLM occupation are expected to be 60 percent higher than those of workers in non-CLM occupations (Table 16). A comparison of the mean earnings of CLM and non-CLM employed college graduates found an earnings premium of 98 percent. Although regression controls reduced its size, the regression-adjusted earnings premium associated with college graduates' access to CLM occupations still remained very large.

Table 16: Percent Change in Expected Monthly Earnings from a Change in Predictor Variables: Estimates from Full Earnings Regression Models (Sets A and B) for 21- to 65-Year-Old Employed College Graduates (Findings for a Subset of Explanatory Variables Measuring Job Characteristics)

EXPLANATORY VARIABLES	(A) SET A-FULL MODEL (7) WITH SKILLS MEASURED BY STANDARDIZED LITERACY PROFICIENCY SCORE	(B) SET B-FULL MODEL (7) WITH SKILLS MEASURED BY STANDARDIZED NUMERACY PROFICIENCY SCORE
EMPLOYMENT IN COLLEGE LABOR MARKET OCCUPATION (BASE GROUP IS NON-COLLEGE LABOR MARKET OCCUPATION)		
COLLEGE LABOR MARKET OCCUPATIONS	60.1***	60.0***
R-SQUARED	0.493	0.492

Statistical significance: *** sig. at .01 level.
Explanatory variables in full regression model (Model 7): Literacy/numeracy proficiencies; educational attainment; college major field of study, paid work experience, college labor market occupation, sector of employment, weekly hours of work, school enrollment status, region of residence, gender, race-ethnicity, foreign-born status, and disability status.

Employment-Related Traits of Workers

The next groups of explanatory variables in the earnings regressions presented in Table 17 represent employment-related worker traits. These traits include school enrollment status and weekly hours of work. School-enrolled workers are likely to earn less for a number of reasons.

- They are generally younger and are still in the process of accumulating the labor market work experience that will raise their future earnings.
- They are still engaged in acquiring education that could result in higher future earnings.
- They are less likely to be fully engaged in the labor market since some of their time is spent on schooling activities.

The full earnings regression models in Table 17 found that college graduate workers enrolled in school are expected to earn nearly 23 percent less than those not enrolled in school. The school enrollment coefficient was statistically significant at the .01 level (Table 17).

Weekly hours of work are included in the full earnings regression model as a continuous variable between 2 and 60 hours per week. Findings show a strong and positive connection between weekly hours of work and monthly earnings of employed college graduates. Each additional hour of work is expected to increase monthly earnings of 21- to 65-year-old employed college graduates by 3.3 percent, holding all other explanatory variables constant (Table 17).[45]

Table 17: Percent Change in Expected Monthly Earnings from a Change in Predictor Variables: Estimates from Full Earnings Regression Models (Sets A and B) for 21- to 65-Year-Old Employed College Graduates (Findings for a Subset of Explanatory Variables Measuring Employment-Related Traits of Workers)

EXPLANATORY VARIABLES	(A) SET A-FULL MODEL (7) WITH SKILLS MEASURED BY STANDARDIZED LITERACY PROFICIENCY SCORE	(B) SET B-FULL MODEL (7) WITH SKILLS MEASURED BY STANDARDIZED NUMERACY PROFICIENCY SCORE
SCHOOL ENROLLMENT STATUS (BASE GROUP IS NOT ENROLLED IN SCHOOL)		
ENROLLED IN SCHOOL	-22.5***	-22.9***
WEEKLY HOURS OF WORK (CONTINUOUS VARIABLE, RANGE: 15-60)		
WEEKLY HOURS	3.3***	3.3***
R-SQUARED	0.493	0.492

Statistical significance: *** sig. at .01 level.
Explanatory variables in full regression model (Model 7): Literacy/numeracy proficiencies; educational attainment; college major field of study, paid work experience, college labor market occupation, sector of employment, weekly hours of work, school enrollment status, region of residence, gender, race-ethnicity, foreign-born status, and disability status.

Demographic Traits of Workers

Finally, we looked at demographic traits of workers. The between-group differences that were not statistically significant caught our attention as much as those that were statistically significant. We found a large statistically significant earnings premium for males over females. And, after controlling for all the variables discussed above, we found no statistically significant earnings differences by race-ethnicity, foreign-born status, and for those with a disability.

The full earnings regression models estimated a regression-adjusted gender gap in earnings of 17 to 19 percent in favor of men among 21- to 65-year-old employed college graduates. In a previous section of this report, we had found that the mean monthly earnings of male college graduates were about $2,500, or 48 percent higher, than those of females ($7,675 among men versus $5,200 among women). The regression-adjusted gender gap in the monthly earnings is still large (17 to 19 percent), albeit smaller than the unadjusted gap of 48 percent.

The persistence of the gender gap in earnings is widely studied among researchers. Although a review of the expansive literature on this topic is beyond the scope of this report, we explored some research studies on the earnings gender gap, particularly among college graduates.[46] There is no simple explanation for the persistence of the gender gap in earnings, although a number of research studies found that the gender

gap in earning widens over the working lifetime, attributed by many to career interruption of women as they bear and raise children.[47] Some studies even show near wage parity at graduation, with the gender gap emerging as college graduates age.

Career interruption from family formation is likely to interrupt careers of women due to a withdrawal from the workforce, a reduction in the hours of work, or both. The result would be depreciation in skills and reduced accumulation of one type of human capital that has a strong positive effect on earnings, particularly among college graduates—paid work experience. Also, Claudia Goldin's examination of the growth in the earnings gender gap with age revealed significant differences by occupations. Occupations such as business and law typically require more interactions and have more time pressure and large penalties for time out of the labor force, whereas occupations such as pharmacy have lower penalties for time out.[48] The cost of the career interruption from workforce withdrawal as well as from workforce flexibility, which allows reduced hours of work, last well beyond the time of the career interruption. As Goldin stated, "Flexibility at work has become a prized benefit, but flexibility is of less value if it comes at a high price in terms of earnings."[49]

The full earnings regression model (across all four sets) found no statistically significant difference in the monthly earnings of employed college graduates by their race-ethnicity characteristics, nativity status, and disability status. After controlling for the covariates included in the full regression model, the earnings of employed college graduates who were Black, Hispanic, Asian, and "Other" races were found not to be statistically different from the earnings of White workers. The full regression models also found no statistically significant difference between the regression-adjusted earnings of native- and foreign-born college graduate workers (Table 18).

The disability status of workers is closely related to their labor market outcomes. Workers with disabilities are less likely to participate in the labor market compared to workers without disabilities. And, when they participate in the labor market, workers with disabilities are less likely to find a job and more likely to remain unemployed than workers without disabilities. Individuals with disabilities have lower labor force participation rates, lower employment rates, and higher unemployment rates than individuals without disabilities.[50] Even when employed, workers with disabilities work fewer hours per week and fewer weeks per year than workers without disabilities.

But the gap between these labor market outcomes of individuals with and without disabilities decreases with educational attainment.[51] Our descriptive analysis of PIAAC data found no statistical difference between the mean monthly earnings of 21- to 65-year-old employed college graduates with and without disabilities ($6,375 for workers with disabilities versus $6,275 for workers without disabilities). We also found no statistical difference between the regression-adjusted earnings of workers with and without disabilities (Table 18).

Table 18: Percent Change in Expected Monthly Earnings from a Change in Predictor Variables: Estimates from Full Earnings Regression Models (Sets A and B) for 21- to 65-Year-Old Employed College Graduates (Findings for a Subset of Explanatory Variables Measuring Demographic Traits of Workers)

EXPLANATORY VARIABLES	(A) SET A-FULL MODEL (7) WITH SKILLS MEASURED BY STANDARDIZED LITERACY PROFICIENCY SCORE	(B) SET B-FULL MODEL (7) WITH SKILLS MEASURED BY STANDARDIZED NUMERACY PROFICIENCY SCORE
GENDER (BASE GROUP IS FEMALE)		
MALE	19.3***	17.4***
RACE-ETHNICITY (BASE GROUP IS WHITE)		
HISPANIC	0.6	-0.2
BLACK	4.6	5.7
ASIAN/ PACIFIC ISLANDER	3.7	2.9
OTHER RACE	-1.3	-0.9
NATIVITY STATUS (BASE GROUP IS NATIVE-BORN)		
FOREIGN-BORN	2.9	0.5
DISABILITY STATUS (BASE GROUP IS WORKERS WITHOUT DISABILITIES)		
WITH DISABILITY	-6.1	-6.9
R-SQUARED	0.493	0.492

Statistical significance: *** sig. at .01 level.
Explanatory variables in full regression model (Model 7): Literacy/numeracy proficiencies; educational attainment; college major field of study, paid work experience, college labor market occupation, sector of employment, weekly hours of work, school enrollment status, region of residence, gender, race-ethnicity, foreign-born status, and disability status.

Summary and Conclusion

Earning a bachelor's degree has become a basic goal for American high school students, with 7 out of every 10 high school graduates going into the postsecondary system immediately after high school. Certainly, college remains a worthwhile pursuit for getting ahead in the labor market, with those who graduate finding large advantages on average over those who do not. But gains do not accrue to college graduates across the board. Many, especially recent graduates, do not reap those labor market advantages.

What's crystal clear and of primary importance is that skills matter most. Our analysis shows that those with higher literacy and numeracy proficiencies not only have a better chance at obtaining a CLM job—an occupation that utilizes the skills and knowledge typically associated with a college education—but at succeeding in it even if the job doesn't precisely match their college course of study. The reward is receiving the higher earnings that tends to come with such employment.

Unfortunately, even as the numbers of college graduates have increased, many college graduates fail to acquire the minimum level of skills. One out of every five bachelor's degree holders among employed college graduates ages 21 to 65 lacks minimum skills in literacy according to PIAAC data; for numeracy, the number is one in three. Employers seeking workers find that a four-year college diploma is no guarantee of strong literacy or numeracy skills. And individuals without skills are at risk of losing out on the financial rewards of high earnings and of a CLM position and winding up mal-employed.

Our regression analysis shows that the average monthly earnings of college graduates in CLM jobs is double those of mal-employed graduates. In fact, mal-employed graduates are scarcely better off than those who never progressed beyond high school. There is no earnings premium at all for college graduates who are unsuccessful in obtaining a CLM job. The picture is even grimmer when you consider that there is no premium for individuals who do go on to college but drop out. But, unfortunately, that is exactly what more than 4 in 10 college students do.[52]

In our analyses, we examined various factors related to earnings for employed college graduates. We found differences were evident by levels of college degree, fields of study, work experience, and more. But we found that it primarily comes down to skills.

The data show that when holding all other human-capital traits constant, the regression-adjusted earnings difference associated with one standard deviation unit change in the PIAAC proficiency test score was 11.3 percent on the literacy test and 9.4 percent on numeracy. The earnings premiums (regression-adjusted) of workers with proficiencies at levels 4/5 compared to their counterparts with proficiencies below level 3 was 21.5 percent for literacy and 16.5 percent for numeracy. These findings indicate that although literacy and numeracy proficiencies are important determinants of the earnings for all workers, these proficiencies are even more important in the college labor market. Simply put, employers assign an earnings premium to college graduates with the strongest literacy and numeracy skills.

Looking strictly at skills, while college graduate workers averaged level 3 proficiency, an examination of the distribution of these college graduate workers across the five PIAAC score levels found it to be surprisingly wide across skill levels. The share of employed college graduates with scores below level 3 in literacy varied by the level of college degree: 21 percent of workers with a bachelor's degree, and 15 percent of those with a master's degree. But even at the highest levels of educational attainment—doctoral and professional degrees—we still found that one in eight graduates scored below level 3. In numeracy, the scores were even worse. Nearly one-third of workers with a bachelor's degree, one-quarter of those with a master's degree, one-fifth of those with a professional degree, and 12 percent of doctoral degree workers scored below level 3.

