Degrees of Opportunity

LESSONS LEARNED FROM STATE-LEVEL DATA ON POSTSECONDARY EARNINGS OUTCOMES

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Executive Summary

For the past several decades, the nation has operated under a simple principle: The surest path to labor-market success is through a bachelor's degree at a four-year college or university. Annually, American postsecondary institutions grant far more bachelor's degrees than associate degrees or nondegree certificates. While on average bachelor's degree holders earn more than those with sub-baccalaureate credentials (associate degrees, certificates, and apprenticeships), student earnings vary widely based on the degree pursued, the major studied, and the school attended.

To explore that variation, we use state administrative data from College Measures to calculate five-year earnings and expected 20-year return on investment for students completing bachelor's, associate, certificate, and apprenticeship programs in specific fields of study from public higher education institutions in Florida, Texas, and Tennessee. We draw three main lessons:

First, many associate degree and certificate programs offer valuable routes into the middle class.

Second, majors matter greatly with respect to post-college earnings—no matter the degree level—and skills-oriented programs in health, engineering, and other technical fields are typically more remunerative than many programs in traditional academic fields.

Third, while state flagship universities offer many opportunities for employment with high earnings, there are many high-return programs at regional universities and community colleges.

There are certain caveats to the analysis: The earnings data are only for those who completed programs rather than all those who enrolled; earnings information does not account for the prior ability of those who select and complete certain majors versus others; high-paying sub-baccalaureate programs tend to have fewer graduates than their bachelor's degree counterparts; and the skills imparted by technical programs may have greater diminishing returns over time relative to bachelor's degree programs.

Limitations aside, these new data should add new dimensions to the current debate around the value of postsecondary education. We conclude that, if we move beyond our current fixation on the bachelor's degree and widen the aperture to include all the postsecondary pathways at our disposal, far more educational options emerge that can lead students to economic success.

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Students enroll in college for a variety of reasons: to obtain a general education, learn more about subjects that interest them, find purpose in their lives, and so on. As evident across numerous surveys, one of college students' primary goals is to obtain a credential that will help them find a good job with good wages. Roughly 85 percent of first-time college freshman, for instance, cited the ability to get a better job as a "very important" consideration in deciding to attend college, the top reason cited by respondents.[1]

To that point, for the past several decades the nation has operated under a simple principle: The surest path to labor-market success is through a bachelor's degree at a four-year college or university. Perhaps it is not surprising, then, that annually we grant far more bachelor's degrees (roughly two million) than associate degrees (more than one million) or shorter-term, nondegree certificates (just under one million).[2] The number of associate degrees awarded likely understates the importance of the bachelor's degree; roughly half of associate degrees are awarded to students from associate degree programs in the liberal arts or humanities, programs designed to prepare students for bachelor's degree programs rather than the workplace.[3]

The claim that bachelor's degree holders earn more than many people with shorter-term or no postsecondary credentials generally holds true. More precisely, Temple University economist Doug Webber estimates that the net present expected value of attending college (pursuing a bachelor's degree) varies between $95,000 and $275,000, depending on the major.[4] As this variation makes clear, though, not all bachelor's degrees are created equal. There are significant differences in earnings outcomes depending on factors such as completing the degree,[5] major or field of study,[6] quality or selectivity of the institution attended,[7] occupation after college,[8] and so on.

Given this variation—and as the data we present below make clear—the bachelor's degree may not always be the best option for graduates to find economic success after college. For one, bachelor's degrees are usually costlier than shorter-term credentials: average net tuition, fees, room, and board were $14,210 at public four-year institutions in 2016–17, nearly twice the costs of community colleges.[9] And a bachelor's degree takes longer to complete than an associate degree or certificate, increasing costs in terms of the amount invested and forgone wages (keeping in mind that a bachelor's degree usually takes more than four years to complete and many enrollees do not even make it to graduation). Indeed, Webber contends that attending college is "an unambiguously good investment for the vast majority of individuals with low to average college costs . . . [but when] costs of attending college are high . . . gains are far more tenuous."[10]

This brings the *value* of credentials to the fore: Are costs of existing degree pathways commensurate to their long-term payoffs? Are there shorter, less expensive routes (e.g., associate degrees, certificates, and apprenticeships) that can lead to comparable or

higher earnings than bachelor's degree programs? Do we have full and reliable information on returns to these various credentials?

Research on returns to sub-baccalaureate credentials shows that at least some of them can be valuable postsecondary alternatives, and the path to higher wages does not run only through the bachelor's degree. Recently, researchers Clive Belfield and Thomas Bailey found significant returns to associate degrees and certificates, to the tune of approximately $4,640 and $7,160 in average annual earnings gains for male and female associate degree holders (over those with no college) and $2,120 and $2,960 for male and female certificate holders, respectively.[11] Another study by Mina Dadgar and Madeline Joy Trimble examined returns by field of study in Washington State and found that graduates with associate degrees in STEM, nursing, and construction earned a significant payoff and those with an associate in business, humanities, and allied health did not.[12] Additional research using administrative data in several states demonstrates that certificate and associate degree holders in many applied or technical fields can actually outearn their bachelor's degree counterparts five years post-completion, with graduates from some programs maintaining the earnings advantage at least 10 years after completing.[13] Overall, the Georgetown Center on Education and the Workforce estimates that 28 percent of workers with an associate degree earn more than the median earnings of workers with bachelor's degrees.[14]

The important question, thus, is not whether degrees have value but what types of knowledge and skills are in greatest demand and are, in turn, rewarded in the labor market. Framed this way, the degree a student pursues means much less than commonly held: It is the *outcome* that matters. And once we can measure more precisely what the labor market actually rewards, we can begin to identify specific institutions, programs, and fields of study that offer better (or worse) ways for college students to launch their careers and earn good wages.

While we have had general information on returns to majors for the past several years (documented above), for decades we have largely remained in the dark on the returns of graduates who have completed *particular programs of study from specific postsecondary institutions*.

Fortunately, thanks to years of data-collection efforts in eight states by College Measures,[15] more detailed and comprehensive information is now available to better identify the value the labor market assigns to different degrees in different fields from different colleges. These program-level data can help identify general strategies that campuses and states can employ to improve the market value of the education they deliver—or at the very least make known to students the programs that deliver value to those who complete a credential.

In this analysis, we dig into this rich information on earnings and expected return on investment (ROI) for students completing bachelor's, associate, certificate, and apprenticeship programs in specific fields of study from public institutions in Florida, Texas, and Tennessee. These data highlight patterns found in all the states with which College Measures has partnered and are consistent with less detailed national data reported by the Bureau of Labor Statistics and the American Community Survey (ACS).[16]

The following sections provide a snapshot of these data, emphasizing the host of educational pathways—not simply bachelor's degree programs—that can help put students on paths toward economic success.

Data and Method

The data we use in our analysis come from College Measures, which has partnered with eight states to develop data infrastructure designed to identify the earnings of students graduating from different postsecondary programs across each state. The specific administrative data differ slightly between states in collection methods and coverage, which we discuss in Appendix A.

We first examine data from Florida on the earnings of graduates from degree programs across different fields of study five years after degree completion. Next we use 10-year earnings information to estimate expected ROI from different degree programs

and fields of study granted by specific institutions in Texas and Tennessee. Calculating ROI entails estimating the median wages that graduates will earn over a 20-year period relative to median wages of a high school graduate in the state, minus the costs of attaining the credential (including cost of attendance and forgone wages). For the full description of the ROI calculation, see Appendix B.

Throughout the analysis, we use the term "program" to connote (1) degree level and (2) field of study or major (e.g., bachelor's degree in business administration or associate degree in liberal arts). Programs are defined by the federal government's Classification of Instructional Programs.

We do not include data from private institutions in this analysis. Some of the eight states that partner with College Measures collect information on the earnings of graduates from both public and private campuses, others just from institutions in their public systems. Regardless of the data coverage in states, the information on public institutions is generally more complete, and public four- and two-year institutions generally educate the most students.[17]

Further, the data cover earnings information for completers only, rather than all enrollees in a program. As explained later, the completion rate of an institution or program is relevant when comparing programs by earnings or ROI. In short, if you do not complete the program, you are much less likely to reap the expected return.[18] Our results tell us a program's expected value for a student completing a credential but not necessarily the value for all enrollees.

The data do not fully observe individuals who are employed out of state.[19] There is some evidence that additional years of higher education increase geographic mobility for graduates.[20] As a result, data coverage for graduates with bachelor's degrees may be slightly worse than for those with sub-baccalaureate credentials, with potential for some downward bias around earnings outcomes for graduates with bachelor's degrees.

The data also do not specify whether individuals have multiple credentials to their name. That is, we do not know for certain whether an individual who completed a bachelor's degree has any "lower" credentials; students are assigned to the "highest"-level degree they have earned. For example, a student who has an associate degree and then successfully transfers and completes a bachelor's degree is included in the bachelor's degree cohort, and the associate degree's contribution to that student's success is not recorded.

No student is in the database twice; all program categories are mutually exclusive. For the relatively small number of students with multiple majors at the same degree level, the "first major" is assigned by the institution or the state using institution- or state-specific decision rules. Individuals with master's, doctoral, and other professional degrees are excluded in the analysis. We describe data limitations in more detail in Appendix A.

