PPIC | PUBLIC POLICY INSTITUTE OF CALIFORNIA

Improving Career Education Pathways into California's Workforce

Technical Appendices

CONTENTS

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Appendix A. Stakeholder interviews

This study relies on both quantitative and qualitative data sources to investigate the challenges and opportunities in creating more equitable and effective career pathways for students enrolled in the California community college system. The main goal of the qualitative portion of our study was to better understand the role that employers and workforce development intermediaries play in connecting students to career education programs and supporting them to complete training. And more importantly, what can be done to improve these programs and the outcomes for students who pursue them so they can connect with good jobs offering economic mobility.

For this, we relied on semi-structured interviews with employers, workforce development boards and agencies, along with community college practitioners who actively steward and facilitate the career education pipeline from the community college system to the labor force, from the local to the state level. For some interviews, we spoke with individuals one-on-one, while in other cases we discussed topics with multiple people from the same organization. In total, we spoke with 22 people across 14 organizations over the course of four months (December 2020 to March 2021), in an effort to better understand the factors that contribute to effective career education pathways and the potential structural/systemic impediments to creating or maintaining them. Our interview protocols, which varied slightly depending on the groups we were talking with are included below, along with a list of people interviewed.

List of expert interviews

Community College Practitioners

Community college career education faculty member

Community college district administrator; former workforce Dean

Community college workforce Dean

Practitioner researcher; Former community college president

Community college administrator; Former community college faculty

Community college economic development director and staff

Workforce Intermediaries

State-level workforce development directors

Local workforce development board staff and deputy directors

Workforce intermediary directors

Employers

Executive board member of regional manufacturing council

Hiring manager logistics employer

Training manager advanced manufacturing employer

Lead workforce consultant hospital employer

Interview protocols

Note all protocols include researcher contact information and informed consent for participants, though we only include those elements in the first protocol for community college practitioners below.

Community college practitioners

Thank you for agreeing to participate in our research project. The interview is designed to last between 45 and 60 minutes and will be semi-structured. We will propose general topics and questions and let the conversation develop organically. And please do not feel that you need to prepare for this interview; your expertise and experience in this area is all we need. If it is acceptable to you, we would like to audio record your interview for our internal note taking purposes only as this would allow us to more fully engage during the discussion itself. We would not keep your audio recording beyond the life of this project.

The ECMC Foundation and the James Irvine Foundation are funding this research and we anticipate publishing a report on our findings in July 2021. The audience for this report will be community college practitioners, workforce development intermediaries, along with state and local agencies and policymakers. The report will include a list of the people and organizations that we interviewed in an appendix. We may include direct quotes from interviewees in the report, but will provide those to you for review before publication and you will be able to revise and/or decline their inclusion. The second page of this document provides information about your rights as a participant in this project.

We are collecting expert opinions on the following broad topics:

- How do community colleges currently engage with employers and industry groups?
- What are the characteristics of successful college-employer partnerships? What defines success?
- What role can/do effective employer partnerships play in improving students' educational experience and career outcomes?

Examples of specific questions include:

1. Based on your experience, how would you describe the scope and purpose of college-employer partnerships with which you have been involved? What types of activities were used to engage employers and how might these vary across different types of employers?
2. Are college-employer partnerships only necessary for career education program offerings or is there a broader role for employer engagement to inform all community college offerings?
3. What are some challenges in creating and maintaining effective college-employer partnerships? Do you know of any examples where these challenges have been overcome?

Please contact any of the following PPIC researchers involved if you have questions or concerns.

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Informed Consent

The Public Policy Institute of California (PPIC), a non-profit research organization, is conducting a study examining how community colleges engage with employers to inform their programs. A component of the research includes expert interviews and we are requesting your participation by taking part in a 45- to 60-minute interview. The information you provide will be incorporated into a PPIC report focused on how students re-engage with training

programs to advance their careers and the role of employer partnerships and workforce intermediaries. The organizations and names of those interviewed will be included in an appendix of the report, so the information you provide will not be confidential. If we would like to include a direct quote and attribute it to you, we will provide the quote to you before publication and you will have the ability to revise or decline to have it included.

Your participation in the study is completely voluntary. If you do not wish to participate, we may attempt to contact another person within your organization to participate. If you do participate, you can stop at any time, you do not have to answer any questions for any reason, and you should not feel obligated to discuss any topic with which you are not comfortable.

Workforce Intermediaries

Thank you for agreeing to participate in our research project. The interview is designed to last between 45 and 60 minutes and will be semi-structured. We will propose general topics and questions and let the conversation develop organically. And please do not feel that you need to prepare for this interview; your expertise and experience in this area is all we need. If it is acceptable to you, we would like to audio record your interview for our internal note taking purposes only as this would allow us to more fully engage during the discussion itself. We would not keep your audio recording beyond the life of this project.

The ECMC Foundation and the James Irvine Foundation are funding this research and we anticipate publishing a report on our findings in July 2021. The audience for this report will be community college practitioners, workforce development intermediaries, along with state and local agencies and policymakers. The report will include a list of the people and organizations that we interviewed in an appendix. We may include direct quotes from interviewees in the report, but will provide those to you for review before publication and you will be able to revise and/or decline their inclusion. The second page of this document provides information about your rights as a participant in this project.

We are collecting expert opinions on the following broad topics:

- How do community colleges currently engage with workforce intermediaries, employers, and industry groups to design career pathways?
- What are the characteristics of successful college-employer partnerships? What defines success?
- What role can/do effective employer partnerships play in improving students' educational experience and career outcomes?

Examples of specific questions include:

1. In your current role, how do you engage with community colleges to 1) facilitate employer partnerships; 2) to connect students to pathways that can promote economic mobility?
2. How would you characterize the current state of partnerships between the community colleges, workforce intermediaries, and employers in California?
3. What are some challenges in creating and maintaining effective college-employer partnerships? How does the project ensure equity in terms of who is served and how successful they are?

Employers

Thank you for agreeing to participate in our research project. The interview is designed to last about 30 minutes and will be semi-structured. We will propose general topics and questions and let the conversation develop organically. And please do not feel that you need to prepare for this interview; your expertise and experience in this area is all we need. If it is acceptable to you, we would like to audio record your interview for our internal

note taking purposes only as this would allow us to more fully engage during the discussion itself. We would not keep your audio recording beyond the life of this project.