While skills are important in attaining a CLM job, the level of college degree is an important factor, too. We found that just two-thirds of those with only a bachelor's degree were employed in a CLM occupation at the time of the PIAAC study, while 91 percent of employed persons with a master's degree and 93 percent of those with a doctoral or professional degree worked in the college labor market. As far as literacy and numeracy skills, about two-thirds of those with proficiency below level 3, just over three-quarters of those with level 3 proficiencies, and 83-85 percent of those with the highest levels of literacy and numeracy proficiencies (level 4/5) were employed in CLM occupations at the time of the PIAAC survey.

The differences in earnings varied sharply by level of skills proficiency. The earnings premium of workers with level 4/5 scores on the literacy scale was 38 percent compared to college graduates with scores below level 3. College graduates with numeracy scores at level 4/5 on the numeracy scale earned 44 percent more per month relative to their counterparts with scores below level 3. The difference between the mean monthly earnings of workers below level 3 and at level 3 literacy and numeracy proficiencies was not statistically significant.

Mean earnings also rose sharply with the level of degree completion. Those who earned a master's degree had monthly earnings that were 27 percent greater than their bachelor's degree-only counterparts. Workers who had earned a doctoral or professional degree earned 49 percent more than those who had only completed a bachelor's degree.

Estimates of regression-adjusted earnings premiums to higher levels of college degree attainment were somewhat surprising when it came to master's degrees, however. While we did find substantial unadjusted earnings advantages to earning a master's degree, after controlling for skills, access to jobs in CLM occupations, and all other variables included in the earnings regressions, there was no statistically significant difference between the monthly earnings of workers with a master's degree and those with just a bachelor's degree.

This does not necessarily mean that there are no job market advantages to completing a master's degree program, but that these advantages are largely derived from other factors included in the regression such as higher skill levels, a sharply reduced chance of mal-employment, major field of study, and so on. There was, however, a 20 percent earnings advantage among employed graduates with doctoral and professional degrees.

The data show the importance of having the human capital needed to give individuals the best chance of gaining CLM employment. The mean monthly earnings of workers employed in CLM occupations were nearly double (98 percent higher) the earnings of their mal-employed counterparts—($7,200 versus $3,630). Similarly, a comparison of the mean earnings of all college graduate workers with those of high school graduates found that the mean earnings were 99 percent higher among all college graduate workers, and it was 125 percent higher when looking solely at CLM-employed college graduate workers. As noted earlier, there was no statistical difference between the earnings of mal-employed college graduate workers and those of their high school graduate counterparts.

Findings from our earnings regressions revealed that graduates who were able to gain access to employment in CLM occupations continued to have very large monthly earnings premiums, even after regression controls. College graduates employed in the college labor market still were expected to earn 61 percent more than college degree holders who worked outside the college labor market.

Looking at other human-capital factors more closely, we found that college graduates have large earnings returns to work experience, and the size of these gains is considerably larger than the earnings returns to work experience among workers without a college degree. College labor markets reward the work experience of graduates at much higher rates than other labor market segments. Each additional year of lifetime work experience was estimated to increase the earnings of college graduate workers by 4.5 percent, considerably higher than the 3.3 percent estimated earnings premium to work experience for all prime-age, full-time workers. This finding suggests that those with higher levels of human capital can increase their earnings advantage over those with lower stocks of human capital over their working lives. One area for further exploration would be the connection between literacy and numeracy skills and employer and personal investments in human capital among prime age, full-time workers.

The major field of study also influenced the earnings of college graduates. The regression-adjusted earnings premiums to major fields of study (compared to the base group—humanities majors) ranged from 33 percent higher earnings among biological and health science majors and 25 percent among business-related majors to 16-18 percent among STEM-related majors and 17 percent among social science majors, and no statistically significant earnings difference between education majors and the base group—humanities majors. Clearly, choice of fields of study that lend themselves to better levels of pay, such as social sciences and STEM, don't provide guarantees but certainly mitigate the risk of winding up mal-employed.

With the major exception of earnings differences between men and women, demographic traits of college graduate workers (race-ethnicity, disability status, and foreign-born status) had no regression-adjusted effect on their earnings.

Regarding the male-female wage gap, our analysis of the PIAAC data found very large earnings gaps between employed men and women with college degrees. The mean earnings of male college graduates were 48 percent higher than those of female counterparts ($7,675 versus $5,188). In our regression analysis we accounted for differences in a variety of factors that determine the earnings of workers including hours

of work, major field of study, skills differences, and the like. Yet, we found a nearly 20 percent regression-adjusted earnings advantage for men. The persistence of earnings differences between college graduate men and women workers is intriguing but not unique to this study. Other studies, including those using these PIAAC data files, have also found large gender differences in the earnings of college graduate workers. We suspect that part of this difference may be concentrated among college graduate mothers who find the slope of their age-earning profile becoming prematurely shallow relative to their male counterparts. This suggests that birth and child rearing create a stall in the earnings trajectory of college-educated mothers compared to single women and men.

The persistence of large earnings differences between men and women in our analysis of the college labor market is of great concern. Some preliminary work suggests to us that much of the earnings gap is a consequence of depressed earnings among married women with college degrees. We suspect that engaging in the dual role of breadwinner and mother is different than that of breadwinner and father in such a way as to create an earnings penalty among college graduate women who experience work interruptions from temporary withdrawal or reduction of work due to motherhood. Clearly, a much better understanding of the sources of the earnings disparity between college-educated men and women needs to be developed by researchers to understand the extent of the child-bearing penalty for college-educated mothers and ways in which it can be addressed.

The findings of this study of the earnings of college graduates in the context of literacy and numeracy skills may have some important implications for a wide range of persons interested in labor market success after college. First, it is important to note that employers recognize and reward stronger literacy and numeracy proficiencies of their college graduate workers; college graduate workers with strong skills earn significantly more than those with lower levels of skills. Interestingly, the payoff to literacy skills in the college labor market is a bit higher than the returns to numeracy skills. Reading and writing skills are highly valued by employers—perhaps even more than math skills. While secondary and postsecondary educational institutions have placed a heavy focus on improving the mathematics skills of their students, they should understand that reading and writing are at least as highly valued as math skills in the American labor market. In short, to get into a college labor market job, skills matter most. If you don't have the skills, the labor market very likely will find you out.

Second, the choice of field of study in which the degree is earned has a powerful influence on the earnings outcomes of college graduates. Rapidly growing health professional and technical occupations are demanding graduates with very strong skills, knowledge, and experience, and employers pay a substantial premium to gain access to employees with those skills. Students enrolling in college, as well as their parents, need to understand the role of a college degree as a human capital investment, and that if the process of earning a college degree does not bolster literacy and numeracy skills or develop discipline-specific knowledge valued in the job market, then the economic returns to earning that degree are likely to be diminished.

Third, finding employment in the college labor market after college completion has a very powerful effect on the earnings of graduates. Those who are mal-employed, that is, college graduates who work in essentially "high school level occupations," earn no more than a high school graduate. The key to a payoff from a college investment is access to CLM jobs.

This does not mean that college graduates must work in a job or occupation that is related to their field of study. It is true that for a number of health, engineering, computer science, and other occupationally oriented fields of study, a substantial earnings gain occurs by working in a directly related field. But in general, the critical factor is for college graduates to find work in jobs that utilize the proficiencies associated with earning a college degree.

For example, a history major who finds work at an insurance company as an underwriter or a human resource specialist is employed in a position that, while not closely connected to the study of history, uses the literacy, numeracy, and other professional skills associated with a college degree. The newly hired history major may be a good bet for the position and can simply learn the occupational and organizational knowledge required for competency in it through observation and experiences while perhaps engaging in formal and informal classroom training as part of development as an employee. Indeed, we suspect that much of the larger returns to work experience we found among college graduates relative to those with fewer years of schooling is attributable to employers making greater education and training investments in those with higher levels of educational attainment and stronger literacy and numeracy skills.

Therefore, a history major with solid literacy and numeracy skills can expect considerable upward mobility and earnings gains with additional years of work experience—if employed in the college labor market. However, history majors are more likely to have a difficult time finding a CLM position compared to, say, an accounting or nursing major, where the pathways to a successful transition to the college labor market is clear to the student long before graduating.

Continuing with our example, the history major has less clarity about post-college employment options than his or her counterparts in many other fields with close connections to the labor market. We suspect that history graduates with strong literacy and numeracy skills may have substantially better post-college employment and earnings experiences than their counterparts with lower levels of literacy and numeracy skills. This means that literacy and numeracy proficiencies also work to bolster college graduate earnings indirectly by raising the likelihood that a graduate becomes employed in a CLM occupation.

But there are also larger considerations both for individuals and for policy makers. We have to give serious thought to the idea that perhaps we have become too much of a one-trick pony and should emphasize that the next step for a high school graduate does not have to be college. There are many other viable options that parents, teachers, and counselors can help students investigate while still in middle and high school, such as going into technical fields, the trades, and various medical jobs requiring only certification. Colleges need to consider what they are doing as well. More career help is needed even before graduation, with the focus not simply on a diploma but on CLM employment.

This is not to say that all young individuals should have a job in the college labor market as their goal, or should only choose a major based on how much they'll earn during their lifetimes. Studying social work or history, for example, has its own intrinsic rewards. But institutions of higher learning need to better inform students about the pros and cons of the human capital investment choices they make.

Appendix A: Additional Information on the PIAAC Data

Following small cell suppression rules, results from cells that have fewer than 62 cases will be suppressed. This is known as the "rule of 62" (see https://nces.ed.gov/nationsreportcard/glossary.asp).

In regression models appearing in this paper, the literacy and numeracy variables were standardized to have a mean of 0 and a standard deviation of 1 across the entire U.S. PIAAC household sample, regardless of whether they met the criteria to be part of the sample for this study. We have followed Organisation for Economic Co-operation and Development (OECD)-recommended cutoff points for literacy and numeracy plausible values in creating proficiency levels. The definition of PIAAC proficiency levels for literacy and numeracy are displayed in Table A-1.

Table A-1: Range of Plausible Values Defining Literacy and Numeracy Proficiency Levels, PIAAC 2012-2014

PROFICIENCY LEVEL	PLAUSIBLE VALUES RANGE
BELOW LEVEL 1	0 to 175
LEVEL 1	176 to 225
LEVEL 2	226 to 275
LEVEL 3	276 to 325
LEVEL 4/5	326 to 500

Given that just college graduates are included in this paper, the sample sizes in the three lowest levels of literacy and numeracy proficiencies were not large enough to report findings for each level separately. Therefore, we collapsed the lowest three levels (below level 1, level 1, and level 2) for reporting results. Furthermore, in keeping with OECD reporting conventions, we have also combined levels 4 and 5 for reporting results. Level 3, considered the minimum proficiency level, is reported on its own.

Numeracy and literacy results in PIAAC are reported in the form of plausible values for each individual. Plausible values are proficiency estimates based on item response theory and multiple imputation technology. All the analysis and results presented in this paper that involved the use of numeracy and literacy outcomes are based on using all 10 plausible values. Standard errors of the estimates are calculated using the standard formula for calculating standard errors using multiple imputations in combination with the corresponding jackknife replication methods. Standard errors for all analyses of literacy and numeracy proficiencies include measurement errors.

Appendix B: Classification of Major Fields of Study

In PIAAC surveys, respondents with some college or beyond were asked to report their field of study of their highest degree. Major fields of study in PIAAC data for the United States follow the NCES 2010 Classification of Instructional Program (CIP) coding scheme.[53] There were more than 600 CIP majors in the U.S. PIAAC data file. The CIP majors are coded in a hierarchical, three-level structure: two-digit, four-digit, and six-digit series.

Table B-1 shows an example of the CIP hierarchical structure:

Table B-1: Example of CIP Hierarchical Structure

14	ENGINEERING
14.08	Civil Engineering.
14.0801	Civil Engineering, General.
14.0802	Geotechnical and Geoenvironmental Engineering.
14.0803	Structural Engineering.
14.0804	Transportation and Highway Engineering.
14.0805	Water Resources Engineering.
14.0899	Civil Engineering, Other.

The first two digits of each code (14) represent the highest level (14 in this example representing engineering). The four-digit code represents the next level in the hierarchy (14.08 in this example representing civil engineering) and the six-digit code represents the third level in the hierarchy (in this case 14.0801 to 14.0899 representing detailed civil engineering fields).