Finally, the results below are from three specific states (Florida, Texas, and Tennessee). The data bring to light common patterns across the eight College Measures states.[21] We use data from three states rather than just one to broaden the analysis, and we do not use data from all eight College Measures states to avoid burdening the reader with too much data that largely repeat the patterns we document below. Earnings data for all eight states are publicly displayed on the College Measures website and other associated sites.[22] While we do not claim the data are representative across all states in the nation, we believe these examples are illustrative of broader themes characterizing the US labor market.[23]

Who Wins and Who Loses in the Labor Market in Florida?

Let's start with the most basic question: Which programs place their graduates on the path to success in the labor market?

Table 1 documents the highest-paying degree programs across all Florida public institutions five years post-completion by field of study.[24] Sixteen programs in Florida boast graduates with median annual wages of $75,000 or greater five years later.[25]

Here is perhaps the single most important lesson from these data: The path to high wages does not run only through the bachelor's degree.

Table 1. Programs at Public Institutions in Florida with Graduates with Highest Median Earnings Five Years Post-Completion

Field of Study	Degree Level	Median Earnings	Number of Graduates*
Physician Assistant	Associate in Science	$112,200	39
Health Services/Allied Health/ Health Sciences	Bachelor's Degree (FCS)**	$106,900	34
Elevator Constructor/Mechanic	Apprenticeship (DIST)***	$96,600	51
Electrical, Electronic, and Communications Engineering Technology/Technician	Associate in Science	$91,700	69
Computer Engineering	Bachelor's Degree	$83,500	167
Systems Engineering	Bachelor's Degree	$83,400	89
Millwright	Apprenticeship (DIST)	$82,500	69
Heavy Equipment Operation	Apprenticeship (DIST)	$81,000	37
Aerospace, Aeronautical and Astronautical/ Space Engineering	Bachelor's Degree	$80,800	76
Engineering Technology	Bachelor's Degree	$80,000	26
Chemical Engineering	Bachelor's Degree	$78,800	98
Computer/Information Technology Services Administration and Management	Bachelor's Degree (FCS)	$78,400	58
Mechanical Engineering	Bachelor's Degree	$77,600	487
Electrical and Electronics Engineering	Bachelor's Degree	$76,800	331
Fire Prevention and Safety Technology/ Technician	Associate in Applied Science Degree	$76,400	62
Industrial Engineering	Bachelor's Degree	$75,500	68

Notes: For a program to be included, at least 25 graduates had to be found in the state's unemployment insurance (UI) wage data system, and earnings had to be more than $75,000. These are graduates from the 2010–11 academic year with earnings data from the 2016 calendar year. Certificate programs were included in this analysis, yet none surpassed the earnings threshold here. Median earnings are rounded to the hundreds. *Number of graduates represents the number of graduates found in the state's UI database, although not necessarily the total number of graduates from that specific program. See Appendix A for more information. **In Florida, bachelor's degrees in a limited number of technical and career-oriented fields are offered by community colleges, which are part of the Florida college system (FCS). ***District technical centers (DIST) are part of the postsecondary workforce education system in Florida.
Source: College Measures, 2016.

In Florida, six of the 16 programs with the highest-paid graduates are from associate degree and apprenticeship programs[26] offered by community colleges or technical training centers.

The highest median earnings are for graduates who earned an associate in science training to become a physician's assistant, a shorter and far less expensive track into the medical profession than a medical degree. While on average physician's assistants will earn less than a physician with an M.D., graduates in this associate degree track have outstanding wage returns.

Note also that graduates from three apprenticeship programs (elevator constructor/mechanic, millwright, and heavy equipment operation) make the list of highest earners, all with median earnings above $80,000 and elevator mechanics closer to $100,000. These annual earnings are higher than the median earnings of most of the graduates from the highest-paying university programs. At the same time,

Table 2. Degrees or Credentials at Florida Public Institutions with Median Graduate Earnings Meeting or Exceeding $49,400

Credential	Number of Programs Offered	Number of Programs with Graduate Earnings More Than $49,400	Share of Programs with Graduate Earnings More Than $49,400	Median Earnings
Apprenticeship (FCS)	20	10	50%	$49,400
Apprenticeship (DIST)	28	13	46%	$49,500
Associate in Science	180	81	45%	$57,100
Bachelor's Degree (State Universities)	644	283	44%	$54,200
Bachelor's Degree (FCS)	47	20	43%	$54,400
Associate in Applied Science	65	22	34%	$49,200
Career Certificate (FCS)	205	44	21%	$44,000
Career Certificate (DIST)	151	15	10%	$37,900
Associate in Liberal Arts and Sciences/Liberal Studies	28	0	0%	$40,800

Note: Median earnings displayed here are for five years after degree completion.
Source: College Measures, 2016.

these programs graduate a relatively small number of graduates compared to some of the bachelor's degree programs in Table 1 (e.g., mechanical and electrical engineering), a topic we return to later.

Consider further that the second-highest-paid program has bachelor's degree recipients, but not from the state university system. These students earned bachelor's degrees in the applied field of allied health from the state's community colleges.[27]

One final pattern: Of the 10 bachelor's programs on this list, eight are from state universities, and each one is an engineering program. Field of study matters a great deal when it comes to labor-market outcomes.[28]

Not all programs need to generate such high returns to make them worthwhile on-ramps to the workforce. Also important are programs with graduates earning enough to place them firmly in the middle class. In Table 2, we lower the earnings threshold from $75,000 to $49,400—Florida's current median household earnings[29]—and calculate the percentage of programs at each credential level not broken out by institution or field of study that meet or exceed the $49,400 benchmark.

Of the 1,368 degree programs in Florida that appear in Table 2, 488 have graduates with median earnings that meet or exceed $49,400 five years post-completion. Apprenticeships from both the Florida district technical centers and Florida college system, although few in number of programs, have the highest "success rates" (meaning share of total programs offered with median graduate earnings above Florida's median household income). Associate of science programs and bachelor's degree programs from both Florida universities and Florida colleges have roughly the same success rate.

At the bottom of the list are the associate of liberal arts programs: Not one of the 28 programs in the state have graduates with median earnings above the threshold. One possible explanation for such poor wage outcomes is that these programs are usually considered transfer programs, and therefore many graduates of these programs could be enrolled in continuing education. However, according to Florida data, only about 17 percent of graduates from these programs are enrolled in continuing education.[30]

Table 3. Programs at Public Institutions in Florida with Graduates with Lowest Median Earnings Five Years Post-Completion

Field of Study	Degree Level	Median Earnings	Number of Graduates*
Child Care Provider/Assistant	Apprenticeship (FCS)**	$19,800	42
Athletic Training/Trainer	Bachelor's Degree	$21,000	46
Exercise Physiology	Bachelor's Degree	$21,600	48
Photography	Associate in Applied Science	$21,600	32
Equestrian/Equine Studies	Associate in Science	$21,700	52
Teacher Education and Professional Development, Specific Levels and Methods	Associate in Science	$21,800	26
Physical Fitness Technician	Associate in Science	$21,900	27
Graphic Design	Bachelor's Degree	$22,000	39
Technical Theater/Theater Design and Technology	Associate in Science	$22,100	96
Kinesiology and Exercise Science	Bachelor's Degree	$22,200	191
Zoology/Animal Biology	Bachelor's Degree	$22,400	100
Criminalistics and Criminal Science	Bachelor's Degree	$22,600	43
Early Childhood Education	Apprenticeship (DIST)***	$22,600	249
Photography	Bachelor's Degree	$22,600	57
Cinematography and Film/Video Production	Bachelor's Degree	$22,700	56
Music	Bachelor's Degree	$22,800	72
Music Technology	Associate in Science	$22,900	42
Wildlife, Fish and Wildlands Science and Management	Bachelor's Degree	$23,100	31
Dance	Bachelor's Degree	$23,200	31
Anthropology	Bachelor's Degree	$23,400	330
Environmental Studies	Bachelor's Degree	$23,500	46
Medical Microbiology and Bacteriology	Bachelor's Degree	$23,500	197
Classics and Classical Languages, Literatures, and Linguistics	Bachelor's Degree	$23,700	32
Photography	Associate in Science	$23,700	197
Hospitality Administration/Management	Associate in Science	$23,800	58
Asian Studies/Civilization	Bachelor's Degree	$24,000	84
Automotive Engineering Technology/Technician	Associate in Applied Science	$24,200	46
Liberal Arts and Sciences Studies and Humanities	Bachelor's Degree	$24,200	139
Water, Wetlands, and Marine Resources Management	Bachelor's Degree	$24,300	50
Interior Design	Bachelor's Degree	$24,300	47
Animal Sciences	Bachelor's Degree	$24,300	351

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Table 3. Programs at Public Institutions in Florida with Graduates with Lowest Median Earnings Five Years Post-Completion (*continued*)

Field of Study	Degree Level	Median Earnings	Number of Graduates*
Restaurant, Culinary, and Catering Management/Manager	Associate in Applied Science	$24,400	170
Baking and Pastry Arts/Baker/Pastry Chef	Associate in Science	$24,800	82
Child Care and Support Services Management	Associate in Science	$24,800	246
Community Health Services/Liaison/Counseling	Associate in Science	$24,800	62
Health and Physical Education/Fitness	Bachelor's Degree	$24,800	55
Hospitality Administration/Management	Associate in Applied Science	$24,800	80
Early Childhood Education and Teaching	Associate in Science	$24,900	178
Fine/Studio Arts	Bachelor's Degree	$24,900	233
Animal Sciences	Associate in Science	$24,900	170
Entomology	Bachelor's Degree	$24,900	34
Visual and Performing Arts	Bachelor's Degree	$24,900	54

Notes: For a degree program to be included, at least 25 graduates had to be found in the state's UI wage data system, and median earnings had to be less than $25,000. These are graduates from the 2010–11 academic year with earnings data from the 2016 calendar year. Certificate programs were included in this analysis, yet all surpassed the earnings threshold here. *Number of graduates represents the number of graduates found in the state's UI database, although not necessarily the total number of graduates from that specific program. See Appendix A for more information. **In Florida, apprenticeships are offered at community colleges, which are part of the FCS. ***In Florida, apprenticeships are also offered by district technical centers (DIST), which are part of the postsecondary workforce education system in Florida.
Source: College Measures, 2016.

