Higher Education and the School-Work Mismatch in an Evolving Labor Market

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Veronique de Rugy and Jack Salmon. "Higher Education and the School-Work Mismatch in an Evolving Labor Market." Mercatus Research, Mercatus Center at George Mason University, Arlington, VA, November 2019.

ABSTRACT

In relation to an evolving labor market, the main focus of this paper is to examine whether the traditional model of higher education is effectively matching graduate skills to labor market demand. In light of a growing student debt burden and proposals for significant expansions in higher education funding aid, this paper also assesses the orthodox view that a traditional college education is a human capital investment that yields a growing college wage premium. The paper reviews the existing literature on the school-work skills mismatch and concludes that there may be a need to rethink higher education policies to prepare future generations for an increasingly dynamic and evolving labor market.

JEL codes: O33, J62, J24, I26

Keywords: higher education, skills mismatch, human capital investment, technological change, returns to education, vocational training

This paper can be accessed at https://www.mercatus.org/publications/government-spending/higher-education-and-school-work-mismatch-evolving-labor-market

As automation, robotics, and artificial intelligence continue to disrupt and reshape the labor market, the question of whether institutions of higher education are keeping up with this pace of change is a serious one to ponder. Previous work on this subject has looked at the increasing costs of college attendance, with gross tuition rates and fees increasing more than threefold, in real terms, since 1980.[1] As a result of rising tuition costs, the burden of debt for millions of students and graduates is an increasingly familiar problem after graduation, with total outstanding student loan debt for the country as a whole at more than $1.5 trillion by the end of 2018.[2] However, little research has been carried out on the subject of whether these increasing costs and debt burdens are being reflected in growing college wage premiums and greater employment opportunities for college graduates. To address this gap in the data, we review the literature on the education-to-work-skills mismatch and suggest ways in which policymakers might rethink higher education policies to better reflect the changing dynamics of the labor market.

The first section of this paper assesses the orthodox view that traditional college is a human capital investment that results in higher lifetime earnings and better employment opportunities. The literature surrounding this subject has been growing in recent years, but the latest data on the earnings difference ratio may posit some challenges to this traditional view. The college wage premium acts as an important signaling tool of underemployment in the labor market, which can help us break down the worker mismatch problem by level of education and choice of major. Underemployment is a measure of labor utilization

1. Veronique de Rugy and Jack Salmon, "Reevaluating the Effects of Federal Financing in Higher Education" (Mercatus Policy Brief, Mercatus Center at George Mason University, Arlington, VA, August 2019).
2. Federal Reserve Bank of New York, "Center for Microeconomic Data," accessed October 17, 2019, https://www.newyorkfed.org/microeconomics/databank; US Department of Education, "Student Loan Default Rates," accessed October 17, 2019, https://www.ed.gov/category/keyword/student-loan-default-rates.

that assesses the phenomenon of college graduates working in jobs that require a skill set below their qualifications. The second section of the paper examines whether relying on the traditional model of higher education results in effective matches between graduate skills and labor market demand. In the digital age, it is becoming increasingly difficult for educators to effectively equip students for the future of work when we consider that in 20 to 30 years most students will likely be working in jobs that do not even exist today. Before concluding remarks, the third section of the paper briefly reviews alternative avenues of higher education and skills-based vocational education to encourage continual and flexible vocational training.

TRADITIONAL COLLEGE EDUCATION AS A HUMAN CAPITAL INVESTMENT

Addressing the Joint Session of Congress in 2009, President Barack Obama proclaimed, "We will provide the support necessary for you to complete college and meet a new goal: by 2020, America will once again have the highest proportion of college graduates in the world."[3] This is the orthodox view: that sending every young person through the traditional avenue of college education is necessary to both promote equity and maintain US competitiveness in the global economy. Under this view, increased federal investment aimed at driving a larger share of high school graduates toward traditional college education is a "human capital investment" that leads to higher lifetime earnings. To ascertain the validity of this notion, it is necessary to examine the data on the college wage premium—the ratio of wages that college graduates make in comparison with those with only a high school diploma.

A study by the Federal Reserve Bank of Cleveland analyzes data from the American Community Survey (ACS) for the years 2009 and 2010 to calculate the college four-year degree wage premium broken down into college majors.[4] The study finds that earnings of degree holders outpaced those of high school graduates during the 1980s and early 1990s, but the college wage premium flattened somewhat thereafter. More interesting is that the data reveal that the earnings premium is heavily dependent on the field of study that the student majors in. Students who studied engineering, computer science, economics, and

3. White House Archives, "Making College Affordable," accessed October 17, 2019, https://obamawhitehouse.archives.gov/issues/education/higher-education/making-college-affordable.
4. Jonathan James, "The College Wage Premium" (Economic Commentary No. 2012-10, Federal Reserve Bank of Cleveland, August 8, 2012).