We collapsed college majors for our analysis into two-digit levels and then further grouped these two-digit college majors into seven broad areas of study for our analysis. The two-digit college majors included in each of the seven areas of study used in this paper are presented in Table B-2.

Table B-2: Major Fields of Study Included in Each of the Seven Broad Areas of Study

TWO-DIGIT CIP (2010)	AREA OF STUDY
	ENGINEERING, MATH, AND PHYSICAL SCIENCES
11	Computer And Information Sciences And Support Services
14	Engineering
15	Engineering Technologies And Engineering-Related Fields
27	Mathematics And Statistics
40	Physical Sciences
41	Science Technologies/Technicians
04	Architecture And Related Services
10	Communications Technologies/Technicians And Support Services
	BIOLOGICAL AND HEALTH PROFESSIONS
26	Biological And Biomedical Sciences
51	Health Professions And Related Programs
	HUMANITIES
16	Foreign Languages, Literatures, And Linguistics
09	Communication, Journalism, And Related Programs
05	Area, Ethnic, Cultural, Gender, And Group Studies
38	Philosophy And Religious Studies
39	Theology And Religious Vocations
24	Liberal Arts And Sciences, General Studies And Humanities
25	Library Science
54	History
50	Visual And Performing Arts
22	Legal Professions And Studies
23	English Language And Literature/Letters
	SOCIAL SCIENCES
42	Psychology
43	Homeland Security, Law Enforcement, Firefighting And Related Protective Services
44	Public Administration And Social Service Professions
45	Social Sciences

Table B-2: Major Fields of Study Included in Each of the Seven Broad Areas of Study (Cont.)

TWO-DIGIT CIP (2010)	AREA OF STUDY
19	Family And Consumer Sciences/Human Sciences
03	Natural Resources And Conservation
	BUSINESS
52	Business, Management, Marketing, And Related Support Services
01	Agriculture, Agriculture Operations, And Related Sciences
	EDUCATION AND TRAINING
13	Education
31	Parks, Recreation, Leisure, And Fitness Studies
32	Basic Skills And Developmental/Remedial Education
36	Leisure And Recreational Activities
37	Personal Awareness And Self-Improvement
	ALL OTHER FIELDS OF STUDY
12	Personal And Culinary Services
28	Military Science, Leadership, And Operational Art
29	Military Technologies And Applied Sciences
46	Construction Trades
47	Mechanic And Repair Technologies/Technicians
48	Precision Production
49	Transportation And Materials Moving
53	High School/Secondary Diplomas And Certificates
60	Residency Programs
99	Missing/don't know
30	Multi/Interdisciplinary Studies

Appendix C: Defining College Labor Market Occupations

The definition of CLM occupations used in this report is based on job zone classifications from the U.S. Department of Labor's Occupational Information Network, also called O*NET.[54] O*NET analysis of occupations is based on extensive surveys of incumbent workers, supervisors, and experts in each occupational area. The O*NET database contains the following detailed information for each of more than 900 eight-digit Standard Occupational Classification (SOC) occupations.

- Worker characteristics (abilities, occupational interests, work values, work styles)
- Worker requirements (skills, knowledge, education)
- Experience requirements (experience and training, skills, entry requirement, licensing)
- Occupational requirements (work abilities, organizational context, work context)
- Workforce characteristics (labor market information, occupational outlook)
- Occupation-specific information (title, description, alternate titles, tasks, tools and technology)

Based on this information, O*NET assigns a job zone to each of the O*NET SOC occupations. The job zone is a summary measure representing the level of education, skills, experience, and training needed to work in an occupation. There are five job zones ranging from 1 to 5, with job zone 1 representing occupations with the lowest education, skills, experience, and training requirements, and job zone 5 representing the highest education, skills, experience, and training requirements. Table C-1 below displays the five O*NET level job zones along with the levels of education, training, and work experience requirements for working in occupations within each zone as well as examples of those occupations.

Table C-1: O*NET Job Zone Descriptions

JOB ZONE	DESCRIPTION OF EDUCATION TRAINING AND WORK EXPERIENCE REQUIREMENTS	EXAMPLES
1	Occupations that need little or no preparation. Occupations under job zone 1 may require high school diploma or GED certificate	Food servers – non-restaurant, food preparation workers, taxi drivers and chauffeurs, rental clerks, dishwashers, cashiers, landscaping and groundskeeping workers, logging equipment operators, and baristas
2	Occupations that need some preparation. Occupations under job zone 2 may require a high school diploma.	Nursing, psychiatric, and home health aides, physical therapist aides, ambulance drivers and attendants, except emergency medical technicians, orderlies, forest firefighters, customer service representatives, security guards, upholsterers, and tellers
3	Occupations that need medium preparation. Occupations under job zone 3 may require training in vocational schools, related on-the-job experience, or an associate's degree. Previous work-related skill, knowledge, or experience is required for these occupations.	Registered nurses, clinical laboratory technologists and technicians, medical records and health information technicians, electricians, agricultural technicians, barbers, nannies, and medical assistants
4	Occupations that need considerable preparation. Not all, but most of these occupations require a four-year bachelor's degree. A considerable amount of work-related skill, knowledge, or experience is needed for these occupations. Workers in job zone 4 level occupations usually need several years of work-related experience, on-the-job training, and/or vocational training.	Human resources, training, and labor relations specialists, recreational therapists, accountants, sales managers, database administrators, graphic designers, chemists, art directors, and cost estimators.
5	Occupations that need extensive preparation. Most of these occupations require graduate school. Extensive skill, knowledge, and experience are needed for these occupations. Many require more than five years of experience. Workers in job zone 5 level occupations may need some on-the-job training, but most of these occupations assume that the person will already have the required skills, knowledge, work-related experience, and/or training.	Physicians and surgeons, physical therapists, physician assistants, psychologists, librarians, lawyers, astronomers, biologists, clergy, surgeons, veterinarians.

Crosswalk between ISCO-08 and SOC 2010 Occupations

PIAAC survey respondents in all participating countries were asked to name the occupational title of their current and/or past jobs. These occupations were then assigned the International Standard Classification of Occupations 2008 (ISCO-08) codes developed by the International Labor Organization.[55] In August 2012, the U.S. Bureau of Labor Statistics (BLS), on behalf of the Standard Occupational Classification Policy Committee (SOCPC), published a crosswalk between 438 ISCO-08 occupations and the 2010 SOC codes.[56]

For our analysis, we needed to assign an O*NET-developed job zone for each of the PIAAC ISCO-08 occupations. To do this, one-to-one matches between ISCO-08 and O*NET SOC needed to be established first. There were a total 410 occupational categories in the U.S. PIAAC 2012-2014 data file.[57] The staff at the Center for Labor Markets and Policy developed a crosswalk between the O*NET SOC and ISCO-08 occupations using the BLS-developed ISCO-SOC crosswalk, the O*NET, and other sources, including in some cases assigning a job zone based on multiple sources, such as the educational levels requirement matrix from the BLS employment projections.[58] The job zone assigned to each ISCO-08 occupation is presented in Table C-2.

Based on these job zones, occupations were assigned to the college labor market category (CLM) or the non-CLM category as follows:

- Occupations in job zones 4 and 5 were assigned to the CLM category.
- Occupations in job zones 1 and 2 were assigned to the non-CLM category.
- For occupations in job zone 3, measures of required education were used to classify them.
    - All wage and salary workers who indicated that a bachelor's or higher degree is required for their job were assigned to CLM.[59]
    - For self-employed college graduates, we used a different method because self-employed workers were not asked about the educational requirement at their jobs, incorporating the educational requirement information of wage and salary workers. If 50 percent or more wage and salary workers in these occupations indicated that a bachelor's or higher degree was required for someone to be employed in the occupation, we assigned self-employed in those occupations into CLM.
    - The remaining occupations were classified as non-CLM.

Table C-3 displays workers in job zone 3 who were assigned CLM occupations based on their responses on levels of educational attainment requirements (these are also shown by an asterisk in Table C-2).

Table C-2: PIAAC-O*NET Occupational Crosswalk and Assignment of Job Zone to Each PIAAC ISCO-08 Occupation

PIAAC ISCO8 CODE	PIAAC TITLE	ASSIGNED JOB ZONE
21	Science and engineering professionals	4
22	Health professionals	3
23	Teaching professionals	4
24	Business and administration professionals	4
25	Information and communications technology professionals	4
42	Customer services clerks	2
51	Personal service workers	2
74	Electrical and electronic trades workers	3
91	Cleaners and helpers	2
121	Business services and administration managers	3
211	Physical and earth science professionals	4
216	Architects, planners, surveyors and designers	4
241	Finance professionals	4
242	Administration professionals	4
243	Sales, marketing and public relations professionals	4
251	Software and applications developers and analysts	4
311	Physical and engineering science technicians	3
331	Financial and mathematical associate professionals	4
332	Sales and purchasing agents and brokers	4
335	Regulatory government associate professionals	3
342	Sports and fitness workers	4
351	Information and communications technology operations and user support technicians	3
431	Numerical clerks	3
432	Material-recording and transport clerks	2
532	Personal care workers in health services	2
712	Building finishers and related trades workers	2
713	Painters, building structure cleaners and related trades workers	2
722	Blacksmiths, toolmakers and related trades workers	2
815	Textile, fur and leather products machine operators	2
834	Mobile plant operators	2
911	Domestic, hotel and office cleaners and helpers	2
921	Agricultural, forestry and fishery laborers	1
932	Manufacturing laborers	2
1111	Legislators	4

Table C-2: PIAAC-O*NET Occupational Crosswalk and Assignment of Job Zone to Each PIAAC ISCO-08 Occupation (Cont.)

PIAAC ISCO8 CODE	PIAAC TITLE	ASSIGNED JOB ZONE
1112	Senior government officials	4
1114	Senior officials of special-interest organizations	4
1120	Managing directors and chief executives	5
1211	Finance managers	4
1212	Human resource managers	4
1213	Policy and planning managers	4
1219	Business services and administration managers not elsewhere classified	4
1221	Sales and marketing managers	4
1222	Advertising and public relations managers	4
1223	Research and development managers	4
1311	Agricultural and forestry production managers	4
1321	Manufacturing managers	4
1322	Mining managers	4
1323	Construction managers	4
1324	Supply, distribution and related managers	4
1330	Information and communications technology service managers	4
1341	Child care services managers	4
1342	Health services managers	5
1343	Aged care services managers	5
1344	Social welfare managers	4
1345	Education managers	4
1346	Financial and insurance services branch managers	4
1349	Professional services managers not elsewhere classified	4
1411	Hotel managers	3
1412	Restaurant managers	3
1420	Retail and wholesale trade managers	4
1431	Sports, recreation and cultural center managers	4
1439	Services managers not elsewhere classified	4
2111	Physicists and astronomers	5
2113	Chemists	4
2114	Geologists and geophysicists	4
2120	Mathematicians, actuaries and statisticians	5
2131	Biologists, botanists, zoologists and related professions	5
2133	Environmental protection professionals	4

Table C-2: PIAAC-O*NET Occupational Crosswalk and Assignment of Job Zone to Each PIAAC ISCO-08 Occupation (Cont.)

PIAAC ISCO8 CODE	PIAAC TITLE	ASSIGNED JOB ZONE
2141	Industrial and production engineers	4
2142	Civil engineers	4
2143	Environmental engineers	5
2144	Mechanical engineers	4
2145	Chemical engineers	4
2149	Engineering professionals not elsewhere classified	4
2151	Electrical engineers	4
2152	Electronics engineers	4
2153	Telecommunications engineers	4
2161	Building architects	4
2162	Landscape architects	4
2163	Product and garment designers	3
2164	Town and traffic planners	5
2165	Cartographers and surveyors	4
2166	Graphic and multimedia designers	4
2211	Generalist medical practitioners	5
2212	Specialist medical practitioners	5
2221	Nursing professionals	3
2222	Midwifery professionals	5
2230	Traditional and complementary medicine professionals	5
2240	Paramedical practitioners	5
2250	Veterinarians	5
2261	Dentists	5
2262	Pharmacists	5
2263	Environmental and occupational health and hygiene professionals	4
2264	Physiotherapists	5
2265	Dieticians and nutritionists	5
2266	Audiologists and speech therapists	5
2267	Optometrists and ophthalmic opticians	5
2269	Health professionals not elsewhere classified	3
2310	University and higher education teachers	5
2320	Vocational education teachers	4
2330	Secondary education teachers	4
2341	Primary school teachers	4
2342	Early childhood educators	3

Table C-2: PIAAC-O*NET Occupational Crosswalk and Assignment of Job Zone to Each PIAAC ISCO-08 Occupation (Cont.)