About 44 percent of the 644 university-based bachelor programs in Florida have median earnings above the "middle-class" benchmark of $49,400. At the same time, because so many bachelor's programs are offered by state universities, these bachelor's degree programs represent the greatest number of programs with outcomes exceeding the benchmark. Bachelor's degree programs thus help sustain Florida's middle class, but they are by no means the only programs that do so.

In general, these data confirm that there are viable routes into the middle class in addition to the bachelor's degree. And, importantly, there are many programs that middle-class aspirants should pursue with caution.

To that end, we identify the programs in Florida with graduates whom the labor market does not reward. Table 3 displays the labor-market laggards: programs with graduates earning less than $25,000 five years after completing. By way of comparison, in 2010 the median earnings of high school graduates in Florida was $26,600,[31] meaning graduates from these higher education programs had median incomes lower than those of high school graduates.[32] Forty-two programs fail to cross this threshold (Table 3).

Four of these low-paying programs (two associate and two apprenticeship) train students for jobs in early child care. Despite the lip service we pay to the importance of early child care, society pays graduates working in this profession very little. Another cluster of programs are bachelor's degree programs concentrated in traditional liberal arts fields: anthropology, Asian studies, cinematography, dance, fine and studio arts, liberal arts, music, photography, and visual and performing arts. Like early child care training programs, these liberal arts programs may have high social value—but graduates from these programs command low earnings in the labor market.[33]

Using Return on Investment to Estimate Long-Term Outcomes in Texas and Tennessee

The previous section presented median annual earnings after five years for students who completed different programs. But earnings outcomes in the long run also merit exploration.

To examine longer-run payoffs, we extend our analysis to another way of looking at labor-market success: expected ROI. Here we estimate how different programs from different institutions potentially affect expected earnings over the long term, accounting for the amount of money invested in and forgone wages from attending the program. Rather than continue working with Florida data, we use information from two other states to round out the analysis, emphasizing again that the patterns we document are relatively common across states.

To capture the relationship of different programs of study with wages over a work life, we calculate the expected ROI for graduates from different programs housed in different institutions. We use actual earnings information from graduates 10 years post-completion and estimate the median earnings of graduates from each program over a 20-year work life relative to the earnings of a high school graduate, subtracting the costs of attaining the credential. While ROI is often presented as a percentage, we present a dollar figure[34] of the net-added earnings associated with completing a program of study from a given postsecondary institution. (Again, see the methodology in Appendix B.)

In the following analysis, we use data from Texas to support the notion that there are a variety of rewarding postsecondary pathways to the labor market.

In Table 4, we focus on the programs of study from specific institutions where the expected ROI for graduates exceeds $1 million.[35] We have identified 39 programs in Texas where, given current trends,[36] the expected ROI over a 20-year career exceeds that mark (Table 4).

Among these highly rewarding programs, 19 are associate level, six are sub-baccalaureate certificates offered by community colleges, and the remaining 14 are bachelor's degrees. That means more than half of the programs with the highest expected ROI in Texas are at the sub-baccalaureate level.

Consider also that while multiple programs housed in the state flagships appear on the list—University of Texas at Austin (twice) and Texas A&M University (three times)—so do programs offered by community colleges. Lee College boasts four degree programs on the list, and both Brazosport College and the Lamar Institute of Technology have three.

Finally, another distinguishing characteristic of these high ROI programs is the concentration of programs in technical fields of study. For instance, the term "technician" appears with great frequency in these programs' nomenclature. Twenty-four have "technician" and two more have "technology" in their program name. And while one program, Electrical and Power Transmission Installers, has neither technology nor technician in its title, it obviously trains students for a defined occupation.

Expected ROI from Tennessee's Top 12 Bachelor's Degree Programs

In this section, we turn to data from one more state, Tennessee, where our results reinforce that what you study is at least as important as where you study. Some previous research has touched on the fact that not all bachelor's degree programs are created equal, and the returns to bachelor's degrees vary significantly based on institution attended and field of study.[37] To flesh out further these differences among bachelor's degree programs, we examine expected ROI of bachelor's degree programs at public universities in Tennessee from the 12 fields of study with the largest statewide undergraduate enrollment.

In Figure 1, note the relationship between field of study and the maximum expected ROI: The highest ROI among criminal justice programs is found at Austin Peay State University ($542,000). For psychology programs, the highest, from the state flagship University of Tennessee, Knoxville (UT Knoxville), is $100,000 less ($433,000). But these maximum values are below the lowest ROI for accounting programs (East Tennessee

Table 4. Programs at Public Institutions in Texas with an Expected ROI over $1 Million

Institution	Field of Study	Credential	ROI
The University of Texas at Austin	Business/Commerce	Bachelor's Degree	$1,625,000
Austin Community College	Fire Protection	Associate Degree	$1,490,000
College of the Mainland	Physical Science Technologies/ Technicians	Associate Degree	$1,446,000
Lamar Institute of Technology	Heavy/Industrial Equipment Maintenance Technologies	Associate Degree	$1,401,000
Wharton County Junior College	Physical Science Technologies/ Technicians	Associate Degree	$1,360,000
Lamar Institute of Technology	Physical Science Technologies/ Technicians	Associate Degree	$1,352,000
Texas A&M University	Industrial Production Technologies/ Technicians	Bachelor's Degree	$1,351,000
Alvin Community College	Physical Science Technologies/ Technicians	Associate Degree	$1,312,000
Brazosport College	Physical Science Technologies/ Technicians	Associate Degree	$1,306,000
Lee College	Physical Science Technologies/ Technicians	Associate Degree	$1,284,000
The University of Texas–Pan American	Allied Health Diagnostic, Intervention, and Treatment Professions	Bachelor's Degree	$1,270,000
Lamar State College–Orange	Physical Science Technologies/ Technicians	Associate Degree	$1,258,000
Odessa College	Quality Control and Safety Technologies/Technicians	Associate Degree	$1,238,000
Odessa College	Quality Control and Safety Technologies/Technicians	Sub-Baccalaureate Certificate	$1,233,000
University of Houston–Downtown	Quality Control and Safety Technologies/Technicians	Bachelor's Degree	$1,232,000
Lee College	Electromechanical and Instrumentation and Maintenance Technologies/ Technicians	Associate Degree	$1,228,000
Victoria College	Physical Science Technologies/ Technicians	Associate Degree	$1,212,000
University of Houston	Electrical Engineering Technologies/ Technicians	Bachelor's Degree	$1,171,000
Frank Phillips College	Industrial Production Technologies/ Technicians	Sub-Baccalaureate Certificate	$1,167,000
El Paso Community College	Electrical/Electronics Maintenance and Repair Technology	Sub-Baccalaureate Certificate	$1,162,000
Lamar Institute of Technology	Electromechanical and Instrumentation and Maintenance Technologies/ Technicians	Associate Degree	$1,154,000

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Table 4. Programs at Public Institutions in Texas with an Expected ROI over $1 Million (*continued*)

