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25 YEARS

Career Pathways and Economic Mobility at California's Community Colleges

Technical Appendices

CONTENTS

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Appendix A. Data sources

COMIS

The primary data source used in this report comes from the California Community College Chancellor's Office (CCCCO). The Chancellor's Office Management Information System (COMIS) is a longitudinal dataset that includes information on all students enrolled in colleges across the California Community College system. It contains detailed information on student characteristics, including demographics, measures of economic and academic disadvantage, and disability, along with course enrollments, financial aid receipt, and award completion. We have these records for all students between the fall term of 1993 and the spring term of 2017.

The data system also contains information on the awards or credentials that a student completes.[1] We classify all awards that students earn in the system into three categories—short-term certificates, long-term certificates, and associate degrees. Short-term and long-term certificates are defined based on the length of time, measured in terms of units and assuming full-time course loads, it takes to complete the degrees. Short-term degrees take less than 1 year to complete and include certificates requiring less than 30 units to complete. Long-term degrees are defined as those requiring between 1 and 2 years to complete and include certificates requiring 60 or more units and those requiring 30-59 units. Associate degrees can be either associate of art or science and typically take 2 or more years to complete.

All courses and awards include information that designates a specific field of study called a Taxonomy of Program (TOP) code. The TOP system of numerical codes is used to collect and report information on programs and courses in different colleges throughout the state that have similar outcomes. We use TOP codes to identify career education awards. The CCCCO designates all career education or vocational programs based on the 6-digit TOP code.

The TOP codes were designed to aggregate information about programs and all courses and awards are coded with a 6-digit TOP code. The first two digits of the six-digit TOP denote the discipline and is used to define our broad career education areas of interest which include Business and Management (05), Information Technology (07), Engineering (09), Family and Consumer Sciences (13) and Public and Protective Services (21). The first four digits are intended to denote a sub-discipline (e.g. 1305: Child Development/Early Childhood Education), and the entire six digits denote a specific field of study (e.g. 130580: Child Development Administration and Management).

UI Earnings Data

The analysis of labor market returns relies on administrative wage data from the state's Unemployment Insurance (UI) system. The UI data was provided by the California Employment Development Department and merged with student records from the COMIS data files by the Chancellor's Office. Data from the UI system include quarterly wage records and industrial sector of employment defined by 6-digit NAICS codes. Only jobs that are covered by UI are included in these official wage data; that excludes self-employed, contract, seasonal, and informal work, as well as military employment. We have UI records from the first quarter of 2000 through the second quarter of 2017. Students with employment in a covered industry in California have a record that includes the total of wages earned in the quarter for each covered industry in which any wages were earned.

[1] One caveat in our research pertains to the potential underreporting of short-term certificates that are not approved by the Chancellor's office. These 'local' certificates are college- and department-specific certificates less than 12 units. Because the CCCCO does not require colleges to report local certificates in COMIS – although many do – non-reported local certificates are not included in our analysis.

Poverty Thresholds

Our examination of wage trajectories relies on comparing earnings levels with poverty thresholds developed by the California Poverty Measure (CPM). The CPM is a joint effort by PPIC and the Stanford Center on Poverty and Inequality to create a detailed, California-specific version of the Census Bureau's Supplemental Poverty Measure (Bohn, Danielson, Levin, Mattingly, and Wimer 2013; Fox 2018), which is itself a more up-to-date and comprehensive picture of poverty.

The key feature of the CPM that we use in this study are poverty thresholds that reflect differences in cost of living across California. The CPM utilizes the Census Bureau's Supplemental Poverty Measure baseline threshold adjusting up or down according to five-year average housing costs by county (or county group for smaller counties). CPM thresholds also vary by family size and composition (adults vs. children) and by whether the dwelling is rented or owned.

We use the CPM threshold for a single person, renter household for our analysis since the UI data in our study pertains only to single individuals, not the households they may be a part of. In addition we compare only wage and salary totals to the CPM threshold; this differs from CPM calculations, which also account for other sources of income and support (taxes, business income, cash welfare, in-kind government program support). Our analysis compares UI earnings to the appropriate geographically adjusted poverty threshold. This gives us an estimate of whether UI earnings exceeded poverty-level earnings, and by how much, for each individual in our study.

Since our focus in this report is on regional labor market needs and regional community college credential production, we average CPM thresholds by region, as shown in Table A1. In addition, we average across three years of CPM thresholds, 2014 – 2016. As in past work (Reed 2004; Bohn and Schiff 2011), annual earnings that are two-times the threshold or below are considered low-income, earnings levels that correspond to two to seven-times the threshold are considered middle-income, and those that are seven-times or higher are high-income.

TABLE A1

Income ranges based on California Poverty Measure (CPM) thresholds

Region	CPM Threshold	Low-income Range (Less than 2X CPM)	Middle-income Range (2X – 7X CPM)	High-income Range (Over 7X CPM)
Northern	$11,996	Under $23,992	$23,992 - $83,972	Above $83,972
Sacramento	$12,970	Under $25,940	$25,940 - $90,790	Above $90,790
San Francisco Bay Area	$15,839	Under $31,678	$31,678 - $110,873	Above $110,873
Santa Clara/Santa Cruz/Monterey	$16,394	Under $32,788	$32,788 - $114,758	Above $114,758
Central Valley/Mother Lode	$11,709	Under $23,418	$23,418 - $81,963	Above $81,963
Central Coast	$15,000	Under $30,000	$30,000 - $105,000	Above $105,000
Los Angeles	$14,346	Under $28,692	$28,692 - $100,422	Above $100,422
Inland Empire	$12,983	Under $25,966	$25,966 - $90,881	Above $90,881
Orange County	$15,816	Under $31,632	$31,632 - $110,712	Above $110,712
San Diego/Imperial	$14,584	Under $29,168	$29,168 - $102,088	Above $102,088

SOURCES: California Poverty Measure, Bohn et al. 2013.

NOTES: Regional thresholds are an average of CPM county or county group thresholds for the years 2014, 2015 and 2016. See Appendix B for region definitions.

American Community Survey

The American Community Survey (ACS) is a large household survey administered by the Census that includes detailed individual-level information on a representative sample of California households. It is designed to produce reliable estimates at the state and sub-state levels due to its relatively large sample size. We use the ACS public use microdata sample (PUMS) 1-year files for the years 2014-2017 to generate estimates of the education and earnings levels of current workers by detailed occupation code. For more information on how we use the ACS and EDD projections data to examine future middle-skill jobs, refer to Technical Appendix E.

Employment Development Department Projections

The EDD produces short-term and long-term employment projections for detailed occupations and industries both at the state and regional level. We use the long-term, 10-year projections in our estimates of projected future jobs by occupation and skill level. For the statewide information presented in the report, the employment projections are for the period 2016 – 2026. The regional employment estimates are for the period 2014 – 2024.

Appendix B: Geographies

In order to examine outcomes across different areas of the state, we aggregated counties into ten regions. Students completing career education credentials are assigned to the county of the college at which they earned their first award. The information from the ACS and EDD employment projections that we use to examine current middle-skill workers and earnings levels do not have all counties individually delineated. As a result, we needed to align available county and county group definitions available across our data sources into consistent regions.

The ten regions used in our analysis were created by harmonizing three different geographic boundaries available:

- 265 Public Use Microdata Areas (PUMAs) available in the American Community Survey
- 34 Metropolitan Statistical Areas (MSAs) used by the California Employment Development Department (CA EDD) for their regional employment projections
- 15 Career Education (CE) regions used by the Chancellor's Office Division of Workforce and Economic Development to organize regional collaborations and activities for career education programs.

PUMAs are the smallest geographic unit available in the 1-year Public Use Microdata Sample (PUMS) and designed to include about 100,000 population. As a result, some PUMAs are comprised of multiple small counties and these groupings do not necessarily correspond to a distinct MSA or CE region. To the extent possible, we attempted to keep the geographies across data sources as consistent as possible, but in some case these was more difficult than others. In particular, San Benito County is included in the Santa Clara County MSA used in the EDD projections, but is aggregated with Monterey County in the ACS PUMAs. As a result, we include San Benito along with Santa Clara, Monterey and Santa Cruz counties into a single region.

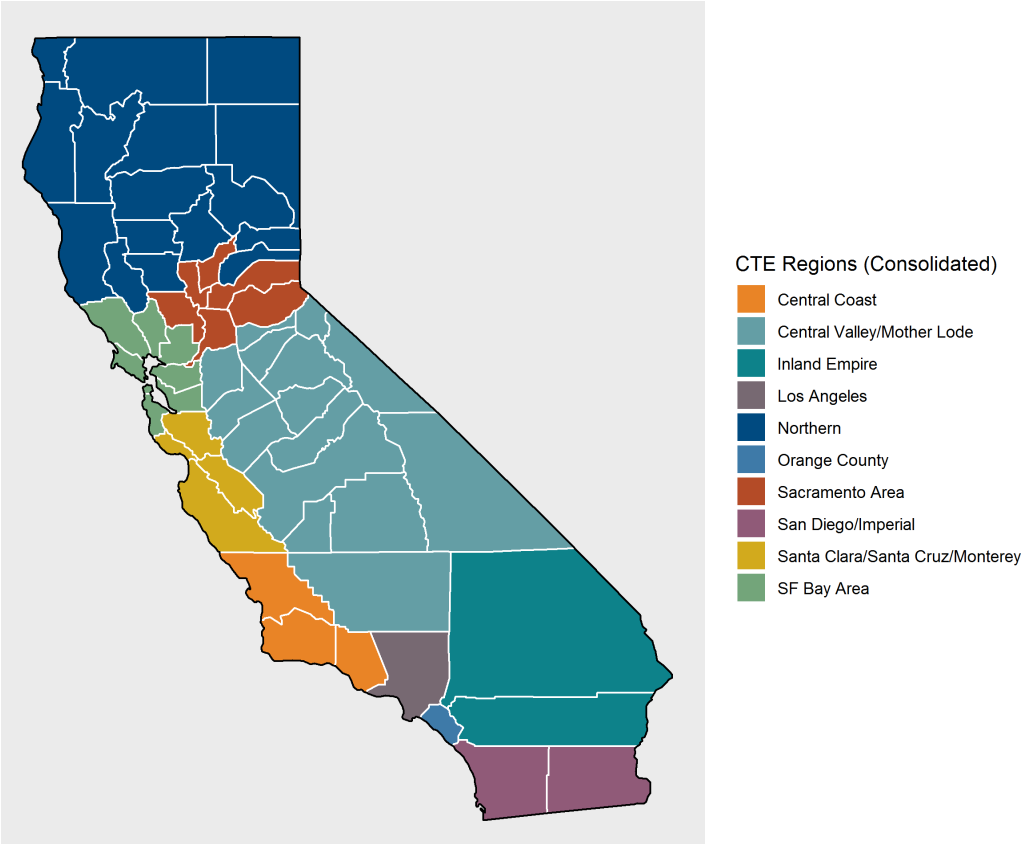
TABLE B1

Regional definitions by county/county group and data source

Region	CE Region	County/County Group	Number of PUMAs	Number of MSAs
Northern	Northern Inland Northern Coastal	Butte, Colusa, Del Norte, Glenn, Humboldt, Lake, Lassen, Mendocino, Modoc, Nevada, Plumas, Shasta, Sierra, Siskiyou, Tehama, Trinity (16)	8	5
Sacramento	Greater Sacramento	El Dorado, Placer, Sacramento, Sutter, Yolo, Yuba (6)	18	2
San Francisco Bay Area	North Bay East Bay Mid-Peninsula	Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Solano, Sonoma (8)	41	6
Santa Clara/Santa Cruz/Monterey	Silicon Valley Santa Cruz & Monterey	San Benito, Santa Clara, Santa Cruz, Monterey (4)	19	1 Consolidated (3 as original EDD MSAs)
Central Valley & Mother Lode	Central Valley Mother Lode	Alpine, Amador, Calaveras, Fresno, Inyo, Kern, Kings, Madera, Mariposa, Merced, Mono, San Joaquin, Stanislaus, Tulare, Tuolumne (15)	28	9 Consolidated (10 as original EDD MSAs)
Central Coast	South Central Coast	San Luis Obispo, Santa Barbara, Ventura (3)	11	3
Los Angeles	Los Angeles	Los Angeles County (1)	69	1
Orange County	Orange County	Orange County (1)	18	1
Inland Empire	Inland Empire	Riverside, San Bernardino (2)	30	1
San Diego & Imperial	San Diego	Imperial, San Diego (2)	23	2
Total: 10	15 CTE Regions	58 Counties	265 PUMAs	31 MSAs (34)

FIGURE B1

Map of regional definitions by county



Appendix C. Sample Construction and Sample Statistics

Sample Construction

We build our sample universe from the COMIS data file that records the awards students earn. We first identify students who earned their first career education credential (at least since 1993) in the community college system sometime after the 2000/2001 school year. We designate students earning career education credentials based on the designation of vocational programs provided in the Taxonomy of Programs (TOP) manual 6th Edition (California Community Colleges, Academic Affairs Division, July 2013) and focus on the six largest programs including Business and Management (05), Information Technology (07), Engineering and Industrial Technology (09), Health (12), Family and Consumer Sciences (13), and Public and Protective Services (21).

We exclude non-credit credentials (only about 3% of all career education credentials). We further restrict our sample to students who have an SSN (scrambled and de-identified in our data extract) recorded as an identifier. Each community college assigns school-level student identification numbers, but these are not unique across the entire system. Restricting our sample to students with an SSN as an identifier allows us to track students across multiple colleges so we have a complete picture of their coursework and credentials.

Throughout our analysis, we exclude students who transferred to a four-year college within six years of completing that award. For our presentation of student characteristics across programs, we include all students who earned their first career education credential between school years 2000/01 and 2016/17. For our main analysis of earnings returns, we further restrict our sample to students completing credentials between school years 2003 and 2010 in order to allow to observe earnings for students for a number of years before and after they have earned their credentials. To ensure we have enough of a wage history and wage trajectory we keep earnings that are as far as 5 years prior to a student's first award, and earnings that are within 6 years after earning the first award.

Defining Career Pathways/Stackable Credentials

While there is no set definition of what constitutes a career pathway or stackable credential, we rely on the TOP codes attached to credentials to flag students who stack credentials. Specifically, we define a student as stacking credentials if their first CE award in the community colleges was a short-term or long-term certificate and they complete another award (of any level) in the same broad CE discipline based on the first 2-digits of the TOP code within 6 years of their first CE award.

In about 15 percent of cases, we observe students completing two or more credentials on the exact some date. Most often these awards are also completed in the same program i.e. a student earns a long-term certificate and an associate degree in the same detailed 6-digit TOP code. Because the two awards are completed concurrently, we do not consider this an instance of stacking credentials. In these cases, we assign the student the highest level award completed and use other subsequent awards, if any, to identify degree stacking.

Sample Descriptive Statistics

Table C1 provides descriptive statistics for all students who earned a career education credential any time between school years 2000/01 and 2016/17. The table shows distributions by various demographic characteristics across different career education programs.

TABLE C1

Demographics of students completing career education credentials across programs

	Overall	Business	Engineering	Family and consumer sciences	Health	Information technology	Public and protective services
Gender							
Female	53.8%	66.5%	7.3%	89.8%	71.9%	30.0%	33.4%
Male	46.2%	33.5%	92.7%	10.2%	28.1%	70.0%	66.6%
Age at 1st award							
Mean age	31.2	32.3	30.7	32.3	30.6	33.0	29.9
Age 18-22	20.8%	19.0%	22.8%	20.6%	19.0%	14.3%	24.8%
Age 23-27	24.8%	22.3%	23.8%	22.3%	26.6%	22.0%	28.1%
Age 28-37	28.5%	28.1%	29.6%	25.2%	31.6%	31.8%	25.7%
Age 38-54	25.9%	30.6%	23.8%	31.9%	22.8%	31.9%	21.4%
Race/ethnicity							
Latinx	33.3%	30.7%	37.2%	42.9%	26.9%	21.8%	36.5%
Asian/Pacific Islander	15.4%	20.2%	13.8%	12.9%	19.8%	24.1%	6.2%
African American	6.9%	7.3%	5.6%	9.3%	6.1%	6.3%	7.1%
Non-hispanic White	40.6%	38.1%	39.0%	31.3%	43.9%	43.5%	46.7%
Other/multi-race	3.7%	3.8%	4.4%	3.6%	3.3%	4.3%	3.4%
Citizenship							
Citizen	85.0%	77.7%	85.5%	79.6%	86.6%	78.5%	95.6%
Legal permanent resident	10.8%	14.4%	10.9%	15.3%	10.5%	13.4%	3.4%
Non-citizen	4.2%	7.9%	3.7%	5.1%	2.9%	8.1%	1.0%
Education level							
Less than HS	4.2%	3.9%	6.1%	6.1%	2.7%	3.7%	3.6%
HS degree	74.6%	76.2%	80.6%	76.7%	69.8%	67.7%	74.3%
AA/AS	6.8%	7.6%	3.9%	5.1%	9.5%	8.0%	6.1%
Bachelor's or higher	9.0%	7.1%	4.0%	7.0%	13.1%	15.5%	9.9%
Missing/other	5.3%	5.2%	5.3%	5.1%	4.8%	5.1%	6.1%
Markers of disadvantage							
Disabled	8.4%	7.5%	7.5%	12.0%	7.5%	9.4%	7.9%
Ever CalWORKS	6.6%	8.9%	4.0%	10.9%	5.6%	4.6%	5.1%
Ever Pell Grant (Low-Income)	42.9%	46.7%	39.1%	51.3%	43.0%	36.0%	36.9%
Ever BOG/Promise	61.4%	63.1%	55.3%	69.4%	66.4%	53.0%	53.3%

	Overall	Business	Engineering	Family and consumer sciences	Health	Information technology	Public and protective services
Sample size	429,669	79,527	72,097	65,574	114,106	17,906	80,459

SOURCES: Authors Calculations from COMIS.

NOTES: Includes students age 18 – 54 when they completed their first career education credential. Excludes students who transferred to a four-year college within six years of earning credential. All students who earn credit career education credentials of any level between the school years 2000/01 and 2016/17 are included. There are only minor differences in these demographics across students by the level of credential they complete (associate degree, long-term certificate, short-term certificate).

Tables C2 – C4 provide descriptive statistics for the analytic sample used in our earnings analysis – so only students who completed their first career education credential between 2003 and 2010. Table C2 provides counts by career education programs of students who are excluded from our earnings sample because they transfer to a four-year college. In all, about 23 percent of students who earned credentials in this period transferred to a four year.

Table C3 describes the analytic sample, including a breakdown by the number of awards received.

Table C4 presents sample statistics broken down by the program of study. Students are categorized according to the program of their first CE award. Of those who earn more than one CE credential, about 85% earn that within the same program, although this varies slightly across different programs.

TABLE C2

Transfers by program

	Transfers	Total Credential Earners	% Transfer
Business	19,398	45,224	43%
Information technology	2,017	7,957	25%
Engineering	2,638	30,922	9%
Health	11,234	63,383	18%
Family and consumer science	7,313	33,541	22%
Public and protective services	10,103	42,283	24%

SOURCES: Authors Calculations from COMIS.