The ECMC Foundation and the James Irvine Foundation are funding this research and we anticipate publishing a report on our findings in July 2021. The audience for this report will be community college practitioners, workforce development intermediaries, along with state and local agencies and policymakers. We plan to include a list of the people and organizations that we interviewed in an appendix. We may include direct quotes from interviewees in the report, but will provide those to you for review before publication and you will be able to revise and/or decline their inclusion. The second page of this document provides information about your rights as a participant in this project.

We are collecting expert opinions on the following broad topics:

- How do community colleges currently engage with workforce intermediaries, employers, and industry groups to design career pathways?
- What are the characteristics of successful college-employer partnerships? What defines success?
- What role can/do effective employer partnerships play in improving students' educational experience and career outcomes?

Examples of specific questions for employers include:

1. In your current role, how do you engage with community college programs to meet your workforce needs—both for entry-level workers and incumbent workers?
2. How do you value different types of training programs and/or post-secondary credentials in terms of current workers who may be looking to advance in their careers?
3. What makes certain workforce training programs and/or training providers better than others – for employers and students/workers?

Appendix B. Sample Construction and Descriptive Statistics

Our quantitative analyses relies on the California Community College Chancellor's Office Management Information System (MIS), a student-level longitudinal data system that includes but is not limited to detailed information on student characteristics, course information, enrollment, financial aid receipt, and award completion. The MIS data spans the 1993 fall term to the fall term of 2019.

The award information available in the MIS data system contains details on all credentials that a student completes[1]. We classify all credit awards that students earn into three categories—short-term certificates, long-term certificates, and associate degrees, defined based on the number of units required to earn the credential. Assuming a full-time course-load, short-term degrees take less than one year to complete and include certificates requiring less than 30 units to complete. Long-term degrees take between one and two years to complete and include certificates requiring 30–59 units. Associate degrees, either an associate of art or science, require 60 or more units and take two 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 collects and reports information on programs and courses in different colleges throughout the state that have similar outcomes. We use TOP codes to identify the career education disciplines or fields that people pursue. The CCCCO designates all career education or vocational programs based on the 6-digit TOP code. The TOP codes aggregate information about programs, with a 6-digit TOP code assigned to all courses and awards. 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).

Our sample universe consisted of students who earned at least one credit in one of the six focal career education disciplines between the fall 2007 academic term and the fall 2016 academic term, which totaled more than 5 million students. Only students with a de-identified SSN as their identifier are included in our analysis so that we can track students across the system and see enrollment and award completion across multiple community colleges; this restriction excludes about 12 percent of the sample universe.

From this universe of students, the sample of students we focus on are those that exhibit intent to complete a career education credential, which we define as completing at least 8 units in a given career education discipline within three years of earning their first career education unit. For our main analyses presented in the report, we also exclude students who transfer to a four-year college. While transfer to a four-year institution can be an important milestone along the career education pipeline, we cannot observe what students do after they transfer out of the community college system. Though we exclude students who transfer from our main analysis, we do include students who transferred to a four-year college after they became career-intending in some of the descriptive tables below and in sensitivity checks in our regression analyses.

[1] One caveat in our research pertains to the potential underreporting of short-term certificates 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.

Depending on the outcome of interest, we use different sample cohorts based on when a student completed their first CE units. Our analyses focused on completion of an initial CE credential includes students who completed their first CE units between the 2010 and 2016 academic years. For analyses focused on completion of a stackable credential pathway, which includes earning a first credential, re-enrolling in the community college, and completing a 2nd credential in the same field, we include students who earned their first CE units between the 2007 and 2013 academic years. This allows us to observe students for a full six years to give them time to return and complete additional credentials.

Table B1 provides summary statistics for each of these samples with and without the inclusion of students who transfer to a four-year college. Again, the main analyses presented in the report exclude students who transfer after becoming CE-intending, but it is useful to see how this exclusion may impact our sample along key dimensions of interest. There are some small differences across the first award and the stackable 2nd award samples; Latinos comprise a slightly higher share in the first award sample – the more recent group of students. It also appears that more students have received Pell grants in recent years compared to the earlier time period. In terms of differences that result from exclusion of transfer students – when transfer students are included there are higher shares of students pursuing Business credentials and younger students age 24 or less.

TABLE B1

Summary statistics for different analytic samples, with and without transfer students

	First award sample, no transfers	Stack 2nd award sample, no transfers	First award sample, with transfers	Stack 2nd award sample, with transfers
Discipline				
Business	25.5%	24.9%	30.4%	29.4%
IT	7.7%	6.7%	8.5%	7.3%
Engineering	19.5%	20.3%	16.6%	17.4%
Health	13.8%	13.5%	12.7%	12.7%
Family/Consumer	16.5%	16.9%	15.5%	16.0%
Public/Protective	16.9%	17.7%	16.4%	17.2%
Race/ethnicity				
Latino	39.6%	35.0%	38.6%	33.9%
White	34.2%	37.5%	33.9%	37.4%
Black	6.7%	7.4%	6.1%	6.9%
Asian	13.9%	14.7%	15.8%	16.5%
Multi-racial	5.5%	5.4%	5.6%	5.4%
Age at intending				
24 or younger	53.9%	51.5%	59.9%	57.5%
25 - 34	27.8%	26.4%	24.8%	23.9%
35 - 49	12.7%	15.6%	10.8%	13.3%
50 or older	5.6%	6.5%	4.5%	5.2%
Socio-economic status				
Never receive Pell grant	38.9%	46.1%	37.4%	44.2%
Ever receive Pell grant	61.1%	53.9%	62.6%	55.8%
Full-time enrollment				
Never complete full-time term	47.5%	49.5%	40.6%	42.6%
Ever complete full-time term	52.5%	50.5%	59.4%	57.4%
Sample	501,295	473,661	646,312	615,288

SOURCES: Authors' calculations from MIS data.

NOTES: Excludes students who earned a credential in a discipline different from the CE-intending discipline. First award sample includes students who complete first CE units between 2010 and 2016. Stack 2nd award sample includes students who complete first CE units between 2007 and 2013.