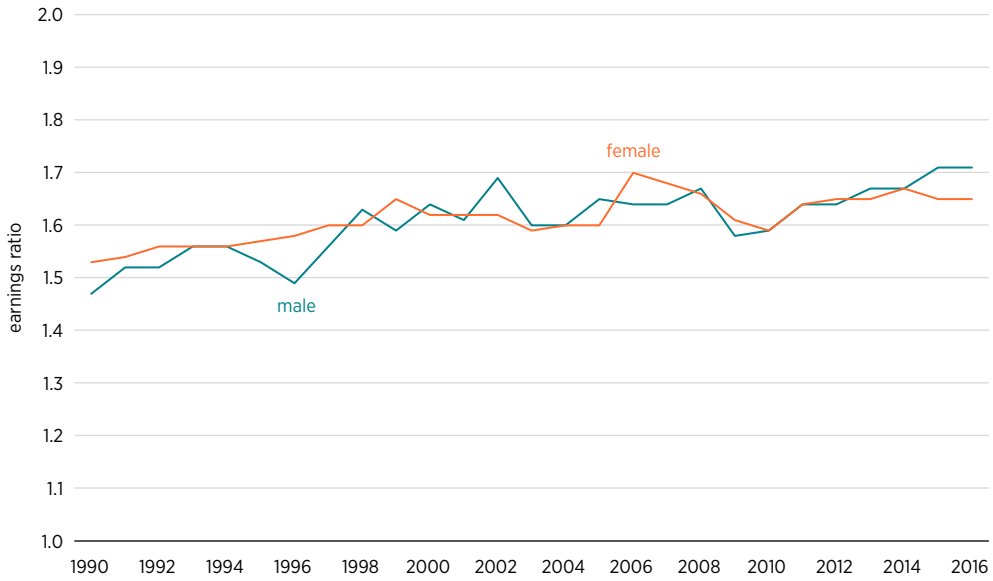
accounting had high wage premiums (around 80 to 160 percent higher than high school graduates), while students who studied education, psychology, English literature, and culinary arts had lower wage premiums (around 20 to 50 percent higher than high school graduates).

The pattern of a flattening wage premium in recent years is also visible in the earnings data from the *Digest of Education Statistics*.[5] Figure 1 displays the earnings ratio between high school and bachelor's graduates from 1990 to 2016 broken down by gender. For males there is a clear period of growth up until 2002, from which point the earnings ratio has remained relatively flat. For females, too, there is a period of growth until around 2006, after which the earnings ratio has actually declined slightly. The significance of this stagnation in the college wage premium over the past 15 years is important not only because this emerging pattern may pose some challenges to the orthodox view that college is a "human capital investment" that leads to higher lifetime earnings, but also because over the same 15-year period the cost of college has grown by more than 50 percent. So, while the costs of pursuing a traditional four-year degree have grown appreciably, the payoff from taking on the additional burden of debt has grown at a much slower rate for around 15 years. These findings are broadly supported by the existing literature: Valletta[6] and Gallipoli and Makridis[7] find that college earnings premiums have flattened in the aggregate since around 2000. Valletta concludes that the flattening of the wage premium in recent years can be explained by a shift away from middle-skilled occupations driven by technological change and a weakening in the demand for advanced cognitive skills. Beaudry, Green, and Sand[8] argue that the college wage premium has actually reversed for cohorts entering after 2000. Their explanation for this reversal corroborates the findings of Valletta, concluding that it was largely driven by a decline in demand for cognitive tasks after 2000.

Using 2016 data from the *Digest of Education Statistics*, we can project and compare the lifetime earnings of a high school graduate, a bachelor's graduate with a low-earnings-ratio major (1.2), and a bachelor's graduate with

5. National Center for Education Statistics, *Digest of Education Statistics: 2017 (2018-070)*, 2018, table 502.20, "Median Annual Earnings, Number, and Percentage of Full-Time Year-Round Workers 25 Years Old and Over, by Highest Level of Educational Attainment and Sex: 1990 through 2016."
6. R. Valletta, "Recent Flattening in the Higher Education Wage Premium: Polarization, Skill Downgrading, or Both?" (NBER Working Paper No. 22935, National Bureau of Economic Research, Cambridge, MA, December 2016).
7. G. Gallipoli and C. Makridis, "Structural Transformation and the Rise of Information Technology," *Journal of Monetary Economics* 97 (2018): 91–110.
8. P. Beaudry, D. A. Green, and B. M. Sand, "The Declining Fortunes of the Young since 2000," *American Economic Review* 104, no. 5 (2014): 381–86.

FIGURE 1. EARNINGS RATIO, HIGH SCHOOL VS. BACHELOR'S, 1990–2016



Source: National Center for Education Statistics, *Digest of Education Statistics: 2017 (2018-070)*, 2018, table 502.20, "Median Annual Earnings, Number, and Percentage of Full-Time Year-Round Workers 25 Years Old and Over, by Highest Level of Educational Attainment and Sex: 1990 through 2016," https://nces.ed.gov/programs/digest/d17/tables/dt17_502.20.asp?referrer=report.

a high-earnings-ratio major (1.8). The calculations are based on baseline earnings for high school graduates in 2016,[9] four years of additional education for bachelor's graduates, the latest statistics on average debt repayments, and the latest data on wage growth and average retirement age.[10] The data reveal that a high school graduate will earn $3,732,813 in wages over a lifetime, a bachelor's graduate with a low earnings ratio will earn $3,818,248, and a bachelor's graduate with a high earnings ratio will earn $5,737,436.[11] While college graduates with a degree in accounting will earn around 54 percent more over their lifetime than high school graduates, college graduates with a degree in elementary education will earn only around 2 percent more (after accounting for debt repayments and lost time). These findings corroborate the conclusions of the Cleveland Federal

9. *Digest of Education Statistics*, table 502.20.
10. Student Loan Hero, "A Look at the Shocking Student Loan Debt Statistics for 2019," February 4, 2019, https://studentloanhero.com/student-loan-debt-statistics/; Federal Reserve Bank of Atlanta, "Wage Growth Tracker," May 9, 2019, https://www.frbatlanta.org/chcs/wage-growth-tracker.aspx; Board of Governors of the Federal Reserve System, *Survey of Household Economics and Decisionmaking*, May 23, 2019.
11. Earnings data reflect present value of lifetime earnings.