PIAAC ISCO8 CODE	PIAAC TITLE	ASSIGNED JOB ZONE
2351	Education methods specialists	5
2352	Special needs teachers	4
2353	Other language teachers	4
2354	Other music teachers	3
2355	Other arts teachers	3
2356	Information technology trainers	4
2359	Teaching professionals not elsewhere classified	3
2411	Accountants	4
2412	Financial and investment advisers	4
2413	Financial analysts	4
2421	Management and organization analysts	5
2422	Policy administration professionals	4
2423	Personnel and careers professionals	4
2424	Training and staff development professionals	4
2431	Advertising and marketing professionals	4
2432	Public relations professionals	4
2433	Technical and medical sales professionals (excluding ICT)	4
2434	Information and communications technology sales professionals	4
2511	Systems analysts	4
2512	Software developers	4
2513	Web and multimedia developers	3
2514	Applications programmers	4
2519	Software and applications developers and analysts not elsewhere classified	4
2521	Database designers and administrators	4
2522	Systems administrators	4
2523	Computer network professionals	4
2529	Database and network professionals not elsewhere classified	4
2611	Lawyers	5
2612	Judges	5
2621	Archivists and curators	5
2622	Librarians and related information professionals	5
2631	Economists	5
2633	Philosophers, historians and political scientists	5
2634	Psychologists	5

Table C-2: PIAAC-O*NET Occupational Crosswalk and Assignment of Job Zone to Each PIAAC ISCO-08 Occupation (Cont.)

PIAAC ISCO8 CODE	PIAAC TITLE	ASSIGNED JOB ZONE
2635	Social work and counseling professionals	4
2636	Religious professionals	4
2641	Authors and related writers	4
2642	Journalists	4
2643	Translators, interpreters and other linguists	4
2651	Visual artists	3
2652	Musicians, singers and composers	3
2654	Film, stage and related directors and producers	4
2655	Actors	2
2656	Announcers on radio, television and other media	4
2659	Creative and performing artists not elsewhere classified	2
3111	Chemical and physical science technicians	3
3112	Civil engineering technicians	3
3113	Electrical engineering technicians	3
3114	Electronics engineering technicians	3
3115	Mechanical engineering technicians	3
3116	Chemical engineering technicians	3
3117	Mining and metallurgical technicians	3
3118	Draftspersons	3
3119	Physical and engineering science technicians not elsewhere classified	3
3122	Manufacturing supervisors	2
3123	Construction supervisors	3
3131	Power production plant operators	2
3132	Incinerator and water treatment plant operators	3
3133	Chemical processing plant controllers	2
3134	Petroleum and natural gas refining plant operators	2
3135	Metal production process controllers	2
3139	Process control technicians not elsewhere classified	3
3141	Life science technicians (excluding medical)	4
3142	Agricultural technicians	3
3152	Ships' deck officers and pilots	3
3153	Aircraft pilots and related associate professionals	3
3154	Air traffic controllers	3
3211	Medical imaging and therapeutic equipment technicians	3
3212	Medical and pathology laboratory technicians	3

Table C-2: PIAAC-O*NET Occupational Crosswalk and Assignment of Job Zone to Each PIAAC ISCO-08 Occupation (Cont.)

PIAAC ISCO8 CODE	PIAAC TITLE	ASSIGNED JOB ZONE
3213	Pharmaceutical technicians and assistants	3
3214	Medical and dental prosthetic technicians	3
3221	Nursing associate professionals	3
3240	Veterinary technicians and assistants	3
3251	Dental assistants and therapists	3
3252	Medical records and health information technicians	3
3253	Community health workers	4
3254	Dispensing opticians	3
3255	Physiotherapy technicians and assistants	3
3256	Medical assistants	3
3257	Environmental and occupational health inspectors and associates	4
3258	Ambulance workers	3
3259	Health associate professionals not elsewhere classified	3
3311	Securities and finance dealers and brokers	4
3312	Credit and loans officers	3
3313	Accounting associate professionals	3
3314	Statistical, mathematical and related associate professionals	4
3315	Valuers and loss assessors	3
3321	Insurance representatives	4
3322	Commercial sales representatives	4
3323	Buyers	3
3324	Trade brokers	4
3331	Clearing and forwarding agents	3
3332	Conference and event planners	4
3333	Employment agents and contractors	4
3334	Real estate agents and property managers	3
3339	Business services agents not elsewhere classified	4
3341	Office supervisors	3
3342	Legal secretaries	3
3343	Administrative and executive secretaries	3
3344	Medical secretaries	3
3351	Customs and border inspectors	3
3352	Government tax and excise officials	3
3353	Government social benefits officials	3
3354	Government licensing officials	2

Table C-2: PIAAC-O*NET Occupational Crosswalk and Assignment of Job Zone to Each PIAAC ISCO-08 Occupation (Cont.)

PIAAC ISCO8 CODE	PIAAC TITLE	ASSIGNED JOB ZONE
3355	Police inspectors and detectives	3
3359	Regulatory government associate professionals not elsewhere classified	2
3411	Police inspectors and detectives	3
3412	Social work associate professionals	4
3413	Religious associate professionals	4
3421	Athletes and sports players	2
3422	Sports coaches, instructors and officials	4
3423	Fitness and recreation instructors and program leaders	3
3431	Photographers	3
3432	Interior designers and decorators	4
3433	Gallery, museum and library technicians	4
3434	Chefs	3
3435	Other artistic and cultural associate professionals	3
3511	Information and communications technology operations technicians	3
3512	Information and communications technology user support technicians	3
3513	Computer network and systems technicians	4
3514	Web technicians	3
3521	Broadcasting and audio-visual technicians	3
3522	Telecommunications engineering technicians	3
4110	General office clerks	2
4120	Secretaries (general)	3
4131	Typists and word processing operators	2
4132	Data entry clerks	2
4211	Bank tellers and related clerks	2
4212	Bookmakers, croupiers and related gaming workers	2
4213	Pawnbrokers and money-lenders	3
4214	Debt collectors and related workers	2
4221	Travel consultants and clerks	2
4222	Contact center information clerks	2
4223	Telephone switchboard operators	2
4224	Hotel receptionists	2
4225	Inquiry clerks	2
4226	Receptionists (general)	2
4227	Survey and market research interviewers	2

Table C-2: PIAAC-O*NET Occupational Crosswalk and Assignment of Job Zone to Each PIAAC ISCO-08 Occupation (Cont.)

PIAAC ISCO8 CODE	PIAAC TITLE	ASSIGNED JOB ZONE
4229	Client information workers not elsewhere classified	3
4311	Accounting and bookkeeping clerks	3
4312	Statistical, finance and insurance clerks	3
4313	Payroll clerks	2
4321	Stock clerks	2
4322	Production clerks	3
4323	Transport clerks	2
4411	Library clerks	4
4412	Mail carriers and sorting clerks	2
4413	Coding, proofreading and related clerks	4
4415	Filing and copying clerks	2
4416	Personnel clerks	3
4419	Clerical support workers not elsewhere classified	2
5111	Travel attendants and travel stewards	2
5112	Transport conductors	2
5113	Travel guides	3
5120	Cooks	2
5131	Waiters	1
5132	Bartenders	2
5141	Hairdressers	3
5142	Beauticians and related workers	3
5152	Domestic housekeepers	2
5153	Building caretakers	2
5162	Companions and valets	2
5163	Undertakers and embalmers	3
5164	Pet groomers and animal care workers	1
5169	Personal services workers not elsewhere classified	2
5211	Stall and market salespersons	2
5221	Shopkeepers	4
5222	Shop supervisors	2
5223	Shop sales assistants	2
5230	Cashiers and ticket clerks	1
5241	Fashion and other models	1
5242	Sales demonstrators	2
5243	Door to door salespersons	2

Table C-2: PIAAC-O*NET Occupational Crosswalk and Assignment of Job Zone to Each PIAAC ISCO-08 Occupation (Cont.)

PIAAC ISCO8 CODE	PIAAC TITLE	ASSIGNED JOB ZONE
5244	Contact center salespersons	2
5245	Service station attendants	2
5246	Food service counter attendants	1
5249	Sales workers not elsewhere classified	2
5311	Child care workers	2
5312	Teachers' aides	3
5321	Health care assistants	2
5322	Home-based personal care workers	2
5329	Personal care workers in health services not elsewhere classified	2
5411	Firefighters	3
5412	Police officers	3
5413	Prison guards	2
5414	Security guards	2
5419	Protective services workers not elsewhere classified	2
6111	Field crop and vegetable growers	1
6112	Tree and shrub crop growers	1
6113	Gardeners, horticultural and nursery growers	2
6121	Livestock and dairy producers	1
6122	Poultry producers	1
6130	Mixed crop and animal producers	1
6210	Forestry and related workers	3
6224	Hunters and trappers	1
6320	Subsistence livestock farmers	1
7111	House builders	4
7112	Bricklayers and related workers	2
7114	Concrete placers, concrete finishers and related workers	2
7115	Carpenters and joiners	2
7119	Building frame and related trades workers not elsewhere classified	2
7121	Roofers	2
7122	Floor layers and tile setters	2
7123	Plasterers	1
7124	Insulation workers	2
7126	Plumbers and pipe fitters	3
7127	Air conditioning and refrigeration mechanics	3
7131	Painters and related workers	2

Table C-2: PIAAC-O*NET Occupational Crosswalk and Assignment of Job Zone to Each PIAAC ISCO-08 Occupation (Cont.)

PIAAC ISCO8 CODE	PIAAC TITLE	ASSIGNED JOB ZONE
7132	Spray painters and varnishers	2
7211	Metal molders and coremakers	2
7212	Welders and flamecutters	3
7213	Sheet-metal workers	2
7214	Structural-metal preparers and erectors	2
7215	Riggers and cable splicers	2
7221	Blacksmiths, hammersmiths and forging press workers	2
7222	Toolmakers and related workers	3
7223	Metal working machine tool setters and operators	2
7224	Metal polishers, wheel grinders and tool sharpeners	2
7231	Motor vehicle mechanics and repairers	3
7232	Aircraft engine mechanics and repairers	3
7233	Agricultural and industrial machinery mechanics and repairers	3
7234	Bicycle and related repairers	2
7314	Potters and related workers	3
7318	Handicraft workers in textile, leather and related materials	2
7321	Pre-press technicians	3
7322	Printers	3
7411	Building and related electricians	3
7412	Electrical mechanics and fitters	3
7413	Electrical line installers and repairers	3
7421	Electronics mechanics and servicers	3
7422	Information and communications technology installers and servicers	3
7511	Butchers, fishmongers and related food preparers	2
7512	Bakers, pastry cooks and confectionery makers	2
7513	Dairy products makers	2
7515	Food and beverage tasters and graders	3
7516	Tobacco preparers and tobacco products makers	2
7522	Cabinet-makers and related workers	2
7523	Woodworking-machine tool setters and operators	2
7531	Tailors, dressmakers, furriers and hatters	3
7532	Garment and related pattern-makers and cutters	3
7533	Sewing, embroidery and related workers	1
7534	Upholsterers and related workers	2
7543	Product graders and testers (excluding foods and beverages)	2

Table C-2: PIAAC-O*NET Occupational Crosswalk and Assignment of Job Zone to Each PIAAC ISCO-08 Occupation (Cont.)