Tables B2 through B4 present different completion metrics across multiple samples and by CE disciplines, student demographics, and whether students ever received Pell grants or completed a full-time term. Table B2 provides completion rates for the sample that we present results for in the report that excludes students who transfer to a four-year college after becoming CE intending. Table B3 keeps transfer students in the sample and reports identical completion rates, which do go up slightly with the inclusion of sample transfer students increasing by about 3 to 5 percentage points, overall. The biggest increase is for business students who see a 7 percentage point increase. Finally, Table B4 uses more restrictive definitions of who is consider "career education" intending. The first changes the CE intending unit cutoff from 8 units to 12 units and the other limits the sample to only those students who earn at least 50% of their total credits in the CE discipline. Again, we see

increases in completion rates when we tighten our criteria on who may be intending to complete a career education credential.

TABLE B2

Completion rates for First Award sample, excludes students who transfer after becoming intending

	Complete CE award, 3yr	Complete CE award, 6yr	Sample	Complete any award, 3yr	Complete any award, 6yr	Sample
Overall	18.0%	27.7%	501295	22.1%	33.9%	554126
Discipline						
Business	13.2%	21.3%	128037	17.8%	28.4%	141949
IT	9.0%	15.1%	38671	16.6%	26.9%	45521
Engineering	16.8%	26.6%	97820	18.5%	29.2%	102099
Health	40.1%	53.4%	69343	44.6%	59.2%	80654
Family/Consumer	14.4%	24.6%	82821	18.1%	31.1%	91831
Public/Protective	16.2%	26.5%	84603	20.0%	31.7%	92072
Race/ethnicity						
Latino	17.0%	27.3%	198547	20.8%	33.2%	218623
White	19.3%	28.8%	171496	23.7%	35.3%	190893
Black	14.5%	22.5%	33587	18.1%	28.0%	36429
Asian	20.0%	29.6%	69867	24.4%	35.9%	77498
Multi-racial	16.9%	25.8%	27798	21.1%	32.1%	30683
Age at intending						
24 or younger	16.1%	25.8%	270350	20.5%	32.8%	302693
25 - 34	21.0%	30.3%	139211	24.9%	35.8%	152244
35 - 49	20.4%	31.2%	63703	23.7%	35.9%	68907
50 or older	17.0%	25.8%	27861	20.5%	31.0%	30104
Socio-economic status						
Ever receive Pell grant	19.9%	31.4%	306099	24.3%	38.2%	344598
Never receive Pell grant	15.1%	22.0%	195172	18.5%	26.8%	209500
Full-time enrollment						
Ever full-time term	25.0%	37.0%	262933	29.9%	44.4%	302385
Never full-time term	10.3%	17.5%	238362	12.9%	21.3%	251741

NOTES: Excludes students who transfer to 4-year after becoming 'career intending'. Sample for completion rates in the same CE discipline exclude students who earn their 1st award in another field. Those students are included in 2nd panel that shows completion rates of any award.

TABLE B3

Completion rates for First Award sample, includes students who transfer after becoming intending

	Complete CE award, 3yr	Complete CE award, 6yr	Sample	Complete any award, 3yr	Complete any award, 6yr	Sample
Overall	21.1%	32.0%	646,538	27.1%	40.8%	753,072
Discipline						
Business	20.6%	30.8%	196,506	27.0%	39.7%	228,037
IT	9.4%	15.7%	54,706	21.2%	33.5%	70,489
Engineering	17.0%	26.6%	107,393	19.8%	31.1%	115,419
Health	42.0%	55.8%	82,027	47.3%	62.7%	99,152
Family/Consumer	16.3%	27.6%	99,965	22.8%	38.7%	120,336
Public/Protective	20.8%	33.7%	105,941	25.7%	40.4%	119,639
Race/ethnicity						
Latino	21.2%	33.4%	249,195	26.7%	42.0%	290,405
White	21.4%	31.6%	219,485	27.6%	40.6%	256,007
Black	16.5%	25.7%	39,528	21.4%	33.2%	44,425
Asian	22.7%	32.6%	102,419	29.6%	42.0%	120,392
Multi-racial	19.9%	29.6%	35,911	26.1%	38.9%	41,843
Age at intending						
24 or younger	20.6%	31.7%	387,180	27.5%	42.0%	464,329
25 - 34	22.9%	33.1%	160,268	27.8%	39.8%	179,989
35 - 49	21.8%	33.4%	69,795	25.8%	39.0%	76,793
50 or older	17.6%	26.8%	29,095	21.5%	32.6%	31,750
Socio-economic Status						
Ever receive Pell grant	23.5%	36.4%	404,523	29.7%	45.7%	482,560
Never receive Pell	17.2%	24.7%	241,989	22.5%	32.0%	270,482
Full-time enrollment						
Ever full-time term	27.9%	40.8%	384,153	34.6%	50.8%	470,706
Never full-time term	11.3%	19.1%	262,385	14.6%	24.1%	282,366

NOTES: Includes students who transfer to 4-year college after becoming 'career intending'. Sample for completion rates in the same CE discipline exclude students who earn their 1st award in another field. Those students are included in 2nd panel that shows completion rates of any award – regardless of whether it is the CE-intending discipline – within 3 and 6 years.

TABLE B4

Completion rates for more restrictive "CE intending" criteria, First Award Sample excludes transfer

	Complete CE award, 3yr	Complete CE award, 6yr	Sample	Complete CE award, 3yr	Complete CE award, 6yr	Sample
	Restrict to sample completing at least 12 units in CE discipline (rather than 8)			**Restrict to sample where at least half of total units are in CE discipline**		
Overall	23.7%	36.5%	351,019	21.0%	30.0%	317,424
Discipline						
Business	19.0%	30.6%	79389	12.8%	19.1%	65588
IT	14.0%	23.3%	23172	12.6%	18.2%	18876
Engineering	21.3%	33.6%	74354	17.8%	27.5%	81291
Health	50.7%	68.1%	48092	47.5%	61.0%	48745
Family/Consumer	19.0%	32.2%	60566	17.1%	26.8%	52260
Public/Protective	19.9%	32.4%	65446	18.2%	25.3%	50664
Race/ethnicity						
Latino	22.1%	35.5%	140466	19.8%	29.1%	120051
White	25.0%	37.6%	120599	22.0%	30.8%	113903
Black	19.6%	30.5%	22780	16.6%	24.2%	21591
Asian	27.1%	40.1%	48188	24.4%	33.6%	44643
Multi-racial	22.6%	34.6%	18986	19.8%	28.0%	17236
Age at intending						
24 or younger	21.5%	34.7%	183802	19.5%	28.4%	145189
25 - 34	26.9%	38.9%	100511	23.1%	31.9%	103371
35 - 49	25.9%	39.7%	46852	22.0%	31.7%	47931
50 or older	22.3%	33.9%	19757	18.8%	26.7%	20831
Socio-economic Status						
Never receive Pell	20.4%	30.3%	127370	15.7%	22.1%	150730
Ever receive Pell	25.5%	40.0%	223633	25.9%	37.1%	166682
Full-time enrollment						
Never full-time term	14.6%	25.4%	211265	11.4%	18.4%	188391
Ever full-time term	29.7%	43.8%	139754	35.2%	46.9%	129033