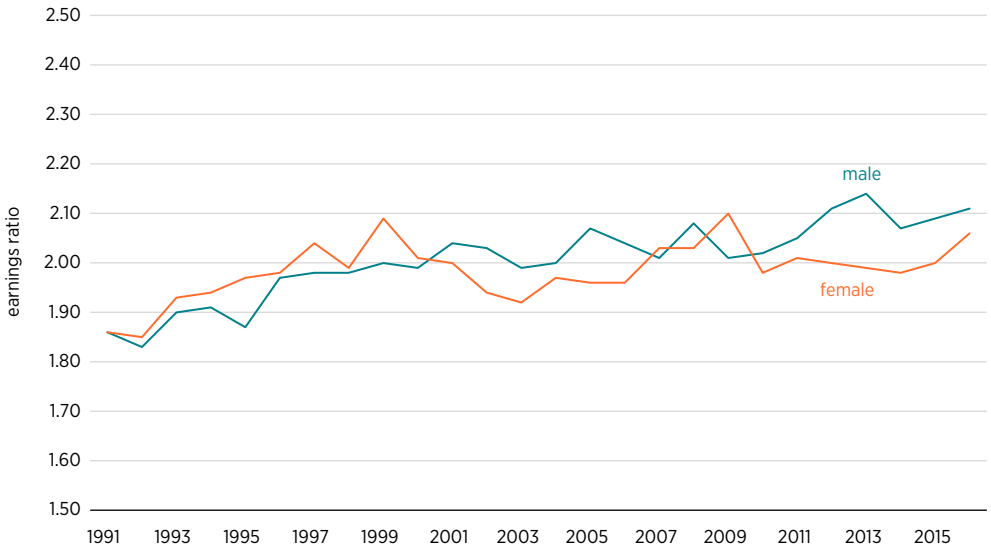
Reserve study: that the payoff from a college education depends to a great extent on the choice of major. This conclusion is also largely in line with the findings of a study by Kirkeboen, Leuven, and Mogstad, who analyze the earnings payoff resulting from students choosing different fields of study.[12] They find that "different fields have widely different payoffs, even after accounting for institutional differences and quality of peer groups. For many fields the difference in payoffs rivals the college wage premiums, suggesting the choice of field is potentially as important as the decision to enroll in college."[13]

The choice of college major is not the only factor in determining the earnings premium of college graduates. It would not be entirely fair if we overlooked the increasing returns to college enrollment that result from postgraduate studies; for this sample of the population, we can review the earnings data for graduates with a master's degree. Depending on the category of major, the decision to pursue an advanced degree could more than double the wage premium. While the earnings data from the *Digest of Education Statistics* suggest a wage premium of 65 to 71 percent for bachelor's graduates, for master's graduates this premium is a much higher 106 to 111 percent—almost double.[14] As for the changes in the master's wage premium since 1991, figure 2 shows that the premiums for both male and female master's graduates experienced strong growth in the 1990s. After 2000, males have continued to see growth in the master's wage premium (at a slower rate); however, females have seen a broadly flattening pattern, with the wage premium in 2016 being roughly where it was in 1999—although still at more than double the earnings of a high school graduate. Furthermore, while the average cumulative debt incurred from enrolling in postgraduate studies is $66,000 (compared with $33,950 for a bachelor's), this additional burden of debt is more than compensated for by the higher wage premium of earning a postgraduate degree.

What the data tend to reveal is that there has been some slowing or flattening of the college wage premium in the first decade of the 21st century; however, the payoff for investing in a college education is still relatively high (especially for postgraduate studies). The downside to this pattern of slowing wage premiums is the rate at which college tuition prices are drastically outpacing the payoff in

12. L. J. Kirkeboen, E. Leuven, and M. Mogstad, "Field of Study, Earnings, and Self-Selection," *Quarterly Journal of Economics* 131, no. 3 (2016): 1057–1112.
13. Kirkeboen, Leuven, and Mogstad, "Field of Study, Earnings, and Self-Selection," 1060.
14. National Center for Education Statistics, *Digest of Education Statistics: 2017 (2018-070)*, 2018, table 322.45, "Percentage of Graduate Degree Completers with Student Loan Debt and Average Cumulative Amount Owed, by Level of Education Funded and Graduate Degree Type, Institution Control, and Degree Program: Selected Years, 1999–2000 through 2015–16."

FIGURE 2. EARNINGS RATIO, HIGH SCHOOL VS. MASTER'S, 1991–2016



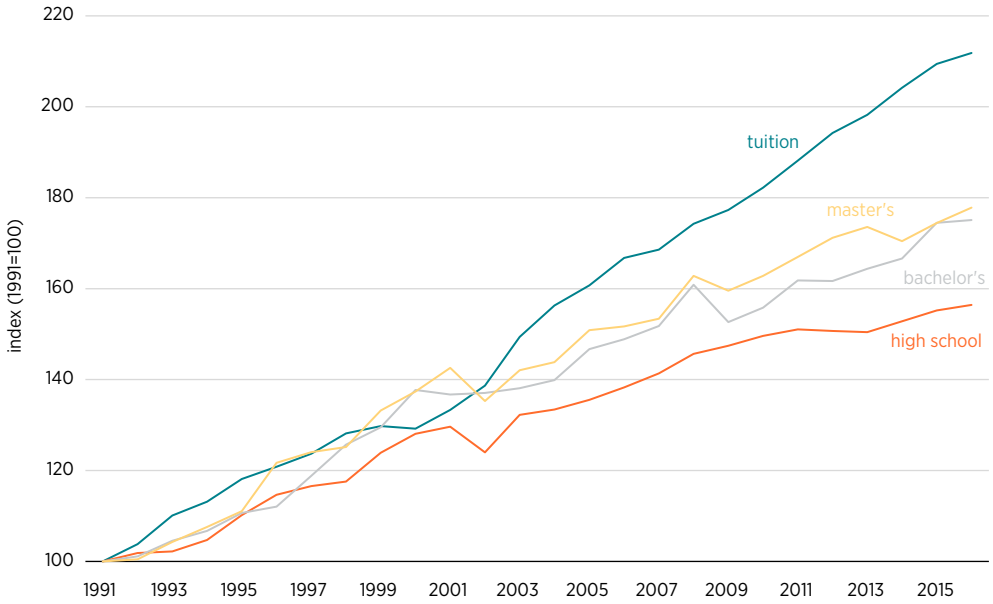
Source: National Center for Education Statistics, *Digest of Education Statistics: 2017 (2018-070)*, 2018, table 502.20, "Median Annual Earnings, Number, and Percentage of Full-Time Year-Round Workers 25 Years Old and Over, by Highest Level of Educational Attainment and Sex: 1990 through 2016," https://nces.ed.gov/programs/digest/d17/tables/dt17_502.20.asp?referrer=report.