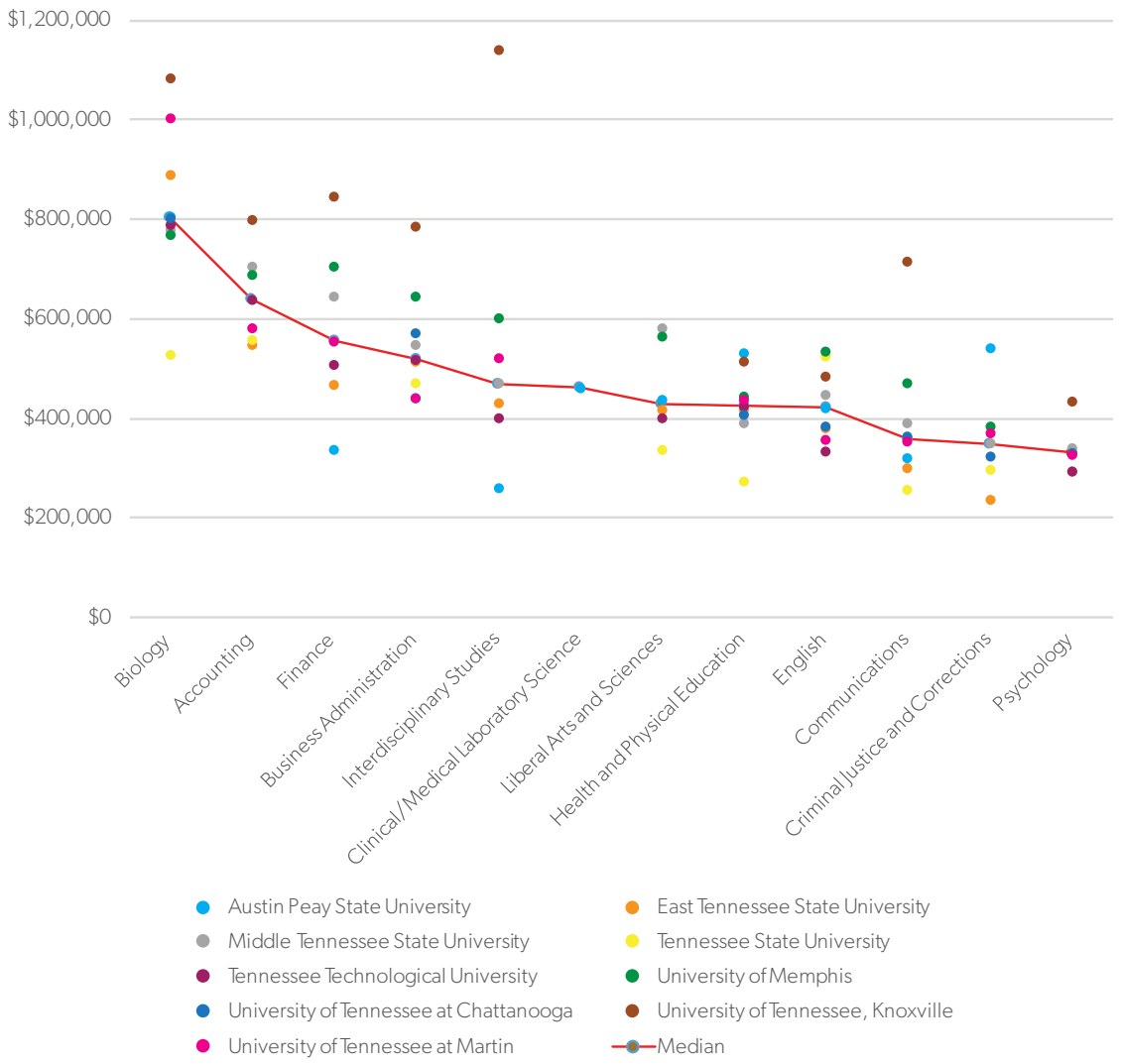
Institution	Field of Study	Credential	ROI
Panola College	Industrial Production Technologies/ Technicians	Associate Degree	$1,146,000
Texas A&M University	Electrical Engineering Technologies/ Technicians	Bachelor's Degree	$1,143,000
The University of Texas at Austin	Computer and Information Sciences	Bachelor's Degree	$1,142,000
Del Mar College	Physical Science Technologies/ Technicians	Sub-Baccalaureate Certificate	$1,135,000
West Texas A&M University	Public Administration	Bachelor's Degree	$1,134,000
University of Houston	Mechanical Engineering Related Technologies/Technicians	Bachelor's Degree	$1,124,000
University of Houston	Information Science/Studies	Bachelor's Degree	$1,121,000
Brazosport College	Electromechanical and Instrumentation and Maintenance Technologies/ Technicians	Associate Degree	$1,120,000
Weatherford College	Fire Protection	Associate Degree	$1,120,000
Kilgore College	Industrial Production Technologies/ Technicians	Associate Degree	$1,102,000
Texas A&M University	Computer Science	Bachelor's Degree	$1,099,000
San Antonio College	Fire Protection	Associate Degree	$1,092,000
Brazosport College	Electrical and Power Transmission Installers	Associate Degree	$1,078,000
The University of Texas at San Antonio	Computer/Information Technology Administration and Management	Bachelor's Degree	$1,064,000
Lee College	Electromechanical and Instrumentation and Maintenance Technologies/ Technicians	Sub-Baccalaureate Certificate	$1,049,000
Collin County Community College District	Computer Systems Networking and Telecommunications	Sub-Baccalaureate Certificate	$1,028,000
Texas A&M University–Corpus Christi	Geography and Cartography	Bachelor's Degree	$1,012,000
The University of Texas at San Antonio	Computer and Information Sciences	Bachelor's Degree	$1,006,000

Note: See Appendix B regarding ROI calculations.
Source: College Measures, 2016.

State, $548,000) and biology programs (Tennessee State University, $527,000). Put simply, majors matter when it comes to postcollege earnings.

Not surprisingly, median expected ROI is higher in technical and business-related fields. ROI for any given field of study is also somewhat clustered, especially among the comprehensive and regional universities. Consider psychology: If UT Knoxville is dropped from consideration, the range for ROI for the remaining seven programs is just $47,000, from $292,000 at East Tennessee State to $339,000 at Middle Tennessee State. The range is somewhat larger in the other fields of study displayed (see finance and biology), but students often have many choices across Tennessee's regional campuses without extreme variation in expected ROI over a work life.

Figure 1. Expected ROI from Tennessee's 12 Largest Bachelor's Degree Programs



Notes: See Appendix B regarding ROI calculations. The programs displayed here are the dozen bachelor's degree programs with highest enrollment across institutions in Tennessee.
Source: College Measures, 2016.

Figure 1 shows that UT Knoxville, Tennessee's flagship university, generally bests Tennessee's comprehensive colleges in expected ROI across fields of study, sometimes by a wide margin (see communications and interdisciplinary studies). But completing a credential from the flagship does not always mean graduates make the most money. Returns to programs at regional universities can exceed those of programs in other fields at the flagship university. (For instance, compare the biology programs in Figure 1 with psychology programs.) Expected ROI from programs at Tennessee's regional universities are even higher than that of UT Knoxville programs in two fields of study, health and physical education and English. Again, what you study can matter more than where you study it.

Tennessee's data show that, while enrolling in a state flagship can lead to a high ROI, it is not the only

route to labor-market success.[38] Students can still enroll in a less prestigious school and find programs in which, upon completing, the market will reward them well. This is important, as not everyone can attend the state flagship. UT Knoxville enrolls just 20 percent of all degree-seeking undergraduate students at public, four-year institutions in the state.[39] For the other 80 percent, it is worth knowing that there are valuable bachelor's degree pathways at schools other than the state flagship university.

The Data Are Compelling, But Some Words of Caution

While these results are striking, several caveats are worth considering, including completion rates, student ability, scale, and the diminishing returns to vocational education.

Completion Rates. Except for the nation's most selective institutions, completion rates are often mediocre across institutions of higher education. A recent report by the National Student Clearinghouse Research Center shows that, for the cohort of students starting college for the first time in the fall of 2010, just under 55 percent of students completed a credential six years later. Importantly, completion rates vary by institution type: Six-year completion rates for "four-year" public colleges were roughly 63 percent. On the other hand, community colleges, which award the lion's share of associate degrees and certificates, have much lower six-year completion rates (about 39 percent).[40]

The information on program-level earnings and ROI used in this report are for completers only. Bear in mind, if a student does not complete a program, there is a smaller chance he or she will reap the expected return. One better way to calculate and display earnings information from different programs from different institutions might be to incorporate program-level completion rates (i.e., the share of students who ultimately completed the program out of all those who enrolled) alongside labor-market outcomes. A more complete measure of ROI could account for the probability of attaining a particular outcome (for example, creating an expected ROI that measures the value for graduates multiplied by the program's completion rate). Unfortunately, program-level graduation rates do not yet exist.[41]

Completion rates also vary by student backgrounds and characteristics. For example, more affluent students complete credentials at higher rates than less affluent ones.[42] This is another important consideration when interpreting these results, especially for prospective enrollees comparing one program to another.

Differences in Ability. Our results document that certain fields of study pay better than others, often regardless of degree level or institution. And many programs with high returns are clustered in technical fields, such as engineering. But do these findings signify that these programs are directly contributing to these outcomes and successfully imparting valuable skills to graduates? Or is there something inherently marketable about the individuals who sort into and complete these programs?

Both are likely true. While research exists on returns to postsecondary education accounting for students' abilities,[43] what we know about the value added to students from particular institutions and programs is comparably thin. Our analysis here is purely descriptive, and we do not make any claims about the ability levels of students who choose one program over another. Any interpretation of these findings should consider that the variance in earnings between programs likely stems in some part from students' characteristics and abilities.

Scale. As noted above, many of the top subbaccalaureate programs in terms of earnings have a small number of graduates compared to their bachelor's degree counterparts. For instance, in Florida, the elevator mechanic apprenticeship with five-year median earnings over $90,000 had just 51 completers in the 2010–11 academic year, whereas the high-paying bachelor's degree programs in mechanical engineering and electrical engineering had 487 and 331 graduates, respectively. This suggests that the top

sub-baccalaureate programs in these states might be more specialized or less scalable than their bachelor's degree counterparts. One may also wonder about negative returns to scale: If Florida tripled its number of elevator mechanic apprentices, for example, median earnings may fall for program graduates. These are valid concerns worth considering more deeply.