TABLE C3

Characteristics of first career education credential for the earnings analytic sample

	Counts				Distribution			
	One Award	Two Award	Three+ Awards	Total	One Award	Two Award	Three+ Award	Total
Totals	160,306	26,836	7,780	194,922	82	14	4	100
First Award								
Associates (AA/AS)	61,473	4,581	633	66,687	38	17	8	34
Long Term(>=30)	36,615	7,025	1,055	44,695	23	26	14	23
Short Term(<=30)	23,267	5,592	1,262	30,121	15	21	16	15
Local	38,951	9,638	4,830	53,419	24	36	62	27
					100	100	100	100
First Award TOP 2-Digit								
Business	20,990	3,787	1,049	25,826	13	14	13	13
Information Tech	4,749	897	294	5,940	3	3	4	3
Engineering & InTech.	23,311	3,682	1,291	28,284	15	14	17	15
Health	43,311	6,812	2,026	52,149	27	25	26	27
Family & Consumer Science	19,825	4,847	1,556	26,228	12	18	20	13
Public & Protective Services	26,412	4,605	1,163	32,180	16	17	15	17

	Counts				Distribution			
	One Award	Two Award	Three+ Awards	Total	One Award	Two Award	Three+ Award	Total
Year of first award								
2003	19,639	3,265	1,017	23,921	12	12	13	12
2004	19,383	3,455	1,012	23,850	12	13	13	12
2005	20,351	3,596	986	24,933	13	13	13	13
2006	19,834	3,456	848	24,138	12	13	11	12
2007	20,606	3,337	949	24,892	13	12	12	13
2008	21,207	3,321	977	25,505	13	12	13	13
2009	19,914	3,265	1,010	24,189	12	12	13	12
2010	19,372	3,141	981	23,494	12	12	13	12
					100	100	100	100
Regions								
Northern	7,086	1,291	464	8,841	4	5	6	5
Sacramento Area	11,160	1,475	356	12,991	7	5	5	7
SF Bay Area	24,296	4,476	1,998	30,770	15	17	26	16
Santa Clara/Santa Cru	12,490	1,586	414	14,490	8	6	5	7
Central Valley/Mother	18,354	2,681	510	21,545	11	10	7	11
Central Coast	8,634	1,241	439	10,314	5	5	6	5
Los Angeles	34,660	6,896	1,871	43,427	22	26	24	22
Inland Empire	15,737	3,461	930	20,128	10	13	12	10
Orange County	12,290	1,714	423	14,427	8	6	5	7
San Diego/Imperial	15,413	1,992	373	17,778	10	7	5	9
					100	100	100	100
Ethnicity Categories								
Hispanic	47,163	8,423	2,267	57,853	29	31	29	30
Asian-PI	22,891	4,033	1,252	28,176	14	15	16	14
Black	11,704	1,987	503	14,194	7	7	6	7
White	72,916	11,590	3,487	87,993	45	43	45	45
Other/multi/missin	5,632	803	271	6,706	4	3	3	3
					100	100	100	100
Gender								
Female	91,234	15,580	3,960	110,774	57	58	51	57
Male	68,828	11,227	3,810	83,865	43	42	49	43
					100	100	100	100
Parent Education Level								
No HS	7,586	1,227	395	9,208	5	5	5	5
HS/GED	113,605	20,494	6,079	140,178	71	76	78	72
AA	11,464	1,384	365	13,213	7	5	5	7
BA+	16,781	1,978	549	19,308	10	7	7	10
Other/missing	10,870	1,753	392	13,015	7	7	5	7
					100	100	100	100

	Counts				Distribution			
	One Award	Two Award	Three+ Awards	Total	One Award	Two Award	Three+ Award	Total
Age								
22 or Younger	35,675	7,224	2,581	45,480	22	27	33	23
23-27	38,636	6,277	1,620	46,533	24	23	21	24
28-37	43,982	6,476	1,687	52,145	27	24	22	27
38 or Older	42,013	6,859	1,892	50,764	26	26	24	26
					100	100	100	100
Median Quarterly Earnings								
Before first award	$3,900	$3,081	$2,586	$3,720				
After first (before second)	$6,808	$5,448	$4,561	$6,520				
After second (before third)		$6,531	$5,571	$6,351				
After third			$6,159	$6,159				
Total	160,306	26,836	7,780	194,922	82	14	4	100

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Restricted to analytic earnings sample which includes students who earned their first career education credential between school years 2003 and 2010 and did not transfer to a four-year college within six years.

TABLE C4

Student sample characteristics by program, analytic earnings sample

	Count					
	Business	IT	Engineering	Health	Family and Consumer Sciences	Public and Protective Services
First Award						
AA/AS	13,097	2,392	4,227	25,126	6,167	9,427
Long Term	2,264	518	11,173	11,211	4,120	5,548
Short Term	10,465	3,030	12,884	15,812	15,941	17,205
Region						
Northern	1,008	171	1,274	2,126	886	2,161
Sacramento Area	2,320	735	2,628	2,303	1,731	1,262
SF Bay Area	3,425	990	3,096	9,227	4,449	6,591
Santa Clara/Santa Cruz/Monterey	2,174	540	3,514	3,768	1,229	1,182
Central Valley/Mother Lode	3,042	413	2,908	7,190	2,744	3,728
Central Coast	1,195	211	747	4,005	1,090	1,575
Los Angeles	5,758	976	5,903	9,616	7,878	7,318
Inland Empire	2,517	985	1,837	6,993	2,784	3,579
Orange County	1,740	364	2,213	3,390	966	2,427
San Diego/Imperial	2,624	550	4,141	3,459	2,391	2,353
Race						
Hispanic	6,989	1,214	9,536	12,461	10,875	10,499
Asian-PI	4,789	1,199	3,977	10,501	3,148	1,953
Black	1,986	389	1,521	3,436	2,734	2,554
White	11,186	2,906	12,024	24,267	8,635	16,218
Other/multi/missing	876	232	1,226	1,484	836	956
Age						
18-22	3,307	644	5,705	9,043	4,581	7,521
23-27	5,374	1,093	6,503	13,774	5,174	9,081
28-37	6,981	1,747	8,056	15,923	6,311	8,085
38-54	8,918	2,084	7,069	12,178	8,536	6,473
Total	25,826	5,940	28,284	52,149	26,228	32,180

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Restricted to analytic earnings sample which includes students who earned their first career education credential between school years 2003 and 2010 and did not transfer to a four-year college within six years. Students are categorized according to the program area in which they complete their first credential. Program of first award categories are not mutually exclusive. A student may have a first award in two or more CE fields.

Appendix D. Analysis of Wage Trajectories

Wage returns

Our analysis of earnings returns relies on statistical models relating earnings outcomes to student characteristics at the time of earning a credential. Comparing which community college awards are associated with the highest earnings does differences in earnings do not account for the differences between students who choose different pathways and degree types. Instead we can use a multiple regression framework to analyze the returns to awards and account for the student characteristics in our rich data set. Even controlling for observable characteristics, however, only tells us a little about the variation in post-award earnings. Since CE students tend to be older and have relatively long pre-credential earnings histories, we can utilize their prior earnings as controls for unobservable characteristics that are also likely associated with their future earnings. The thus measure the labor market returns to credentials relative to an individual's own earnings in a student fixed effects model. The student fixed effects also subsume any characteristics that do not vary over time, such as race, gender, and program choice.

Relying on pre-enrollment earnings to control for individual ability or latent earnings capacity is still potentially misleading if entry into a CE program is motivated by a dip in earnings. This endogeneity problem could produce overestimated returns to CE credentials even after controlling for student ability. Stevens et al (2018) and Bohn et al (2016a) used data from the same source, and constructed various control groups of students who appeared to intend to get a credential in a CE field, but for whatever reason did not. They found that models using student fixed effects only and those that included control groups yielded almost identical results. Because our focus in the present paper is returns to potentially multiple CE awards we opt to not include a control group in this analysis since it imposes some sample restrictions. However, in our modeling students who earn only one award serve as a control for those who earn two or more. As the report explains, some students return to the community college to re-enroll, but still never complete subsequent credential.

Our regression model uses a sample of students who earned a CE award between 2003 and 2010, and include a window of up to 5 years of pre-award earnings and up to 6 years of post (first) award earnings. The longer time frame after the first award is to give students who earn multiple credentials time to earn those credentials and then enter the workforce. The sample is also limited to students who have earnings at least one year (four quarters) prior to earning their first award. As we show in the descriptive statistics, the median age of CE award earners is 28, which leaves plenty of time for a pre-award earnings profile.

To estimate these returns specifically we employed the following model:

$$Ln(wage_{it}) = \alpha_i + \gamma_t + \beta Enrolled_{it} + \sum_k \delta_k Postawardk_{it} + \sum_j \varphi_j (Age = j)_{it} + \varepsilon_{it} \qquad (1)$$

Where subscript *i* denotes individual and *t* denotes year-quarter, as our earnings data is given at the quarter level (school terms are matched to the appropriate calendar quarters).The logarithm of quarterly earnings is the key dependent variable and δ is the coefficient of interest, measuring the change in quarterly earnings due to credential receipt. *Postawardk* is an indicator that becomes 1 in every quarter after the student receives a credential a kth credential. Students often earn multiple credentials in one quarter, and for those we only use the highest award earned (Associates>long-term certificate>short or local certificate). The presence of multiple post-award indicators in a single model means that each indicator beyond the first measures the wage return for a second, or third, for example, compared to the first. Student-level fixed effects are captured in α and time effects are in γ. These effects imply that wage returns should be considered "within student" meaning the post-award

indicator identifies the wage gain to an award relative to that student's pre-award earnings. Indicator variables for age at term *t*, control for age-earnings profile. And *Enrolled* is an indicator variable for whether a student is enrolled during term *t* which controls for depressed wages while in school. This model closely follows the specifications in Stevens et al (2018) and Bohn et al (2016a, 2016b). To identify differences between fields or groups of students, we run the student and period fixed effects models for different programs and award levels.

To interpret *Postawardk* coefficients as increases in earnings, we apply the following:

% increase in earnings from first award = exp(coefficient for *Postaward1*)-1 (2)

% increase in earnings from first and second award = exp(coefficient for *Postaward1*+ *Postaward2*)-1 (3)

% increase in earnings from second award beyond the first = (3) – (2)

First we present summary statistics for our baseline student sample. We have 253,511 students in the analytic sample. These are students who received their first award at a community college between 2003 and 2010, and had an earnings history of at least one year (4 quarters) prior to receiving an award. About 90 percent of students who earned their first award between 2003 and 2010 had earnings histories at least one year prior to receiving an award. In fact, as Table D1 and D2 show a vast majority of students had earnings histories that predated their degrees by 4 to 5 years (or 3-4 years in the case of the first cohort whose data availability only extend 3 to 4 years before a first degree), and we are able to track a vast majority of students earning trajectories out to 5 to 6 years after their first award.

A majority of students (81%) complete only one award in our sample window, 15% complete two awards, and only 4% complete three or more awards. Students who complete a different number of awards differ on some characteristics. Students who earn multiple awards tend to be younger, earn a higher salary before they earn their first award, and are more likely to earn local, short, and long-term certificates compared to associates degrees. There are fewer differences between single and multiple degree earners in terms of geographic location of their colleges, ethnicities, and parent education level.

TABLE D1

Earliest earnings records before first completed awards, by first award year

	2003	2004	2005	2006	2007	2008	2009	2010	Total
0-1 year	2	1	1	1	1	1	1	1	1
1-2 years	8	6	5	5	5	5	4	3	5
2-3 Years	20	10	8	7	7	7	6	6	9
3-4 years	70	20	10	9	8	8	8	8	17
4-5 Years	0*	63	75	78	79	80	80	83	68
	100	100	100	100	100	100	100	100	100

SOURCES: COMIS and EDD.

NOTES: For the 2003 cohort, the data window did not extend back to 4-5 years prior to earning an award.

TABLE D2

Latest earnings records after completed awards, by first award year

	2003	2004	2005	2006	2007	2008	2009	2010	Total
0-1 Years	6	6	6	6	7	7	7	8	7
1-2 Years	2	2	2	2	2	2	2	3	2
2-3 Years	2	2	2	2	2	2	3	3	2
3-4 Years	2	2	2	2	2	2	3	3	2
4-5 Years	2	2	2	2	2	3	3	3	2
5-6 Years	2	2	2	2	3	3	3	5	3
6+ Years	84	83	83	82	82	81	79	76	81
	100	100	100	100	100	100	100	100	100

SOURCES: COMIS and EDD.

Table D3 presents detailed regression results from our baseline estimates for all of the six CE programs, while Table D4 through D9 break the results out by TOP code. For all pooled CE programs, a simple comparison of average wages before and after awards indicates a substantial boost in wages to a first credential, on the order of about 63 percent and a negative return to the second or third degree (Model 1). Controlling for the fact that earnings rise over time and with age and experience moves both the positive and negative estimates closer to zero (Model 2). Including student fixed effects (Model 3) further reduces the return for the first award to about 18 percent, and shows a modes two one percent return to the second award. The third award shows no discernable effect. Model 4 shows that returns vary across types of credential. Restricting the sample to those who first obtained an associate's degree (Model 5 and 6), a long certificate (Model 7 and 8) and a short or local certificate (Model 9 and 10) show that gains in second and third awards come primarily from those who earn short or long term certificates, rather than associates degrees.

The associations between certificate receipt and earnings show important differences across which programs students complete. While health shows relatively large returns across most award types, associate's degree programs are associated with higher returns than longer term and shorter term credentials. The same is true in engineering, though the returns are much smaller. In public and protective services, the opposite is true. Information technology shows little, and even negative returns, though stacking on a long-term credential shows promise in generating returns.

TABLE D3

Quarterly log earnings regression estimates, all CE programs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Student FE			X	X	X	X	X	X	X	X
Age FE		X	X	X	X	X	X	X	X	X
Year-qtr FE		X	X	X	X	X	X	X	X	X
Sample	All Students with 1+ Award				1st Award: Associate degree		1st Award: Long-term certificate		1st Award: Short-term certificate	
postfirstaward	0.632**	0.329**	0.184**		0.274**		0.192**		0.0729**	
	(0.00196)	(0.00311)	(0.00130)		(0.00207)		(0.00301)		(0.00204)	
postsecondaward	-0.150**	-0.140**	0.0138**		-0.00456		0.155**		0.0552**	
	(0.00496)	(0.00483)	(0.00176)		(0.00355)		(0.00359)		(0.00248)	
postthirdaward	-0.104**	-0.0755**	0.00648		0.00249		0.0301**		0.0505**	
	(0.00978)	(0.00963)	(0.00352)		(0.0104)		(0.00889)		(0.00418)	
post1_x_assoc				0.315**		0.274**				
				(0.00152)		(0.00207)				
post1_x_long				0.179**				0.193**		
				(0.00188)				(0.00301)		
post1_x_short				0.0698**						0.0757**
				(0.00151)						(0.00205)
post2_x_assoc				0.0885**		-0.0748**		0.183**		0.113**
				(0.00221)		(0.00485)		(0.00385)		(0.00324)
post2_x_long				0.0522**		0.0559**		0.0353**		0.0684**
				(0.00438)		(0.00734)		(0.00938)		(0.00671)
post2_x_short				0.00517		0.0750**		-0.00632		-0.0207**
				(0.00298)		(0.00633)		(0.0124)		(0.00355)
post3_x_assoc				0.0648**		-0.0631**		0.0840**		0.0935**
				(0.00490)		(0.0148)		(0.0105)		(0.00600)
post3_x_long				0.0596**		0.145**		0.0325		0.0676**
				(0.00895)		(0.0226)		(0.0215)		(0.0109)
post3_x_short				0.0502**		-0.0281		-0.0225		0.0655**
				(0.00555)		(0.0180)		(0.0234)		(0.00608)
Observations	6,786,915	6,786,915	6,786,915	6,786,915	3,098,247	3,098,247	1,202,127	1,202,127	2,486,541	2,486,541
R-squared	0.074	0.180	0.538	0.540	0.528	0.528	0.520	0.520	0.563	0.563

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column is a separate model based on equation (1). Robust standard errors in parentheses. ** p<0.01, * p<0.05.

TABLE D4

Quarterly log earnings regression estimates, Business (TOP code 05)

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Student FE			X	X	X	X	X	X	X	X
Age FE		X	X	X	X	X	X	X	X	X
Year-qtr FE		X	X	X	X	X	X	X	X	X
Sample	All Students with 1+ Award				1st Award: Associate degree		1st Award: Long-term certificate		1st Award: Short-term certificate	
postfirstaward	0.318**	0.0971**	0.0189**		0.0205**		0.0304*		0.0324**	
	(0.00509)	(0.00927)	(0.00363)		(0.00505)		(0.0122)		(0.00593)	
postsecondaward	-0.0810**	-0.110**	0.0391**		0.0916**		0.0160		0.0259**	
	(0.0154)	(0.0152)	(0.00519)		(0.0113)		(0.0127)		(0.00712)	
postthirdaward	-0.104**	-0.101**	0.00823		0.0659*		0.102**		-0.0110	
	(0.0310)	(0.0307)	(0.0106)		(0.0304)		(0.0265)		(0.0131)	
post1_x_assoc				0.0228**		0.0206**				
				(0.00412)		(0.00505)				
post1_x_long				0.0356**				0.0304*		
				(0.00691)				(0.0122)		
post1_x_short				0.0124**						0.0332**
				(0.00421)						(0.00594)
post2_x_assoc				0.0543**		0.0893**		0.0215		0.0458**
				(0.00647)		(0.0154)		(0.0137)		(0.00872)
post2_x_long				0.00888		0.115**		0.0155		-0.0485*
				(0.0143)		(0.0286)		(0.0283)		(0.0211)
post2_x_short				0.0196*		0.0848**		-0.0373		0.00644
				(0.00892)		(0.0185)		(0.0385)		(0.0110)
post3_x_assoc				0.0163		0.0410		0.0663*		0.0152
				(0.0142)		(0.0464)		(0.0315)		(0.0179)
post3_x_long				0.0388		0.272**		0.0574		-0.0161
				(0.0274)		(0.0671)		(0.0739)		(0.0341)
post3_x_short				0.0190		-0.00274		0.300**		0.000150
				(0.0179)		(0.0466)		(0.0604)		(0.0214)
enrolled		-0.130**	-0.141**	-0.140**	-0.111**	-0.111**	-0.145**	-0.145**	-0.169**	-0.168**
		(0.00603)	(0.00224)	(0.00228)	(0.00326)	(0.00326)	(0.00735)	(0.00736)	(0.00357)	(0.00359)
Observations	0.318**	0.0971**	0.0189**		0.0205**		0.0304*		0.0324**	
R-squared	(0.00509)	(0.00927)	(0.00363)		(0.00505)		(0.0122)		(0.00593)	

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column is a separate model based on equation (1). Robust standard errors in parentheses. ** p<0.01, * p<0.05.