college wage premiums. Figure 3 shows the index of the cost of average tuition for full-time male undergraduate students and the index of earnings by educational attainment since 1991.[15] While the earnings of bachelor's and master's graduates continue to outpace the earnings growth of high school graduates, there is a clear divergence in tuition price growth after 2002—this gap continues to grow substantially over time. This divergence between cost and earnings highlights the importance of choosing a high-earnings-ratio major when enrolling in college (or pursuing an advanced degree) to reap the largest returns on a college investment.

Yet, for millions of Americans, simply enrolling in college will not be enough to reap the benefits of a wage premium—around a quarter of students enrolled in four-year degrees do not complete their degrees. The six-year completion rates for students who enrolled in college in 2012 were 76 percent for four-year private nonprofit institutions, 66 percent for four-year public institutions, and just 37 percent for four-year private for-profit institutions.[16] The dropout rate

15. Average undergraduate tuition and fees are measured as listed prices (constant 2017–2018 dollars), and median annual earnings are measured as full-time year-round workers 25 years old and over, by highest level of educational attainment and sex.
16. D. Shapiro et al., "Completing College: A National View of Student Completion Rates—Fall 2012 Cohort" (Signature Report No. 16, National Student Clearinghouse Research Center, Herndon, VA, 2018).

FIGURE 3. INDEX OF TUITION COST AND MALE GRADUATE EARNINGS BY EDUCATIONAL ATTAINMENT, 1991–2016



Source: Authors' calculations from US Department of Education, *Digest of Education Statistics: 2017 (2018-070)*, 2018, table 330.10, "Average Undergraduate Tuition and Fees and Room and Board Rates Charged for Full-Time Students in Degree-Granting Postsecondary Institutions, by Level and Control of Institution: Selected Years, 1963–64 through 2016–17," https://nces.ed.gov/programs/digest/d17/tables/dt17_330.10.asp; table 502.20, "Median Annual Earnings, Number, and Percentage of Full-Time Year-Round Workers 25 Years Old and Over, by Highest Level of Educational Attainment and Sex: 1990 through 2016," https://nces.ed.gov/programs/digest/d17/tables/dt17_502.20.asp?referrer=report.

reported by the National Student Clearinghouse Research Center is 23 percent for four-year degrees and 46 percent for two-year degrees. The quarter of four-year-degree students who do not graduate are burdened with large debt repayments and a lower wage premium[17]—many of these students will be financially worse off over their lifetime than high school graduates without postsecondary education. It is becoming increasingly important for prospective students to weigh the increasing costs of higher education with the stagnating benefits of a traditional college education. As Valletta argues in his research on the higher education wage premium, "Although higher education may be financially advantageous on average, the flattening of returns as costs have continued to rise suggests that college may be an unfavorable financial investment for rising numbers of individuals."[18]

17. G. Castex, "College Risk and Return," *Review of Economic Dynamics* 26 (2017): 91–112.
18. R. Valletta, "Recent Flattening in the Higher Education Wage Premium," 26.

LABOR MARKET MISMATCH AND THE FUTURE OF WORK

While a flattening wage premium may act as a signal of underemployment, a second and arguably more important way of assessing the payoff from a college education is through the lens of rapid technological change and an increasingly dynamic and evolving labor market. In 2016, a World Economic Forum report found that "in many industries and countries, the most in-demand occupations or specialties did not exist 10 or even five years ago, and the pace of change is set to accelerate. By one popular estimate, 65% of children entering primary school today will ultimately end up working in completely new job types that don't yet exist."[19] The future of work will not be about college degrees—increasingly, it will be about skills. A traditional college degree will not protect future generations from the unpredictability of technological change and disruption. In light of these developments already changing the nature of the labor market in the United States, there is a mismatch between the abilities of college graduates and the in-demand skills of the evolving labor market.

The top-down push to drive up college enrollment rates has led to most gains in graduate employment being low-skilled jobs, many of which do not pay high wages. The term used to refer to the phenomenon of college graduates working in jobs that require a skill set below their qualifications is *underemployment*. There is an oversupply of college graduates, which means that there are a lot of educated people and not enough suitable jobs for them to fill. Graduates who are underemployed do not receive relevant or full-time work experience, so they do not have the necessary work experience to take a full-time job in the field of their major when it does become available—this cycle works to perpetuate underemployment further. A study from the Center of College Affordability and Productivity found that between 1992 and 2008, 60 percent of the increased college graduate population ended up in these lower-skilled jobs, with 35 percent of college graduates underemployed in 2008 alone.[20] These statistics should stand as a signal of unintended consequences to policymakers who push to increase the proportion of Americans attending and graduating from four-year colleges. It appears that the rate of underemployment has been on the rise for graduates and recent college graduates since around 2001, representing a return to the level of underemployment that existed in the early 1990s. A study by the Federal Reserve Bank of New York notes that the share of underemployed college gradu-

19. World Economic Forum, *The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution*, January 2016, 3.
20. R. Vedder et al., *From Wall Street to Wal-Mart: Why College Graduates Are Not Getting Good Jobs* (Washington, DC: Center for College Affordability and Productivity, 2010).

ates in full-time jobs with an annual wage of roughly $45,000 or more has fallen sharply, while the share working in low-wage jobs has risen since 2001.[21] Taken together, these trends suggest that the quality of jobs for underemployed college graduates, and especially for recent college graduates, has been on the decline, particularly since 2001.