Conversely, compare these numbers to the significant number of credentials awarded each year—bachelor's or sub-baccalaureate—from programs with graduates with the lowest earnings, many in the arts and humanities (see Table 3, with the lowest-paying programs in Florida after five years). These data suggest these programs may be too large, based on how poorly the market rewards their graduates.

Diminishing Returns to Vocational Education. A fourth caveat comes from the emerging body of research on the lifelong effects of vocational education. As Eric Hanushek and Ludger Woessmann argue in a recent Brookings Institution paper, "The skills generated by vocational education appear to facilitate the transition into the labor market but later on become obsolete at a faster rate."[44] Hanushek and Woessmann believe we should exercise caution before advocating that larger shares of students enroll in existing vocational educational and career and technical education pathways. However, there is some budding evidence that technical skills are more transferable than previously thought.[45] Moreover, we have less information than we would like on the extent to which and rate at which different skills in different fields decay over time.

We do know that, in state data systems that track postcollege earnings, graduates with bachelor's degrees who entered the labor market with credentials in low-paying fields are generally still at the bottom of the earnings distribution 10 years later.[46] And even if elevator mechanics in Florida are stuck at a given earnings level over the long term, they are stuck at a high floor.

We recognize, though, that educational pathways that prioritize technical skills may put students at risk of unemployment in the long term. Indeed, some of the programs we laud in technical fields with graduates who command high wages in the short term may not provide students with skills that will be rewarded down the line in our increasingly digital and knowledge-based economy. However, the same could be said for graduates from many nontechnical programs as well, especially as technological advances begin to assume tasks once handled by highly educated graduates (e.g., accountants, attorneys).[47]

In the meantime, many students are enrolling in programs that do not provide reasonable returns, no matter the time horizon. And many students are still in the dark about which programs offer a worthwhile on-ramp to a rewarding career. Information, like that drawn from the College Measures data, shines a light on programs that can help students find economic opportunity. The data can also potentially help steer students away from the laggards and toward programs that will provide them with skills that, at a minimum, offer them a foundation for success in life.

Alternative Pathways and Credentials

Overall, our results suggest that the widespread belief in the bachelor's degree as the be-all and end-all of higher education does not necessarily comport with students' desire for good careers with decent to high wages.

True, many bachelor's degree programs (especially in skills-oriented fields such as engineering or computer science) can lead to high wages. And, again, on average those with a bachelor's degree tend to outearn graduates with associate degrees or other short-term credentials. (One estimate, noted earlier, shows that 28 percent of workers with an associate degree earn more than the median earnings of workers with bachelor's degrees.) Yet averages mask the wide variation in the labor-market success of students completing different programs in different fields of study from different institutions, including programs at the sub-baccalaureate level.

A number of technical and career-oriented programs from community colleges produce graduates who command high wages, often far higher than graduates with bachelor's degrees, especially those who

Table 5. Median Five-Year Earnings for Graduates of Apprenticeship Programs at Tennessee Colleges of Applied Technologies

Tennessee College of Applied Technology	Field of Study	Job-Placement Rate	Median Earnings
Murfreesboro	Industrial Electrical Maintenance	84%	$78,890
McMinnville	Electronics Technology	N/A	$56,250
Memphis	Electronics Technology	70%	$56,250
Pulaski	Industrial Maintenance Technology	100%	$56,250
Jackson	Industrial Electricity	78%	$52,720
Knoxville	Industrial Electricity	83%	$52,720
Morristown	Industrial Electricity	95%	$52,720
Newbern	Drafting/CAD Technology	93%	$51,640
McKenzie	Industrial Maintenance Technology	79%	$50,040
Paris	Industrial Maintenance Technology	92%	$50,040
Shelbyville	Industrial Electricity	84%	$41,570
Whiteville	Industrial Electricity Technology	100%	$41,570
Livingston	Automotive Technology	86%	$32,220

Source: Tennessee Colleges of Applied Technology, 2017.

majored in education, social work, psychology, and similar fields. Indeed, many of the programs—bachelor's degree or otherwise—producing graduates with high wages and ROI have one thing in common: They graduate students who know how to build and fix things. (The frequent appearance of the word "technician" in the titles of programs with the highest ROI supports this point.)

As we move beyond the fixation on the bachelor's degree and widen the aperture to include all the postsecondary pathways at our disposal, several worthwhile options emerge for students. In fact, as we move beyond a general fixation on degrees and focus on the skills associated with strong outcomes, we can begin to envision a radically different future compared to the expensive higher education system we now support, one with a diversity of shorter and lower-cost delivery models that help individuals launch and further their careers.

Here are some alternative postsecondary credentials and pathways that could come to the fore.

Apprenticeships. Of the states that partner with College Measures, only Florida collects detailed information on the earnings of apprentices completing state-organized programs. The results from Florida are striking: Several programs with the highest-earning completers are apprenticeships.

There is scattered evidence that Florida is not unique. For instance, culling data from individual apprenticeship programs in Tennessee technical colleges yields impressive outcomes, as seen in Table 5. These programs have job-placement rates that would make many college programs envious. And the estimated earnings for most of the programs exceed Tennessee's 2015 median household income of $47,300.[48]

Confirmatory data come from the state of Washington, where, for example, 94 percent of completers were employed during the third quarter after leaving the program and had annual earnings around $75,000.[49] Data from Michigan also show strong earnings results. According to a recent report, the average starting wage of people who registered for apprenticeship programs was around $14 per hour. Wages nearly doubled to more than $25 per hour among students who completed their programs.[50] But systematic data on earnings from apprenticeships are still lacking.[51]

Again, most apprenticeship programs across the nation are relatively small and concentrated in construction, building, and maintenance. Can apprenticeship programs be scaled within these sectors? Perhaps more importantly, can the apprenticeship model be offered in nonconstruction occupations, including digital and white-collar jobs?[52] There is some evidence of growth: The number of new entrants in registered apprenticeship programs increased by 50 percent from 2008 to 2015 (yet as of 2016 there were just over 500,000 active registered apprentices).[53]

Both the Obama and Trump administrations designated apprenticeships as a priority of their domestic policy platforms.[54] One interim step to make apprenticeships more widespread is to build a better case for their economic value. Florida's data on apprentices are a model of what can and should be made available. Other states and the federal government should increase access to these data, if for no other reason than to help increase demand for this potentially valuable avenue into well-paying employment opportunities.

Certificates. Certificates, profiled at length in this analysis, are nondegree credentials mostly offered by community colleges and proprietary institutions. According to federal statistics, in the 2014–15 academic year, there were more than 485,000 less-than-one-year certificates and more than 475,000 less-than-four-year certificates awarded to students. In both cases, this represented a manyfold increase in certificates awarded just 10 years earlier.[55]

This growth may reflect the recognition that some certificates have high market value.[56] Recall that the estimated ROI for several certificate programs in Texas was more than $1 million.

On the other hand, some certificate programs have low or no value.[57] These certificate programs, many clustered in human development and family studies, others in culinary arts, may be training people for fields about which students care passionately. Some types of certificates, such as cosmetology, may train people who will work part-time or "off the books," so earnings data may not be accurate or representative.

Any campaign to increase the use of certificates needs to remain focused on the skills offered by a program as recognized by employment and wages after completing; ultimately it is marketable skills that matter, not the credential.

Certifications. It is easy to confuse certificates with certifications, but they are distinct credentials. According to the Association for Career and Technical Education, certificates (described above) are tied to and offered by a specific educational provider—and the range and level of skills mastered may vary considerably from program to program.[58] Certificates largely lack independent verification of the skills learned in a given program.

In contrast, certifications are expressly designed by industry groups to convey mastery of specific knowledge, skills, or processes. Moreover, certifications are measured against a set of accepted standards, usually coupled with a formal assessment and validation designed in cooperation with a business, trade association, or other industry group. Certifications often carry the term "industry-recognized," again designed to certify mastery of skills deemed important across the employers in a particular sector or field.

To the extent that these criteria are met, industry-recognized certifications may carry more precise information about skills than certificates granted by community colleges and other providers. Yet the United States is just beginning to explore in depth the different certifications that are granted and their market value. Systematic, national efforts to count certifications did not begin until early 2015, when questions on certifications and licenses were introduced to the Current Population Survey. According to the US Census, in 2016 about 25 percent of the employed population workforce had some combination of certifications or licenses.[59]

From all the data we explored earlier, we should expect substantial earnings variations based on the particular skills certified. It is an open question, worth further exploration, how and the extent to which certifications (and licensure) interact with existing degree programs regarding students' earnings outcomes.

Ending the Bachelor's Degree Addiction

As a nation, we have long equated higher education with the bachelor's degree. However:

- Many sub-baccalaureate programs provide avenues to the middle class. And there are programs with subpar earnings—bachelor's degree or otherwise—that middle-class aspirants should either avoid altogether or have full knowledge of their potential earnings prospects in advance.

- Majors matter a great deal to postcollege earnings, and skills-oriented programs in health, engineering, and other technical fields are generally more valuable than programs in traditional academic fields, on the bachelor's and associate levels.

- Just as bachelor's degrees are not the only way into employment opportunities with high earnings, state flagship universities are not the only way to those outcomes either. Valuable programs exist at regional universities and community colleges too.

Students, taxpayers, and policymakers need to be made aware of these alternatives to the traditional bachelor's degree and of the fact that these pathways may more effectively satisfy students' number-one goal: finding a good job with good wages.