TABLE D5

Quarterly log earnings regression estimates, Information Technology (TOP code 07)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Student FE			X	X	X	X	X	X	X	X
Age FE		X	X	X	X	X	X	X	X	X
Year-qtr FE		X	X	X	X	X	X	X	X	X
Sample	All Students with 1+ Award				1st Award: Associate degree		1st Award: Long-term certificate		1st Award: Short-term certificate	
postfirstaward	0.313**	0.0121	-0.0116		-0.00217		-0.0571*		-0.00119	
	(0.0110)	(0.0185)	(0.00731)		(0.0115)		(0.0259)		(0.0103)	
postsecondaward	-0.0289	-0.0412	0.0131		0.0461		-0.0155		0.0236	
	(0.0329)	(0.0322)	(0.0103)		(0.0248)		(0.0282)		(0.0130)	
postthirdaward	0.0781	0.0661	-0.0360		0.316**		0.120*		-0.0694**	
	(0.0616)	(0.0588)	(0.0199)		(0.0750)		(0.0588)		(0.0227)	
post1_x_assoc				0.0253**		-0.00279				
				(0.00875)		(0.0115)				
post1_x_long				-0.0174				-0.0579*		
				(0.0141)				(0.0259)		
post1_x_short				-0.0342**						0.000576
				(0.00803)						(0.0103)
post2_x_assoc				0.0742**		0.114**		-0.0242		0.0916**
				(0.0147)		(0.0404)		(0.0309)		(0.0191)
post2_x_long				0.0582*		0.0210		0.364**		-0.00412
				(0.0259)		(0.0512)		(0.0803)		(0.0332)
post2_x_short				-0.0345*		-0.00206		-0.180**		-0.0249
				(0.0148)		(0.0375)		(0.0599)		(0.0171)
post3_x_assoc				-0.00123		0.294**		0.134		-0.0438
				(0.0286)		(0.113)		(0.0696)		(0.0337)
post3_x_long				-0.0227		1.014**		0.439*		-0.0850
				(0.0405)		(0.169)		(0.180)		(0.0442)
post3_x_short				-0.0229		-0.00928		0.0410		-0.0271
				(0.0323)		(0.122)		(0.125)		(0.0357)
enrolled		-0.195**	-0.166**	-0.160**	-0.140**	-0.141**	-0.161**	-0.165**	-0.171**	-0.169**
		(0.0122)	(0.00441)	(0.00449)	(0.00731)	(0.00731)	(0.0153)	(0.0153)	(0.00615)	(0.00616)
Observations	163,510	163,510	163,510	163,510	67,053	67,053	13,413	13,413	83,044	83,044
R-squared	0.022	0.142	0.599	0.600	0.601	0.601	0.603	0.604	0.599	0.599

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column is a separate model based on equation (1). Robust standard errors in parentheses. ** p<0.01, * p<0.05.

TABLE D6

Quarterly log earnings regression estimates, Engineering and Industrial Technology (TOP code 09)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Student FE			X	X	X	X	X	X	X	X
Age FE		X	X	X	X	X	X	X	X	X
Year-qtr FE		X	X	X	X	X	X	X	X	X
Sample	All Students with 1+ Award				1st Award: Associate degree		1st Award: Long-term certificate		1st Award: Short-term certificate	
postfirstaward	0.408**	0.184**	0.0428**		0.131**		0.0365**		0.0248**	
	(0.00433)	(0.00757)	(0.00319)		(0.00868)		(0.00504)		(0.00474)	
postsecondaward	-0.134**	-0.111**	0.0723**		0.0742**		0.0935**		0.0778**	
	(0.0125)	(0.0121)	(0.00453)		(0.0162)		(0.00747)		(0.00618)	
postthirdaward	-0.170**	-0.0914**	0.0413**		-0.00941		0.111**		0.0481**	
	(0.0224)	(0.0217)	(0.00872)		(0.0378)		(0.0195)		(0.0104)	
post1_x_assoc				0.142**		0.131**				
				(0.00498)		(0.00868)				
post1_x_long				0.0473**				0.0365**		
				(0.00373)				(0.00505)		
post1_x_short				0.0144**						0.0265**
				(0.00359)						(0.00474)
post2_x_assoc				0.103**		0.0448		0.0802**		0.135**
				(0.00667)		(0.0248)		(0.00968)		(0.00997)
post2_x_long				0.118**		0.127**		0.121**		0.110**
				(0.00842)		(0.0289)		(0.0122)		(0.0128)
post2_x_short				0.0326**		0.0645*		0.0775**		0.0267**
				(0.00721)		(0.0261)		(0.0200)		(0.00830)
post3_x_assoc				0.0832**		-0.0250		0.101**		0.0892**
				(0.0145)		(0.0579)		(0.0268)		(0.0182)
post3_x_long				0.118**		0.105		0.156**		0.0928**
				(0.0204)		(0.0810)		(0.0337)		(0.0271)
post3_x_short				0.0445**		-0.0547		0.0218		0.0633**
				(0.0121)		(0.0571)		(0.0460)		(0.0133)
enrolled		-0.103**	-0.127**	-0.121**	-0.186**	-0.186**	-0.103**	-0.103**	-0.120**	-0.118**
		(0.00495)	(0.00200)	(0.00201)	(0.00551)	(0.00551)	(0.00320)	(0.00320)	(0.00294)	(0.00294)
Observations	878,576	878,576	878,576	878,576	126,968	126,968	360,189	360,189	391,419	391,419
R-squared	0.038	0.177	0.560	0.560	0.575	0.575	0.533	0.533	0.576	0.576

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column is a separate model based on equation (1). Robust standard errors in parentheses. ** p<0.01, * p<0.05.

TABLE D7

Quarterly log earnings regression estimates, Health (TOP code 12)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Student FE			X	X	X	X	X	X	X	X
Age FE		X	X	X	X	X	X	X	X	X
Year-qtr FE		X	X	X	X	X	X	X	X	X
Sample	All Students with 1+ Award				1st Award: Associate degree		1st Award: Long-term certificate		1st Award: Short-term certificate	
postfirstaward	0.996**	0.626**	0.522**		0.867**		0.488**		0.0478**	
	(0.00403)	(0.00622)	(0.00284)		(0.00428)		(0.00581)		(0.00544)	
postsecondaward	-0.0915**	-0.0546**	0.106**		0.166**		0.305**		0.299**	
	(0.0103)	(0.00945)	(0.00418)		(0.00872)		(0.00708)		(0.00689)	
postthirdaward	-0.193**	-0.103**	0.0254**		0.0617		0.173**		0.0774**	
	(0.0238)	(0.0219)	(0.00940)		(0.0363)		(0.0221)		(0.0117)	
post1_x_assoc				0.872**		0.869**				
				(0.00327)		(0.00428)				
post1_x_long				0.484**				0.488**		
				(0.00370)				(0.00581)		
post1_x_short				0.156**						0.0667**
				(0.00350)						(0.00544)
post2_x_assoc				0.408**		0.269**		0.323**		0.614**
				(0.00533)		(0.0148)		(0.00728)		(0.00983)
post2_x_long				0.157**		0.0322*		0.0981**		0.311**
				(0.00970)		(0.0145)		(0.0265)		(0.0157)
post2_x_short				0.0408**		0.207**		0.0602		-0.0134
				(0.00767)		(0.0154)		(0.0426)		(0.00968)
post3_x_assoc				0.322**		0.282**		0.226**		0.325**
				(0.0132)		(0.0603)		(0.0252)		(0.0175)
post3_x_long				0.174**		0.0473		0.375**		0.193**
				(0.0262)		(0.0529)		(0.0627)		(0.0364)
post3_x_short				0.102**		-0.0232		-0.0901		0.0923**
				(0.0144)		(0.0873)		(0.0785)		(0.0162)
enrolled		-0.356**	-0.405**	-0.285**	-0.357**	-0.356**	-0.252**	-0.251**	-0.243**	-0.223**
		(0.00428)	(0.00178)	(0.00184)	(0.00289)	(0.00289)	(0.00353)	(0.00353)	(0.00331)	(0.00333)
Observations	1,643,821	1,643,821	1,643,821	1,643,821	873,316	873,316	357,789	357,789	412,716	412,716
R-squared	0.185	0.276	0.522	0.536	0.534	0.534	0.491	0.491	0.494	0.497

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column is a separate model based on equation (1). Robust standard errors in parentheses. ** p<0.01, * p<0.05.

TABLE D8

Quarterly log earnings regression estimates, Family & Consumer Sciences (TOP code 13)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Student FE			X	X	X	X	X	X	X	X
Age FE		X	X	X	X	X	X	X	X	X
Year-qtr FE		X	X	X	X	X	X	X	X	X
Sample	All Students with 1+ Award				1st Award: Associate degree		1st Award: Long-term certificate		1st Award: Short-term certificate	
postfirstaward	0.311**	0.177**	0.0776**		0.0956**		0.0686**		0.0757**	
	(0.00522)	(0.00843)	(0.00387)		(0.00753)		(0.0104)		(0.00507)	
postsecondaward	-0.0553**	-0.0465**	0.0310**		0.0845**		0.0730**		0.0190**	
	(0.0115)	(0.0115)	(0.00486)		(0.0159)		(0.0125)		(0.00584)	
postthirdaward	-0.0426	-0.0371	0.0103		0.338**		-0.179**		0.0235*	
	(0.0222)	(0.0219)	(0.00931)		(0.0471)		(0.0348)		(0.0102)	
post1_x_assoc				0.0947**		0.0958**				
				(0.00527)		(0.00753)				
post1_x_long				0.0813**				0.0686**		
				(0.00609)				(0.0104)		
post1_x_short				0.0729**						0.0782**
				(0.00418)						(0.00507)
post2_x_assoc				0.0691**		0.155**		0.0617**		0.0680**
				(0.00691)		(0.0426)		(0.0139)		(0.00840)
post2_x_long				0.0182		0.0868**		0.0672*		-0.0251
				(0.0121)		(0.0253)		(0.0295)		(0.0157)
post2_x_short				0.00324		0.0663**		0.166**		-0.0136
				(0.00697)		(0.0218)		(0.0335)		(0.00771)
post3_x_assoc				0.0525**		0.478**		-0.0940*		0.0697**
				(0.0130)		(0.0802)		(0.0434)		(0.0143)
post3_x_long				0.0243		0.476**		-0.631**		0.0647**
				(0.0231)		(0.131)		(0.0927)		(0.0248)
post3_x_short				-0.00331		0.234**		-0.239**		0.00276
				(0.0149)		(0.0624)		(0.0755)		(0.0160)
enrolled		-0.119**	-0.124**	-0.121**	-0.0775**	-0.0775**	-0.198**	-0.199**	-0.120**	-0.117**
		(0.00539)	(0.00232)	(0.00238)	(0.00479)	(0.00479)	(0.00643)	(0.00643)	(0.00301)	(0.00303)
Observations	710,520	710,520	710,520	710,520	179,550	179,550	108,475	108,475	422,495	422,495
R-squared	0.021	0.077	0.462	0.462	0.460	0.460	0.488	0.488	0.453	0.454

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column is a separate model based on equation (1). Robust standard errors in parentheses. ** p<0.01, * p<0.05.

TABLE D9

Quarterly log earnings regression estimates, Public & Protective Services (TOP code 21)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Student FE			X	X	X	X	X	X	X	X
Age FE		X	X	X	X	X	X	X	X	X
Year-qtr FE		X	X	X	X	X	X	X	X	X
Sample	All Students with 1+ Award				1st Award: Associate degree		1st Award: Long-term certificate		1st Award: Short-term certificate	
postfirstaward	0.612**	0.334**	0.149**		0.0750**		0.124**		0.186**	
	(0.00491)	(0.00770)	(0.00307)		(0.00611)		(0.00763)		(0.00403)	
postsecondaward	-0.119**	-0.102**	0.0563**		0.179**		0.0205		0.0283**	
	(0.0140)	(0.0138)	(0.00471)		(0.0120)		(0.0105)		(0.00588)	
postthirdaward	-0.0187	-0.00909	0.0683**		0.0322		0.236**		0.0485**	
	(0.0314)	(0.0301)	(0.0102)		(0.0323)		(0.0304)		(0.0116)	
post1_x_assoc				0.0896**		0.0753**				
				(0.00402)		(0.00611)				
post1_x_long				0.147**				0.125**		
				(0.00467)				(0.00763)		
post1_x_short				0.176**						0.186**
				(0.00334)						(0.00403)
post2_x_assoc				0.00664		-0.0896**		0.0141		0.00557
				(0.00641)		(0.0290)		(0.0113)		(0.00810)
post2_x_long				0.114**		0.201**		-0.0681		0.104**
				(0.0140)		(0.0229)		(0.0386)		(0.0201)
post2_x_short				0.0816**		0.242**		0.128**		0.0416**
				(0.00701)		(0.0153)		(0.0297)		(0.00819)
post3_x_assoc				-0.000859		-0.0634		0.148**		-0.0237
				(0.0185)		(0.0737)		(0.0379)		(0.0222)
post3_x_long				0.298**		0.246**		0.203*		0.342**
				(0.0314)		(0.0640)		(0.0910)		(0.0391)
post3_x_short				0.0238		-0.0453		0.466**		0.0277*
				(0.0130)		(0.0420)		(0.0596)		(0.0140)
enrolled		-0.0154**	-0.0574**	-0.0647**	-0.0781**	-0.0782**	-0.0747**	-0.0749**	-0.0546**	-0.0550**
		(0.00477)	(0.00181)	(0.00183)	(0.00367)	(0.00367)	(0.00454)	(0.00454)	(0.00238)	(0.00239)
Observations	1,016,133	1,016,133	1,016,133	1,016,133	291,802	291,802	166,360	166,360	557,971	557,971
R-squared	0.071	0.215	0.579	0.579	0.577	0.577	0.552	0.552	0.581	0.581

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column is a separate model based on equation (1). Robust standard errors in parentheses. ** p<0.01, * p<0.05.

Wage Returns by Region and Student Characteristics

The main student fixed effects models above, which compare an individual's earnings before and after an award, do not allow us to determine whether the returns of awards differ by student characteristics. To do so, we run separate models by groups. This equates to running model (1) for a particular subgroup, essentially averaging individual earnings returns for all individuals in the subgroup. The tables that follow estimate earnings returns by region, region-program, gender, gender-program, age, age-program, race/ethnicity and race-program. In some cases, to facilitate comparisons across multiple dimensions, we have estimated models for students whose first award is an associate degree.

Results by Region

TABLE D10

Student fixed effects models by region

	Northern	Sacramento	SF Bay Area	San Jose region	Central Valley	Central Coast	Los Angeles	Inland Empire	Orange County	San Diego region
postfirstaward	0.252**	0.172**	0.166**	0.142**	0.326**	0.231**	0.179**	0.147**	0.170**	0.147**
	(0.00733)	(0.00544)	(0.00332)	(0.00492)	(0.00416)	(0.00601)	(0.00282)	(0.00429)	(0.00485)	(0.00438)
postsecondaward	0.0427**	0.0198*	-0.0102*	0.0699**	-0.0294**	0.0206*	0.0668**	0.104**	0.0257**	-0.0204**
	(0.00958)	(0.00779)	(0.00429)	(0.00736)	(0.00590)	(0.00850)	(0.00355)	(0.00532)	(0.00681)	(0.00640)
postthirdaward	0.112**	0.00469	0.0345**	-0.00489	0.0436**	0.216**	-0.0647**	0.137**	0.0166	-0.0587**
	(0.0178)	(0.0182)	(0.00756)	(0.0164)	(0.0150)	(0.0168)	(0.00756)	(0.0111)	(0.0155)	(0.0162)
enrolled	-0.351**	-0.222**	-0.212**	-0.236**	-0.273**	-0.228**	-0.195**	-0.211**	-0.159**	-0.163**
	(0.00446)	(0.00335)	(0.00199)	(0.00308)	(0.00257)	(0.00361)	(0.00171)	(0.00257)	(0.00296)	(0.00270)
Observations	257,228	410,005	982,042	462,776	691,422	319,589	1,360,404	612,196	462,854	558,584
R-squared	0.489	0.540	0.560	0.533	0.537	0.544	0.546	0.533	0.555	0.537

SOURCE: Authors Calculations from COMIS and EDD

NOTE: Each column represents a separate regression model. All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05

TABLE D11

Student fixed effects models by region and award level

	Associates degree									
	Northern	**Sacramento**	**SF Bay**	**San Jose region**	**Central Valley**	**Central Coast**	**Los Angeles**	**Inland Empire**	**Orange County**	**San Diego**
postfirstaward	0.388**	0.329**	0.437**	0.263**	0.464**	0.408**	0.295**	0.316**	0.416**	0.275**
	(0.0127)	(0.00778)	(0.00801)	(0.00826)	(0.00628)	(0.0106)	(0.00499)	(0.00878)	(0.00933)	(0.00733)
postsecondaward	0.0421*	0.000433	-0.0379*	0.108**	-0.0146	0.0216	0.122**	0.0439**	-0.0381*	-0.0691**
	(0.0199)	(0.0142)	(0.0149)	(0.0151)	(0.0114)	(0.0206)	(0.00820)	(0.0130)	(0.0172)	(0.0154)
postthirdaward	0.0914*	-0.00781	-0.0294	-0.171**	0.0940*	-0.0989	-0.101**	0.147**	0.319**	0.0218
	(0.0437)	(0.0416)	(0.0428)	(0.0445)	(0.0394)	(0.0727)	(0.0263)	(0.0307)	(0.0502)	(0.0523)
enrolled	-0.344**	-0.243**	-0.296**	-0.273**	-0.290**	-0.236**	-0.235**	-0.271**	-0.231**	-0.225**
	(0.00794)	(0.00497)	(0.00513)	(0.00523)	(0.00412)	(0.00666)	(0.00323)	(0.00561)	(0.00590)	(0.00467)
Observations	89,450	209,255	215,955	193,288	336,936	111,108	487,643	165,569	146,503	222,519
R-squared	0.514	0.535	0.539	0.523	0.548	0.544	0.523	0.528	0.507	0.522
	Long-term Certificate									
	Northern	**Sacramento**	**SF Bay**	**San Jose region**	**Central Valley**	**Central Coast**	**Los Angeles**	**Inland Empire**	**Orange County**	**San Diego**
postfirstaward	0.345**	0.0131	0.175**	0.132**	0.352**	0.264**	0.140**	0.190**	0.0982**	0.102**
	(0.0148)	(0.0119)	(0.00796)	(0.0103)	(0.00990)	(0.0130)	(0.00574)	(0.0105)	(0.00889)	(0.00835)
postsecondaward	0.223**	0.185**	0.0752**	0.164**	0.0621**	0.00573	0.262**	0.0604**	0.203**	0.0848**
	(0.0178)	(0.0172)	(0.0101)	(0.0149)	(0.0127)	(0.0203)	(0.00644)	(0.0124)	(0.0125)	(0.0116)
postthirdaward	0.339**	0.150**	0.110**	0.222**	0.00754	0.202**	-0.0216	0.102**	0.0540	-0.00316
	(0.0411)	(0.0442)	(0.0291)	(0.0326)	(0.0374)	(0.0480)	(0.0182)	(0.0321)	(0.0395)	(0.0324)
enrolled	-0.327**	-0.110**	-0.192**	-0.158**	-0.224**	-0.203**	-0.198**	-0.208**	-0.116**	-0.0798**
	(0.00904)	(0.00741)	(0.00486)	(0.00650)	(0.00595)	(0.00789)	(0.00351)	(0.00628)	(0.00544)	(0.00523)
Observations	61,901	85,587	185,200	95,475	118,892	71,745	367,654	106,434	145,622	145,136
R-squared	0.494	0.525	0.525	0.541	0.509	0.553	0.533	0.528	0.559	0.553
	Short-term Certificate									
	Northern	**Sacramento**	**SF Bay**	**San Jose region**	**Central Valley**	**Central Coast**	**Los Angeles**	**Inland Empire**	**Orange County**	**San Diego**
postfirstaward	0.110**	0.0747**	0.0718**	0.0356**	0.127**	0.0825**	0.0793**	0.0489**	0.0370**	0.0517**
	(0.0117)	(0.0102)	(0.00415)	(0.00764)	(0.00697)	(0.00906)	(0.00435)	(0.00565)	(0.00736)	(0.00728)
postsecondaward	0.0252	0.0817**	0.0474**	0.122**	0.0782**	0.0899**	-0.00129	0.183**	0.0505**	0.0411**
	(0.0144)	(0.0117)	(0.00501)	(0.0101)	(0.00854)	(0.0109)	(0.00514)	(0.00671)	(0.00915)	(0.00898)
postthirdaward	0.130**	0.000110	0.0512**	0.0187	0.102**	0.248**	0.0223*	0.150**	0.0214	-0.0695**
	(0.0233)	(0.0235)	(0.00798)	(0.0203)	(0.0186)	(0.0190)	(0.00889)	(0.0129)	(0.0174)	(0.0201)
enrolled	-0.281**	-0.190**	-0.132**	-0.177**	-0.159**	-0.177**	-0.105**	-0.140**	-0.0737**	-0.117**
	(0.00719)	(0.00604)	(0.00248)	(0.00480)	(0.00424)	(0.00537)	(0.00257)	(0.00341)	(0.00439)	(0.00439)