To ensure that the uptick in college underemployment is not a phenomenon resulting from the 2007–2008 recession, we can review the most recent data on the underemployment rate and assess whether it has risen or declined in recent years. A report published in 2018 uncovered the extent of college graduate underemployment and how this phenomenon may also disrupt graduates' long-term career prospects. The report finds that 43 percent of college graduates are underemployed in their first job and that two-thirds of those graduates will still be underemployed after 5 years.[22] The report also finds that underemployed graduates earned around $10,000 (27 percent) less than appropriately employed graduates and that graduates with science, technology, engineering, and mathematics (STEM) degrees had the lowest levels of underemployment. The data on graduate underemployment reveal a number of issues within the traditional college education system: (1) the push to drive enrollment higher has led to an oversupply of college degree holders, (2) a significant share of employment gains for these degree holders has been in low-skilled jobs, (3) there is a serious mismatch between the skills of college graduates and the in-demand skills of the labor market, and (4) the underemployment effect has damaging long-term impacts on the career prospects and earning potential of college graduates in non-STEM fields.

To truly understand whether the current model of higher education is effectively matching graduate skills to labor market demand, we review the existing literature on the school-work skills mismatch. Robst examines the mismatch between workers' educational attainment and their job by assessing whether their current job is related to their field of study.[23] The study finds that majors with the highest probability of mismatch are English and foreign languages, home economics, liberal arts, psychology, and social sciences. By contrast, health professions, computer science, engineering, business management, and architecture have some of the lowest mismatch rates. Further, workers with postgraduate degrees are less likely to be mismatched than those with bachelor's

21. J. R. Abel, R. Deitz, and Y. Su, "Are Recent College Graduates Finding Good Jobs?," Federal Reserve Bank of New York, *Current Issues in Economics and Finance* 20, no. 1 (2014).
22. Burning Glass Technologies and Strada Institute for the Future of Work, *The Permanent Detour: Underemployment's Long-Term Effects on the Careers of College Grads*, 2018.
23. J. Robst, "Education and Job Match: The Relatedness of College Major and Work," *Economics of Education Review* 26, no. 4 (2007): 397–407.

degrees. Overall, Robst finds that 45 percent of workers report some level of mismatch between their work and their field of study. The breakdown of college majors suggests that majors that emphasize general skills (e.g., liberal arts) have a higher prevalence of mismatch than those that emphasize occupation-specific skills (e.g., engineering). An international field study on the relationship between college major and skills mismatch reveals results similar to those concluded by Robst. Among recent college graduates age 22 to 27 with a bachelor's degree or higher between 2009 and 2011, 25 to 35 percent of those with majors in engineering, health, math, and computer science are either unemployed or underemployed, compared with 60 percent for those with a major in liberal arts.[24] Montt finds that humanities, languages, and arts have the highest rates of skills mismatch—almost three-quarters of graduates are working in fields other than their field of study.[25] Montt also finds that careers in healthcare, business, teaching, and engineering have the lowest rates of mismatch, with less than one-third working in fields that do not match their field of higher education. When associated with overqualification, mismatched skills increase the likelihood of low job satisfaction, unemployment, and lower wages, not to mention the economic costs of developing human capital that will not be utilized. Montt notes that "field saturation is predictive of a higher likelihood of individual field-of-study mismatch. The demand for skills in the labour market is one of the drivers of mismatch: when there are more graduates from a particular field than jobs available in that field, some necessarily need to look elsewhere for a job."[26]

Another way in which the skills-mismatch literature has been conducted in recent years is to analyze how this phenomenon is reflected in the earnings of college graduates and mismatched workers. On the topic of school-to-work linkages, Bol and his coauthors show that workers have higher earnings when their occupations match their level of education and field of study.[27] They conclude their study by stating that "an institutional environment that promotes strong school-to-work pathways appears to be an effective strategy for providing workers with secure, well-paying jobs."[28] Other studies on mismatch and earnings potential have examined this pattern across developed countries. In line

24. G. Castex, "College Risk and Return."
25. G. Montt, "The Causes and Consequences of Field-of-Study Mismatch" (OECD Social, Employment and Migration Working Papers, Organisation for Economic Co-operation and Development, Paris, 2015), 167.
26. Montt, "Causes and Consequences of Field-of-Study Mismatch," 37.
27. T. Bol et al., "School-to-Work Linkages, Educational Mismatches, and Labor Market Outcomes," *American Sociological Review* 84, no. 2 (2019): 275–307.
28. Bol et al., "School-to-Work Linkages," Abstract.

with other studies, Levels, Van der Velden, and Allen reveal that underemployed workers earn less than equally educated workers who are employed in their field.[29] Nordin, Persson, and Rooth conducted a study on education-occupation mismatch in Sweden that reveals that the income penalty for mismatched graduates is 32 percent for men and 28 percent for women, and for some the income penalty is permanent.[30] What is more, the income penalty decreases with work experience, which indicates that education-specific skills and work experience are substitutes to an extent. Finally, a study on the skills mismatch and earnings relationship by Zamfir, Matei, and Lungu explores how education-work mismatches impact the earnings of higher education graduates. The authors find that "education-job mismatch has a negative impact on higher education graduates earnings in most of the countries included in the dataset."[31]