PIAAC ISCO8 CODE	PIAAC TITLE	ASSIGNED JOB ZONE
7544	Fumigators and other pest and weed controllers	2
7549	Craft and related workers not elsewhere classified	3
8111	Miners and quarriers	2
8113	Well drillers and borers and related workers	2
8114	Cement, stone and other mineral products machine operators	2
8121	Metal processing plant operators	2
8122	Metal finishing, plating and coating machine operators	2
8131	Chemical products plant and machine operators	2
8141	Rubber products machine operators	2
8142	Plastic products machine operators	2
8143	Paper products machine operators	2
8151	Fiber preparing, spinning and winding machine operators	2
8152	Weaving and knitting machine operators	2
8153	Sewing machine operators	1
8156	Shoemaking and related machine operators	2
8157	Laundry machine operators	1
8160	Food and related products machine operators	2
8172	Wood processing plant operators	2
8181	Glass and ceramics plant operators	2
8183	Packing, bottling and labeling machine operators	2
8189	Stationary plant and machine operators not elsewhere classified	2
8211	Mechanical machinery assemblers	2
8212	Electrical and electronic equipment assemblers	2
8219	Assemblers not elsewhere classified	2
8311	Locomotive engine drivers	2
8312	Railway brake, signal and switch operators	2
8321	Motorcycle drivers	2
8322	Car, taxi and van drivers	1
8331	Bus and tram drivers	2
8332	Heavy truck and lorry drivers	2
8341	Mobile farm and forestry plant operators	2
8342	Earthmoving and related plant operators	2
8343	Crane, hoist and related plant operators	3
8344	Lifting truck operators	2
8350	Ships' deck crews and related workers	2

Table C-2: PIAAC-O*NET Occupational Crosswalk and Assignment of Job Zone to Each PIAAC ISCO-08 Occupation (Cont.)

PIAAC ISCO8 CODE	PIAAC TITLE	ASSIGNED JOB ZONE
9111	Domestic cleaners and helpers	2
9112	Cleaners and helpers in offices, hotels and other establishments	2
9122	Vehicle cleaners	2
9123	Window cleaners	2
9129	Other cleaning workers	1
9211	Crop farm laborers	1
9212	Livestock farm laborers	1
9213	Mixed crop and livestock farm laborers	1
9214	Garden and horticultural laborers	1
9215	Forestry laborers	3
9311	Mining and quarrying laborers	2
9312	Civil engineering laborers	2
9313	Building construction laborers	2
9321	Hand packers	2
9329	Manufacturing laborers not elsewhere classified	2
9331	Hand and pedal vehicle drivers	1
9333	Freight handlers	2
9334	Shelf fillers	2
9411	Fast food preparers	1
9412	Kitchen helpers	1
9510	Street and related service workers	2
9520	Street vendors (excluding food)	2
9611	Garbage and recycling collectors	2
9612	Refuse sorters	2
9613	Sweepers and related laborers	1
9621	Messengers, package deliverers and luggage porters	2
9622	Odd job persons	2
9623	Meter readers and vending-machine collectors	2
9629	Elementary workers not elsewhere classified	2

Table C-3: Job Zone 3 Occupations of Self-Employed Workers Designated as College Labor Market Occupations

JOB ZONE 3 (ISCO08 OCCUPATIONS CODE)	OCCUPATIONS TITLE
2163	Product and garment designers
2269	Health professionals not elsewhere classified
2513	Web and multimedia developers
2652	Musicians, singers and composers
3153	Aircraft pilots and related associate professionals
3255	Physiotherapy technicians and assistants
3315	Valuers and loss assessors
3334	Real estate agents and property managers
3343	Administrative and executive secretaries
3344	Medical secretaries
3411	Police inspectors and detectives
3431	Photographers
3434	Chefs

Appendix D: Details on PIAAC Proficiency Levels for Literacy and Numeracy Scales

Table D-1: Score Boundaries and Task Descriptions for PIAAC Proficiency Levels on the Literacy Scale

LITERACY PROFICIENCY LEVELS AND SCORE BOUNDARIES	LITERACY TASK DESCRIPTIONS
BELOW LEVEL 1 (0 TO 175)	The tasks at this level require the respondent to read brief texts on familiar topics to locate a single piece of specific information. Only basic vocabulary knowledge is required, and the reader is not required to understand the structure of sentences or paragraphs or make use of other text features. There is seldom any competing information in the text and the requested information is identical in form to information in the question or directive. While the texts can be continuous, the information can be located as if the text were noncontinuous. Tasks below Level 1 do not make use of any features specific to digital texts.
LEVEL 1 (176 TO 225)	Most of the tasks at this level require the respondent to read relatively short digital or print continuous, noncontinuous or mixed texts to locate a single piece of information which is identical to or synonymous with the information given in the question or directive. Some tasks may require the respondent to enter personal information into a document, in the case of some noncontinuous texts. Little, if any, competing information is present. Some tasks may require simple cycling through more than one piece of information. Knowledge and skill in recognizing basic vocabulary, evaluating the meaning of sentences, and reading of paragraph text is expected.
LEVEL 2 (226 TO 275)	At this level, the complexity of text increases. The medium of texts may be digital or printed, and texts may comprise continuous, noncontinuous or mixed types. Tasks in this level require respondents to make matches between the text and information, and may require paraphrase or low-level inferences. Some competing pieces of information may be present. Some tasks require the respondent to ▪ cycle through or integrate two or more pieces of information based on criteria, ▪ compare and contrast or reason about information requested in the question, or ▪ navigate within digital texts to access and identify information from various parts of a document.
LEVEL 3 (276 TO 325)	Texts at this level are often dense or lengthy, including continuous, noncontinuous, mixed or multiple pages. Understanding text and rhetorical structures become more central to successfully completing tasks, especially in navigation of complex digital texts. Tasks require the respondent to identify, interpret or evaluate one or more pieces of information and often require varying levels of inferencing. Many tasks require the respondent construct meaning across larger chunks of text or perform multistep operations in order to identify and formulate responses. Often tasks also demand that the respondent disregard irrelevant or inappropriate text content to answer accurately. Competing information is often present, but it is not more prominent than the correct information.

Source: Claudia Tamassia and Mary Louise Lennon, "PIAAC Proficiency Scales (Chapter 21)," *Technical Report of the Survey of Adult Skills (PIAAC),* Organisation for Economic Co-operation and Development, 2013, http://www.oecd.org/skills/piaac/_technical%20report_17oct13.pdf.

Table D-1: Score Boundaries and Task Descriptions for PIAAC Proficiency Levels on the Literacy Scale (Cont.)

LITERACY PROFICIENCY LEVELS AND SCORE BOUNDARIES	LITERACY TASK DESCRIPTIONS
LEVEL 4 (326 TO 375)	Tasks at this level often require respondents to perform multiple-step operations to integrate, interpret, or synthesize information from complex or lengthy continuous, noncontinuous, mixed, or multiple type texts. Complex inferences and application of background knowledge may be needed to perform successfully. Many tasks require identifying and understanding one or more specific, noncentral ideas in the text in order to interpret or evaluate subtle evidence claim or persuasive discourse relationships. Conditional information is frequently present in tasks at this level and must be taken into consideration by the respondent. Competing information is present and sometimes seemingly as prominent as correct information.
LEVEL 5 (376 TO 500)	At this level, tasks may require the respondent to search for and integrate information across multiple, dense texts; construct syntheses of similar and contrasting ideas or points of view; or evaluate evidence-based arguments. Application and evaluation of logical and conceptual models of ideas may be required to accomplish tasks. Evaluating reliability of evidentiary sources and selecting key information is frequently a key requirement. Tasks often require respondents to be aware of subtle, rhetorical cues and to make high-level inferences or use specialized background knowledge.

Source: Claudia Tamassia and Mary Louise Lennon, "PIAAC Proficiency Scales (Chapter 21)," *Technical Report of the Survey of Adult Skills (PIAAC),* Organisation for Economic Co-operation and Development, 2013, http://www.oecd.org/skills/piaac/_technical%20report_17oct13.pdf.

Table D-2: Score Boundaries and Task Descriptions for PIAAC Proficiency Levels on the Numeracy Scale

NUMERACY PROFICIENCY LEVELS AND SCORE BOUNDARIES	NUMERACY TASK DESCRIPTIONS
BELOW LEVEL 1 (0 TO 175)	Tasks at this level are set in concrete, familiar contexts where the mathematical content is explicit with little or no text or distractors and that require only simple processes such as counting, sorting, performing basic arithmetic operations with whole numbers or money, or recognizing common spatial representations.
LEVEL 1 (176 TO 225)	Tasks in this level require the respondent to carry out basic mathematical processes in common, concrete contexts where the mathematical content is explicit with little text and minimal distractors. Tasks usually require simple one-step or two-step processes involving, for example, performing basic arithmetic operations; understanding simple percents such as 50 percent; or locating, identifying and using elements of simple or common graphical or spatial representations.
LEVEL 2 (226 TO 275)	Tasks in this level require the respondent to identify and act upon mathematical information and ideas embedded in a range of common contexts where the mathematical content is fairly explicit or visual with relatively few distractors. Tasks tend to require the application of two or more steps or processes involving, for example, calculation with whole numbers and common decimals, percents and fractions; simple measurement and spatial representation; estimation; and interpretation of relatively simple data and statistics in texts, tables and graphs.
LEVEL 3 (276 TO 325)	Tasks in this level require the respondent to understand mathematical information which may be less explicit, embedded in contexts that are not always familiar, and represented in more complex ways. Tasks require several steps and may involve the choice of problem-solving strategies and relevant processes. Tasks tend to require the application of, for example, number sense and spatial sense; recognizing and working with mathematical relationships, patterns, and proportions expressed in verbal or numerical form; and interpretation and basic analysis of data and statistics in texts, tables and graphs.
LEVEL 4 (326 TO 375)	Tasks in this level require the respondent to understand a broad range of mathematical information that may be complex, abstract or embedded in unfamiliar contexts. These tasks involve undertaking multiple steps and choosing relevant problem-solving strategies and processes. Tasks tend to require analysis and more complex reasoning about, for example, quantities and data; statistics and chance; spatial relationships; change; proportions; and formulas. Tasks in this level may also require comprehending arguments or communicating well-reasoned explanations for answers or choices.
LEVEL 5 (376 TO 500)	Tasks in this level require the respondent to understand complex representations and abstract and formal mathematical and statistical ideas, possibly embedded in complex texts. Respondents may have to integrate multiple types of mathematical information where considerable translation or interpretation is required; draw inferences; develop or work with mathematical arguments or models; and justify, evaluate and critically reflect upon solutions or choices.

Source: Claudia Tamassia and Mary Louise Lennon, "PIAAC Proficiency Scales (Chapter 21)," *Technical Report of the Survey of Adult Skills (PIAAC),* Organisation for Economic Co-operation and Development, 2013, http://www.oecd.org/skills/piaac/_technical%20report_17oct13.pdf.

Appendix E: Mean Monthly Earnings

Table E-1: Mean Monthly Earnings of Subgroups of Employed 21- to 65-Year Old College Graduates with a Bachelor's or Higher Degree

GROUP	MEAN OF MONTHLY EARNINGS	STANDARD ERROR	SAMPLE SIZE
ALL	$6,361	374	1,350
GENDER			
MALE	$7,675	524	585
FEMALE	$5,188	316	765
RACE-ETHNICITY			
WHITE	$6,530	446	991
BLACK	$5,470	567	136
HISPANIC	$5,092	770	80
ASIAN/PACIFIC ISLANDER	$7,032	912	113
AGE			
21-24	$2,822	206	83
25-34	$4,692	262	477
35-44	$7,718	762	289
45-54	$7,340	565	273
55-65	$6,527	422	228
NATIVITY STATUS			
NATIVE-BORN	$6,227	396	1,155
FOREIGN-BORN	$7,145	950	195
EDUCATIONAL ATTAINMENT LEVEL			
BACHELOR'S DEGREE	$5,616	389	829
MASTER'S DEGREE	$7,130	546	369
PROFESSIONAL/PH.D. DEGREE	$8,394	779	152
ENROLLMENT STATUS			
ENROLLED	$3,950	345	150
NOT ENROLLED	$6,610	394	1,200

Table E-1: Mean Monthly Earnings of Subgroups of Employed 21- to 65-Year Old College Graduates with a Bachelor's or Higher Degree (Cont.)