Observations	105,877	115,163	580,887	174,013	235,594	136,736	505,107	340,193	170,729	190,929
R-squared	0.469	0.552	0.584	0.554	0.528	0.530	0.574	0.536	0.594	0.538

SOURCES: Authors Calculations from COMIS and EDD

NOTES: Each column represents a separate regression model. All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05

TABLE D12

Student fixed effects models by region and program

	Business									
	Northern	Sacramento	SF Bay	San Jose region	Central Valley	Central Coast	Los Angeles	Inland Empire	Orange County	San Diego region
postfirstaward	0.0398	0.0583**	0.0216*	-0.0171	0.0740**	0.0164	0.00361	-0.00812	0.0175	0.0148
	(0.0214)	(0.0121)	(0.00947)	(0.0130)	(0.0117)	(0.0162)	(0.00717)	(0.0122)	(0.0133)	(0.0119)
postsecondaward	0.154**	0.0983**	-0.0264*	0.0759**	0.0569**	-0.0256	0.0485**	0.0289	0.0322	-0.0112
	(0.0287)	(0.0181)	(0.0134)	(0.0189)	(0.0178)	(0.0259)	(0.00925)	(0.0183)	(0.0213)	(0.0175)
postthirdaward	0.175**	0.158**	-0.0511	-0.123**	-0.0138	-0.0451	0.0722**	-0.110**	-0.172**	-0.0616
	(0.0670)	(0.0430)	(0.0295)	(0.0415)	(0.0385)	(0.0486)	(0.0167)	(0.0395)	(0.0499)	(0.0371)
Enrolled	-0.244**	-0.145**	-0.142**	-0.163**	-0.166**	-0.103**	-0.116**	-0.124**	-0.0884**	-0.154**
	(0.0130)	(0.00746)	(0.00570)	(0.00802)	(0.00744)	(0.00973)	(0.00446)	(0.00747)	(0.00807)	(0.00733)
Observations	26,490	68,305	99,663	60,625	83,573	33,001	166,315	66,661	49,759	70,960
R-squared	0.513	0.580	0.570	0.554	0.552	0.597	0.576	0.578	0.572	0.562
	Information Technology									
	Northern	Sacramento	SF Bay	San Jose region	Central Valley	Central Coast	Los Angeles	Inland Empire	Orange County	San Diego region
postfirstaward	-0.127	0.0678**	-0.00152	0.0660*	-2.18e-07	-0.0383	-0.0247	-0.0394*	0.00134	-0.0567*
	(0.0672)	(0.0196)	(0.0194)	(0.0265)	(0.0338)	(0.0384)	(0.0160)	(0.0171)	(0.0261)	(0.0245)
postsecondaward	-0.429**	0.0548*	-0.0608*	0.173**	-0.212**	0.309**	-0.0272	0.0992**	-0.0575	-0.0870*
	(0.0880)	(0.0257)	(0.0305)	(0.0372)	(0.0574)	(0.0647)	(0.0225)	(0.0214)	(0.0388)	(0.0388)
postthirdaward	-0.535**	-0.0381	-0.419**	-0.109	0.407**	-0.191	0.0589	-0.00554	0.0587	-0.0951
	(0.176)	(0.0489)	(0.0693)	(0.0918)	(0.102)	(0.115)	(0.0461)	(0.0343)	(0.0748)	(0.0993)
Enrolled	-0.492**	-0.123**	-0.182**	-0.200**	-0.252**	-0.124**	-0.154**	-0.143**	-0.0259	-0.151**
	(0.0405)	(0.0119)	(0.0113)	(0.0159)	(0.0210)	(0.0224)	(0.00982)	(0.0103)	(0.0160)	(0.0153)
Observations	3,334	21,501	26,394	14,434	10,327	5,714	28,431	27,998	10,557	14,734
R-squared	0.519	0.604	0.582	0.570	0.589	0.621	0.619	0.626	0.609	0.585
	Engineering									
	Northern	Sacramento	SF Bay	San Jose region	Central Valley	Central Coast	Los Angeles	Inland Empire	Orange County	San Diego region
postfirstaward	0.176**	0.0207	0.0172	0.0282**	0.102**	0.0303	0.103**	0.0452**	0.0103	0.0146
	(0.0221)	(0.0117)	(0.0101)	(0.00751)	(0.0108)	(0.0208)	(0.00733)	(0.0129)	(0.0102)	-0.00776

postsecondaward	0.164**	0.189**	0.0387**	0.118**	0.0216	-0.0406	0.0344**	0.0733**	0.0784**	0.0409**
	(0.0283)	(0.0173)	(0.0129)	(0.0140)	(0.0163)	(0.0358)	(0.00956)	(0.0166)	(0.0122)	-0.0122
postthirdaward	-0.124	-0.0105	-0.0117	0.216**	0.143**	0.342**	0.0494*	-0.0155	0.000492	0.139**
	(0.0697)	(0.0386)	(0.0174)	(0.0283)	(0.0368)	(0.0809)	(0.0208)	(0.0348)	(0.0224)	-0.03
enrolled	-0.446**	-0.104**	-0.181**	-0.0684**	-0.200**	-0.182**	-0.172**	-0.133**	-0.0307**	-0.0368**
	(0.0144)	(0.00723)	(0.00614)	(0.00517)	(0.00692)	(0.0130)	(0.00450)	(0.00780)	(0.00609)	-0.00498
Observations	31,010	82,694	91,172	122,808	85,924	21,465	176,052	53,735	71,897	141,268
R-squared	0.492	0.511	0.590	0.509	0.547	0.579	0.557	0.575	0.585	0.511
Health										
	Northern	**Sacramento**	**SF Bay**	**San Jose region**	**Central Valley**	**Central Coast**	**Los Angeles**	**Inland Empire**	**Orange County**	**San Diego region**
postfirstaward	0.713**	0.774**	0.375**	0.526**	0.722**	0.451**	0.588**	0.314**	0.602**	0.588**
	(0.0146)	(0.0139)	(0.00670)	(0.0112)	(0.00758)	(0.0100)	(0.00662)	(0.00797)	(0.0112)	-0.0107
postsecondaward	0.141**	-0.00465	-0.0872**	0.104**	0.187**	0.0318*	0.208**	0.295**	-0.0169	0.112**
	(0.0203)	(0.0358)	(0.00956)	(0.0164)	(0.0136)	(0.0157)	(0.00824)	(0.0105)	(0.0203)	-0.0199
postthirdaward	0.257**	-0.150	-0.0498**	0.0547	0.108*	0.251**	-0.0461	0.336**	-0.199*	-0.281**
	(0.0461)	(0.133)	(0.0152)	(0.0417)	(0.0486)	(0.0284)	(0.0316)	(0.0224)	(0.0776)	-0.0755
enrolled	-0.432**	-0.425**	-0.386**	-0.471**	-0.409**	-0.355**	-0.352**	-0.401**	-0.340**	-0.354**
	(0.00891)	(0.00919)	(0.00408)	(0.00708)	(0.00489)	(0.00619)	(0.00420)	(0.00492)	(0.00718)	-0.00676
Observations	65,769	78,768	284,323	117,576	238,765	120,768	310,853	200,935	110,432	113,178
R-squared	0.523	0.535	0.525	0.517	0.547	0.519	0.524	0.515	0.499	0.51
Family and Consumer Sciences										
	Northern	**Sacramento**	**SF Bay**	**San Jose region**	**Central Valley**	**Central Coast**	**Los Angeles**	**Inland Empire**	**Orange County**	**San Diego region**
postfirstaward	0.103**	0.0761**	0.120**	0.117**	0.117**	0.110**	0.0468**	0.0748**	0.0173	0.0665**
	(0.0231)	(0.0157)	(0.00947)	(0.0185)	(0.0116)	(0.0202)	(0.00680)	(0.0127)	(0.0199)	-0.0127
postsecondaward	-0.00725	0.0928**	0.0332**	0.102**	0.0345*	0.0634*	0.0188*	0.00973	0.120**	0.0169
	(0.0287)	(0.0217)	(0.0122)	(0.0264)	(0.0147)	(0.0295)	(0.00817)	(0.0148)	(0.0244)	-0.0166
postthirdaward	0.108*	-0.107**	0.0502*	-0.0581	0.226**	0.193**	-0.0102	-0.00415	0.0212	-0.208**
	(0.0548)	(0.0414)	(0.0243)	(0.0582)	(0.0328)	(0.0659)	(0.0137)	(0.0335)	(0.0434)	-0.0385
enrolled	-0.0824**	-0.132**	-0.115**	-0.123**	-0.108**	-0.171**	-0.125**	-0.127**	-0.191**	-0.0876**
	(0.0131)	(0.00947)	(0.00565)	(0.0114)	(0.00697)	(0.0121)	(0.00406)	(0.00761)	(0.0123)	-0.00788

Observations	22,623	46,794	119,848	32,901	77,850	28,635	215,643	72,581	26,491	65,318
R-squared	0.413	0.451	0.476	0.475	0.427	0.448	0.478	0.418	0.484	0.469
Public and Protective Services										
	Northern	**Sacramento**	**SF Bay**	**San Jose region**	**Central Valley**	**Central Coast**	**Los Angeles**	**Inland Empire**	**Orange County**	**San Diego region**
postfirstaward	0.171**	0.112**	0.136**	0.0623**	0.167**	0.144**	0.149**	0.217**	0.140**	0.110**
	(0.0151)	(0.0173)	(0.00634)	(0.0171)	(0.00938)	(0.0141)	(0.00611)	(0.00922)	(0.0104)	-0.012
postsecondaward	0.00703	0.0710**	0.0932**	0.0575	0.118**	0.1000**	0.0382**	-0.00689	0.132**	-0.0623**
	(0.0227)	(0.0263)	(0.00892)	(0.0317)	(0.0162)	(0.0228)	(0.00926)	(0.0145)	(0.0166)	-0.0179
postthirdaward	0.00871	0.395**	0.141**	0.0506	0.0203	0.169**	0.0148	0.000533	0.0638	0.0906
	(0.0340)	(0.0843)	(0.0165)	(0.0793)	(0.0584)	(0.0653)	(0.0219)	(0.0346)	(0.0451)	-0.0478
enrolled	-0.251**	-0.0857**	-0.0454**	-0.0669**	-0.0923**	-0.0359**	-0.0231**	-0.0149**	-0.0255**	-0.0785**
	(0.00892)	(0.0102)	(0.00384)	(0.0103)	(0.00547)	(0.00798)	(0.00355)	(0.00538)	(0.00615)	-0.00705
Observations	62,252	38,527	216,993	37,585	118,096	49,368	235,042	107,911	79,802	70,429
R-squared	0.485	0.559	0.602	0.554	0.570	0.596	0.585	0.555	0.582	0.558

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model. All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D13

Student fixed effects models by region and program, for students whose first award is an associate degree

Region	Northern						Sacramento					
Program (2-digit TOP code)	Business	IT	Engineering	Health	Family and Consumer Sciences	Public and Protective Services	Business	IT	Engineering	Health	Family and Consumer Sciences	Public and Protective Services
postfirstaward	0.0107	0.0365	0.164**	1.010**	0.126**	0.0328	0.0601**	0.0904**	0.209**	0.902**	0.0941**	0.0802**
	(0.0267)	(0.0952)	(0.0481)	(0.0213)	(0.0381)	(0.0347)	(0.0149)	(0.0293)	(0.0262)	(0.0153)	(0.0285)	(0.0211)
postsecondaward	0.220**	0.279	-0.109	0.158**	-0.257*	0.246**	0.0555	0.238**	0.207**	0.196**	0.0356	0.0438
	(0.0481)	(0.177)	(0.0947)	(0.0400)	(0.128)	(0.0494)	(0.0315)	(0.0552)	(0.0466)	(0.0604)	(0.0584)	(0.0438)
postthirdaward	-0.164		0.145	0.760**	0.528**	-0.179*	0.380**	0.462	-0.389**	-0.161	0.575**	0.806**
	(0.171)		(0.165)	(0.150)	(0.202)	(0.0881)	(0.0797)	(0.268)	(0.119)	(0.335)	(0.195)	(0.167)
enrolled	-0.213**	-0.182**	-0.388**	-0.446**	-0.0561*	-0.198**	-0.0930**	-0.112**	-0.175**	-0.401**	-0.0638**	-0.0768**
	(0.0166)	(0.0612)	(0.0303)	(0.0139)	(0.0232)	(0.0206)	(0.00967)	(0.0183)	(0.0168)	(0.0103)	(0.0181)	(0.0125)
Observations	16,283	1,524	6,832	32,668	8,119	12,138	44,856	10,146	15,489	67,706	14,448	25,438
R-squared	0.543	0.572	0.487	0.565	0.461	0.527	0.584	0.597	0.594	0.537	0.447	0.571

	SF Bay						San Jose region					
Program (2-digit TOP code)	Business	IT	Engineering	Health	Family and Consumer Sciences	Public and Protective Services	Business	IT	Engineering	Health	Family and Consumer Sciences	Public and Protective Services
postfirstaward	0.0406*	0.0153	0.125**	0.970**	0.157**	0.0694**	0.00462	0.00255	0.0591*	0.785**	0.134**	0.00971
	(0.0165)	(0.0385)	(0.0287)	(0.0130)	(0.0267)	(0.0203)	(0.0172)	(0.0382)	(0.0301)	(0.0154)	(0.0286)	(0.0196)
postsecondaward	0.00380	-0.0222	0.0674	0.0779*	0.232**	0.191**	0.285**	-0.115	0.259**	0.186**	-0.112	0.147**
	(0.0360)	(0.0905)	(0.0567)	(0.0333)	(0.0891)	(0.0356)	(0.0380)	(0.0892)	(0.0461)	(0.0284)	(0.0621)	(0.0542)
postthirdaward	-0.145	0.248	0.655*	0.0916	0.377	0.133	-0.222	1.343**	-0.254**	0.828**	-0.0815	0.117
	(0.0998)	(0.203)	(0.289)	(0.124)	(0.365)	(0.0941)	(0.114)	(0.221)	(0.0809)	(0.224)	(0.158)	(0.207)
enrolled	-0.120**	-0.101**	-0.165**	-0.363**	-0.0618**	-0.0753**	-0.126**	-0.148**	-0.108**	-0.450**	-0.119**	-0.0556**
	(0.0107)	(0.0244)	(0.0180)	(0.00870)	(0.0165)	(0.0121)	(0.0111)	(0.0235)	(0.0193)	(0.0102)	(0.0181)	(0.0120)
Observations	34,381	6,249	11,389	103,097	14,336	27,972	35,247	6,511	8,916	67,674	13,809	28,410
R-squared	0.591	0.605	0.588	0.550	0.496	0.583	0.560	0.602	0.624	0.529	0.470	0.566

Region	Central Valley						Central Coast					
Program (2-digit TOP code)	Business	IT	Engineering	Health	Family and Consumer Sciences	Public and Protective Services	Business	IT	Engineering	Health	Family and Consumer Sciences	Public and Protective Services
postfirstaward	0.0177	0.0671	0.151**	1.021**	0.132**	0.0780**	0.0597*	0.0572	0.0137	0.899**	0.105**	0.140**
	(0.0141)	(0.0452)	(0.0239)	(0.0103)	(0.0156)	(0.0157)	(0.0240)	(0.0497)	(0.0434)	(0.0186)	(0.0345)	(0.0228)
postsecondaward	0.119**	-0.437**	0.137**	0.169**	0.141**	0.162**	-0.00675	-0.124	0.149	0.285**	0.127	0.363**
	(0.0331)	(0.118)	(0.0448)	(0.0239)	(0.0315)	(0.0323)	(0.0755)	(0.119)	(0.0984)	(0.0485)	(0.107)	(0.0560)
postthirdaward	0.107	1.216**	0.0824	0.351**	0.405**	-0.654**	-0.126		0.748**	-0.606*	0.748**	-3.656**
	(0.0877)	(0.282)	(0.0986)	(0.109)	(0.0974)	(0.158)	(0.180)		(0.247)	(0.271)	(0.193)	(0.612)
enrolled	-0.118**	-0.204**	-0.236**	-0.340**	-0.0595**	-0.134**	-0.0703**	-0.0491	-0.220**	-0.322**	-0.186**	-0.0614**
	(0.00918)	(0.0292)	(0.0157)	(0.00717)	(0.00989)	(0.00960)	(0.0152)	(0.0299)	(0.0284)	(0.0123)	(0.0216)	(0.0132)
Observations	52,326	6,122	16,893	149,091	38,764	49,055	16,323	3,242	4,990	44,740	10,090	18,651
R-squared	0.581	0.581	0.589	0.570	0.429	0.572	0.588	0.623	0.602	0.528	0.469	0.629
Region	Los Angeles						Inland Empire					
Program (2-digit TOP code)	Business	IT	Engineering	Health	Family and Consumer Sciences	Public and Protective Services	Business	IT	Engineering	Health	Family and Consumer Sciences	Public and Protective Services
postfirstaward	0.0127	-0.0359	0.153**	0.793**	0.0345*	0.0481**	0.00919	-0.0860*	0.125**	0.861**	0.117**	0.0635**
	(0.0102)	(0.0243)	(0.0162)	(0.00927)	(0.0150)	(0.0124)	(0.0166)	(0.0352)	(0.0389)	(0.0152)	(0.0295)	(0.0228)
postsecondaward	0.0430*	0.132**	0.0717*	0.218**	0.0583*	0.240**	0.0496	-0.0771	0.0365	0.0832**	0.0681	0.0666
	(0.0213)	(0.0436)	(0.0325)	(0.0144)	(0.0297)	(0.0213)	(0.0405)	(0.0694)	(0.0656)	(0.0219)	(0.0633)	(0.0490)
postthirdaward	0.192**	-0.0498	0.0636	-0.00579	0.291**	0.0525	-0.193*		-0.0360	0.00239	0.464*	0.392**
	(0.0532)	(0.114)	(0.0841)	(0.138)	(0.0999)	(0.0567)	(0.0963)		(0.116)	(0.0488)	(0.198)	(0.0955)
enrolled	-0.0958**	-0.157**	-0.171**	-0.303**	-0.0715**	-0.0716**	-0.0924**	-0.185**	-0.172**	-0.372**	-0.0473*	-0.0770**
	(0.00669)	(0.0156)	(0.0102)	(0.00628)	(0.00970)	(0.00749)	(0.0105)	(0.0223)	(0.0241)	(0.0104)	(0.0191)	(0.0136)
Observations	84,863	13,297	33,224	190,979	40,252	64,385	35,409	7,398	7,368	66,982	12,703	20,364
R-squared	0.581	0.603	0.561	0.522	0.480	0.571	0.575	0.611	0.563	0.540	0.459	0.598

Region	Orange County						San Diego region					
Program (2-digit TOP code)	Business	IT	Engineering	Health	Family and Consumer Sciences	Public and Protective Services	Business	IT	Engineering	Health	Family and Consumer Sciences	Public and Protective Services
postfirstaward	0.0101	-0.000690	0.0932*	0.853**	0.159**	0.125**	0.00474	-0.000911	0.0439	0.719**	0.0590**	0.112**
	(0.0189)	(0.0440)	(0.0393)	(0.0152)	(0.0402)	(0.0256)	(0.0170)	(0.0308)	(0.0237)	(0.0136)	(0.0227)	(0.0186)
postsecondaward	0.156**	-0.180	-0.0331	0.272**	0.322**	0.137**	-0.00469	0.215	-0.173**	0.0693	-0.0153	0.0981
	(0.0453)	(0.145)	(0.0579)	(0.0630)	(0.0623)	(0.0410)	(0.0467)	(0.120)	(0.0515)	(0.0392)	(0.0460)	(0.0513)
postthirdaward	-0.233	-1.544**	0.570**		0.345*	0.251*	0.0472	0.766**	-0.271	0.461	0.234	-0.128
	(0.131)	(0.396)	(0.167)		(0.150)	(0.100)	(0.157)	(0.265)	(0.206)	(0.266)	(0.184)	(0.136)
enrolled	-0.0860**	-0.0472	-0.118**	-0.331**	-0.0423	0.000174	-0.140**	-0.151**	-0.175**	-0.341**	-0.0758**	-0.0584**
	(0.0121)	(0.0283)	(0.0245)	(0.0101)	(0.0255)	(0.0150)	(0.0110)	(0.0203)	(0.0147)	(0.00902)	(0.0145)	(0.0113)
Observations	26,763	3,814	5,774	71,232	7,087	14,279	35,722	8,750	16,027	76,811	19,582	31,025
R-squared	0.554	0.644	0.590	0.500	0.515	0.624	0.561	0.627	0.587	0.509	0.463	0.574

SOURCES: Author's calculations from COMIS and EDD.