NOTES: Completion rates are based on students completing a credential in the same CE discipline in which they become intending. Excludes students who transfer to 4-year college after becoming 'career intending' and students who earn an award in a different discipline. The first panel increases the number of units in a CE discipline a student must complete to be considered CE-intending to 12 units rather than 8 units as is used in the main analysis. The second panel includes only students who earn at least 50% of their total units in the CE discipline in which they were intending.

TABLE B5

Distribution of first awards by discipline and level and estimated wage return for 1st and 2nd credentials in same field, First Award sample

	Associate	Wage return, 1st award	Long-term certificate	Wage return, 1st award	Wage return, 2nd award	Short-term certificate	Wage return, 1st award	Wage return, 2nd award
Business	60.7%	2.1%	7.5%	3.0%	0.0%	31.8%	3.2%	2.6%
Engineering	17.1%	14.0%	36.8%	3.7%	9.7%	46.1%	2.5%	8.1%
Family/Consumer	27.7%	10.0%	16.1%	7.1%	7.6%	56.2%	7.9%	1.9%
Health	56.4%	138.0%	20.1%	62.9%	35.7%	23.5%	4.9%	35.0%
IT	46.2%	0.0%	7.6%	0.0%	0.0%	46.2%	0.0%	0.0%
Public/ Protective	44.1%	7.8%	14.4%	13.2%	0.0%	41.5%	20.4%	2.8%

SOURCES: Authors calculations using MIS; Bohn, Jackson and McConville (2018) "Career Pathways and Economic Mobility at California Community Colleges", PPIC.

NOTES: Share of each award level is based on the highest level first credential student received in the same discipline as they became intending. Distribution of awards is based on the first award sample that includes students who completed their first CE credits between the 2010 and 2016 academic years.

TABLE B6

Reported goals of students who became career-education intending in school years 2017 and 2018

	Non-transfer, intending sample	Transfer after intending
Ever undecided	38.0%	39.9%
Ever AA, no transfer	26.4%	10.1%
Ever transfer	58.3%	89.7%
Ever Career Education	32.7%	8.4%
Ever CE or AA, no transfer	51.6%	17.2%
Ever not transfer	70.0%	50.1%

SOURCES: Authors calculations using MIS

NOTES: Student goals are reported every term a student is enrolled and can be updated in any term. We only look at two recent cohorts of intending students because prior to 2017 the MIS data was not completed for many students. About 95% of CE intending students in 2017 and 2018 reported goals in at least one term they were enrolled.

TABLE B7

Course-taking behavior of first award sample, excludes transfer students

	Terms enrolled	Ever full-time, completed	Ever full-time, attempted	Full-time terms, completed	Units attempted, per term	Units completed, per term	CE unit total, 3 years		All unit total, 3 years		Share CE Units
Discipline	Means				Median		Median	P10/P90	Median	P10/P90	
Business	5.0	51.9%	65.2%	1.1	9.1	7.3	13	9/27	32	12/65	40.6%
IT	5.3	52.4%	66.9%	1.1	9.1	7.1	12.5	8/29	33.5	12/68	37.3%
Engineering	5.0	44.9%	55.8%	1.0	8.2	6.7	17	9/45	27	11/64	63.0%
Health	5.1	57.9%	67.4%	1.2	9.2	7.9	18.5	9/48	38.5	13/65	48.1%
Family/Consumer	5.3	47.1%	61.4%	1.0	8.4	6.7	15	9/34	31	12/64	48.4%
Public/Protective	5.0	62.8%	78.8%	1.2	10.1	7.6	18	9/33	34	12/66	52.9%
Race/ethnicity											
Latino	5.4	51.9%	67.0%	1.0	8.9	6.9	15	9/36	33	12/66	45.5%
White	4.8	52.5%	63.4%	1.1	9.1	7.5	15	9/39	31	12/64	48.4%
Asian	5.0	53.6%	63.2%	1.2	9.0	7.6	15	9/41	33	12/68	45.5%
Black	5.1	52.0%	70.1%	1.0	9.2	6.8	15	9/37	30	12/63	50.0%
Multi-racial	4.9	52.9%	66.2%	1.1	9.3	7.3	15	9/37	34	12/67	44.1%
Age at intending											
24 or younger	5.3	58.8%	74.8%	1.2	9.6	7.5	17	9/42	35	12/66	41.0%
25 - 34	4.8	47.2%	57.3%	0.9	8.5	7.0	15	9/37	32	12/64	45.5%
35 - 49	4.9	42.5%	50.9%	0.9	8.0	6.8	14	9/36	31	12/68	47.0%
50 or older	4.8	40.1%	48.6%	0.9	7.8	6.6	14	9/35	30	12/63	48.1%

SOURCES: Authors calculations using MIS

NOTES: Terms enrolled refers to all term enrollments after student earns their first CE units. Students may have additional terms enrolled prior to completing their first CE course. Ever full-time completed indicates students completed a full-time courseload measured as 12 or more units in the three year period after they completed their first CE course. Full-time attempted indicates if a student attempted at least 12 units but did not necessarily earn 12 units.

Appendix C. Regression Analysis

To assess the characteristics associated with completion of career education milestones in a multivariate setting we use two sets of regression models: point-in-time logistic models and discrete time hazard models. Both allow us to control for individual, program, college, and time effects simultaneously. The hazard model also allows us to account for some of the dynamics of enrollment and credential completion.

Models of Completion

To analyze the correlates of completion in a parsimonious manner, we use simple logit models that estimate whether an intending student completes a credential and whether a student who has earned a first credential completes a stacked, second credential.

$$logit(y_i) = \alpha + \boldsymbol{G}'\beta + \boldsymbol{Z}'\delta$$

where *y* is a binary variable of completion, $\boldsymbol{G}$ is a vector of student characteristics (age, race-ethnicity, gender, etc) and $\boldsymbol{Z}$ is a set of fixed effects (college, program, year). In the set of models for completion of a second credential, $\boldsymbol{G}$ also includes the type of first credential (long term, short term, or local certificate).