GROUP	MEAN OF MONTHLY EARNINGS	STANDARD ERROR	SAMPLE SIZE
DISABILITY STATUS			
WITH DISABILITIES	$6,376	325	202
WITHOUT DISABILITIES	$6,275	973	1,148
COLLEGE MAJOR			
ENGINEERING, MATH AND PHYSICAL SCIENCES	$6,644	356	169
BIOLOGICAL AND HEALTH SCIENCES	$6,524	475	192
HUMANITIES	$6,037	573	200
SOCIAL SCIENCES	$6,943	1,115	207
BUSINESS	7,215	498	292
EDUCATION AND TRAINING	4,230	271	243
REGIONS OF RESIDENCE			
NORTHEAST	6,786	600	325
MIDWEST	5,682	349	272
SOUTH	6,425	829	523
WEST	6,430	590	230
SECTOR OF WORK			
PRIVATE SECTOR	7,060	471	769
PUBLIC SECTOR	5,403	391	423
NON-PROFIT SECTOR	5,229	373	158
FULL-TIME/PART-TIME HOURS			
FULL-TIME	7,010	362	1,128
PART-TIME	2,874	422	222
YEARS OF PAID WORK			
LESS THAN 10 YEARS	4,097	278	323
10-19 YEARS	5,812	334	403
20-29 YEARS	7,644	808	281
30-39 YEARS	8,104	615	230
40+ YEARS	5,627	478	113

Table E-1: Mean Monthly Earnings of Subgroups of Employed 21- to 65-Year Old College Graduates with a Bachelor's or Higher Degree (Cont.)

GROUP	MEAN OF MONTHLY EARNINGS	STANDARD ERROR	SAMPLE SIZE
COLLEGE LABOR MARKET OCCUPATIONS			
IN COLLEGE LABOR MARKET OCCUPATIONS	7,200	442	1,019
NOT IN COLLEGE LABOR MARKET OCCUPATIONS	3,632	254	331
LITERACY PROFICIENCY LEVEL			
BELOW LEVEL 3	5,333	582	258
LEVEL 3	6,117	499	670
LEVEL 4/5	7,337	466	422
NUMERACY PROFICIENCY LEVEL			
BELOW LEVEL 3	5,307	510	405
LEVEL 3	6,280	453	611
LEVEL 4/5	7,644	587	335

Appendix F: Method Used for Multivariate Earnings Regressions

The multivariate earnings regressions estimated in this report are an expanded version of Jacob Mincer's basic human capital earnings function.[60] The basic Mincerian human capital earnings function is specified with a dependent variable consisting of the natural log of earnings and explanatory variables consisting of measures of human capital.

The earnings functions estimated in this report include human capital measures as well as other covariates that are known to affect the earnings of college graduates. Three measures of human capital are included in these earnings regressions: skills, educational attainment, and labor market work experience, which is a measure of post-school on-the-job learning that contributes to the productive capabilities of workers.[61]

Supplementary variables in the enhanced Mincerian human capital earnings function include the following: major field of study: which measures the type of educational human capital of college graduates; job characteristics: access to CLM occupations, weekly hours of employment, and the economic sector of the job; job-related traits of workers: school enrollment status and region of residence; and demographic traits of workers: gender, race-ethnicity, nativity status, and disability status.

We have used PIAAC literacy and numeracy proficiencies to measure worker skills in these regressions. The PIAAC literacy and numeracy proficiencies of workers are specified in the regressions as standardized scores of workers on the PIAAC literacy and numeracy tests. Educational attainment is represented in the earnings regressions with dummy variables representing college degree levels. The third measure of human capital, work experience, is specified in the regressions as a quadratic variable based on the human capital theory that earnings increase with additional work experience, but that these gains occur at a diminishing rate, reaching a maximum at a certain level of work experience.

The earnings functions are estimated with a series of regressions designed to focus on the human capital of workers, particularly their literacy and numeracy proficiencies. We have followed a slightly different order from a standard Mincerian human capital earnings function that typically begins with education and work experience before the addition of skills/abilities and other covariates. Because of our focus on skills, the earnings functions that we have estimated begin with skills (the literacy and numeracy proficiencies of workers), followed by blocks of variables representing educational attainment (college degree) of workers, college major, years of paid work experience, characteristics of the job in which they were employed, employment-related traits of workers, and demographic traits of workers. These earnings regressions are designed to measure independent effects of human capital traits on the earnings of college graduate workers.

Appendix G: Definitions of Variables in Earnings Regressions

Below are the definitions from PIAAC 2012-2014 of the dependent and independent variables included in the earnings regression models predicting the monthly earnings of 21- to 65-year-olds having a bachelor's or higher degree.

Dependent Variable:

lnearns = natural log of monthly earnings (including bonuses for wage and salary earners and self-employed workers)

Independent Variables:

Individual Literacy and Numeracy Score

PVlit = continuous standardized literacy proficiency score of 16 and older persons in PIAAC survey

PVnum = continuous standardized numeracy proficiency score of 16 and older persons in PIAAC survey

Individual Literacy/Numeracy Level

Base group is level 2 or lower

pv_litdum3 = a dichotomous literacy proficiency level variable
= 1 if literacy proficiency level was 3
= 0, if else

pv_litdum45 = a dichotomous literacy proficiency level variable
= 1 if literacy proficiency level was 4 or 5
= 0, if else

pv_numdum3 = a dichotomous numeracy proficiency level variable
= 1 if numeracy proficiency level was 3
= 0, if else

pv_numdum45 = a dichotomous numeracy proficiency level variable
= 1 if numeracy proficiency level was 4 or 5
= 0, if else

Educational Attainment Levels

Base group is Bachelor's degree

masters_degree = a dichotomous educational attainment variable
= 1, if Master's degree
= 0, if else

prof_phd_degree = a dichotomous educational attainment variable
= 1, if Professional degree or Ph.D. degree
= 0, if else

College Major

Base group is humanities major

eng_math_phy_sc = a dichotomous college major variable
= 1, if college major was Engineering, Math, and Physical sciences
= 0, if else

bio_health_prof = a dichotomous college major variable
= 1, if college major was Biological and Health sciences
= 0, if else

social_sciences = a dichotomous college major variable
= 1, if college major was Social sciences

= 0, if else
business = a dichotomous college major variable
= 1, if college major was Business
= 0, if else
educ_training = a dichotomous college major variable
= 1, if college major was Education and Training
= 0, if else
all_other_major = a dichotomous college major variable
= 1, if college major was remaining "All other majors"
= 0, if else

Years of Work Experience

experience = continuous years of actual work experience
experience_sq = continuous years of actual work experience squared

College Labor Market Occupation Status

Base group is employed in non-college labor market occupations
clm_occ = a dichotomous college labor market employment variable
= 1, if working in college labor market occupations
= 0, if else

Economic Sector of Employment

Base group is private sector workers
nonprofit_sector = a dichotomous class of worker status variable
= 1, if employed in non-profit sector
= 0, if else
public_sector = a dichotomous class of worker status variable
= 1, if employed in public sector
= 0, if else

Weekly Hours of Work

weekly_hours = continuous weekly hours of work in the current job

School Enrollment Status

Base group is not enrolled in school
enrolled = a dichotomous school enrollment variable
= 1, if enrolled in school
= 0, if not enrolled in school

Region of Residence of Worker

Base group is South region
northeast = a dichotomous region of residence variable
= 1, if region of residence was Northeast region
= 0, if else
midwest = a dichotomous region of residence variable
= 1, if region of residence was Midwest region
= 0, if else
west = a dichotomous region of residence variable
= 1, if region of residence was West region
= 0, if else

Gender

Base group is female

male = a dichotomous gender variable
= 1, if male
= 0, if female

Race-Ethnicity

Base group is White

black = a dichotomous race-ethnicity variable
= 1, if Black
= 0, if else

hispanic = a dichotomous race-ethnicity variable
= 1, if Hispanic
= 0, if else

asian_pi = a dichotomous race-ethnicity variable
= 1, if Asian/Pacific Islander
= 0, if else

other_race = a dichotomous race-ethnicity variable
= 1, if "other" races
= 0, if else

Nativity Status

Base group is native-born

foreign_born = a dichotomous nativity status variable
= 1, if foreign-born
= 0, if native-born

Disability Status

Base group is disabled

with_disabilities = a dichotomous disability status variable
= 1, if with disabilities (difficulty seeing print, hearing conversation, or diagnosed with a learning disability)
= 0, if else

Table G-2: Descriptive Statistics of 21- to 65-Year-Old Employed College Graduates Included in the Earnings Regression Models, PIAAC 2012-2014

TYPE OF VARIABLE	OBSERVATIONS	MEAN	STD. DEV.	MIN	MAX
DEPENDENT VARIABLE					
LNINC_MONTHLY	1,350	8.349	0.852	3.546	11.135
INDEPENDENT VARIABLE					
MASTERS_DEGREE	1,350	0.273	0.446	0	1
PROF_PHD_DEGREE	1,350	0.113	0.316	0	1
ENG_MATH_PHY_SC	1,350	0.125	0.331	0	1
BIO_HEALTH_PROF	1,350	0.142	0.349	0	1
SOCIAL_SCIENCES	1,350	0.153	0.360	0	1
BUSINESS	1,350	0.216	0.412	0	1
EDUC_TRAINING	1,350	0.144	0.352	0	1
ALL_OTHER_MAJOR	1,350	0.035	0.183	0	1
EXPERIENCE	1,350	+20	12	0	47
EXPERIENCE_SQ	1,350	535	562	0	2209
CLM_OCC_REV	1,350	0.755	0.430	0	1
NONPROFIT_SECTOR	1,350	0.117	0.322	0	1
PUBLIC_SECTOR	1,350	0.313	0.464	0	1
WEEKLY_HOURS	1,350	42	12	2	60
ENROLLED	1,350	0.111	0.314	0	1
NORTHEAST	1,350	0.241	0.428	0	1
MIDWEST	1,350	0.201	0.401	0	1
WEST	1,350	0.170	0.376	0	1
MALE	1,350	0.433	0.496	0	1
HISPANIC	1,350	0.059	0.236	0	1
BLACK	1,350	0.101	0.301	0	1
ASIAN_PI	1,350	0.084	0.277	0	1
OTHER_RACE	1,350	0.022	0.147	0	1
FOREIGN_BORN	1,350	0.144	0.352	0	1
WITH_DISABILITIES	1,350	0.150	0.357	0	1

Appendix H: Estimated Coefficients and Percent Effects of Each Earnings Regression Model

Table H-1 (Coefficients): Estimated Coefficients of Monthly Earnings Regressions for 21- to 65-Year-Old Employed College Graduates, 2012-2014 (Estimated from Earnings Regression Models 1-7, Set A)