NOTES: Each region-program sub-column represents a separate regression model. All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D14

Number of students earning an associate degree by program and region

	Business	IT	Engineering	Health	Family and Consumer Sciences	Public and Protective Services	Total
Northern	1,008	171	1,274	2,126	886	2,161	7,626
Sacramento	2,320	735	2,628	2,303	1,731	1,262	10,979
SF Bay Area	3,425	990	3,096	9,227	4,449	6,591	27,778
San Jose region	2,174	540	3,514	3,768	1,229	1,182	12,407
Central Valley	3,042	413	2,908	7,190	2,744	3,728	20,025
Central Coast	1,195	211	747	4,005	1,090	1,575	8,823
Los Angeles	5,758	976	5,903	9,616	7,878	7,318	37,449
Inland Empire	2,517	985	1,837	6,993	2,784	3,579	18,695
Orange County	1,740	364	2,213	3,390	966	2,427	11,100
San Diego region	2,624	550	4,141	3,459	2,391	2,353	15,518
Total	25,803	5,935	28,261	52,077	26,148	32,176	

SOURCES: Author's calculations from COMIS

Results by Gender, Race/Ethnicity, and Age

Table D15 provides overall earnings returns for each of the demographic groups we focus on in the report. These estimates, however, do not account for differences in the program areas or credential lengths completed by students across these groups, which as we have seen can have a large impact on the observed returns to credentials. To address this, for each demographic group, we present a set of five tables that provide earnings returns for 1) only the program area, 2) only the credential level, 3) program area for associate degrees, 4) program area for long-term certificates and 5) program area for short-term certificates. We highlight differences in earnings returns to associate degrees by program area across groups in the report, but include returns to long certificates and short certificates by program area for each group here as a point of comparison

TABLE D15

Student fixed effects models by gender, race/ethnicity, and age

	Female	Male	Hispanic	Asian/PI	Black	White	Age 18-22	Age 23-27	Age 28-37	Age 38-54
postfirstaward	0.241**	0.119**	0.154**	0.235**	0.129**	0.205**	0.215**	0.267**	0.215**	0.116**
	(0.00190)	(0.00192)	(0.00233)	(0.00354)	(0.00558)	(0.00206)	(0.00369)	(0.00304)	(0.00260)	(0.00251)
postsecondaward	0.00949**	0.0524**	0.0349**	0.0288**	0.0188*	0.0342**	0.0900**	0.0408**	0.00457	-0.0103**
	(0.00250)	(0.00262)	(0.00310)	(0.00458)	(0.00744)	(0.00279)	(0.00412)	(0.00384)	(0.00354)	(0.00333)
postthirdaward	0.0319**	0.0169**	0.00851	-0.0540**	0.0305	0.0722**	0.101**	0.0283**	-0.0304**	0.000509
	(0.00553)	(0.00515)	(0.00667)	(0.00931)	(0.0165)	(0.00576)	(0.00760)	(0.00833)	(0.00786)	(0.00720)
enrolled	-0.263**	-0.157**	-0.176**	-0.255**	-0.225**	-0.224**	-0.125**	-0.192**	-0.250**	-0.242**
	(0.00116)	(0.00116)	(0.00141)	(0.00219)	(0.00331)	(0.00125)	(0.00210)	(0.00170)	(0.00153)	(0.00152)
Observations	3,395,821	2,719,216	1,871,184	880,678	419,780	2,753,487	1,112,864	1,514,063	1,686,902	1,601,876
R-squared	0.519	0.562	0.533	0.544	0.530	0.553	0.504	0.482	0.508	0.565

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted. All students of that subgroup are included regardless of the CE program or award type earned. All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D16

Student fixed effects models by gender and program

	Business		IT		Engineering		Health		Family and Consumer		Public and Protective	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
postfirstaward	0.0257**	0.00282	-0.0231	-0.00782	0.0644**	0.0417**	0.583**	0.364**	0.0803**	0.0401**	0.144**	0.151**
	(0.00430)	(0.00683)	(0.0145)	(0.00845)	(0.0144)	(0.00328)	(0.00339)	(0.00519)	(0.00408)	(0.0124)	(0.00586)	(0.00359)
postsecondaward	0.0465**	0.00217	0.0785**	-0.0177	0.0686**	0.0726**	0.123**	0.0694**	0.0354**	-0.0153	0.0385**	0.0586**
	(0.00593)	(0.0108)	(0.0198)	(0.0121)	(0.0202)	(0.00465)	(0.00492)	(0.00796)	(0.00507)	(0.0173)	(0.00876)	(0.00557)
postthirdaward	0.0169	-0.0217	-0.116*	0.00174	0.173**	0.0336**	0.102**	-0.108**	0.00804	0.0357	0.115**	0.0433**
	(0.0122)	(0.0216)	(0.0455)	(0.0222)	(0.0391)	(0.00896)	(0.0121)	(0.0151)	(0.00983)	(0.0293)	(0.0205)	(0.0118)
enrolled	-0.146**	-0.126**	-0.135**	-0.176**	-0.139**	-0.126**	-0.410**	-0.379**	-0.115**	-0.214**	-0.0509**	-0.0629**
	(0.00263)	(0.00423)	(0.00870)	(0.00512)	(0.00874)	(0.00205)	(0.00215)	(0.00318)	(0.00243)	(0.00779)	(0.00351)	(0.00211)
Observations	522,209	202,553	45,072	118,148	52,672	824,001	1,201,049	441,015	635,989	73,488	298,961	716,359
R-squared	0.560	0.592	0.598	0.601	0.558	0.559	0.516	0.541	0.455	0.509	0.550	0.584

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is earned in the given program (based on 2-digit TOP code, and including awards of any length). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D17

Student fixed effects models by gender and award level

	Associate		Long-term Certificate		Short-term Certificate	
	Female	**Male**	**Female**	**Male**	**Female**	**Male**
postfirstaward	0.435**	0.2033**	0.2190**	0.1098**	0.06695**	0.0726**
	(0.0031)	(0.0038)	(0.0044)	(0.0038)	(0.0029)	(0.0028)
postsecondaward	0.00605	0.0815**	0.1874**	0.1334**	0.08770**	0.05035**
	(0.0056)	(0.0065)	(0.0052)	(0.0051)	(0.0034)	(0.0035)
postthirdaward	0.0366*	-0.0092	0.08437**	0.0721**	0.08318**	0.03732**
	(0.0183)	(0.0170)	(0.0144)	(0.0137)	(0.0064)	(0.0060)
enrolled	-0.2799**	-0.2112**	-0.2167**	-0.1254**	-0.15661**	-0.11944**
	(0.0020)	(0.0024)	(0.0027)	(0.0023)	(0.0018)	(0.0017)
Observations	1,415,551	763,877	696,525	686,249	1,283,745	1,269,090
R-squared	0.5158	0.5581	0.4992	0.5414	0.5191	0.5767

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is of the length noted (regardless of the program area in which it is earned). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D18

Student fixed effects models by gender and program, for students whose first award is an associate degree

	Business		IT		Engineering		Health		Family and Consumer		Public and Protective	
	Female	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**
postfirstaward	0.0189**	0.0253**	-0.0535*	0.0124	0.0861**	0.137**	0.902**	0.734**	0.102**	-0.00665	0.0923**	0.0641**
	(0.00604)	(0.00924)	(0.0238)	(0.0132)	(0.0313)	(0.00903)	(0.00486)	(0.00891)	(0.00776)	(0.0320)	(0.0109)	(0.00734)
postsecondaward	0.118**	-0.00373	0.120*	0.0194	0.170**	0.0624**	0.165**	0.184**	0.0894**	-0.0103	0.141**	0.165**
	(0.0127)	(0.0250)	(0.0530)	(0.0281)	(0.0569)	(0.0169)	(0.00998)	(0.0177)	(0.0167)	(0.0547)	(0.0237)	(0.0138)
postthirdaward	0.0715*	0.0869	0.622**	0.268**	-0.399**	0.0707	0.218**	-0.390**	0.359**	0.0384	0.0179	0.0205
	(0.0358)	(0.0578)	(0.171)	(0.0836)	(0.105)	(0.0410)	(0.0431)	(0.0661)	(0.0490)	(0.172)	(0.0636)	(0.0372)
enrolled	-0.112**	-0.106**	-0.145**	-0.137**	-0.212**	-0.185**	-0.353**	-0.368**	-0.0691**	-0.207**	-0.0923**	-0.0778**
	(0.00389)	(0.00595)	(0.0150)	(0.00838)	(0.0193)	(0.00575)	(0.00330)	(0.00591)	(0.00492)	(0.0214)	(0.00674)	(0.00435)
Observations	265,424	116,501	17,283	49,770	12,250	114,518	695,313	177,285	168,026	11,414	98,230	193,469
R-squared	0.571	0.580	0.600	0.600	0.572	0.576	0.528	0.554	0.457	0.511	0.524	0.595

SOURCES: Authors Calculations from COMIS and EDD

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is an Associate degree earned in the given program (based on 2-digit TOP code). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05

TABLE D19

Student fixed effects models by gender and program, for students whose first award is a long-term certificate

	Business		IT		Engineering		Health		Family and Consumer		Public and Protective	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
postfirstaward	0.0459**	-0.0197	0.0148	-0.0769*	0.0116	0.0383**	0.510**	0.441**	0.0737**	0.0310	0.133**	0.121**
	(0.0139)	(0.0254)	(0.0482)	(0.0310)	(0.0276)	(0.00512)	(0.00699)	(0.0104)	(0.0117)	(0.0233)	(0.0145)	(0.00895)
postsecondaward	-0.00747	0.0739**	-0.148**	0.0610	0.0236	0.0977**	0.309**	0.317**	0.0708**	0.0733*	0.0199	0.0326*
	(0.0143)	(0.0277)	(0.0515)	(0.0337)	(0.0376)	(0.00761)	(0.00824)	(0.0139)	(0.0136)	(0.0317)	(0.0189)	(0.0127)
postthirdaward	0.109**	0.0129	-0.000256	0.122	0.427**	0.0897**	0.205**	0.0225	-0.233**	0.270**	0.224**	0.231**
	(0.0291)	(0.0672)	(0.176)	(0.0627)	(0.0925)	(0.0200)	(0.0253)	(0.0468)	(0.0369)	(0.103)	(0.0636)	(0.0344)
enrolled	-0.142**	-0.155**	-0.115**	-0.160**	-0.149**	-0.100**	-0.255**	-0.245**	-0.186**	-0.247**	-0.0946**	-0.0676**
	(0.00839)	(0.0152)	(0.0290)	(0.0181)	(0.0167)	(0.00325)	(0.00423)	(0.00635)	(0.00714)	(0.0148)	(0.00875)	(0.00531)
Observations	47,718	13,933	4,268	9,083	16,699	342,673	257,232	100,237	85,166	23,089	50,664	115,504
R-squared	0.563	0.606	0.636	0.596	0.537	0.531	0.469	0.516	0.486	0.509	0.509	0.556

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is a long-term certificate earned in the given program (based on 2-digit TOP code). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D20

Student fixed effects models by gender and program, for students whose first award is a short-term certificate

	Business		IT		Engineering		Health		Family and Consumer		Public and Protective	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
postfirstaward	0.0491**	-0.0158	-0.00819	0.000261	0.0706**	0.0213**	0.0656**	0.0217*	0.0770**	0.0582**	0.164**	0.195**
	(0.00697)	(0.0113)	(0.0202)	(0.0119)	(0.0202)	(0.00488)	(0.00706)	(0.00856)	(0.00532)	(0.0168)	(0.00799)	(0.00467)
postsecondaward	0.0205*	0.0230	0.136**	-0.0276	0.0739**	0.0775**	0.404**	0.115**	0.0255**	-0.0614**	0.00433	0.0375**
	(0.00827)	(0.0141)	(0.0248)	(0.0153)	(0.0266)	(0.00636)	(0.00852)	(0.0119)	(0.00606)	(0.0226)	(0.0110)	(0.00695)
postthirdaward	-0.00318	-0.0348	-0.193**	-0.0170	0.216**	0.0397**	0.153**	0.00145	0.0218*	0.0565	0.113**	0.0198
	(0.0153)	(0.0253)	(0.0505)	(0.0255)	(0.0470)	(0.0107)	(0.0155)	(0.0181)	(0.0108)	(0.0328)	(0.0230)	(0.0133)
enrolled	-0.184**	-0.128**	-0.119**	-0.189**	-0.108**	-0.120**	-0.256**	-0.215**	-0.113**	-0.191**	-0.0359**	-0.0617**
	(0.00420)	(0.00681)	(0.0119)	(0.00717)	(0.0123)	(0.00303)	(0.00433)	(0.00515)	(0.00315)	(0.0105)	(0.00482)	(0.00274)
Observations	209,067	72,119	23,521	59,295	23,723	366,810	248,504	163,493	382,797	38,985	150,067	407,386
R-squared	0.546	0.611	0.592	0.604	0.574	0.576	0.484	0.510	0.445	0.512	0.566	0.582

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is a short-term certificate earned in the given program (based on 2-digit TOP code). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

Race/Ethnicity

TABLE D21

Student fixed effects models by race/ethnicity and program

	Business				Information Technology				Engineering			
	Latinx	Asian	Black	White	Latinx	Asian	Black	White	Latinx	Asian	Black	White
postfirstaward	0.0288**	0.0369**	-0.0141	0.00897	-0.0160	-0.00504	-0.0359	-0.00473	0.0479**	0.0348**	0.0345*	0.0507**
	(0.00680)	(0.00833)	(0.0155)	(0.00544)	(0.0149)	(0.0161)	(0.0344)	(0.0105)	(0.00525)	(0.00838)	(0.0176)	(0.00493)
postsecondaward	0.0186	0.0720**	-0.0438	0.0366**	-0.0185	0.0128	0.154**	0.0162	0.0644**	0.0609**	0.0913**	0.0718**
	(0.00978)	(0.0112)	(0.0229)	(0.00788)	(0.0198)	(0.0229)	(0.0566)	(0.0148)	(0.00746)	(0.0104)	(0.0246)	(0.00734)
postthirdaward	0.00232	-0.0176	-0.148**	0.0692**	-0.102**	-0.0512	0.162	-0.0114	0.0143	0.00769	0.216**	0.0532**
	(0.0187)	(0.0229)	(0.0482)	(0.0170)	(0.0363)	(0.0476)	(0.104)	(0.0285)	(0.0154)	(0.0166)	(0.0581)	(0.0148)

enrolled	-0.119**	-0.135**	-0.163**	-0.147**	-0.128**	-0.129**	-0.190**	-0.192**	-0.120**	-0.154**	-0.138**	-0.118**
	(0.00416)	(0.00520)	(0.00919)	(0.00336)	(0.00903)	(0.00983)	(0.0205)	(0.00628)	(0.00325)	(0.00520)	(0.0106)	(0.00311)
Observations	201,949	131,356	51,311	317,643	34,526	33,056	10,743	79,355	310,201	117,739	41,175	372,871
R-squared	0.551	0.562	0.558	0.592	0.591	0.595	0.550	0.614	0.538	0.562	0.525	0.575
	Health				**Family and Consumer Science**				**Public and Protective Services**			
	Latinx	**Asian**	**Black**	**White**	**Latinx**	**Asian**	**Black**	**White**	**Latinx**	**Asian**	**Black**	**White**
postfirstaward	0.479**	0.519**	0.388**	0.570**	0.0782**	0.133**	0.0529**	0.0580**	0.131**	0.165**	0.136**	0.161**
	(0.00551)	(0.00626)	(0.0111)	(0.00427)	(0.00552)	(0.0109)	(0.0136)	(0.00724)	(0.00509)	(0.0120)	(0.0122)	(0.00438)
postsecondaward	0.122**	0.162**	0.102**	0.0830**	0.0190**	0.0438**	0.0271	0.0381**	0.0415**	-0.0175	0.110**	0.0589**
	(0.00806)	(0.00912)	(0.0168)	(0.00633)	(0.00684)	(0.0140)	(0.0168)	(0.00923)	(0.00788)	(0.0183)	(0.0186)	(0.00667)
postthirdaward	0.103**	-0.0872**	0.237**	0.0243	-0.00621	-0.0462	0.0415	0.0297	0.0317	0.0913*	0.0661	0.0681**
	(0.0210)	(0.0233)	(0.0428)	(0.0128)	(0.0136)	(0.0259)	(0.0298)	(0.0176)	(0.0184)	(0.0405)	(0.0428)	(0.0140)
enrolled	-0.362**	-0.387**	-0.319**	-0.441**	-0.0806**	-0.124**	-0.191**	-0.166**	-0.0640**	-0.0294**	-0.0662**	-0.0557**
	(0.00342)	(0.00399)	(0.00683)	(0.00267)	(0.00328)	(0.00676)	(0.00794)	(0.00439)	(0.00299)	(0.00710)	(0.00718)	(0.00258)
Observations	396,582	340,500	110,224	751,451	311,737	69,749	224,759	83,598	339,251	62,110	73,550	512,934
R-squared	0.523	0.533	0.495	0.522	0.440	0.473	0.473	0.496	0.572	0.593	0.568	0.585

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is earned in the given program (based on 2-digit TOP code, and including awards of any length). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D22