Our key outcome variables are restricted by time, in keeping with typical practice for measuring student success. Earning a first career education credential must be completed within 3 years of the first career education course taken. The models of the second credential require that it is earned within 6 years of the first career education course. So as not to truncate students' trajectories, in baseline models we limit our sample to students whose first career education course was taken between 2010-2016 for first award achievement and taken between 2007 and 2013 for the second award. Award achievement in these models must be within the same career education discipline as that in which the student becomes "intending". Similarly, second award achievement must be a stackable credential, meaning it is earned in the same discipline as the first. Some students become intending in more than one discipline or earn a credential without becoming intending by our definition; these are excluded from the models of completion. In line with all analyses in this report, we exclude students who transfer from our baseline models.

Table C1 provides the regression results from of the logit model of earning a first career education credential and key robustness checks. Model (1) is our main model, which includes all relevant covariates and our preferred sample representing the most recent students. Models (2)-(7) implement a number of checks on the sample and one check on the dependent variable. These models yield nearly identical results. We exclude health students given their exemplary completion rate (Model (2)); we drop college fixed effects in Model (3); we check if findings differ when transfer students are included in Model (4); we look at a smaller subset of the most recent students in Model (5); we expand the sample to all students back to 2000 in Model (6); and we relax the time clock on completion in Model (7).

Table C2 replicates these models on completion of a second, stacked credential. For these models we measure 6-year completion of the second credential, measured from the first career education course. The sample of students includes all students in the prior baseline model (Table C1 Model 1) who earned a long-term, short-term, or local certificate in their intending career education discipline within 3 years. Their second, stacked credential must also be in the same discipline. Students whose first award was an associate degree are excluded since there is not credential that can be stacked above the associates.

In the second award models we observe students for the same length window (6 academic years) but we shift the window backwards to ensure students all have 6 years to earn a first and second credential. That is, our baseline model observes students whose first career education course was between 2007 and 2013; we track their second award completion rate through fall 2019. We rely on year fixed effects to control for differences in the years sampled across the first and second award models; however, we do not observe strong time trends in completion of a first or second award. The robustness checks on 6 year completion proceed identically to Table C1; we find similar results across all models.

Tables C3 and C4 provide detailed estimates and confidence intervals for the average predicted probability of completion from the baseline model (Model (1)) in both Table C1 and C2. These predicted probabilities are used in Figures 6 and 9 in the report.

TABLE C1

Logit models of completion of first career education credential: Odds ratios

	Baseline	Exclude Health-intending students	No College fixed effects	Include transfers	Most recent years: First course in 2013-2016	All years: First course in 2000- 2016	Estimate 6 year completion
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Asian	1.135***	1.090***	1.098***	1.055***	1.113***	1.139***	1.140***
	(0.0152)	(0.0173)	(0.0137)	(0.0112)	(0.0188)	(0.0106)	(0.0131)
Black	0.750***	0.762***	0.741***	0.707***	0.741***	0.793***	0.696***
	(0.0140)	(0.0159)	(0.0133)	(0.0113)	(0.0178)	(0.0101)	(0.0109)
White	1.072***	1.062***	1.073***	0.986*	1.072***	1.072***	1.058***
	(0.0110)	(0.0124)	(0.0102)	(0.00835)	(0.0139)	(0.00777)	(0.00928)
Multiracial/ other	0.939***	0.945***	0.944***	0.905***	0.960*	0.933***	0.910***
	(0.0176)	(0.0199)	(0.0173)	(0.0139)	(0.0226)	(0.0127)	(0.0146)
Age 25-34 at intending	1.404***	1.390***	1.423***	1.279***	1.369***	1.472***	1.321***
	(0.0133)	(0.0154)	(0.0132)	(0.0102)	(0.0164)	(0.0102)	(0.0108)
Age 35-49	1.533***	1.591***	1.551***	1.370***	1.521***	1.700***	1.567***
	(0.0197)	(0.0231)	(0.0194)	(0.0156)	(0.0256)	(0.0138)	(0.0172)
Age 50+	1.359***	1.408***	1.354***	1.190***	1.257***	1.496***	1.302***
	(0.0260)	(0.0296)	(0.0253)	(0.0215)	(0.0321)	(0.0189)	(0.0214)
Male	0.837***	0.923***	0.847***	0.822***	0.831***	0.835***	0.804***
	(0.00782)	(0.0101)	(0.00772)	(0.00613)	(0.00979)	(0.00552)	(0.00647)
Full-time in less than 25% terms	2.264***	2.425***	2.248***	2.220***	2.201***	2.504***	2.439***
	(0.0274)	(0.0347)	(0.0269)	(0.0231)	(0.0332)	(0.0215)	(0.0244)
…in 25-50% terms	2.938***	3.211***	2.891***	3.083***	2.856***	3.270***	2.746***
	(0.0312)	(0.0394)	(0.0302)	(0.0279)	(0.0381)	(0.0245)	(0.0247)
…in more than 50% terms	4.781***	5.138***	4.704***	5.265***	4.566***	5.323***	3.974***
	(0.0539)	(0.0656)	(0.0515)	(0.0490)	(0.0657)	(0.0421)	(0.0397)