VARIABLE	MODEL 1	SIG. LEVEL	MODEL 2	SIG. LEVEL	MODEL 3	SIG. LEVEL	MODEL 4	SIG. LEVEL	MODEL 5	SIG. LEVEL	MODEL 6	SIG. LEVEL	MODEL 7	SIG. LEVEL
PVLIT	0.191	0.000	0.160	0.000	0.149	0.000	0.150	0.000	0.107	0.002	0.106	0.001	0.107	0.001
MASTERS_DEGREE			0.276	0.000	0.342	0.000	0.286	0.000	0.136	0.047	0.070	0.142	0.070	0.115
PROF_PHD_DEGREE			0.404	0.000	0.471	0.000	0.458	0.000	0.304	0.000	0.192	0.006	0.165	0.017
ENG_MATH_PHY_SC					0.258	0.009	0.290	0.004	0.247	0.008	0.240	0.002	0.164	0.038
BIO_HEALTH_PROF					0.228	0.008	0.216	0.005	0.230	0.003	0.259	0.000	0.285	0.000
SOCIAL_SCIENCES					0.144	0.157	0.142	0.126	0.178	0.037	0.158	0.026	0.154	0.029
BUSINESS					0.405	0.000	0.384	0.000	0.378	0.000	0.243	0.003	0.223	0.004
EDUC_TRAINING					-0.145	0.216	-0.157	0.160	-0.156	0.125	-0.187	0.029	-0.148	0.082
ALL_OTHER_MAJOR					0.316	0.065	0.320	0.045	0.295	0.051	0.275	0.031	0.280	0.021
EXPERIENCE							0.062	0.000	0.060	0.000	0.044	0.000	0.044	0.000
EXPERIENCE_SQ							-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000
CLM_OCC									0.656	0.000	0.464	0.000	0.470	0.000
NONPROFIT_SECTOR											-0.118	0.014	-0.105	0.017
PUBLIC_SECTOR											-0.065	0.176	-0.060	0.204
WEEKLY_HOURS											0.034	0.000	0.032	0.000
ENROLLED											-0.262	0.000	-0.255	0.000
NORTHEAST											0.131	0.115	0.121	0.153
MIDWEST											-0.038	0.592	-0.043	0.560
WEST											0.117	0.184	0.100	0.231
MALE													0.176	0.000
HISPANIC													0.006	0.950
BLACK													0.045	0.469
ASIAN_PI													0.036	0.702
OTHER_RACE													-0.013	0.894
FOREIGN_BORN													0.029	0.727
WITH_DISABILITIES													-0.063	0.245
_CONS	8.282	0.000	8.181	0.000	7.996	0.000	7.324	0.000	6.944	0.000	5.879	0.000	5.861	0.000
E_R2	0.027	0.007	0.059	0.000	0.103	0.000	0.166	0.000	0.258	0.000	0.484	0.000	0.493	0.000
E_N	1350	0.000	1350	0.000	1350	0.000	1350	0.000	1350	0.000	1350	0.000	1350	0.000

Table H-2 (Percent Effects): Estimated Percent Effects on the Monthly Earnings of 21- to 65-Year-Old Employed College Graduates, 2012-2014 (Estimated from Earnings Regression Models 1-7, Set A)

VARIABLE	MODEL 1	SIG. LEVEL	MODEL 2	SIG. LEVEL	MODEL 3	SIG. LEVEL	MODEL 4	SIG. LEVEL	MODEL 5	SIG. LEVEL	MODEL 6	SIG. LEVEL	MODEL 7	SIG. LEVEL
PVLIT	21.1%	0.000	17.3%	0.000	16.1%	0.000	16.2%	0.000	11.3%	0.002	11.2%	0.001	11.3%	0.001
MASTERS_DEGREE			31.8%	0.000	40.7%	0.000	33.1%	0.000	14.5%	0.047	7.2%	0.142	7.2%	0.115
PROF_PHD_DEGREE			49.8%	0.000	60.1%	0.000	58.1%	0.000	35.5%	0.000	21.2%	0.006	18.0%	0.017
ENG_MATH_PHY_SC					29.4%	0.009	33.6%	0.004	28.0%	0.008	27.1%	0.002	17.8%	0.038
BIO_HEALTH_PROF					25.6%	0.008	24.1%	0.005	25.8%	0.003	29.6%	0.000	33.0%	0.000
SOCIAL_SCIENCES					15.5%	0.157	15.2%	0.126	19.5%	0.037	17.1%	0.026	16.7%	0.029
BUSINESS					50.0%	0.000	46.9%	0.000	45.9%	0.000	27.4%	0.003	25.0%	0.004
EDUC_TRAINING					-13.5%	0.216	-14.5%	0.160	-14.4%	0.125	-17.0%	0.029	-13.8%	0.082
ALL_OTHER_MAJOR					37.1%	0.065	37.7%	0.045	34.3%	0.051	31.7%	0.031	32.2%	0.021
EXPERIENCE							6.4%	0.000	6.2%	0.000	4.5%	0.000	4.5%	0.000
EXPERIENCE_SQ							-0.1%	0.000	-0.1%	0.000	-0.1%	0.000	-0.1%	0.000
CLM_OCC									92.7%	0.000	59.1%	0.000	60.1%	0.000
NONPROFIT_SECTOR											-11.1%	0.014	-9.9%	0.017
PUBLIC_SECTOR											-6.3%	0.176	-5.8%	0.204
WEEKLY_HOURS											3.4%	0.000	3.3%	0.000
ENROLLED											-23.0%	0.000	-22.5%	0.000
NORTHEAST											14.0%	0.115	12.8%	0.153
MIDWEST											-3.8%	0.592	-4.2%	0.560
WEST											12.4%	0.184	10.5%	0.231
MALE													19.3%	0.000
HISPANIC													0.6%	0.950
BLACK													4.6%	0.469
ASIAN_PI													3.7%	0.702
OTHER_RACE													-1.3%	0.894
FOREIGN_BORN													2.9%	0.727
WITH_DISABILITIES													-6.1%	0.245

Table H-3 (Coefficients): Estimated Coefficients of Monthly Earnings Regressions for 21- to 65-Year-Old Employed College Graduates, 2012-2014 (Estimated from Earnings Regression Models 1-7, Set B)

VARIABLE	MODEL 1	SIG. LEVEL	MODEL 2	SIG. LEVEL	MODEL 3	SIG. LEVEL	MODEL 4	SIG. LEVEL	MODEL 5	SIG. LEVEL	MODEL 6	SIG. LEVEL	MODEL 7	SIG. LEVEL
PVNUM	0.232	0.000	0.203	0.000	0.182	0.000	0.175	0.000	0.133	0.002	0.101	0.006	0.090	0.021
MASTERS_DEGREE			0.267	0.000	0.333	0.000	0.280	0.000	0.132	0.050	0.071	0.136	0.075	0.093
PROF_PHD_DEGREE			0.393	0.000	0.458	0.000	0.449	0.000	0.297	0.000	0.194	0.007	0.175	0.012
ENG_MATH_PHY_SC					0.202	0.037	0.236	0.017	0.206	0.024	0.210	0.005	0.148	0.055
BIO_HEALTH_PROF					0.232	0.007	0.220	0.004	0.233	0.002	0.262	0.000	0.285	0.000
SOCIAL_SCIENCES					0.139	0.169	0.137	0.136	0.174	0.040	0.155	0.027	0.152	0.030
BUSINESS					0.387	0.000	0.367	0.000	0.365	0.000	0.232	0.004	0.214	0.006
EDUC_TRAINING					-0.136	0.241	-0.149	0.181	-0.148	0.142	-0.189	0.026	-0.159	0.059
ALL_OTHER_MAJOR					0.306	0.069	0.310	0.050	0.288	0.055	0.268	0.035	0.273	0.025
EXPERIENCE							0.062	0.000	0.060	0.000	0.044	0.000	0.045	0.000
EXPERIENCE_SQ							-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000
CLM_OCC									0.649	0.000	0.465	0.000	0.470	0.000
NONPROFIT_SECTOR											-0.119	0.014	-0.107	0.015
PUBLIC_SECTOR											-0.058	0.227	-0.055	0.241
WEEKLY_HOURS											0.034	0.000	0.032	0.000
ENROLLED											-0.267	0.000	-0.260	0.000
NORTHEAST											0.129	0.121	0.120	0.153
MIDWEST											-0.038	0.590	-0.043	0.558
WEST											0.113	0.203	0.100	0.231
MALE													0.161	0.000
HISPANIC													-0.002	0.985
BLACK													0.056	0.397
ASIAN_PI													0.029	0.766
OTHER_RACE													-0.009	0.925
FOREIGN_BORN													0.005	0.952
WITH_DISABILITIES													-0.071	0.195
_CONS	8.247	0.000	8.148	0.000	7.982	0.000	7.319	0.000	6.941	0.000	5.903	0.000	5.896	0.000
E_R2	0.043	0.003	0.073	0.000	0.112	0.000	0.173	0.000	0.263	0.000	0.484	0.000	0.492	0.000
E_N	1350	0.000	1350	0.000	1350	0.000	1350	0.000	1350	0.000	1350	0.000	1350	0.000

Table H-4 (Percent Effects): Estimated Percent Effects on the Monthly Earnings of 21- to 65-Year-Old Employed College Graduates, 2012-2014 (Estimated from Earnings Regression Models 1-7, Set B)

VARIABLE	MODEL 1	SIG. LEVEL	MODEL 2	SIG. LEVEL	MODEL 3	SIG. LEVEL	MODEL 4	SIG. LEVEL	MODEL 5	SIG. LEVEL	MODEL 6	SIG. LEVEL	MODEL 7	SIG. LEVEL
PVNUM	26.1%	0.000	22.5%	0.000	19.9%	0.000	19.2%	0.000	14.2%	0.002	10.6%	0.006	9.4%	0.021
MASTERS_DEGREE			30.6%	0.000	39.5%	0.000	32.3%	0.000	14.1%	0.050	7.3%	0.136	7.8%	0.093
PROF_PHD_DEGREE			48.2%	0.000	58.1%	0.000	56.7%	0.000	34.5%	0.000	21.4%	0.007	19.1%	0.012
ENG_MATH_PHY_SC					22.4%	0.037	26.6%	0.017	22.9%	0.024	23.4%	0.005	16.0%	0.055
BIO_HEALTH_PROF					26.2%	0.007	24.6%	0.004	26.2%	0.002	29.9%	0.000	32.9%	0.000
SOCIAL_SCIENCES					14.9%	0.169	14.7%	0.136	19.0%	0.040	16.8%	0.027	16.5%	0.030
BUSINESS					47.3%	0.000	44.4%	0.000	44.1%	0.000	26.2%	0.004	23.9%	0.006
EDUC_TRAINING					-12.7%	0.241	-13.8%	0.181	-13.8%	0.142	-17.2%	0.026	-14.7%	0.059
ALL_OTHER_MAJOR					35.8%	0.069	36.3%	0.050	33.3%	0.055	30.7%	0.035	31.3%	0.025
EXPERIENCE							6.4%	0.000	6.2%	0.000	4.5%	0.000	4.6%	0.000
EXPERIENCE_SQ							-0.1%	0.000	-0.1%	0.000	-0.1%	0.000	-0.1%	0.000
CLM_OCC									91.3%	0.000	59.2%	0.000	60.0%	0.000
NONPROFIT_SECTOR											-11.2%	0.014	-10.2%	0.015
PUBLIC_SECTOR											-5.7%	0.227	-5.4%	0.241
WEEKLY_HOURS											3.4%	0.000	3.3%	0.000
ENROLLED											-23.4%	0.000	-22.9%	0.000
NORTHEAST											13.8%	0.121	12.8%	0.153
MIDWEST											-3.8%	0.590	-4.2%	0.558
WEST											11.9%	0.203	10.5%	0.231
MALE													17.4%	0.000
HISPANIC													-0.2%	0.985
BLACK													5.7%	0.397
ASIAN_PI													2.9%	0.766
OTHER_RACE													-0.9%	0.925
FOREIGN_BORN													0.5%	0.952
WITH_DISABILITIES													-6.9%	0.195

Table H-5 (Coefficients): Estimated Coefficients of Monthly Earnings Regressions for 21- to 65-Year-Old Employed College Graduates, 2012-2014 (Estimated from Earnings Regression Models 1-7, Set C)