One challenge: It is still an open question how to scale the programs with stellar outcomes to accommodate larger numbers of students. Technical programs are expensive to deliver and often serve niche and specialized markets. The opportunity then lies in parsing out the expansible programs from the determinate ones and wrestling with strategies to see how far we can extend these programs without obviating their benefits.

Questions of scale do not take away from the highly remunerative sub-baccalaureate alternatives that already exist. Yet policymakers and practitioners must recognize that expanding seats in high-paying programs may not directly lead to commensurate increases in graduates with high-earnings outcomes.

A final point: This entire exercise was made possible by administrative data on postsecondary programs collected and disseminated by states. The eight College Measures partner states are pioneers, while other states are moving forward, often slowly, with their own data-collection efforts.

Lately there has been renewed congressional support for more expansive data collection to capture longitudinal data on students.[60] While such an initiative has proved politically fraught in the past, any effort on any level of government to invest in more comprehensive information on student outcomes is a step in the right direction.[61] The proliferation of program-level data like those from the states and College Measures is leading the way.

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Appendix A: Data Sources and Coverage

College Measures receives wage data for graduates from each program at institutions in a state at several points in time, usually one, three, five, and 10 years after completion.

"Program" is defined by the federal government's Classification of Instructional Programs (CIP), reported for each program in each of the state's public institutions. We focus on certificate, associate degree, and bachelor's degree programs, although states often provide data on master's, doctoral, and other professional programs. Different types of degrees (e.g., associate of arts and associate of science) are also recorded. In the case of Florida, data on a set of apprenticeship programs are available.

The data come from state higher education agencies in each of the eight College Measures partner states: Arkansas, Colorado, Florida, Minnesota, Rhode Island, Tennessee, Texas, and Virginia. These higher education authorities partner with state labor agencies via data-sharing agreements and match program completers' social security numbers against their unemployment insurance (UI) wage records.

To protect privacy, depending on the state, multiple cohorts of graduate data may be combined. Data from small programs, those with less than 10 graduates—even after combining cohorts—are suppressed. College Measures, in general, receives the data in the format shown in Table A1.

The data used here overwhelmingly include completers from in-state, public institutions who are matched against wage records in the state's UI database. In other words, these data capture wages for individuals who have completed a credential and found employment in the state. State practices vary somewhat—for example, Florida also adds in data from the Department of Labor's Wage Record Interchange System, and Texas has some data on federal employees—but the bulk of the wage data come from the state's UI data.

Some states also have data on private institutions (e.g., Virginia has excellent data on almost all the not-for-profit institutions in the state; Minnesota on both proprietary and not-for-profit institutions), but all states have extensive data on their public institutions, which educate most students. The data on private schools can be found on the state-specific websites.

Students are assigned to the "highest"-level degree they have earned. For example, a student who has an associate degree and then successfully transfers and completes a bachelor's degree will be in the bachelor's degree cohort—and the contribution the associate degree may have made to that student's success is not recorded. Students with dual majors on the same degree level are assigned to their first choice as indicated in student-level data gathered by institutions. No students are in the database twice.

As a result, these data have limits. For example, in general the data do not capture students who enrolled in a particular program but did not complete a credential or students who do not work in an industry covered by UI (e.g., contractors). The data also do not cover students who completed a particular program from an in-state, private institution or students who completed a credential but moved to or found employment in another state. But UI data cover the bulk of the civilian workforce and are administrative—not self-reported—earnings data.

Table A1. Graduate Data Format

Institution	Major Code (CIP)	Degree Code	N	Year 1 (Y1)	Year 3 (Y3)	Year 5 (Y5)	Year 10 (Y10)

Source: College Measures.

Appendix B: Estimation of Return on Investment

In estimating expected ROI, College Measures starts with wage data for graduates from each program (CIP code) at an institution in a state one, three, five, and 10 years after completing the credential. College Measures defines ROI as the present value of a 20-year stream of wages a graduate from a specific program of study might expect to earn, net of:

- The present value of a 20-year wage stream of high school graduates;
- The estimated total net price of a student's degree program; and
- Opportunity costs, which are an estimate of wages forgone while the student is completing the program.

Calculating Graduates' Wage Streams. As noted above, each ROI calculation is based on a 20-year stream of wages. The primary source of those data is the state itself, which provides College Measures with program-level wages for graduates one, three, five, and 10 years after completion.

The state generates program-level wages by matching several cohorts of college graduates to its UI wage records. (Combining cohorts increases the number of graduates, allowing College Measures to report data on many more programs while not running afoul of privacy concerns.) To generate year one wages, for example, the state matches up to five cohorts of graduates to its UI system, capturing each graduate's wages during his or her first year after completion. Wages are then adjusted for inflation to current dollars, and an average is calculated. The same process is followed for wages three, five, and 10 years after completion. Program-level averages, as well as the number of graduates those averages are based on, are then provided to College Measures.

To help ensure the accuracy of estimates, College Measures does not attempt to calculate program-level wage streams if: (1) averages are missing for year one or year three; (2) year three wages are based on fewer than five graduates; (3) year five wages, if present, are based on fewer than 10 graduates; or (4) year 10 wages, if present, are based on fewer than 15 graduates. For programs that exceed these criteria, College Measures completes the year one to year 10 wage stream for each program as described below.

- If data are present for year one, three, five, and 10, each intervening year is imputed via simple linear interpolation.
- If data are present for year one, three, and five but missing for year 10, years one through five are linearly interpolated. Then, wages for year 10 are estimated by (1) calculating the average rate of change between year five and year 10 wages for programs at the same degree level and in the same four-digit CIP code as the program with missing year 10 data and (2) multiplying the missing program's observed year five wage by that ratio. Intervening years are then linearly interpolated. If no other institution offers a program at the same level of study for the same four-digit CIP code, the average rate of change across all programs at the observed level of study is used as the multiplier.
- If data are present for year one and year three, but missing for year five and year 10, the same process—this time using ratios based on the rate of change between year three and year 10—is used.

Wages beyond year 10 are not available from the states. To calculate wages beyond the 10th year after completion, College Measures turns to state-specific results from the ACS. All ACS respondents report their earnings from work; those who have earned a bachelor's degree also report the field of their degree. College Measures uses a two-step process to estimate earnings after graduates' 10th year after leaving college.

First, each ACS respondent is placed in one of nine age cohorts, ranging from "24 or less" to "65 and older" (e.g., 25–29 or 30–34). College Measures then estimates the median earnings from work for each age cohort as follows, creating a synthetic wage trajectory as described below.

- For bachelor's graduates, ACS "field of degree" values are mapped to the corresponding four-digit CIP code. Within each four-digit code, we estimate the median wage for each cohort. The rate of wage change between each age cohort—for example, the median wage of the 35–39 cohort of psychology degree graduates (representing wages approximately 15 years after college graduation) relative to the median wage of the 30–34 cohort of psychology degree graduates (representing wages approximately 10 years after college graduation)—is retained.

- For associate and certificate graduates, a similar process is used. However, because the ACS does not collect field of degree for sub-baccalaureate credentials, field-specific rates of change in wages cannot be calculated.

Using the ACS-based wage trajectory and the wage-change ratios calculated from it, College Measures builds out estimated program-level earnings between year 10 and year 20, starting by multiplying the observed year 10 wage by the ratio of year 15 to year 10 wages to estimate year 15 wages and so on. Finally each intervening year is linearly interpolated.

These streams of earnings are then discounted (at 2 percent) and added together to create the present value associated with graduating from a specific program of study. To create the net present value, as noted, opportunity costs and an estimate of the direct costs of earning that degree are subtracted.

Notes

1. Kevin Eagan et al., *The American Freshman: National Norms Fall 2016*, Cooperative Institutional Research Program, Higher Education Research Institute at UCLA, 2017, www.heri.ucla.edu/monographs/TheAmericanFreshman2016.pdf.

2. National Student Clearinghouse Research Center, *Undergraduate Degree Earners Report, 2015–16*, February 6, 2017, https://nscresearchcenter.org/undergraduatedegreeearners-2015-16/.

3. Authors' calculations using US Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, "Data Center," https://nces.ed.gov/ipeds/datacenter/login.aspx?gotoReportId=3.

4. Doug Webber accounts for several factors including ability, selection bias, and the likelihood of non-completion. See Douglas A. Webber, "Are College Costs Worth It? How Individual Ability, Major Choice, and Debt Affect Optimal Schooling Decisions," *Economics of Education Review* 53 (August 2016): 296–310. To be clear, the numbers cited here reflect net present expected value of attending college—that is, the expected value of trying to get a college degree, rather than the actual value of completing the degree.

5. Ibid.

6. See Mark Schneider, *Majors Matter: Differences in Wages over Time in Texas*, College Measures, July 20, 2016, www.air.org/resource/majors-matter-differences-wages-over-time-texas; and Anthony P. Carnevale, Jeff Strohl, and Michelle Melton, *What's It Worth? The Economic Value of College Majors*, Georgetown University Center on Education and the Workforce, November 2014, https://cew.georgetown.edu/wp-content/uploads/2014/11/whatsitworth-complete.pdf.