Student fixed effects models by race/ethnicity and award level

	Associate				Long-term				Short-term			
	Latinx	Asian	Black	White	Latinx	Asian	Black	White	Latinx	Asian	Black	White
postfirstaward	0.279**	0.442**	0.200**	0.383**	0.132**	0.210**	0.133**	0.171**	0.0791**	0.0434**	0.0781**	0.0690**
	(0.00433)	(0.00617)	(0.0103)	(0.00358)	(0.00502)	(0.00728)	(0.0113)	(0.00447)	(0.00337)	(0.00544)	(0.00839)	(0.00310)
postsecondaward	0.0670**	0.0566**	-0.0431*	0.0284**	0.144**	0.181**	0.135**	0.189**	0.0480**	0.0970**	0.0559**	0.0727**
	(0.00738)	(0.0107)	(0.0180)	(0.00649)	(0.00642)	(0.00833)	(0.0144)	(0.00575)	(0.00411)	(0.00646)	(0.0102)	(0.00375)
postthirdaward	0.0139	-0.0270	0.0992	0.0380*	0.0143	0.0275	0.0853*	0.119**	0.0454**	-0.0139	0.0641**	0.0985**
	(0.0210)	(0.0314)	(0.0703)	(0.0190)	(0.0190)	(0.0208)	(0.0415)	(0.0156)	(0.00769)	(0.0110)	(0.0191)	(0.00664)
enrolled	-0.214**	-0.302**	-0.263**	-0.270**	-0.149**	-0.185**	-0.205**	-0.174**	-0.118**	-0.152**	-0.158**	-0.141**
	(0.00279)	(0.00403)	(0.00642)	(0.00229)	(0.00306)	(0.00448)	(0.00673)	(0.00274)	(0.00200)	(0.00333)	(0.00494)	(0.00186)
Observations	595,522	353,740	129,954	1,039,416	423,399	203,222	111,140	597,620	852,263	323,716	178,686	1,116,451
R-squared	0.521	0.545	0.521	0.533	0.526	0.526	0.509	0.554	0.544	0.562	0.540	0.577

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is of the length noted (regardless of the program area in which it is earned). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D23

Student fixed effects models by race/ethnicity and program, for students whose first award is an associate degree

	Business				Information Technology				Engineering			
	Latinx	**Asian**	**Black**	**White**	**Latinx**	**Asian**	**Black**	**White**	**Latinx**	**Asian**	**Black**	**White**
postfirstaward	0.0124	0.0321*	-0.00723	0.0274**	-0.00339	-0.0326	-0.0578	0.0133	0.143**	0.177**	0.0636	0.118**
	(0.00937)	(0.0126)	(0.0224)	(0.00734)	(0.0238)	(0.0274)	(0.0482)	(0.0161)	(0.0152)	(0.0226)	(0.0457)	(0.0127)
postsecondaward	0.0516*	0.126**	-0.0984*	0.119**	-0.00438	0.00603	0.146	0.102**	0.0624*	0.180**	-0.0409	0.0211
	(0.0216)	(0.0254)	(0.0495)	(0.0169)	(0.0431)	(0.0567)	(0.142)	(0.0373)	(0.0282)	(0.0347)	(0.0761)	(0.0264)
postthirdaward	0.0225	0.0349	0.553**	0.142**	-0.00898	-0.00998		0.549**	-0.0935	0.0369		-0.00904
	(0.0499)	(0.0616)	(0.172)	(0.0524)	(0.224)	(0.130)		(0.104)	(0.0706)	(0.0834)		(0.0547)
enrolled	-0.0944**	-0.124**	-0.147**	-0.106**	-0.130**	-0.140**	-0.160**	-0.149**	-0.171**	-0.185**	-0.124**	-0.193**
	(0.00606)	(0.00819)	(0.0140)	(0.00472)	(0.0155)	(0.0175)	(0.0303)	(0.0101)	(0.00965)	(0.0146)	(0.0275)	(0.00807)
Observations	105,246	61,503	24,144	179,851	14,415	12,556	4,866	33,320	37,556	18,847	5,193	61,148
R-squared	0.549	0.567	0.548	0.598	0.575	0.575	0.553	0.626	0.550	0.570	0.582	0.595

	Health				Family and Consumer Science				Public and Protective Services			
	Latinx	Asian	Black	White	Latinx	Asian	Black	White	Latinx	Asian	Black	White
postfirstaward	0.820**	0.813**	0.570**	0.953**	0.0993**	0.130**	0.0146	0.0955**	0.0615**	0.0616*	0.0342	0.0893**
	(0.00859)	(0.00901)	(0.0178)	(0.00637)	(0.0107)	(0.0252)	(0.0292)	(0.0130)	(0.00973)	(0.0242)	(0.0283)	(0.00884)
postsecondaward	0.150**	0.251**	0.0560	0.179**	0.0891**	0.0583	0.0507	0.0876**	0.215**	0.140**	0.291**	0.145**
	(0.0151)	(0.0180)	(0.0425)	(0.0142)	(0.0217)	(0.0559)	(0.0604)	(0.0286)	(0.0186)	(0.0501)	(0.0566)	(0.0174)
postthirdaward	0.144**	-0.0556	0.374*	0.00125	0.301**	0.195	0.625*	0.254*	-0.0451	-0.232	-0.0785	0.0868*
	(0.0556)	(0.0897)	(0.162)	(0.0598)	(0.0658)	(0.114)	(0.260)	(0.103)	(0.0528)	(0.526)	(0.166)	(0.0438)
enrolled	-0.321**	-0.353**	-0.306**	-0.382**	-0.0339**	-0.0951**	-0.140**	-0.113**	-0.0978**	-0.0580**	-0.119**	-0.0648**
	(0.00588)	(0.00604)	(0.0117)	(0.00430)	(0.00682)	(0.0163)	(0.0179)	(0.00826)	(0.00598)	(0.0145)	(0.0168)	(0.00522)
Observations	191,849	198,483	50,954	409,922	75,488	17,046	13,173	68,739	108,403	17,340	15,684	143,099
R-squared	0.541	0.554	0.486	0.530	0.434	0.481	0.497	0.472	0.555	0.593	0.582	0.591

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is an Associate degree earned in the given program (based on 2-digit TOP code). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D24

Student fixed effects models by region and program, for students whose first award is a long-term certificate

	Business				Information Technology				Engineering			
	Latinx	Asian	Black	White	Latinx	Asian	Black	White	Latinx	Asian	Black	White
postfirstaward	0.0761**	0.0408	-0.132*	0.0266	-0.191**	0.116*	-0.0641	-0.0284	0.0377**	0.0473**	0.0134	0.0470**
	(0.0233)	(0.0255)	(0.0621)	(0.0182)	(0.0583)	(0.0559)	(0.149)	(0.0366)	(0.00833)	(0.0137)	(0.0273)	(0.00766)
postsecondaward	0.0187	0.0419	-0.0153	-0.0176	0.157*	-0.0431	0.106	-0.000387	0.110**	0.0795**	-0.00234	0.0973**
	(0.0243)	(0.0261)	(0.0677)	(0.0188)	(0.0689)	(0.0633)	(0.252)	(0.0380)	(0.0124)	(0.0168)	(0.0379)	(0.0121)
postthirdaward	0.0668	-0.0372	-0.468**	0.229**	-0.547**	0.0126		0.239**	0.0554	0.166**	0.599**	0.0373
	(0.0589)	(0.0508)	(0.151)	(0.0381)	(0.163)	(0.130)		(0.0726)	(0.0378)	(0.0370)	(0.125)	(0.0304)
enrolled	-0.134**	-0.117**	-0.237**	-0.144**	-0.205**	-0.0968**	-0.155	-0.125**	-0.0960**	-0.104**	-0.144**	-0.101**
	(0.0140)	(0.0155)	(0.0364)	(0.0110)	(0.0341)	(0.0339)	(0.0827)	(0.0215)	(0.00520)	(0.00859)	(0.0164)	(0.00494)
Observations	17,641	11,903	3,665	26,182	2,706	2,942	692	6,543	127,176	43,219	19,204	154,937
R-squared	0.537	0.567	0.536	0.615	0.610	0.572	0.699	0.632	0.509	0.560	0.491	0.544
	Health				Family and Consumer Science				Public and Protective Services			

	Latinx	Asian	Black	White	Latinx	Asian	Black	White	Latinx	Asian	Black	White
postfirstaward	0.484**	0.424**	0.417**	0.536**	0.0569**	0.217**	0.00394	0.0293	0.124**	0.180**	0.112**	0.122**
	(0.0111)	(0.0120)	(0.0182)	(0.00956)	(0.0158)	(0.0267)	(0.0352)	(0.0190)	(0.0136)	(0.0311)	(0.0267)	(0.0106)
postsecondaward	0.260**	0.350**	0.209**	0.319**	0.0669**	-0.160**	0.182**	0.133**	-0.0539**	-0.0145	0.112**	0.0350*
	(0.0142)	(0.0142)	(0.0221)	(0.0115)	(0.0177)	(0.0328)	(0.0494)	(0.0235)	(0.0190)	(0.0367)	(0.0378)	(0.0147)
postthirdaward	0.163**	0.109*	0.144*	0.231**	-0.165**	-0.128	-0.169	-0.278**	0.156**	0.102	0.179	0.269**
	(0.0490)	(0.0427)	(0.0716)	(0.0359)	(0.0467)	(0.124)	(0.126)	(0.0677)	(0.0601)	(0.0944)	(0.0983)	(0.0426)
enrolled	-0.215**	-0.238**	-0.187**	-0.303**	-0.141**	-0.156**	-0.299**	-0.251**	-0.0782**	-0.00418	-0.0389*	-0.0854**
	(0.00666)	(0.00737)	(0.0109)	(0.00585)	(0.00965)	(0.0168)	(0.0216)	(0.0119)	(0.00816)	(0.0187)	(0.0159)	(0.00629)
Observations	90,804	82,795	35,102	139,812	40,609	15,414	12,373	35,959	46,057	9,779	16,420	88,137
R-squared	0.492	0.492	0.473	0.494	0.446	0.529	0.497	0.510	0.546	0.555	0.491	0.566

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is a long-term certificate earned in the given program (based on 2-digit TOP code). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D25

Student fixed effects models by region and program, for students whose first award is a short-term certificate

	Business				Information Technology				Engineering			
	Latinx	Asian	Black	White	Latinx	Asian	Black	White	Latinx	Asian	Black	White
postfirstaward	0.0551**	0.0464**	0.0181	0.00460	0.00666	-0.00616	0.0370	0.000388	0.0371**	-0.0103	0.0594*	0.0290**
	(0.0112)	(0.0126)	(0.0232)	(0.00932)	(0.0205)	(0.0216)	(0.0540)	(0.0150)	(0.00761)	(0.0122)	(0.0268)	(0.00756)
postsecondaward	0.00600	0.0519**	-0.0189	0.0235*	-0.0232	-0.00427	0.254**	0.0212	0.0517**	0.0570**	0.219**	0.0857**
	(0.0135)	(0.0150)	(0.0299)	(0.0110)	(0.0245)	(0.0285)	(0.0715)	(0.0190)	(0.0101)	(0.0145)	(0.0364)	(0.0101)
postthirdaward	-0.00242	-0.0111	-0.165**	0.0321	-0.0998*	-0.0720	0.150	-0.0752*	0.0440*	0.0124	0.0382	0.0712**
	(0.0228)	(0.0284)	(0.0558)	(0.0213)	(0.0390)	(0.0557)	(0.117)	(0.0337)	(0.0179)	(0.0199)	(0.0679)	(0.0183)
enrolled	-0.138**	-0.149**	-0.145**	-0.196**	-0.106**	-0.124**	-0.171**	-0.215**	-0.118**	-0.161**	-0.126**	-0.0957**
	(0.00669)	(0.00774)	(0.0136)	(0.00561)	(0.0122)	(0.0130)	(0.0313)	(0.00893)	(0.00469)	(0.00745)	(0.0162)	(0.00472)
Observations	79,062	57,950	23,502	111,610	17,405	17,558	5,185	39,492	145,469	55,673	16,778	156,786
R-squared	0.556	0.558	0.575	0.580	0.605	0.609	0.545	0.608	0.555	0.565	0.553	0.592

	Health				Family and Consumer Science				Public and Protective Services			
	Latinx	Asian	Black	White	Latinx	Asian	Black	White	Latinx	Asian	Black	White
postfirstaward	0.0723**	-0.0180	0.134**	0.0447**	0.0800**	0.108**	0.0798**	0.0522**	0.160**	0.200**	0.175**	0.203**
	(0.0101)	(0.0136)	(0.0244)	(0.00790)	(0.00710)	(0.0138)	(0.0172)	(0.0100)	(0.00671)	(0.0156)	(0.0159)	(0.00577)
postsecondaward	0.312**	0.384**	0.345**	0.257**	0.00606	0.0935**	-0.00918	0.0254*	0.00706	-0.0301	0.0750**	0.0318**
	(0.0134)	(0.0171)	(0.0337)	(0.00971)	(0.00823)	(0.0165)	(0.0194)	(0.0113)	(0.00980)	(0.0240)	(0.0233)	(0.00831)
postthirdaward	0.174**	-0.0586	0.391**	0.0640**	0.00806	-0.0706*	0.0654*	0.0658**	0.0337	0.103*	0.0723	0.0356*
	(0.0273)	(0.0308)	(0.0625)	(0.0152)	(0.0150)	(0.0279)	(0.0317)	(0.0193)	(0.0207)	(0.0458)	(0.0497)	(0.0158)
enrolled	-0.223**	-0.258**	-0.213**	-0.249**	-0.0793**	-0.120**	-0.179**	-0.158**	-0.0577**	-0.0449**	-0.0714**	-0.0526**
	(0.00609)	(0.00851)	(0.0149)	(0.00478)	(0.00418)	(0.00850)	(0.00993)	(0.00601)	(0.00390)	(0.00927)	(0.00940)	(0.00343)
Observations	113,929	59,222	24,168	201,717	195,640	51,138	44,203	120,061	184,791	34,991	41,446	281,698
R-squared	0.460	0.521	0.462	0.506	0.436	0.495	0.460	0.459	0.579	0.593	0.584	0.582

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is a short-term certificate earned in the given program (based on 2-digit TOP code). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D26

Student fixed effects models by age group and program

	Business				Information Technology				Engineering			
	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54
postfirstaward	0.107**	0.0430**	0.0391**	-0.0180**	0.126**	0.0282	-0.0430**	-0.0285*	0.173**	0.0407**	0.00763	0.00380
	(0.0139)	(0.00914)	(0.00697)	(0.00565)	(0.0312)	(0.0195)	(0.0131)	(0.0115)	(0.00888)	(0.00711)	(0.00571)	(0.00605)
postsecondaward	-0.0207	0.0294*	0.0682**	0.0201**	-0.0761*	0.0651*	0.0197	0.0451**	0.0250*	0.126**	0.0641**	0.0502**
	(0.0185)	(0.0135)	(0.00954)	(0.00748)	(0.0388)	(0.0258)	(0.0182)	(0.0158)	(0.0103)	(0.00990)	(0.00840)	(0.00837)
postthirdaward	-0.0293	0.0443	-0.0143	0.00477	0.0263	0.0271	-0.00152	-0.121**	0.0619**	0.0387*	0.0407*	-0.00279
	(0.0376)	(0.0270)	(0.0198)	(0.0155)	(0.0661)	(0.0570)	(0.0350)	(0.0295)	(0.0163)	(0.0188)	(0.0185)	(0.0186)
enrolled	-0.0317**	-0.112**	-0.135**	-0.162**	-0.166**	-0.137**	-0.143**	-0.167**	-0.144**	-0.121**	-0.110**	-0.124**
	(0.00809)	(0.00534)	(0.00415)	(0.00339)	(0.0185)	(0.0113)	(0.00763)	(0.00682)	(0.00534)	(0.00419)	(0.00347)	(0.00371)
Observations	85,491	149,454	196,640	262,633	15,475	29,402	49,940	59,756	159,662	211,086	263,524	221,141
R-squared	0.483	0.476	0.548	0.608	0.547	0.538	0.565	0.595	0.537	0.523	0.499	0.529

	Health				Family and Consumer Science				Public and Protective Services			
	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54
postfirstaward	0.444**	0.668**	0.584**	0.411**	0.142**	0.105**	0.0980**	0.0460**	0.210**	0.212**	0.123**	0.0741**
	(0.00795)	(0.00597)	(0.00520)	(0.00579)	(0.0113)	(0.00826)	(0.00964)	(0.00631)	(0.00833)	(0.00647)	(0.00552)	(0.00621)
postsecondaward	0.170**	0.123**	0.0948**	0.0505**	0.0182	0.0204*	-0.00481	0.0419**	0.0691**	-0.00864	-0.00551	0.129**
	(0.00962)	(0.00793)	(0.00772)	(0.00899)	(0.0121)	(0.0103)	(0.0113)	(0.00781)	(0.00986)	(0.00957)	(0.00894)	(0.00934)
postthirdaward	0.0628**	-0.0729**	0.0488*	0.0289	0.0232	-0.0209	0.0593**	0.0316*	0.0550**	0.107**	0.0448*	0.0838**
	(0.0168)	(0.0192)	(0.0212)	(0.0214)	(0.0210)	(0.0196)	(0.0227)	(0.0153)	(0.0208)	(0.0211)	(0.0190)	(0.0211)
enrolled	-0.241**	-0.365**	-0.435**	-0.474**	-0.0655**	-0.134**	-0.111**	-0.132**	-0.0482**	-0.0371**	-0.0635**	-0.0601**
	(0.00454)	(0.00347)	(0.00319)	(0.00365)	(0.00649)	(0.00476)	(0.00536)	(0.00373)	(0.00439)	(0.00344)	(0.00315)	(0.00372)
Observations	234,817	447,380	528,984	397,183	115,712	170,039	141,790	241,156	222,668	294,026	269,324	203,446
R-squared	0.521	0.501	0.484	0.501	0.415	0.428	0.389	0.507	0.538	0.492	0.551	0.638

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is earned in the given program (based on 2-digit TOP code, and including awards of any length). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D27

Student fixed effects models by age group and award level

	Associate				Long-term				Short-term			
	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54
postfirstaward	0.320**	0.470**	0.417**	0.247**	0.293**	0.203**	0.143**	0.112**	0.127**	0.106**	0.0657**	0.0236**
	(0.00764)	(0.00507)	(0.00452)	(0.00458)	(0.00783)	(0.00637)	(0.00546)	(0.00551)	(0.00517)	(0.00481)	(0.00393)	(0.00362)
postsecondaward	0.138**	0.0604**	-0.0477**	-0.0150	0.177**	0.262**	0.172**	0.100**	0.0897**	0.0378**	0.0778**	0.0533**
	(0.0101)	(0.00835)	(0.00812)	(0.00827)	(0.00904)	(0.00739)	(0.00688)	(0.00666)	(0.00538)	(0.00543)	(0.00480)	(0.00438)
postthirdaward	0.0496	0.00990	0.0747**	-0.106**	0.215**	0.0817**	-0.0212	0.0669**	0.114**	0.0861**	0.0101	0.0468**
	(0.0264)	(0.0247)	(0.0259)	(0.0256)	(0.0235)	(0.0214)	(0.0196)	(0.0176)	(0.00870)	(0.00990)	(0.00901)	(0.00826)
enrolled	-0.0630**	-0.219**	-0.316**	-0.298**	-0.122**	-0.147**	-0.184**	-0.182**	-0.118**	-0.114**	-0.136**	-0.158**
	(0.00441)	(0.00309)	(0.00280)	(0.00289)	(0.00451)	(0.00361)	(0.00323)	(0.00334)	(0.00293)	(0.00262)	(0.00230)	(0.00218)
Observations	307,258	608,064	658,958	556,638	274,103	339,037	381,737	345,574	531,503	566,962	646,207	699,664
R-squared	0.532	0.486	0.490	0.541	0.502	0.485	0.496	0.533	0.487	0.487	0.546	0.601