	Baseline	Exclude Health-intending students	No College fixed effects	Include transfers	Most recent years: First course in 2013-2016	All years: First course in 2000- 2016	Estimate 6 year completion
Pell recipient in 1+term	1.191***	1.159***	1.216***	1.215***	1.200***	1.193***	1.379***
	(0.0111)	(0.0125)	(0.0109)	(0.00914)	(0.0142)	(0.00764)	(0.0110)
Associates degree prior	1.217***	1.256***	1.115***		1.208***	1.121***	1.055***
	(0.0170)	(0.0216)	(0.0150)		(0.0215)	(0.0109)	(0.0128)
Bachelor's degree prior	1.070***	1.053**	1.074***		1.089***	1.172***	1.006
	(0.0223)	(0.0253)	(0.0214)		(0.0312)	(0.0144)	(0.0183)
IT	0.699***	0.674***	0.679***	0.426***	0.640***	0.689***	0.703***
	(0.0144)	(0.0139)	(0.0137)	(0.00700)	(0.0163)	(0.0102)	(0.0117)
Engineering	1.577***	1.524***	1.589***	0.990	1.443***	1.569***	1.614***
	(0.0216)	(0.0214)	(0.0206)	(0.0111)	(0.0248)	(0.0155)	(0.0187)
Health	4.286***		4.115***	3.066***	3.819***	4.735***	4.151***
	(0.0545)		(0.0492)	(0.0313)	(0.0610)	(0.0429)	(0.0468)
Family & Consumer	1.127***	1.155***	1.128***	0.793***	1.011	1.354***	1.192***
	(0.0159)	(0.0166)	(0.0155)	(0.00892)	(0.0179)	(0.0132)	(0.0139)
Public & Protective	1.213***	1.175***	1.237***	1.005	1.106***	1.477***	1.294***
	(0.0166)	(0.0164)	(0.0161)	(0.0104)	(0.0191)	(0.0142)	(0.0149)
Constant	0.0318***	0.0275***	0.0573***	0.0638***	0.0472***	0.0369***	0.0732***
	(0.00252)	(0.00222)	(0.00116)	(0.00373)	(0.00455)	(0.00203)	(0.00425)
Year fixed effects	X	X	X	X	X	X	X
College fixed effects	X		X	X	X	X	X
Observations	506,885	436,510	506,885	654,210	301,383	1,120,809	506,885

SOURCES: Authors' calculations from MIS.

NOTES: Robust standard errors in parentheses, clustered by college. *** p<0.01, ** p<0.05, * p<0.1. Reference categories: Latino, age 24 or less, female, never attended full-time, never received Pell, no prior degree, intending in Business. Unless otherwise noted, models include intending students whose first career education course was between 2010-2016 and who did not transfer. Also all models except (7) estimate 3 year completion rates. Student age is measured in the term they become "intending".

TABLE C2

Logit models of completion of second, stacked career education credential: Odds ratios

	Baseline	Exclude Health-intending students	No College fixed effects	Include transfers	Most recent years: First course in 2010-2013	All years: First course in 2000- 2013	No time constraint on completion
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Asian	1.251***	1.180***	1.361***	1.162***	1.221***	1.234***	1.262***
	(0.0477)	(0.0522)	(0.0481)	(0.0392)	(0.0606)	(0.0344)	(0.0466)
Black	0.820***	0.830***	0.850***	0.836***	0.774***	0.913**	0.799***
	(0.0420)	(0.0468)	(0.0416)	(0.0381)	(0.0533)	(0.0341)	(0.0396)
White	1.129***	1.077**	1.264***	1.082***	1.119***	1.191***	1.126***
	(0.0334)	(0.0359)	(0.0344)	(0.0285)	(0.0427)	(0.0262)	(0.0321)
Multiracial/ other	1.060	0.974	1.164***	1.030	1.088	1.048	1.051
	(0.0577)	(0.0591)	(0.0615)	(0.0507)	(0.0755)	(0.0441)	(0.0549)
Age 25-34 at intending	0.857***	0.807***	0.841***	0.809***	0.841***	0.837***	0.845***
	(0.0242)	(0.0262)	(0.0232)	(0.0203)	(0.0305)	(0.0179)	(0.0230)
Age 35-49	1.075**	1.042	1.032	1.003	1.004	1.025	1.028
	(0.0346)	(0.0374)	(0.0320)	(0.0293)	(0.0439)	(0.0232)	(0.0319)
Age 50+	0.880***	0.844***	0.849***	0.816***	0.808***	0.885***	0.796***
	(0.0419)	(0.0442)	(0.0391)	(0.0364)	(0.0508)	(0.0311)	(0.0369)
Male	0.803***	0.812***	0.812***	0.792***	0.805***	0.861***	0.802***
	(0.0250)	(0.0299)	(0.0244)	(0.0217)	(0.0326)	(0.0196)	(0.0238)
Full-time in less than 25% terms	2.229***	2.122***	2.156***	2.240***	2.225***	2.170***	2.167***
	(0.0828)	(0.0888)	(0.0783)	(0.0757)	(0.109)	(0.0592)	(0.0773)
…in 25-50% terms	2.361***	2.344***	2.226***	2.418***	2.482***	2.219***	2.224***
	(0.0790)	(0.0878)	(0.0720)	(0.0733)	(0.110)	(0.0543)	(0.0713)
…in more than 50% terms	2.180***	2.440***	2.020***	2.364***	2.412***	2.095***	1.997***
	(0.0778)	(0.0973)	(0.0677)	(0.0756)	(0.113)	(0.0539)	(0.0685)
Pell recipient in 1+term	1.790***	1.751***	1.764***	1.851***	1.655***	1.772***	1.740***
	(0.0475)	(0.0526)	(0.0454)	(0.0436)	(0.0584)	(0.0337)	(0.0441)
Associates degree prior	0.864***	0.756***	0.902***		0.899**	0.851***	0.820***
	(0.0355)	(0.0371)	(0.0354)		(0.0474)	(0.0260)	(0.0326)
Bachelor's degree prior	0.826***	0.796***	0.700***		0.822***	0.827***	0.844***
	(0.0422)	(0.0452)	(0.0335)		(0.0620)	(0.0302)	(0.0409)
IT	0.817***	0.854**	0.835**	0.805***	0.815**	0.972	0.803***
	(0.0627)	(0.0665)	(0.0616)	(0.0538)	(0.0770)	(0.0525)	(0.0600)
Engineering	1.194***	1.100*	1.311***	1.075*	1.158**	1.151***	1.142***
	(0.0564)	(0.0542)	(0.0586)	(0.0449)	(0.0701)	(0.0403)	(0.0523)