VARIABLE	MODEL 1	SIG. LEVEL	MODEL 2	SIG. LEVEL	MODEL 3	SIG. LEVEL	MODEL 4	SIG. LEVEL	MODEL 5	SIG. LEVEL	MODEL 6	SIG. LEVEL	MODEL 7	SIG. LEVEL
PV_LITDUM3	0.181	0.066	0.161	0.087	0.163	0.081	0.137	0.142	0.086	0.391	0.092	0.277	0.098	0.243
PV_LITDUM45	0.372	0.000	0.312	0.000	0.286	0.000	0.285	0.000	0.207	0.007	0.196	0.008	0.195	0.008
MASTERS_DEGREE			0.280	0.000	0.346	0.000	0.290	0.000	0.137	0.044	0.072	0.127	0.074	0.091
PROF_PHD_DEGREE			0.413	0.000	0.480	0.000	0.465	0.000	0.304	0.000	0.196	0.006	0.172	0.013
ENG_MATH_PHY_SC					0.256	0.009	0.286	0.004	0.243	0.009	0.237	0.002	0.163	0.039
BIO_HEALTH_PROF					0.226	0.009	0.214	0.005	0.228	0.003	0.258	0.001	0.285	0.000
SOCIAL_SCIENCES					0.144	0.160	0.141	0.131	0.178	0.039	0.158	0.027	0.155	0.028
BUSINESS					0.399	0.000	0.378	0.000	0.372	0.000	0.238	0.003	0.219	0.005
EDUC_TRAINING					-0.152	0.194	-0.163	0.146	-0.159	0.116	-0.192	0.025	-0.155	0.069
ALL_OTHER_MAJOR					0.310	0.071	0.315	0.051	0.291	0.056	0.270	0.035	0.276	0.023
EXPERIENCE							0.063	0.000	0.060	0.000	0.044	0.000	0.044	0.000
EXPERIENCE_SQ							-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000
CLM_OCC									0.662	0.000	0.471	0.000	0.476	0.000
NONPROFIT_SECTOR											-0.118	0.013	-0.106	0.015
PUBLIC_SECTOR											-0.065	0.176	-0.060	0.200
WEEKLY_HOURS											0.034	0.000	0.032	0.000
ENROLLED											-0.262	0.000	-0.254	0.000
NORTHEAST											0.130	0.118	0.119	0.156
MIDWEST											-0.038	0.587	-0.044	0.543
WEST											0.113	0.197	0.097	0.245
MALE													0.179	0.000
HISPANIC													0.000	0.998
BLACK													0.031	0.614
ASIAN_PI													0.031	0.747
OTHER_RACE													-0.019	0.836
FOREIGN_BORN													0.017	0.836
WITH_DISABILITIES													-0.068	0.210
_CONS	8.215	0.000	8.118	0.000	7.935	0.000	7.271	0.000	6.907	0.000	5.846	0.000	5.832	0.000
E_R2	0.024	0.011	0.057	0.000	0.101	0.000	0.164	0.000	0.258	0.000	0.483	0.000	0.492	0.000
E_N	1350	0.000	1350	0.000	1350	0.000	1350	0.000	1350	0.000	1350	0.000	1350	0.000

Table H-6 (Percent Effects): Estimated Percent Effects on the Monthly Earnings of 21- to 65-Year-Old Employed College Graduates, 2012-2014 (Estimated from Earnings Regression Models 1-7, Set C)

VARIABLE	MODEL 1	SIG. LEVEL	MODEL 2	SIG. LEVEL	MODEL 3	SIG. LEVEL	MODEL 4	SIG. LEVEL	MODEL 5	SIG. LEVEL	MODEL 6	SIG. LEVEL	MODEL 7	SIG. LEVEL
PV_LITDUM3	19.9%	0.066	17.5%	0.087	17.7%	0.081	14.7%	0.142	9.0%	0.391	9.6%	0.277	10.3%	0.243
PV_LITDUM45	45.1%	0.000	36.6%	0.000	33.1%	0.000	33.0%	0.000	23.0%	0.007	21.6%	0.008	21.5%	0.008
MASTERS_DEGREE			32.3%	0.000	41.3%	0.000	33.6%	0.000	14.6%	0.044	7.4%	0.127	7.6%	0.091
PROF_PHD_DEGREE			51.1%	0.000	61.6%	0.000	59.2%	0.000	35.6%	0.000	21.6%	0.006	18.8%	0.013
ENG_MATH_PHY_SC					29.2%	0.009	33.1%	0.004	27.5%	0.009	26.7%	0.002	17.7%	0.039
BIO_HEALTH_PROF					25.3%	0.009	23.8%	0.005	25.6%	0.003	29.4%	0.001	33.0%	0.000
SOCIAL_SCIENCES					15.5%	0.160	15.1%	0.131	19.5%	0.039	17.1%	0.027	16.8%	0.028
BUSINESS					49.1%	0.000	45.9%	0.000	45.1%	0.000	26.8%	0.003	24.5%	0.005
EDUC_TRAINING					-14.1%	0.194	-15.1%	0.146	-14.7%	0.116	-17.4%	0.025	-14.3%	0.069
ALL_OTHER_MAJOR					36.4%	0.071	37.0%	0.051	33.8%	0.056	31.1%	0.035	31.8%	0.023
EXPERIENCE							6.5%	0.000	6.2%	0.000	4.5%	0.000	4.5%	0.000
EXPERIENCE_SQ							-0.1%	0.000	-0.1%	0.000	-0.1%	0.000	-0.1%	0.000
CLM_OCC									94.0%	0.000	60.2%	0.000	61.0%	0.000
NONPROFIT_SECTOR											-11.2%	0.013	-10.1%	0.015
PUBLIC_SECTOR											-6.3%	0.176	-5.8%	0.200
WEEKLY_HOURS											3.4%	0.000	3.3%	0.000
ENROLLED											-23.0%	0.000	-22.4%	0.000
NORTHEAST											13.9%	0.118	12.7%	0.156
MIDWEST											-3.8%	0.587	-4.3%	0.543
WEST											12.0%	0.197	10.2%	0.245
MALE													19.6%	0.000
HISPANIC													0.0%	0.998
BLACK													3.1%	0.614
ASIAN_PI													3.2%	0.747
OTHER_RACE													-1.9%	0.836
FOREIGN_BORN													1.7%	0.836
WITH_DISABILITIES													-6.5%	0.210

Table H-7 (Coefficients): Estimated Coefficients of Monthly Earnings Regressions for 21- to 65-Year-Old Employed College Graduates, 2012-2014 (Estimated from Earnings Regression Models 1-7, Set D)

VARIABLE	MODEL 1	SIG. LEVEL	MODEL 2	SIG. LEVEL	MODEL 3	SIG. LEVEL	MODEL 4	SIG. LEVEL	MODEL 5	SIG. LEVEL	MODEL 6	SIG. LEVEL	MODEL 7	SIG. LEVEL
PV_NUMDUM3	0.204	0.012	0.175	0.025	0.155	0.053	0.132	0.089	0.082	0.281	0.043	0.510	0.035	0.596
PV_NUMDUM45	0.433	0.000	0.373	0.000	0.320	0.002	0.315	0.002	0.236	0.009	0.183	0.014	0.153	0.054
MASTERS_DEGREE			0.273	0.000	0.339	0.000	0.285	0.000	0.135	0.045	0.072	0.120	0.079	0.068
PROF_PHD_DEGREE			0.402	0.000	0.467	0.000	0.457	0.000	0.301	0.000	0.196	0.006	0.181	0.010
ENG_MATH_PHY_SC					0.211	0.032	0.241	0.016	0.208	0.025	0.209	0.006	0.150	0.054
BIO_HEALTH_PROF					0.231	0.007	0.219	0.004	0.232	0.003	0.261	0.000	0.285	0.000
SOCIAL_SCIENCES					0.137	0.175	0.134	0.146	0.172	0.045	0.153	0.032	0.152	0.032
BUSINESS					0.387	0.000	0.365	0.000	0.363	0.000	0.228	0.004	0.213	0.006
EDUC_TRAINING					-0.140	0.225	-0.154	0.166	-0.153	0.127	-0.193	0.021	-0.164	0.050
ALL_OTHER_MAJOR					0.297	0.080	0.302	0.059	0.282	0.063	0.264	0.039	0.271	0.026
EXPERIENCE							0.063	0.000	0.061	0.000	0.045	0.000	0.045	0.000
EXPERIENCE_SQ							-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000
CLM_OCC									0.657	0.000	0.470	0.000	0.474	0.000
NONPROFIT_SECTOR											-0.116	0.015	-0.105	0.015
PUBLIC_SECTOR											-0.058	0.228	-0.056	0.240
WEEKLY_HOURS											0.034	0.000	0.032	0.000
ENROLLED											-0.266	0.000	-0.257	0.000
NORTHEAST											0.126	0.131	0.116	0.167
MIDWEST											-0.036	0.618	-0.043	0.561
WEST											0.113	0.200	0.100	0.231
MALE													0.163	0.000
HISPANIC													-0.013	0.893
BLACK													0.028	0.657
ASIAN_PI													0.023	0.812
OTHER_RACE													-0.026	0.774
FOREIGN_BORN													-0.003	0.972
WITH_DISABILITIES													-0.072	0.195
_CONS	8.217	0.000	8.124	0.000	7.963	0.000	7.300	0.000	6.930	0.000	5.895	0.000	5.899	0.000
E_R2	0.035	0.017	0.067	0.000	0.106	0.000	0.168	0.000	0.261	0.000	0.483	0.000	0.491	0.000
E_N	1350	0.000	1350	0.000	1350	0.000	1350	0.000	1350	0.000	1350	0.000	1350	0.000

Table H-8 (Percent Effects): Estimated Percent Effects on the Monthly Earnings of 21- to 65-Year-Old Employed College Graduates, 2012-2014 (Estimated from Earnings Regression Models 1-7, Set D)

VARIABLE	MODEL 1	SIG. LEVEL	MODEL 2	SIG. LEVEL	MODEL 3	SIG. LEVEL	MODEL 4	SIG. LEVEL	MODEL 5	SIG. LEVEL	MODEL 6	SIG. LEVEL	MODEL 7	SIG. LEVEL
PV_NUMDUM3	22.6%	0.012	19.1%	0.025	16.8%	0.053	14.1%	0.089	8.6%	0.281	4.4%	0.510	3.5%	0.596
PV_NUMDUM45	54.1%	0.000	45.2%	0.000	37.7%	0.002	37.0%	0.002	26.6%	0.009	20.1%	0.014	16.5%	0.054
MASTERS_DEGREE			31.3%	0.000	40.4%	0.000	33.0%	0.000	14.4%	0.045	7.5%	0.120	8.2%	0.068
PROF_PHD_DEGREE			49.5%	0.000	59.5%	0.000	58.0%	0.000	35.1%	0.000	21.6%	0.006	19.8%	0.010
ENG_MATH_PHY_SC					23.5%	0.032	27.3%	0.016	23.2%	0.025	23.2%	0.006	16.2%	0.054
BIO_HEALTH_PROF					26.0%	0.007	24.5%	0.004	26.1%	0.003	29.8%	0.000	33.0%	0.000
SOCIAL_SCIENCES					14.7%	0.175	14.4%	0.146	18.8%	0.045	16.6%	0.032	16.5%	0.032
BUSINESS					47.2%	0.000	44.1%	0.000	43.7%	0.000	25.7%	0.004	23.8%	0.006
EDUC_TRAINING					-13.1%	0.225	-14.3%	0.166	-14.2%	0.127	-17.6%	0.021	-15.1%	0.050
ALL_OTHER_MAJOR					34.6%	0.080	35.3%	0.059	32.6%	0.063	30.2%	0.039	31.2%	0.026
EXPERIENCE							6.5%	0.000	6.3%	0.000	4.6%	0.000	4.6%	0.000
EXPERIENCE_SQ							-0.1%	0.000	-0.1%	0.000	-0.1%	0.000	-0.1%	0.000
CLM_OCC									92.8%	0.000	60.1%	0.000	60.6%	0.000
NONPROFIT_SECTOR											-11.0%	0.015	-10.0%	0.015
PUBLIC_SECTOR											-5.6%	0.228	-5.4%	0.240
WEEKLY_HOURS											3.4%	0.000	3.3%	0.000
ENROLLED											-23.4%	0.000	-22.7%	0.000
NORTHEAST											13.4%	0.131	12.4%	0.167
MIDWEST											-3.5%	0.618	-4.2%	0.561
WEST											12.0%	0.200	10.5%	0.231
MALE													17.8%	0.000
HISPANIC													-1.3%	0.893
BLACK													2.9%	0.657
ASIAN_PI													2.4%	0.812
OTHER_RACE													-2.5%	0.774
FOREIGN_BORN													-0.3%	0.972
WITH_DISABILITIES													-7.0%	0.195

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