There is a budding collection of literature on skills mismatch and its link to an oversupply of college-educated workers. Ghaffarzadegan, Xue, and Larson find that drives to incentivize college education have meant that individuals who attain higher degrees of education end up working in jobs that do not require those degrees.[32] To summarize their findings, the authors explain that "people end up obtaining education only to have a competitive advantage during the hiring period, without any further use. The overall result is extra spending on education, a corresponding loss of working years, and an increase in student debt."[33] Under this signaling hypothesis, rather than enhancing a student's skill set, higher education is instead used to certify intelligence and conformity. Professor Bryan Caplan has made the case that higher education is best understood using a signaling model rather than a human capital model, as is often claimed. Caplan explains that students will vie for the easy As and forget most of what they learn after taking final exams; and at the same time, decades of growing access to higher education have resulted not in better jobs for American workers but in runaway credential inflation.[34] In another study of skills mismatch among OECD (Organisation for Economic Co-operation and Development) countries,

29. M. Levels, R. Van der Velden, and J. Allen, "Educational Mismatches and Skills: New Empirical Tests of Old Hypotheses," *Oxford Economic Papers* 66, no. 4 (2014): 959–82.
30. M. Nordin, I. Persson, and D. Rooth, "Education–Occupation Mismatch: Is There an Income Penalty?," *Economics of Education Review* 29, no. 6 (2010): 1047–59.
31. A. Zamfir, M. M. Matei, and E. O. Lungu, "Influence of Education-Job Mismatch on Wages among Higher Education Graduates," *Procedia - Social and Behavioral Sciences* 89 (2013): 297.
32. N. Ghaffarzadegan, Y. Xue, and R. C. Larson, "Work-Education Mismatch: An Endogenous Theory of Professionalization," *European Journal of Operational Research* 261, no. 3 (2017): 1085–97.
33. Ghaffarzadegan, Xue, and Larson, "Work-Education Mismatch," 1096.
34. B. Caplan, *The Case against Education: Why the Education System Is a Waste of Time and Money* (Princeton, NJ: Princeton University Press, 2019).

workers were categorized as underskilled, well matched, or overskilled based on numeracy and literacy skills. Pellizzari and Fichen find that, overall, 16 percent of the entire sample was overskilled.[35] This study reveals not only that graduate skills mismatch is a phenomenon found in other countries but also that it is far more prominent in the United States, with around 1 in 4 workers being overskilled. Şahin and her coauthors examine a slightly different relationship; they develop a framework where mismatch between vacancies and job seekers across sectors translates into high unemployment by lowering the aggregate job-finding rate.[36] The study finds that mismatch explains, at most, one-third of the rise in US unemployment between 2006 and 2010. Moreover, mismatch contributed more than twice as much of the observed increase in the unemployment rate of college graduates as of the increased unemployment rate of high school dropouts. These results suggest that the education-occupation mismatch may be based on labor demand shifts and human capital specialization. But these findings also highlight the issue that an oversupply of college graduates leads to not only an increase in underemployment but also increases in unemployment.

While the rise of artificial intelligence is increasing the scope of tasks that can be automated, technological innovation is redefining rather than replacing in-demand skills. The skills mismatch between graduates and the labor market is a major problem. Acknowledging how the digital age is transforming the nature of work, creating new roles, and requiring new skills, a global report published last year assesses how talent shortages are more acute than they have been for decades.[37] The survey of more than 39,000 businesses finds that 45 percent of employers cannot find the skills they need, while the rate was 46 percent for the United States, above the global average. Skilled trades (electricians, welders, mechanics, and more) as well as engineers, IT professionals, and technicians have ranked among the hardest jobs to fill in recent years. In 2018, around two-thirds of surveyed employers were up-skilling people in hard skills through apprenticeships, technical certifications, and programming courses, while more than one-third of employers were being more flexible about the education or experience requirements for the role. The nature of these in-demand jobs does not always require a traditional college degree, but business survey data reveal that they instead require continual up-skilling as traditional roles are supplemented with new technologies.

35. M. Pellizzari and A. Fichen, "A New Measure of Skill Mismatch: Theory and Evidence from PIAAC," *IZA Journal of Labor Economics* 6, no. 1 (2017): 1–30.
36. A. Şahin et al., "Mismatch Unemployment," *American Economic Review* 104, no. 11 (2014): 3529–64.
37. Manpower Group, *Solving the Talent Shortage: Build, Buy, Borrow and Bridge*, 2018.

THE NEED TO RETHINK HIGHER EDUCATION POLICIES AND ENCOURAGE FLEXIBLE VOCATIONAL TRAINING

In the future, traditional college degrees will not insulate graduates from or prepare them for the unpredictability of technological change. With this in mind, the rise of nontraditional education options should be seriously considered as viable alternatives to traditional avenues of higher education. In fact, some large companies have already begun rolling out pilot programs for high school graduates to begin working in roles that require on-the-job learning instead of a college degree. Large companies such as Google, Apple, IBM, and Ernst & Young are increasingly offering well-paid jobs that do not require a college degree.[38] In 2015, the managing partner for talent at Ernst & Young made clear that a university degree "will no longer act as a barrier to getting a foot in the door."[39] Similarly, in 2018, around half of US employees at Apple did not have a traditional four-year degree. During an address earlier this year to the American Workforce Policy Advisory Board, Apple CEO Tim Cook said that there is a "mismatch between the skills that are coming out of colleges and what the skills are that we believe we need in the future."[40] In other words, the United States has a labor force that is increasingly overeducated and underskilled, and thus it requires continual training and work experience to create value in a rapidly evolving labor market.