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is of the length noted (regardless of the program area in which it is earned). Each region-program sub-column represents a separate regression model. All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D28

Student fixed effects models by age group and program, for students whose first award is an associate degree

	Business				Information Technology				Engineering			
	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54
postfirstaward	0.107**	0.0239*	0.0362**	-0.0244**	0.178**	0.0864**	-0.0443*	-0.0762**	0.410**	0.171**	0.0570**	0.0164
	(0.0177)	(0.0115)	(0.00970)	(0.00813)	(0.0469)	(0.0260)	(0.0205)	(0.0198)	(0.0211)	(0.0199)	(0.0174)	(0.0161)
postsecondaward	-0.0834*	0.0710*	0.0907**	0.143**	-0.0311	0.0438	0.0891	0.107**	-0.0834*	0.239**	-0.0151	0.0439
	(0.0372)	(0.0282)	(0.0213)	(0.0159)	(0.0771)	(0.0509)	(0.0469)	(0.0413)	(0.0420)	(0.0314)	(0.0302)	(0.0291)
postthirdaward	0.218*	0.0754	0.168**	-0.163**	0.241	0.535*	0.975**	-0.0603	0.0243	-0.169*	0.307**	-0.0487
	(0.0919)	(0.0677)	(0.0574)	(0.0489)	(0.173)	(0.226)	(0.151)	(0.122)	(0.0774)	(0.0790)	(0.0734)	(0.0759)
enrolled	0.00732	-0.0995**	-0.121**	-0.130**	-0.0897**	-0.104**	-0.152**	-0.125**	-0.0823**	-0.237**	-0.183**	-0.179**
	(0.0107)	(0.00708)	(0.00599)	(0.00511)	(0.0299)	(0.0160)	(0.0123)	(0.0122)	(0.0130)	(0.0119)	(0.0104)	(0.00991)
Observations	56,405	94,631	101,388	118,713	7,736	15,801	21,504	20,056	29,924	31,525	30,474	31,007

R-squared	0.487	0.471	0.550	0.628	0.587	0.548	0.558	0.596	0.566	0.483	0.516	0.602
	Health				Family and Consumer Science				Public and Protective Services			
	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54
postfirstaward	1.154**	1.134**	0.878**	0.686**	0.224**	0.145**	0.121**	0.0291*	0.159**	0.0752**	0.0583**	0.0589**
	(0.0219)	(0.00861)	(0.00706)	(0.00832)	(0.0256)	(0.0175)	(0.0158)	(0.0121)	(0.0139)	(0.0121)	(0.0120)	(0.0138)
postsecondaward	0.156**	0.206**	0.104**	0.171**	0.0741	0.143**	-0.0405	0.0904**	0.263**	0.0998**	-0.0488	0.219**
	(0.0274)	(0.0158)	(0.0145)	(0.0184)	(0.0391)	(0.0376)	(0.0352)	(0.0242)	(0.0203)	(0.0226)	(0.0266)	(0.0294)
postthirdaward	0.0629	-0.177**	0.325**	0.213*	0.241*	0.343**	0.466**	0.171*	-0.0950	0.00819	0.317**	0.113
	(0.0791)	(0.0665)	(0.0712)	(0.0832)	(0.111)	(0.0935)	(0.111)	(0.0799)	(0.0521)	(0.0652)	(0.0682)	(0.0836)
enrolled	-0.207**	-0.229**	-0.362**	-0.419**	0.0285	-0.0333**	-0.105**	-0.0981**	0.00546	-0.0900**	-0.103**	-0.0765**
	(0.0130)	(0.00557)	(0.00464)	(0.00554)	(0.0150)	(0.0107)	(0.00953)	(0.00749)	(0.00751)	(0.00676)	(0.00680)	(0.00818)
Observations	47,675	252,025	333,099	227,831	27,373	41,547	42,812	58,524	87,966	92,608	64,520	42,782
R-squared	0.638	0.554	0.502	0.510	0.439	0.404	0.414	0.499	0.537	0.473	0.567	0.673

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is an Associate degree earned in the given program (based on 2-digit TOP code). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D29

Student fixed effects models by age group and program, for students whose first award is a long-term certificate

	Business				Information Technology				Engineering			
	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54
postfirstaward	0.287**	0.113**	-0.00421	0.00878	-0.104	-0.0469	0.0253	-0.0623	0.194**	-0.0469	0.00106	-0.0107
	(0.0617)	(0.0343)	(0.0227)	(0.0178)	(0.128)	(0.0694)	(0.0488)	(0.0382)	(0.0156)	(0.0694)	(0.00860)	(0.0101)
postsecondaward	0.147**	0.0381	-0.0216	-0.00344	0.0954	0.133	-0.0223	0.00198	0.0349*	0.133	0.0528**	0.0926**
	(0.0536)	(0.0328)	(0.0235)	(0.0182)	(0.114)	(0.0708)	(0.0532)	(0.0422)	(0.0174)	(0.0708)	(0.0137)	(0.0141)
postthirdaward	-0.124	0.109	0.0972	0.121**	-0.469*	0.236	0.281*	0.145	0.235**	0.236	-0.00207	0.0207
	(0.116)	(0.0746)	(0.0519)	(0.0359)	(0.211)	(0.185)	(0.122)	(0.0792)	(0.0392)	(0.185)	(0.0373)	(0.0409)
enrolled	0.00407	-0.0907**	-0.167**	-0.145**	-0.0192	-0.0955*	-0.113**	-0.208**	-0.148**	-0.0955*	-0.0848**	-0.100**
	(0.0358)	(0.0198)	(0.0134)	(0.0106)	(0.0791)	(0.0383)	(0.0283)	(0.0225)	(0.00949)	(0.0383)	(0.00533)	(0.00621)
Observations	4,205	10,131	18,059	26,504	1,005	2,052	4,197	5,415	54,848	2,052	120,117	85,624
R-squared	0.510	0.490	0.529	0.622	0.487	0.640	0.524	0.658	0.555	0.640	0.458	0.482

	Health				Family and Consumer Science				Public and Protective Services			
	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54
postfirstaward	0.675**	0.550**	0.491**	0.414**	0.183**	0.111**	0.107**	0.0286	0.244**	0.196**	0.0744**	0.0956**
	(0.0165)	(0.0123)	(0.0108)	(0.0117)	(0.0296)	(0.0252)	(0.0225)	(0.0173)	(0.0254)	(0.0172)	(0.0139)	(0.0139)
postsecondaward	0.288**	0.371**	0.324**	0.207**	0.0304	-0.0455	0.118**	0.0896**	-0.00312	-0.00610	-0.0957**	0.124**
	(0.0188)	(0.0129)	(0.0127)	(0.0147)	(0.0320)	(0.0286)	(0.0276)	(0.0194)	(0.0242)	(0.0221)	(0.0195)	(0.0204)
postthirdaward	0.106	0.175**	0.150**	0.244**	0.0953	-0.123	-0.333**	-0.186**	0.406**	0.243**	-0.213**	0.278**
	(0.0544)	(0.0425)	(0.0419)	(0.0433)	(0.0845)	(0.0731)	(0.0741)	(0.0599)	(0.0608)	(0.0628)	(0.0724)	(0.0599)
enrolled	-0.158**	-0.209**	-0.276**	-0.284**	-0.140**	-0.182**	-0.211**	-0.187**	-0.0221	-0.0455**	-0.0972**	-0.0834**
	(0.00912)	(0.00688)	(0.00638)	(0.00709)	(0.0177)	(0.0145)	(0.0133)	(0.0106)	(0.0131)	(0.00924)	(0.00801)	(0.00837)
Observations	54,947	96,805	109,543	88,239	17,959	21,750	25,849	36,662	26,059	40,049	43,168	48,157
R-squared	0.539	0.468	0.465	0.459	0.427	0.398	0.456	0.543	0.519	0.467	0.579	0.567

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is a long-term certificate earned in the given program (based on 2-digit TOP code). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

TABLE D30

Student fixed effects models by age group and program, for students whose first award is a short-term certificate

	Business				Information Technology				Engineering			
	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54
postfirstaward	0.122**	0.0781**	0.0560**	-0.00131	0.145**	-0.0169	-0.0497**	0.0110	0.0809**	0.00707	0.00673	0.0138
	(0.0255)	(0.0171)	(0.0113)	(0.00884)	(0.0467)	(0.0330)	(0.0183)	(0.0153)	(0.0129)	(0.0110)	(0.00855)	(0.00862)
postsecondaward	-0.0257	-0.0173	0.0756**	-0.00781	-0.0452	0.0852*	0.0262	0.0506**	0.0726**	0.111**	0.0833**	0.0288*
	(0.0268)	(0.0195)	(0.0129)	(0.0104)	(0.0535)	(0.0361)	(0.0222)	(0.0194)	(0.0141)	(0.0138)	(0.0114)	(0.0112)
postthirdaward	-0.0420	0.0388	-0.0639**	0.0134	0.124	-0.0489	-0.0736	-0.158**	0.0531**	0.0734**	0.0240	0.0128
	(0.0474)	(0.0340)	(0.0241)	(0.0195)	(0.0805)	(0.0677)	(0.0383)	(0.0338)	(0.0195)	(0.0225)	(0.0225)	(0.0220)
enrolled	-0.0757**	-0.148**	-0.146**	-0.187**	-0.208**	-0.165**	-0.136**	-0.168**	-0.129**	-0.105**	-0.110**	-0.124**
	(0.0143)	(0.00970)	(0.00665)	(0.00526)	(0.0266)	(0.0187)	(0.0107)	(0.00908)	(0.00769)	(0.00641)	(0.00519)	(0.00529)
Observations	24,881	44,692	77,193	117,416	6,734	11,549	24,239	34,285	74,890	86,999	112,933	104,510
R-squared	0.468	0.481	0.547	0.584	0.525	0.516	0.582	0.584	0.510	0.534	0.533	0.542

	Health				Family and Consumer Science				Public and Protective Services			
	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54	Age 18-22	Age 23-27	Age 28-37	Age 38-54
postfirstaward	0.135**	0.0496**	0.0152	-0.0233	0.115**	0.0789**	0.0957**	0.0594**	0.242**	0.276**	0.155**	0.0690**
	(0.0104)	(0.0123)	(0.0121)	(0.0119)	(0.0143)	(0.0132)	(0.0108)	(0.00820)	(0.0116)	(0.00855)	(0.00696)	(0.00802)
postsecondaward	0.256**	0.338**	0.354**	0.269**	0.0415**	-0.00876	0.00492	0.0184	0.0219	-0.0638**	0.0170	0.120**
	(0.0123)	(0.0143)	(0.0145)	(0.0152)	(0.0144)	(0.0138)	(0.0122)	(0.00950)	(0.0131)	(0.0120)	(0.0108)	(0.0112)
postthirdaward	0.104**	0.0191	0.107**	0.0896**	0.0260	0.0658**	-0.00755	0.0521**	0.0443	0.0914**	0.0118	0.0662**
	(0.0189)	(0.0247)	(0.0280)	(0.0272)	(0.0228)	(0.0255)	(0.0213)	(0.0167)	(0.0251)	(0.0238)	(0.0206)	(0.0231)
enrolled	-0.156**	-0.226**	-0.290**	-0.355**	-0.0555**	-0.115**	-0.126**	-0.134**	-0.0905**	-0.0477**	-0.0514**	-0.0347**
	(0.00588)	(0.00674)	(0.00724)	(0.00755)	(0.00814)	(0.00717)	(0.00623)	(0.00483)	(0.00612)	(0.00455)	(0.00403)	(0.00488)
Observations	132,195	98,550	86,342	81,113	70,380	78,493	101,378	145,970	108,643	161,369	161,636	112,507
R-squared	0.454	0.409	0.457	0.525	0.403	0.379	0.422	0.496	0.546	0.502	0.531	0.629

SOURCES: Authors Calculations from COMIS and EDD.

NOTES: Each column represents a separate regression model that includes only students with the demographic characteristic noted and whose first award is a short-term certificate earned in the given program (based on 2-digit TOP code). All models also include student, year-quarter, and age fixed effects. Standard errors in parentheses, **p<.01, *p<.05.

Wage trajectories

In addition to the effect of programs on wages in a purely before-after sense, we also examine longer term wage trajectories for CE students. To do this we track earnings over time for various subsets of students. We also create a summary measure that reflects how quickly after degree receipt students earn middle-income wages. After a student's first CE award, we note the quarter that a student's quarterly earnings are greater than twice the CPM threshold (divided by four). We then count how many quarters it takes for a student to earn middle-income level wages, and summarize those counts across student groups of interest (typically using a median or when half of students have achieved middle-income level).

Wages do fluctuate, so while an individual may have wages above the threshold one quarter and below, or missing wages, the next quarter. However, the first quarter of wages above twice the poverty line may reflect a worker's *potential* to earn at the middle-income level. Tests of this assumption are provided below. As a comparison to data provided in the report, Table D31 shows a much stricter measure – the time it takes for two thirds of students to earn upper-middle-income wages (5 times the CPM threshold). Table D24 provides summary statistics on how stable reaching middle-income wages is, among our student sample.

Figure D1 duplicates the Figure 3 of the report, tracing the time it takes for a majority of students to earn middle-income level wages, but using a regression model to adjust for demographic characteristics. This approach attempts to net out demographic factors that might drive the difference between student groups that are unrelated to the attainment of a CE credential.

Figures D2 through D5 provide wage trajectories for students by a number of factors of interest, including program (2-digit TOP code), gender, race/ethnicity and age.

TABLE D31

Number of quarters after first award that two thirds of graduates made above five times the poverty line

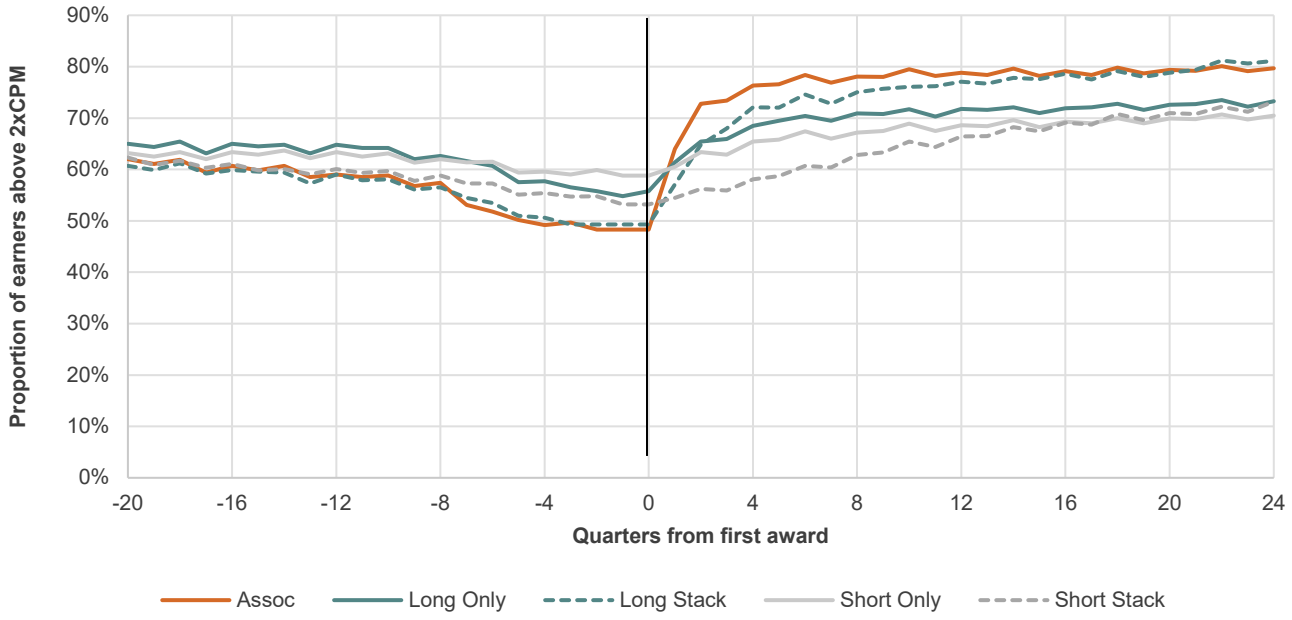
	Business	Information Technology	Engineering	Health	Family and consumer science	Public and protective service
Associate Only	13	10	6	2	18	3
Long Term Only	18	17	2	3	*	2
Long Term w/Stack	13	12	10	4	*	10
Short Term Only	20	16	6	13	*	0
Short Term w/Stack	19	11	12	12	*	6

SOURCES: Author's calculations from COMIS, EDD.

NOTES: * fewer than two thirds of these award completers made above five times the CPM threshold.

FIGURE D1

Regression adjusted probabilities of earning middle-income wages

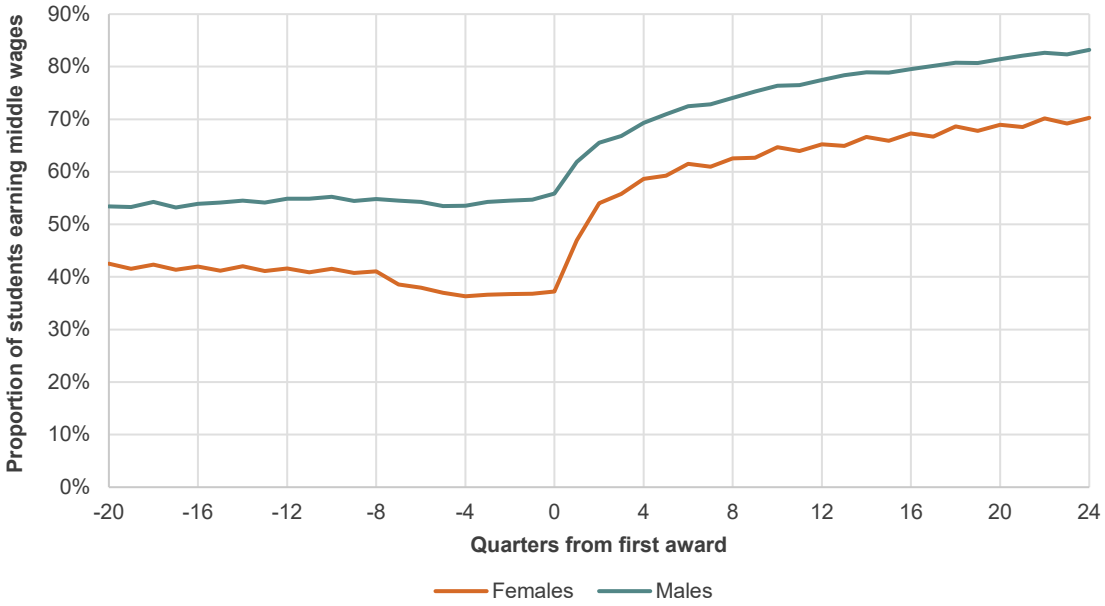


SOURCE: Author's calculations from COMIS, EDD.

NOTE: Wages are adjusted to 2017 dollars using CPI-U. This panel is unbalanced, meaning quarters where students did not work are not recorded as zero, but instead counted as missing. Results adjusted for race, age, gender, Pell grant receipt, English language proficiency, and financial information. The graph shows estimates for a typical student, lwith all covariates held at their means.