7. See Eric R. Eide, Michale J. Hilmer, and Mark H. Showalter, "Is It Where You Go or What You Study? The Relative Influence of College Selectivity and College Major on Earnings," *Contemporary Economic Policy* 34, no. 1 (January 2016): 37–46.

8. See Anthony P. Carnevale, Stephen J. Rose, and Ban Cheah, *The College Payoff: Education, Occupations, Lifetime Earnings*, Georgetown University Center on Education and the Workforce, 2011, https://www2.ed.gov/policy/highered/reg/hearulemaking/2011/college-payoff.pdf. Conversely, there can be a wage penalty for individuals working in occupations unrelated to their college major. See John Robst, "Education and Job Match: The Relatedness of College Major and Work," *Economics of Education Review* 26, no. 4 (February 2007): 397–407.

9. College Board, "Trends in College Pricing: Average Net Price over Time for Full-Time Students, by Sector," 2016, https://trends.collegeboard.org/college-pricing/figures-tables/average-net-price-over-time-full-time-students-sector.

10. Webber, "Are College Costs Worth It?"

11. We annualized the figures for the sake of accessibility for the reader. In the original report, Belfield and Bailey found average quarterly earnings gains (over those with no college) of approximately $1,160 and $1,790 for male and female associate degree holders and $530 and $740 per quarter for male and female certificate holders, respectively. The data represent average quarterly earnings gains for associate degree holders and certificate holders over those with no college five to nine years after entry into the labor market. See Clive Belfield and Thomas Bailey, "Does It Pay to Complete Community College—and How Much?," Center for Analysis of Postsecondary Education and Employment, March 2017, http://capseecenter.org/wp-content/uploads/2017/03/capsee-does-it-pay-complete-community-college.pdf. For additional research on the returns to sub-baccalaureate credentials, see Community College Research Center, Teachers College, Columbia University, "Labor Market Returns for Community College Credentials," http://ccrc.tc.columbia.edu/Labor-Market-Returns-for-Community-College-Credentials.html.

12. Mina Dadgar and Madeline Joy Trimble, "Labor Market Returns to Sub-Baccalaureate Credentials: How Much Does a Community College Degree or Certificate Pay?," *Educational Evaluation and Policy Analysis* 37, no. 4 (November 2014): 399–418, http://journals.sagepub.com/doi/abs/10.3102/0162373714553814.

13. For examples of this from Colorado, Texas, and Minnesota, among other states, see Mark Schneider, *Education Pays in Colorado: Earnings 1, 5, and 10 Years After College*, College Measures, April 2015, www.air.org/sites/default/files/downloads/report/Education-Pays-in-Colorado-Schneider-April-2015.pdf; Mark Schneider, "The Value of Sub-Baccalaureate Credentials," *Issues in Science and*

Technology (Summer 2015): 67–73, www.air.org/sites/default/files/downloads/report/Schneider%20-%20The%20Value%20of%20Sub-baccalaureate%20Credentials%20%28Summer%202015%20IST%29_0.pdf; Schneider, *Majors Matter*; and Mark Schneider, *Degrees of Value: Differences in the Wages of Graduates from Minnesota's Colleges and Universities*, College Measures, September 2016, www.air.org/system/files/downloads/report/College-Measures-Minnesota-September-2016.pdf.

14. Carnevale, Rose, and Cheah, *The College Payoff*.

15. Since 2011, College Measures has partnered with Arkansas, Colorado, Florida, Minnesota, Rhode Island, Tennessee, Texas, and Virginia to identify the wages that graduates from public and often private colleges and universities earn after completing their studies. See American Institutes for Research, "College Measures," www.air.org/center/college-measures.

16. Bureau of Labor Statistics and ACS data are the backbone for the work done by the Georgetown University Center on Education and the Workforce. Many of our findings comport with recent analyses that compare differences in wage outcomes by major. See Anthony P. Carnevale, Ban Cheah, and Andrew R. Hanson, *The Economic Value of College Majors*, Georgetown University Center on Education and the Workforce, 2015, https://cew-7632.kxcdn.com/wp-content/uploads/The-Economic-Value-of-College-Majors-Full-Report-web-FINAL.pdf. Their findings that "not all bachelor's degrees are created equal" and "majors play a larger role in determining earnings than the decision to go to college" are roughly comparable to our analysis.

17. Data are from Florida, as reported to College Measures, 2016.

18. There is some evidence that earning more credits, but not a degree, is associated with higher earnings. See, for instance, Belfield and Bailey, *The Labor Market Returns to Sub-Baccalaureate College*.

19. The various College Measures sites display "match rates"—the share of graduates matched to wage records—for postsecondary programs. For example, see Texas Higher Education Coordinating Board and College Measures, "Texas: Earnings After Graduation," http://tx.edpays.org/. Florida matches its student data with the Wage Record Interchange System II—but the match rate is below 10 percent. Texas also matches its data with several other systems that measure federal employment, also with relatively low match rates.

20. Ofer Malamud and Abigail K. Wozniak, "The Impact of College Education on Geographic Mobility: Identifying Education Using Multiple Components of Vietnam Draft Risk" (working paper, National Bureau of Economic Research, Cambridge, MA, October 2010), www.nber.org/papers/w16463.pdf.

21. This is reflected in prior research by College Measures. For examples of this from Colorado, Texas, and Minnesota, among other states, see Schneider, *Education Pays in Colorado*; Schneider, "The Value of Sub-Baccalaureate Credentials"; Schneider, *Majors Matter*; and Schneider, *Degrees of Value*. The College Measures website also has links to certain state websites. See College Measures, www.collegemeasures.org.

22. For more than just these select findings for Florida, see Beyond Education, "Key Facts About Education Outcomes in Florida," www.beyondeducation.org. Later, we present data from Texas, and more complete data can be found on the website. See Launch My Career Texas, "Welcome to Launch My Career Texas!," www.launchmycareerTX.org. For those interested in exploring other states, current data from Colorado and Tennessee are available. See Launch My Career Colorado, "Welcome to Launch My Career Colorado!," www.launchmycareerColorado.org; and Launch My Career Tennessee, "Welcome to Launch My Career Tennessee!," www.launchmycareerTN. Other College Measures sites include Minnesota and Virginia. See College Measures, "Minnesota Postsecondary Attainment Goal," www.mnedtrends.org/; and State Council of Higher Education for Virginia and College Measures, "Virginia: Earnings After Graduation," http://va.edpays.org/.

23. Carnevale, Cheah, and Hanson find similar results in their report, using less detailed and comprehensive information from the ACS. See Carnevale, Cheah, and Hanson, *The Economic Value of College Majors*. In addition, Dadgar and Trimble use comparable longitudinal data (college transcripts and UI) in Washington to estimate returns to different types of community college credentials: short-term certificates, long-term certificates, and associate degrees (by degree level and field of study). They find greater variation in wage returns by field of study than by degree type. See Dadgar and Trimble, "Labor Market Returns to Sub-Baccalaureate Credentials."

24. These data are based on matching data on students who completed their studies in the 2010–11 academic year with wages earned five years later as found in the state UI system.

25. We recognize that $75,000 is a somewhat arbitrary threshold, yet it is an easily understood number that is roughly 50 percent

higher than the median household income used in Table 2. Note that these are statewide medians, calculated for all students who completed the specific credential regardless of institutional variation.

26. Apprenticeship programs from Florida's district technical centers entail three years of paid apprenticeship work.

27. Florida and around two dozen other states allow their community colleges to award bachelor's degrees, usually in career-oriented fields of study. See Mark Schneider, "Community Colleges Make Four-Year Degrees Pay Off," *Inside Higher Ed*, November 11, 2014, www.insidehighered.com/views/2014/11/14/essay-labor-market-returns-bachelors-degrees-community-colleges.

28. Also see Anthony P. Carnevale et al., *Major Matters Most: The Economic Value of Bachelor's Degrees from the University of Texas System*, Georgetown University Center on Education and the Workforce, 2017, https://cew.georgetown.edu/wp-content/uploads/UT-System.pdf; and Eide, Hilmer, and Showalter, "Is It Where You Go or What You Study?"

29. Department of Numbers, "Florida Household Income," www.deptofnumbers.com/income/florida/#household.

30. Authors' calculations using College Measures data from the state of Florida.

31. National Center for Higher Education Management Systems, Information Center for Higher Education Policymaking and Analysis, "Difference in Median Earnings Between a High School Diploma and an Associates Degree," www.higheredinfo.org/dbrowser/?level=nation&mode=data&state=0&submeasure=364.

32. We are comparing the wages of recent college graduates to the wages of *all* high school graduates age 25 and above. This may be somewhat unfair to college graduates, since they may be earning more than high school graduates of a similar age. However, setting any baseline is always somewhat arbitrary, and certainly, given the overwhelming goal held by students to have a good job and high earnings, annual wages less than $25,000 would not seem congruent with that goal.

33. Some of these students may be in graduate or professional school, which would likely reduce their earnings. But even with the growth of postgraduate degrees, for most students, the bachelor's degree is the end point of their higher education. For example, while Florida's public colleges and universities awarded well over 550,000 associate and bachelor's degrees last year, just slightly more than 17,000 masters and Ph.D.s were awarded. See College Measures, 2016.