	Baseline	Exclude Health-intending students	No College fixed effects	Include transfers	Most recent years: First course in 2010-2013	All years: First course in 2000- 2013	No time constraint on completion
Health	0.647***		0.718***	0.634***	0.548***	0.734***	0.689***
	(0.0295)		(0.0300)	(0.0254)	(0.0329)	(0.0242)	(0.0303)
Family & Consumer	0.979	1.037	1.076*	1.012	0.922	1.020	1.002
	(0.0434)	(0.0463)	(0.0442)	(0.0394)	(0.0541)	(0.0326)	(0.0432)
Public & Protective	0.759***	0.792***	0.788***	0.773***	0.845**	0.741***	0.849***
	(0.0377)	(0.0403)	(0.0368)	(0.0331)	(0.0553)	(0.0269)	(0.0403)
First award: short-term	1.586***	1.475***	1.888***	1.540***	1.512***	1.625***	1.522***
	(0.0547)	(0.0588)	(0.0565)	(0.0475)	(0.0669)	(0.0403)	(0.0501)
First award: local certificate	1.775***	1.539***	2.335***	1.658***	1.693***	1.789***	1.626***
	(0.0656)	(0.0664)	(0.0746)	(0.0547)	(0.0827)	(0.0471)	(0.0577)
Constant	0.103***	0.118***	0.0864***	0.112***	0.0861***	0.0923***	0.166***
	(0.0364)	(0.0421)	(0.00591)	(0.0318)	(0.0458)	(0.0212)	(0.0564)
Year fixed effects	X	X	X	X	X	X	X
College fixed effects	X	X		X	X	X	X
Observations	44,815	33,912	44,822	52,342	25,840	84,130	44,815

SOURCES: Authors' calculations from MIS.

NOTES: Robust standard errors in parentheses, clustered by college. *** p<0.01, ** p<0.05, * p<0.1. Reference categories: Latino, age 24 or less, female, never attended full-time, never received Pell, no prior degree, first award long-term certificate, intending in Business. Unless otherwise noted, models include intending students who earned a career education certificate (long, short, or local) within three years of their first career education course, which was between 2007-2013, and who did not transfer. Also all models except (7) estimate 6 year completion rates. Student age is measured in the term they earn a first credential.

TABLE C3

Predicted Probability of First Award Completion from Logit Model

	Covariate	Average Predicted Margin	95% confidence interval: lower bound	95% confidence interval: upper bound
Overall probability of completion		0.176612		
Race/ethnicity	Latino	0.174	0.172	0.176
	Asian	0.190	0.187	0.193
	Black	0.141	0.137	0.144
	White	0.183	0.181	0.185
	Multiracial/other	0.166	0.162	0.170
Age (at intending)	24 or younger	0.156	0.155	0.158
	25-34	0.199	0.197	0.201
	35-49	0.211	0.208	0.214
	50 or older	0.195	0.190	0.199
Gender	Female	0.188	0.187	0.190
	Male	0.166	0.165	0.167
Full-time	Never FT	0.101	0.100	0.102
	FT in less than 25% terms	0.192	0.190	0.195
	FT in 25-50% terms	0.232	0.229	0.234
	FT in more than 50% terms	0.318	0.314	0.321
Pell	Never Pell	0.163	0.161	0.165
	Ever Pell	0.184	0.183	0.186
Prior education	Neither	0.173	0.172	0.175
	AA	0.199	0.196	0.202
	BA+	0.182	0.177	0.187
Discipline	Business	0.130	0.128	0.132
	IT	0.0968	.0938	0.099
	Engineering	0.185	0.183	0.188
	Health	0.356	0.353	0.360
	Family & Consumer	0.143	0.141	0.146
	Public & Protective	0.152	0.149	0.154
Year became intending in career education	2010	0.178	0.175	0.182
	2011	0.167	0.164	0.170
	2012	0.163	0.160	0.166
	2013	0.170	0.167	0.172
	2014	0.180	0.177	0.183
	2015	0.191	0.188	0.193
	2016	0.204	0.201	0.207
	2017	0.176	0.173	0.180
	2018	0.0717	.0670	0.076
	2019	0.0254	.0180	0.032

SOURCES: Authors' calculations from MIS

NOTES: Average predicted probability of completion from Model (1) of Table C1. Overall completion rate using this sample is provided in the first row, and is the result of a simple logit model of completion on a constant.

TABLE C4

Predicted Probability of Second Award Completion from Logit Model

	Covariate	Average Predicted Margin	95% confidence interval: lower bound	95% confidence interval: upper bound
Overall probability of completion		0.259203		
Race/ethnicity	Latino	0.247	0.241	0.254
	Asian	0.287	0.276	0.298
	Black	0.215	0.201	0.230
	White	0.268	0.262	0.275
	Multiracial/other	0.257	0.240	0.274
Age (at first intending)	24 or younger	0.266	0.260	0.272
	25-34	0.239	0.232	0.247
	35-49	0.279	0.269	0.288
	50 or older	0.244	0.230	0.258
Gender	Female	0.279	0.272	0.286
	Male	0.241	0.235	0.247
Full-time	Never FT	0.169	0.162	0.175
	FT in less than 25% terms	0.298	0.288	0.308
	FT in 25-50% terms	0.309	0.301	0.317
	FT in more than 50% terms	0.294	0.285	0.302
Pell	Never Pell	0.199	0.193	0.205
	Ever Pell	0.298	0.292	0.303
Prior education	Neither	0.264	0.260	0.268
	AA	0.239	0.227	0.252
	BA+	0.232	0.216	0.248
Discipline	Business	0.279	0.266	0.291
	IT	0.243	0.221	0.266
	Engineering	0.312	0.302	0.322
	Health	0.206	0.198	0.214
	Family & Consumer	0.275	0.264	0.285
	Public & Protective	0.231	0.220	0.242
Year	2007	0.256	0.242	0.270
	2008	0.245	0.235	0.256
	2009	0.250	0.240	0.261
	2010	0.251	0.241	0.261
	2011	0.265	0.255	0.275
	2012	0.259	0.249	0.270
	2013	0.278	0.267	0.288
	2014	0.276	0.260	0.293
	2015	0.242	0.190	0.294
	2016	0.436	.0625	0.810

	Covariate	Average Predicted Margin	95% confidence interval: lower bound	95% confidence interval: upper bound
First award length	Long-term	0.200	0.192	0.207
	Short-term	0.276	0.269	0.283
	Local	0.297	0.289	0.305

SOURCES: Authors' calculations from MIS

NOTES: Average predicted probability of completion from Model (1) of Table C2. Overall completion rate using this sample is provided in the first row, and is the result of a simple logit model of completion on a constant.

Dynamic Models of Completion

To assess the timing of completion, we use discrete time hazard models. The hazard model estimates the probability that student (i) completes milestone (y) in term (j) given that they did not complete milestone in earlier terms

$$h(y,tj) = Pr[yi = j \mid yi\ ,G, Z]$$

where G includes student-level time-invariant characteristics (race, gender, age, etc) and Z includes a set of fixed effects for college, program, and year. This analysis closely follows Lin et al (2020).