FIGURE D2

Proportion of students of each quarter earning middle wages, by gender

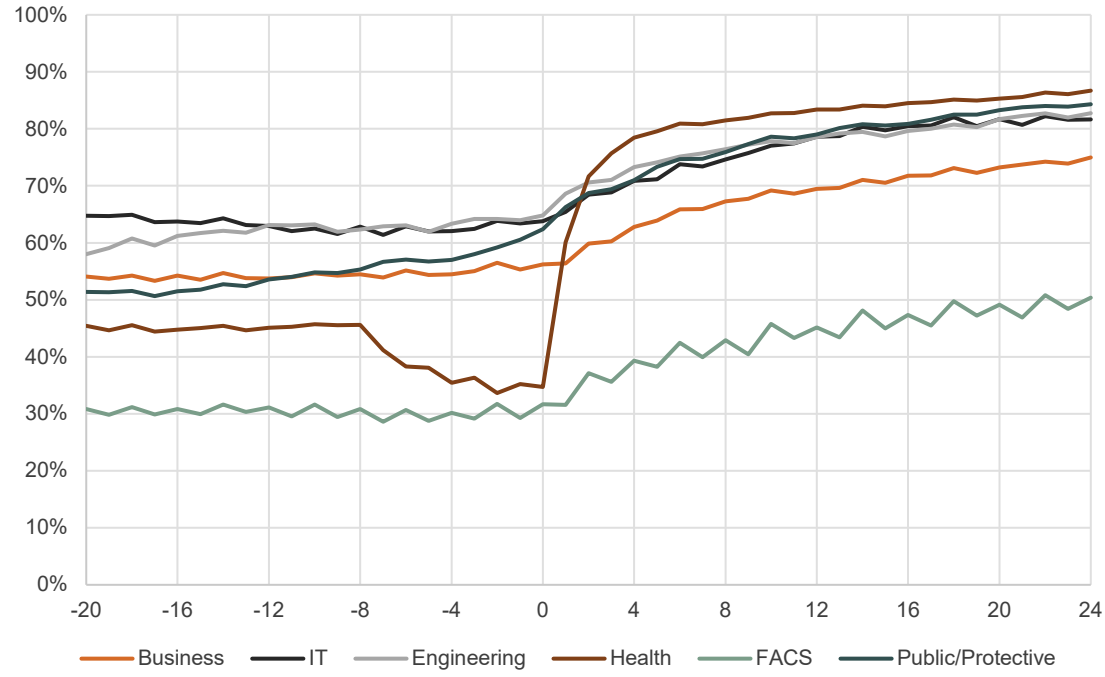


SOURCE: Author's calculations from COMIS, EDD.

NOTE: Wages are adjusted to 2017 dollars using CPI-U. This panel is unbalanced, meaning quarters where students did not work are not recorded as zero, but instead counted as missing.

FIGURE D3

Proportion of students of each quarter earning middle wages, by program

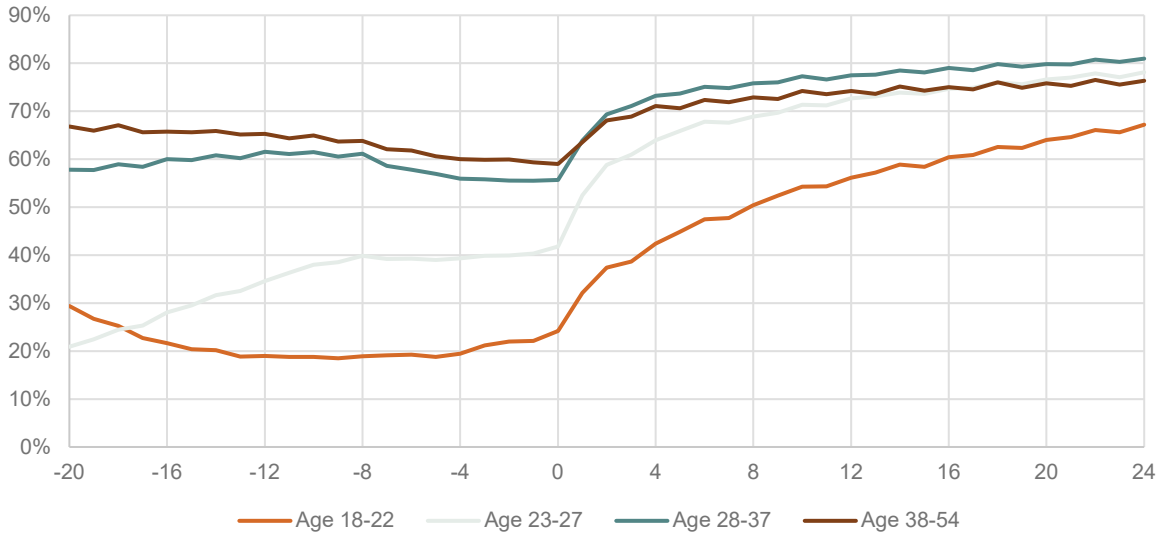


SOURCE: Author's calculations from COMIS, EDD.

NOTE: Wages are adjusted to 2017 dollars using CPI-U. This panel is unbalanced, meaning quarters where students did not work are not recorded as zero, but instead counted as missing.

FIGURE D4

Proportion of students of each quarter earning middle wages, by age at first award

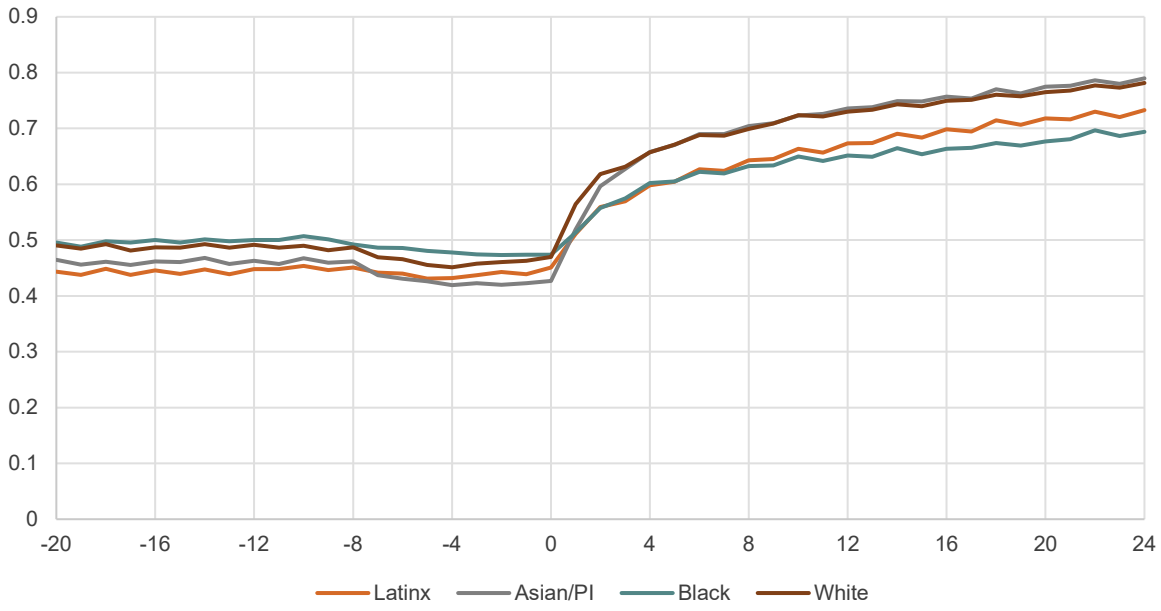


SOURCE: Author's calculations from COMIS, EDD

NOTE: Wages are adjusted to 2017 dollars using CPI-U. This panel is unbalanced, meaning quarters where students did not work are not recorded as zero, but instead counted as missing.

FIGURE D5

Proportion of students of each quarter earning middle wages, by race/ethnicity



SOURCE: Author's calculations from COMIS, EDD

NOTE: Wages are adjusted to 2017 dollars using CPI-U. This panel is unbalanced, meaning quarters where students did not work are not recorded as zero, but instead counted as missing.

Appendix E: Analysis of Middle-Skill Job Growth and Industries

Defining middle-skill, middle income jobs

Our analysis of future middle-skill jobs across regions of the state relies on data from the American Community Survey combined with employment projections developed by the California Employment Development Department (EDD).

We use the ACS public use microdata sample (PUMS) 1-year files for the years 2014-2017 to generate estimates of the education and earnings levels of current workers by detailed occupation code. We included multiple years to increase our samples sizes at the regional level. Our analysis includes workers age 18-54 who reported full-time (35 hours or more), full year (50 weeks) work in order to calculate measures of worker education and earnings by occupation.

We link the ACS data with occupational employment projections from the EDD. We use EDD long-term (10 year) regional occupation projections for the period 2014-2024 (the most current available). Both the ACS and the EDD employment projections use Standard Occupation Classification (SOC) codes to classify jobs. The SOC codes are 6-digits that are organized hierarchically into groups of related occupations. While there is not always a one-to-one match between the ACS and EDD projections at the 6-digit level, we endeavor to link measures of projected job growth to the earnings and education levels of current workers at the most detailed level possible.

From this linked data, we produce our estimates of employment growth for low-skill, middle-skill, and high-skill jobs across major occupation groups (2-digit SOC) and regions. The skill-level categories are based on the education level of current workers in the occupation where low-skill refers to workers with a high-school education or less, middle-skill to workers with an Associate degree or some college, and high-skill to workers with at least a bachelor's degree.

We also construct measures of earnings levels for occupation groups based on poverty thresholds created by the California Poverty Measure (CPM), a joint effort by PPIC and the Stanford Center on Poverty and Inequality. The CPM thresholds vary across counties and regions to reflect the differences in cost of living across California. Specifically, we divide the reported annual earnings by the threshold for a single person, renter household to calculate a "CPM factor." The CPM factor indicates how earnings of current middle-skill workers in certain occupations relate to levels of resources required to meet basic needs (poverty thresholds). As done in past work, annual earnings that are 2 times the CPM threshold or below are considered low-income jobs, earnings levels that correspond to between 2 times and 7 times the threshold are considered middle-income jobs, and those that are 7 times or above are considered high-income. Note, the earnings levels we are using are for full-time, full-year workers and are calculated for workers who have completed some college or an associate degree – our definition of middle-skill.

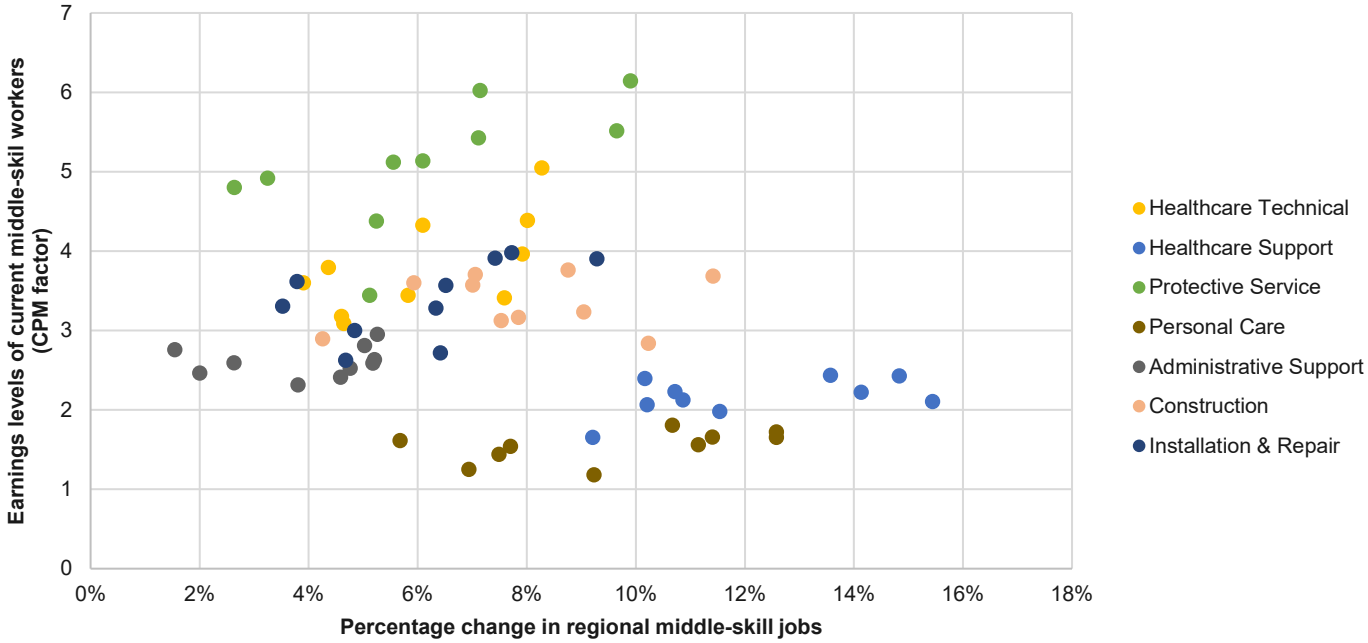
We also calculate job growth for middle-skill workers and earnings levels relative to CPM thresholds at the regional level. We were able to harmonize the EDD 2014-24 projections into 10 regions comprised of counties or county groups and align those with the counties identifiable in the ACS. We also sought to reflect CE regions used by the Chancellor's office in their workforce development division.

Figure E1 highlights occupation groups that have alignment with career education credentials and displays regional differences in job growth and earnings levels for current middle-skill workers. As discussed in the report, there appears to be more differences in the projected growth across regions for middle-skill jobs rather than in the

earnings levels associated with occupations. In general, earnings levels (measured as multiples of the CPM threshold) are consistent across regions; health care technical middle-skill workers seem to have the largest spread of earnings levels across regions.

FIGURE E1

Middle-skill jobs with higher earnings are projected to grow at lower rates, with some differences across regions



SOURCE: ACS linked to regional EDD occupational employment projections.

NOTE: Each dot represents one of 10 regions. Percent change in new jobs calculated by region. CPM factor is an average of all middle-skill workers in the occupation and in the given region.

Primary Industries and Industry Switching among CE Credential Earners

For our analysis of industries, we return to the linked COMIS-EDD student-level data. Recall that the UI quarterly wage records which we have linked for all students in covered employment contains a NAICS code indicating the industry of employment. We use the NAICS codes along with the earnings levels for students to flag primary industries in different time periods relative to when we observe students completing CE credentials. While we could simply flag any time we see a student with earnings in a different industry from the previous quarter, we wanted to attempt to identify their main industry of employment in order to assess how it may have shifted as the result of their CE training.

To identify the primary industry in the period prior to earning their first CE credential, we aggregate total earnings by industries (NAICS) in the 3-year period before the quarter in which the student earns their credential. We use three years in order to capture a long enough time period and account for the fact that many students do not work, or may work much less, while they are enrolled in school. We also looked at mean earnings across industries over this time period and that examination yielded consistent results for identifying primary industries.

We employ a similar strategy to define the primary industry in the post-award period. We constructed three different time periods in the post-period – 1 year after award completion, 2 years after completion, and 3 years

after completion. Again, we designate the primary industry based on the total aggregate quarterly earnings over the entire time period.

TABLE E1

Industry changes for students completing career education credentials

Prime industry	Pre-first award, 3 years	Post-first award, 1 year	Post-first award, 2 years	Post-first award, 3 years
Professions/technical	6.4%	7.8%	8.3%	9.2%
Administrative support	7.5%	8.2%	7.8%	7.8%
Educational services	6.6%	7.7%	7.7%	7.6%
Other government	4.5%	6.1%	6.3%	6.5%
Food service	10.0%	7.7%	7.0%	6.2%
Credit Intermediation (banks, mortgage, credit cards)	4.9%	5.6%	5.7%	5.7%
Social assistance (includes child care)	3.3%	3.5%	3.5%	3.4%
Ambulatory health	2.6%	3.0%	3.1%	3.2%
General merchandise stores	4.6%	3.6%	3.4%	3.2%
Food/beverage stores	3.7%	3.1%	2.9%	2.7%
All Other	54.0%	56.1%	55.6%	55.4%

SOURCES: Authors calculations from COMIS and EDD UI data.

NOTES: Includes students who earned a career education credentials between 2003 and 2010 in any program and of any level. Primary industry based on highest total aggregate earnings over the time period by industry (3-digit NAICS) for students earning career education.

Professional certificates and licenses

Many middle-skill jobs require either a license to be employed in the occupation or have industry-related, professional certifications associated with the job. While industry certifications are not the same as the career education certificates that are the focus of this report, many community college career education programs attempt to align their curriculum to requirements for industry credentials if they are available. For example, in the IT sector, there are several programs in computer networking offering courses and certificates that prepare students to earn various CISCO certification levels.

The ACS does not provide any information on whether workers have licenses or professional certificates related to their employment, but in recent years the Current Population Survey does. Smaller sample sizes in the CPS preclude an analysis of certificates and licenses at the regional level, but can provide valid statewide estimates. Tables E2 and E3 show the share of current California workers, age 18 – 54, that report they have some type of professional certificate or license, whether the license is issued by a government agency, and whether the license is required for their job by education levels and broad occupation categories, respectively.

TABLE E2

Distribution of current workers who report having a professional certificate or license by education level

Education level	Any professional certificate/license	Gov't issued license	Required for job	None
High school or less	9.8%	8.5%	5.5%	90.2%
Some college	18.7%	16.3%	10.2%	81.3%
Associate degree (vocational)	37.7%	33.4%	22.8%	62.3%
Associate degree (academic)	25.5%	22.5%	14.4%	74.5%
Bachelor degree	24.1%	21.4%	13.9%	75.9%
Advanced degree	40.9%	38.0%	26.5%	59.1%

SOURCES: Current population survey, monthly files, 2015 – 2018.

TABLE E3

Distribution of current middle-skill workers who report having a professional certificate or license by occupation

Occupation (SOC2)	Any professional certificate/license	Gov't issued license	Required for job	Share of occupation that is middle-skill
All occupations	22.0%	19.2%	12.2%	26.1%
Healthcare Practitioners and Technical Occupations	70.5%	66.8%	49.8%	23.9%
Healthcare Support Occupations	50.6%	43.9%	34.1%	50.4%
Protective Service Occupations	43.0%	40.6%	29.6%	45.8%
Legal Occupations	35.2%	31.8%	24.2%	12.2%
Personal Care and Service Occupations	29.9%	27.0%	18.3%	34.6%
Construction Trades	29.4%	27.3%	18.3%	23.4%
Installation, Maintenance, and Repair Workers	25.5%	20.1%	11.3%	38.9%
Education, Training, and Library Occupations	27.2%	23.8%	16.6%	13.6%
Community and Social Science Occupations	21.6%	18.5%	15.2%	20.3%
Management Occupations	20.0%	17.5%	10.2%	23.9%
Architecture and Engineering Occupations	21.9%	18.8%	12.8%	14.7%
Sales Occupations	18.3%	16.7%	9.2%	32.4%
Production Occupations	17.0%	13.5%	8.9%	22.7%
Computer and Mathematical Operations	16.1%	7.6%	4.8%	16.2%
Business Operations Specialists; Financial Specialists	16.6%	14.7%	7.7%	20.7%
Farming, Fishing, and Forestry Occupations	14.4%	14.1%	6.7%	9.8%
Transportation and Material Moving Occupations	14.7%	13.2%	8.3%	24.6%
Arts, Design, Entertainment, Sports, and Media Occupations	12.7%	6.1%	2.4%	21.7%
Food Preparation and Serving Occupations	12.8%	11.0%	5.2%	26.8%
Building and Ground Cleaning and Maintenance Occupations	12.6%	11.8%	7.1%	15.8%
Office and Administrative Support Occupations	9.4%	7.7%	3.3%	39.6%
Life, Physical, and Social Science Occupations	10.1%	9.2%	4.4%	6.0%

SOURCES: Current population survey, monthly files, 2015 – 2018. Share of middle-skill workers from American Community Survey, 2014-2017.

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