34. Through extensive focus group research, College Measures found that prospective students and their families better understand and prefer ROI metrics in the form of dollar figures rather than percentages. As a result, in our analysis we present expected ROI in dollars rather than percentages, as those are the only data available to us from College Measures.

35. There is a widely shared myth that a college education is worth a million dollars. Once we take into account that earnings are over a lifetime (and thus must be discounted for time) and that college is not free, a college degree is far from a guaranteed million-dollar payoff. See Mark Schneider, "How Much Is That Bachelor's Degree Really Worth? The Million Dollar Misunderstanding," American Enterprise Institute, May 4, 2009, www.aei.org/publication/how-much-is-that-bachelors-degree-really-worth/. For that reason, however, we use $1 million as the benchmark for expected ROI. Also see Webber, "Are College Costs Worth It?"

36. We acknowledge that these expected ROI estimates may be susceptible to current cyclical trends in Texas—namely, booms in oil and natural gas. Many of the high ROI programs—degree or certificate—are in fields related to that industry. For instance, one commonly listed program in Table 2 is in physical science technologies, a field that prepares individuals to apply scientific principles and technical skills in support of chemical and biochemical research and industrial operations.

37. See Webber, "Are College Costs Worth It?"; and Eide, Hilmer, and Showalter, "Is It Where You Go or What You Study?"

38. We concede that state flagships may have better completion rates than their regional counterparts and may also be better resourced, have better teaching quality, have more student services, and so on.

39. Authors' calculations using US Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, "Data Center," https://nces.ed.gov/ipeds/datacenter/InstitutionByName.aspx.

40. Doug Shapiro et al., "Completing College: A National View of Student Attainment Rates—Fall 2010 Cohort," National Student Clearinghouse Research Center, December 4, 2016, https://nscresearchcenter.org/signaturereport12/.

41. Program-level completion rates would also be difficult to calculate—particularly in the four-year sector—as students may not declare a major right upon entry.

42. Shapiro et al., "Completing College."

43. See Webber, "Are College Costs Worth It?"; and Peter Arcidiacono, "Ability Soring and the Returns to College Major," Duke Uni-

versity, July 31, 2003, http://public.econ.duke.edu/~psarcidi/arcidimetrics.pdf.

44. Eric Hanushek and Ludger Woessmann, "Apprenticeship Programs in a Changing Economic World," Brookings Institution, June 28, 2017, http://hanushek.stanford.edu/sites/default/files/publications/Hanushek%2BWoessmann%202017%20Brookings%20Chalkboard%206-28-2017.pdf. For the full article on which they base their report, see Eric Hanushek et al., "General Education, Vocational Education, and Labor-Market Outcomes over the Lifecycle," *Journal of Human Resources* 52, no. 1 (2017): 48–87.

45. See Claire Cain Miller and Quoctrung Bui, "Changing Careers Doesn't Have to Be Hard: Charting Jobs That Are Similar to Yours," *New York Times*, July 27, 2017, www.nytimes.com/2017/07/27/upshot/switching-careers-is-hard-it-doesnt-have-to-be.html.

46. See Schneider, *Education Pays in Colorado*.

47. There is a large and growing "industry" devoted to analyzing the future of work and which professions will be most affected. See, for example, Executive Office of the President, *Artificial Intelligence, Automation, and the Economy*, December 2016, www.whitehouse.gov/sites/whitehouse.gov/files/images/EMBARGOED%20AI%20Economy%20Report.pdf; James Manyika et al., *Harnessing Automation for a Future That Works*, McKinsey Global Institute, January 2017, http://www.mckinsey.com/global-themes/digital-disruption/harnessing-automation-for-a-future-that-works; and Rachel Rickard Straus, "Will You Be Replaced by a Robot? We Reveal the 100 Occupations Judged Most and Least at Risk of Automation," This Is Money, May 31, 2014, www.thisismoney.co.uk/money/news/article-2642880/Table-700-jobs-reveals-professions-likely-replaced-robots.html.

48. United States Census Bureau, 2015 American Community Survey, "Median Household Income (in 2015 Inflation-Adjusted Dollars)," https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t.

49. Washington Workforce Training and Education Coordinating Board, "Apprenticeship," www.wtb.wa.gov/Apprenticeship-2017dashboard.asp.

50. Michelle Wein, "An Analysis of Registered Apprenticeships in Michigan," State of Michigan Department of Technology, Management and Budget, Bureau of Labor Market Information and Strategic Initiatives, November 2016, http://milmi.org/Portals/137/publications/Apprenticeship_Report_2016.pdf.

51. For a rundown of data on the registered apprenticeship program and its shortcomings, see Workforce Data Quality Campaign, "Registered Apprenticeship Data FAQs," www.workforcedqc.org/sites/default/files/images/3%2031%20Apprentice_FAQ_2pg_web.pdf.

52. For some encouraging evidence on this, see Katherine Mangan, "The Making of a Modern-Day Apprentice," *Chronicle of Higher Education*, June 28, 2017, www.chronicle.com/article/The-Making-of-a-Modern-Day/240466. International data also show that many other advanced economies have apprenticeship programs in a wider range of occupations. For example, see Hilary Steedman, *The State of Apprenticeship in 2010: International Comparisons: Australia, Austria, England, France, Germany, Ireland, Sweden, Switzerland*, Apprenticeship Ambassadors Network, Centre for Economic Performance, London School of Economics and Political Science, August 2010, http://cep.lse.ac.uk/pubs/download/special/cepsp22.pdf.

53. US Department of Labor, Employment and Training Administration, "Data and Statistics," www.doleta.gov/oa/data_statistics.cfm.

54. The White House, Office of the Press Secretary, "Fact Sheet: Investing $90 Million Through ApprenticeshipUSA to Expand Proven Pathways into the Middle Class," press release, April 21, 2016, https://obamawhitehouse.archives.gov/the-press-office/2016/04/21/fact-sheet-investing-90-million-through-apprenticeshipusa-expand-proven; and Ian Kullgren and Marianne Levine, "Trump Signs Executive Order on Apprenticeships," *Politico*, June 15, 2017, www.politico.com/story/2017/06/15/trump-apprenticeship-executive-order-239590.

55. See National Center for Education Statistics, "Table 320.10. Certificates Below the Associate's Degree Level Conferred by Postsecondary Institutions, by Length of Curriculum, Sex of Student, Institution Level and Control, and Discipline Division: 2014–15," https://nces.ed.gov/programs/digest/d16/tables/dt16_320.10.asp?current=yes. Indeed, many of these certificates are offered by for-profit institutions, many of dubious quality. See Jessie Brown and Martin Kurzweil, *The Complex Universe of Alternative Postsecondary Credentials and Pathways*, American Academy of Arts and Sciences, 2017, www.amacad.org/content/publications/publication.aspx?d=22786.

56. For more on the landscape of postsecondary certificates, see Anthony P. Carnevale, Stephen J. Rose, and Andrew R. Hanson, *Certificates: Gateway to Gainful Employment and College Degrees*, Georgetown University Center on Education and the Workforce, June 2012, https://cew.georgetown.edu/wp-content/uploads/2014/11/Certificates.FullReport.061812.pdf.

57. *Inside Higher Ed* reports that "among borrowers who started a postsecondary program in 2003–04, those who earned an undergraduate certificate, as opposed to an associate or bachelor's degree, had a default rate of 29.9 percent—higher than if they dropped out entirely (29 percent)" and that "less than 50 percent of certificates have any reasonable earnings returns." See Andrew Kreighbaum, "Post-Recession Borrowers Struggle to Repay Loans," *Inside Higher Ed*, October 5, 2017, www.insidehighered.com/news/2017/10/05/new-federal-data-student-borrowing-repayment-and-default.

58. Association for Career and Technical Education, "What Is 'Career Ready'?," https://eric.ed.gov/?id=ED509197.

59. US Department of Labor, Bureau of Labor Statistics, "Labor Force Statistics from the Current Population Survey," April 27, 2017, www.bls.gov/cps/certifications-and-licenses.htm. A license is awarded by a government agency and conveys a legal authority to work in an occupation. About 2 percent of the civilian workforce had only a certification—most of these workers had a combination of licenses plus certifications.

60. See Andrew Kreighbaum, "Push for 'Unit Records' Revived," *Inside Higher Ed*, May 16, 2017, www.insidehighered.com/news/2017/05/16/bipartisan-bill-would-overturn-federal-ban-student-unit-record-database; and US House of Representatives, Committee on Education and the Workforce, Subcommittee on Higher Education, "Hearing: Empowering Students and Families to Make Informed Decisions on Higher Education," May 24, 2017, https://edworkforce.house.gov/calendar/eventsingle.aspx?EventID=401652.

61. For some guiding principles for policymakers on reforming postsecondary data collection and dissemination, see Mark Schneider, *Measuring the Economic Success of College Graduates: Lessons from the Field*, American Institutes for Research, June 2014, www.air.org/sites/default/files/downloads/report/Measuring%20the%20Economic%20Success%20of%20College%20Graduates_Mark%20Schneider.pdf; and Mark S. Schneider, "Reforms to Increase Transparency in Higher Education," in *Unleashing Opportunity: Policy Reforms to Strengthen Higher Education* (Washington, DC: National Affairs, June 2017), https://nationalaffairs.com/storage/app/uploads/public/doclib/HigherEd_Ch4_Schneider.pdf.