No individual expert, academic, or organization has access to reliable knowledge about what the jobs of the future will look like—this is a knowledge problem. This is why alternative avenues of higher education, such as apprenticeships (learning a vocation directly from someone who is already fully immersed in the trade), can better match skills with those trades that are most in demand. Vocational training, such as career and technical education, is often treated as a last option for struggling students, not a critical route to a successful and productive career in an ever-changing labor market. Rather than the exception, apprenticeships should be increasingly seen as the norm; encouraging continual on-the-job training will equip workers with the ability to learn new skills, and providing space for private financing will allow people to fund their skills-based education. More than a change in higher education policy, this would require a

38. Glassdoor, "15 More Companies That No Longer Require a Degree—Apply Now," August 14, 2018, https://www.glassdoor.com/blog/no-degree-required/.
39. L. Sherriff, "Ernst & Young Removes University Degree Classification from Entry Criteria as There's 'No Evidence' It Equals Success," *Huffington Post* (UK), August 17, 2017.
40. WhiteHouse.gov, quoted in "Remarks by President Trump at an American Workforce Policy Advisory Board Meeting," March 6, 2019. Retrieved from WhiteHouse.gov website: https://www.whitehouse.gov/briefings-statements/remarks-president-trump-american-workforce-policy-advisory-board-meeting/.

cultural shift, where vocational education is not seen as inferior to a traditional college education.

Preparing students to succeed in a rapidly changing labor market will require not only rethinking avenues of higher education but also starting to reevaluate how school prepares students for higher education learning at the K–12 level. This will require moving beyond a curricular system of preparing for traditional college admissions and moving toward a career-connected learning (CCL) approach that effectively combines classroom instruction with work-related experience.[41] A report published earlier this year explores the possible educational pathways that a CCL program of learning could take. The report examines small-scale CCL projects in the states of Washington and Colorado and finds that the most impactful programs have been market driven and student centered.[42] The most successful programs solve real employer needs, matching training to demand and yielding positive returns on investment, while offering choices for good jobs and equitable access.

One country that has adopted broadly successful apprenticeship and vocational education programs is Switzerland. In Switzerland, roughly two-thirds of high school graduates enroll in some form of vocational education, with the majority of those entering apprenticeships.[43] Swiss businesses tend to view apprentices as a strategy for growing a talent pool, so there is a strong market-oriented incentive system for investing in vocational training programs. A defining feature of the Swiss vocational education system is its close alignment with the labor market—vocational training is focused on actual demand for vocational qualifications and on available jobs.

Considering the adoption of vocational training in other developed countries, there is a growing literature on the economic and individual returns to vocational training as an alternative avenue of education. A key challenge for the future will be to prevent job displacement resulting from disruptive technologies and from a need for better matching of skills between workers and future jobs. Aizenman and his coauthors make the case that pushing more students to BA-granting colleges may no longer be the most efficient way to deal with the challenges caused by the decline in manufacturing employment affecting, in par-

41. Bain & Company, *Making the Leap: How to Take the Promise of Career-Connected Learning to Scale*, February 12, 2019.
42. Bain & Company, *Making the Leap*.
43. H. Steedman, *The State of Apprenticeship in 2010: International Comparisons Australia, Austria, England, France, Germany, Ireland, Sweden, Switzerland* (London: London School of Economics, Centre for Economic Performance, 2010).

ticular, low-income households.[44] This push leads to overinvestment in college education by some segments of society, with little economic returns. Looking at the OECD countries, an observed pattern to solving the issues of mismatch and underemployment is found in improved access to better vocational education. The authors note that "there are too many four-year colleges serving too many students, and too few institutions with greater focus on vocational education and training. This mismatch is sustained by the skewed assistance scheme that is facilitated by the federal government."[45] Similarly, Breen seeks to explain the variation in youth unemployment on the basis of institutional and economic differences across countries.[46] The results of Breen's study reinforce the view that "systems of vocational training which teach specific skills and incorporate a strong work-based element provide a preventative to youth unemployment by offsetting the negative effects of extensive worker protection against dismissals." Vocational education programs send clear signals about job seekers' abilities and skills, imparting transferable vocational skills; countries with such vocational education systems tend to have lower unemployment rates owing to the clear institutional link between vocational training and employers.

Other studies on the benefits of vocational education involve comparative analyses between a traditional college education and vocational training. Meer uses data from the National Student Longitudinal Survey to examine claims that students enrolled on a vocational track would benefit from a more academically rigorous education.[47] The study finds that students enrolled on a technical vocational track are not likely to earn more if they had chosen differently, and students on a non-college-preparatory track are likely to benefit from some technical training. When we consider that almost half of surveyed American businesses say they cannot find the skilled workers they need, and that the most in-demand skills are those of electricians, welders, mechanics, engineers, IT professionals, and technicians, it should not come as a surprise that millions of graduates with general-skills majors cannot find jobs that pay enough to offset the cost of their education. Technological development is rapidly changing the labor market and, therefore, requirements for work performance. Continual vocational education and training allow workers to adapt to new demands within the labor market

44. J. Aizenman et al., "Vocational Education, Manufacturing, and Income Distribution: International Evidence and Case Studies," *Open Economies Review* 29, no. 3 (2018): 641–64.
45. Aizenman et al., "Vocational Education, Manufacturing, and Income Distribution," 9–10.
46. R. Breen, "Explaining Cross-National Variation in Youth Unemployment," *European Sociological Review* 21, no. 2 (2005): 125–34.
47. J. Meer, "Evidence on the Returns to Secondary Vocational Education," *Economics of Education Review* 26, no. 5 (2007): 559–73.

so that they are prepared for an increasingly dynamic and changing labor market. This does not mean that all students should pursue a vocational education rather than a traditional four-year college degree, but the changing nature of work combined with the increasing costs in relation to payoffs from the wage premium may lead to a large share of future college graduates being heavily indebted, being underemployed, and lacking the in-demand skills of the labor market. This skills-work mismatch could be particularly problematic for the roughly one-quarter of college students who fail to graduate.

As Jacobs and Grubb state, vocational education should evolve in sync with changes in information and technology: "To prepare students for high paid, challenging employment, vocational education must take account of the 'knowledge revolution.'"[48] Wolbers explains cross-national patterns of labor market entry among school leavers[49] in relation to employment protection legislation and vocational specificity of the education system.[50] The study finds that in countries where apprenticeship-type vocational training is high, the likelihood of entering a first significant job (i.e., a job of at least 20 hours per week that lasts for at least six months) is greater than in countries where enrollment is low. This is because the negative impact of strict employment regulation is stronger among higher-educated school leavers (i.e., college graduates). School leavers enrolled in apprenticeship-type vocational education are also less likely to become inactive and drop out of the labor force.

On the economic effects of choosing vocational avenues of education, Sala and Silva quantify the extent to which vocational training has contributed to the increase in the growth rate of labor productivity in Europe between 1999 and 2005.[51] The authors find that one extra hour of training per employee contributes to accelerate the growth rate of labor productivity by 0.55 percentage points. These findings are very similar to those from Dearden, Reed, and Van Reenen, who find that a 1 percent increase in work training increases by about 0.6 percent the value added per hour.[52] In light of these findings, vocational education should be deemed an effective policy tool to increase the scope of efficient adjustment

48. J. Jacobs and N. Grubb, *The Federal Role in Vocational-Technical Education* (New York: Columbia University, Community Coll. Research Center, 2003).
49. "School leavers" refers to those who are entering the labor market after high school graduation or college graduation.
50. M. H. Wolbers, "Patterns of Labour Market Entry," *Acta Sociologica* 50, no. 3 (2007): 189–210.
51. H. H. Sala and J. I. Silva, "Labor Productivity and Vocational Training: Evidence from Europe," *Journal of Productivity Analysis* 40, no. 1 (2012): 31–41.
52. L. Dearden, H. Reed, and J. Van Reenen, "The Impact of Training on Productivity and Wages: Evidence from British Panel Data," *Oxford Bulletin of Economics and Statistics* 68, no. 4 (2006): 397–421.

to technological changes. A second study that examines the economic impact of vocational education is by Vu, Hammes, and Im.[53] They find that the common idea that economic growth is driven more by university education than by vocational education may not hold. Since vocational training provides direct working skills, it tends to increase productivity and per capita income more than a traditional college education.

Fixing the mismatch between higher education and labor market skills will not be simple, but policymakers could start by considering reforms that make apprenticeships more attractive to both employers and students. The current US accrediting system focuses too heavily on inputs, such as school facilities, equipment, and supplies, while accreditors who are tasked with certifying the ends have instead mandated the means to be used while mostly ignoring the ends.[54] Removing regulations that focus on processes and replacing them with a "chartering model where providers of higher education submit to accountability for outcomes in return for autonomy in developing and running their programs" would compel educators to focus more acutely on preparing students for the evolving labor market.[55] Policymakers could encourage states to offer students some kind of on-the-job training as an option before high school graduation. The Common Core State Standards claim to be about both college and career readiness, but these standards should be reevaluated in light of a rapidly changing labor market—the focus has tended to be heavily oriented toward college attendance and by many metrics has failed to prepare students for work. Students could choose to finance vocational education through income-share agreements (ISAs), whereby private investors provide the required capital to pay for an apprenticeship or on-the-job training in exchange for a certain percentage of the student's future income over a fixed period (e.g., 17 percent over 2 years).[56] Providing greater legal and regulatory clarity on the status of ISAs would allow for more innovative career training models without putting taxpayers' money at risk for their potential failures.

53. T. B. Vu, D. L. Hammes, and E. I. Im, "Vocational or University Education? A New Look at Their Effects on Economic Growth," *Economics Letters* 117, no. 2 (2012): 426–28.
54. Hank Brown, *Protecting Students and Taxpayers* (Washington, DC: American Enterprise Institute, September 2013).
55. A. Kelly, "Preparing Students for the World of Work," Cato Institute, November 24, 2014.
56. T. Cowen, "How Much Is Your Education Worth? Depends How Much You Make," Bloomberg, April 4, 2019.

CONCLUDING REMARKS

Owing to the rapidly changing nature of jobs in the digital age, new and continually evolving skills are becoming more important than a traditional college degree, particularly in the case of non-STEM majors. This skills-market mismatch has contributed to the problem of underemployment, with underemployed graduates earning around $10,000 less than appropriately employed graduates. While the rise of artificial intelligence is increasing the scope of tasks that can be automated, technological innovation is redefining rather than replacing in-demand skills. The skills mismatch between graduates and the labor market is a serious problem.

In light of a growing student debt burden and proposals for significant expansions in higher education funding aid, this paper examines the orthodox view that a traditional college education is a human capital investment that yields a growing college wage premium. It is clear from the evidence that the returns of investing in a college education have been slowing or flattening for two decades when observing trends in the college wage premium. These trends, however, depend to a large extent on the choice of major and whether students enroll in postgraduate studies. STEM majors continue to provide the greatest payoff on students' investment, but STEM students still account for only around one-fifth of undergraduate students. For the one-quarter of college enrollees who fail to graduate, the payoff is often negative, and the student incurs a large debt burden with little or no earnings premium.

Rather than the exception, apprenticeships should be increasingly seen as the norm; encouraging continual on-the-job training will equip workers with the ability to reskill, and providing space for private financing will allow people to fund their skills-based education. There is a serious need to rethink higher education policies, particularly in relation to the one-size-fits-all federal financial assistance programs, but also other public provisions aimed at driving up college enrollment rates. The United States has a labor force that is overeducated and underskilled, and thus it requires continual training and work experience to create value in a rapidly evolving labor market. This is not going to be an easy challenge to tackle, but policymakers should rethink higher education policies and remove barriers to vocational skill-based alternatives to prepare the next generation for a continually evolving labor market.

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