We implement this model as a logistic regression with a full set of dummy variables for each term a student is potentially enrolled. These term variables count from 1 through 30, reflecting consecutive terms of potential enrollment (fall, winter, spring, summer), and where 1 indicates the term in which a student entered the sample by becoming "intending" (accumulating 8 units in a single career education discipline). Specifically, we estimate models of the form

$$logit(y_i) = \boldsymbol{D}'\boldsymbol{\alpha} + \boldsymbol{G}'\beta + \boldsymbol{Z}'\delta$$

where $\boldsymbol{G}$ and $\boldsymbol{Z}$ are as above, and $\boldsymbol{D}$ includes set of term dummies. Outcome y is bivariate indicating in which term, if any, a student earned a career education credential. We estimate separate models for earning the first credential (among all intending students) and earning a second, stacked credential (among all students who earned a first credential, but excluding associate degree earners). For the second credential the term dummies $\boldsymbol{D}$ start at 1 for the first term after the first award is earned and up to 30. As above, transfer students and those who earn awards in fields other than their intending discipline are excluded. In these models, we track completion through 30 terms (which expedites processing) and without a cutoff for completion – unlike the logits presented in the previous section. The aim of this exercise is to observe the correlates of when students complete term-by-term.

A number of robustness checks are carried out to ensure that our sample definition does not drive the results. Similarly to the previous section, we look at including transfer students, more recent vs older cohorts, and excluding health students.

The first two tables below present results from the hazard models of first and second award completion. Our preferred, baseline model mimics the logit in the previous section in terms of the sample. Students whose first career education course was between 2010-2016 are included. This is shown in Table C5 Model (1). Robustness checks of the sample follow and show similar odds ratios throughout. Table C6 presents estimates from the hazard of second award completion. Again, as in the logit model, our sample includes students whose first career education course was between 2007 and 2013. Model (1) provides our baseline estimates and subsequent columns implement robustness checks. Tables C7 and C8 provide the predicted probability of completion in each term (and cumulatively) from the baseline models.

To understand how students vary in the length of time they take to complete, we also estimate hazard models with additional interaction terms. We focus on differences across students defined by race/ethnicity, age, gender, Pell status, and discipline. In each case, we interact the student characteristic (say, race) with other characteristics in ***G*** (say, age, gender, Pell status, etc), discipline, and term dummies ***D***. The full regression results are lengthy so are not included here but are available upon request. The cumulative predicted probability of completion in each term for each demographic group is estimated from our interacted model; these results are plotted in Figures 7, 8 and 10 of the report. To give a visual sense of the statistical variation in these term-by-term and group-by-group estimates, we provide figures here showing the predicted probability of completion in each term for each group, along with bars denoting a 95% confidence interval. These appear below as Figures C1-C4.

TABLE C5

Discrete-time hazard models: completion of first credential, odds ratios

	Baseline	Exclude Health-intending students	Include transfers	Most recent years: First course in 2013-2016	All years: First course in 2000- 2016	Early years only: First course in 2007-2013	No College fixed effects
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Term 2	0.430***	0.520***	0.405***	0.440***	0.397***	0.415***	0.431***
	(0.0741)	(0.0988)	(0.0592)	(0.0741)	(0.0633)	(0.0680)	(0.0741)
Term 3	1.947***	2.064***	1.974***	1.863***	1.757***	1.990***	1.944***
	(0.207)	(0.174)	(0.155)	(0.203)	(0.162)	(0.232)	(0.207)
Term 4	0.878	0.955	0.858	0.842	0.838	0.921	0.877
	(0.125)	(0.121)	(0.0963)	(0.117)	(0.110)	(0.142)	(0.125)
Term 5	2.366***	2.776***	2.306***	2.334***	2.216***	2.526***	2.360***
	(0.213)	(0.235)	(0.159)	(0.214)	(0.171)	(0.241)	(0.213)
Term 6	0.770*	0.962	0.708**	0.760*	0.709**	0.786	0.769*
	(0.118)	(0.136)	(0.0953)	(0.114)	(0.0995)	(0.122)	(0.118)
Term 7	3.482***	3.253***	3.095***	3.405***	3.215***	3.882***	3.468***
	(0.428)	(0.332)	(0.281)	(0.431)	(0.371)	(0.526)	(0.428)
Term 8	0.967	1.042	0.819	0.908	0.929	1.109	0.966
	(0.195)	(0.226)	(0.132)	(0.184)	(0.170)	(0.228)	(0.195)
Term 9	2.330***	2.873***	2.050***	2.388***	2.101***	2.495***	2.321***
	(0.283)	(0.314)	(0.185)	(0.302)	(0.243)	(0.328)	(0.282)
Term 10	0.539***	0.716*	0.461***	0.525***	0.513***	0.601***	0.538***
	(0.0972)	(0.124)	(0.0681)	(0.0953)	(0.0866)	(0.113)	(0.0973)
Term 11	2.257***	2.334***	1.885***	2.254***	2.057***	2.619***	2.247***
	(0.293)	(0.276)	(0.185)	(0.296)	(0.259)	(0.374)	(0.293)
Term 12	0.416***	0.553***	0.334***	0.403***	0.397***	0.485***	0.415***
	(0.0751)	(0.0963)	(0.0499)	(0.0712)	(0.0680)	(0.0938)	(0.0752)
Term 13	1.366**	1.754***	1.117	1.393**	1.242*	1.536***	1.360**
	(0.178)	(0.204)	(0.110)	(0.182)	(0.155)	(0.216)	(0.178)
Term 14	0.290***	0.397***	0.229***	0.284***	0.273***	0.360***	0.289***
	(0.0509)	(0.0675)	(0.0335)	(0.0500)	(0.0457)	(0.0687)	(0.0510)

	Baseline	Exclude Health-intending students	Include transfers	Most recent years: First course in 2013-2016	All years: First course in 2000- 2016	Early years only: First course in 2007-2013	No College fixed effects
Term 15	0.908	1.220*	0.722***	0.918	0.825	1.054	0.904
	(0.119)	(0.142)	(0.0719)	(0.123)	(0.106)	(0.153)	(0.119)
Term 16	0.197***	0.270***	0.155***	0.175***	0.203***	0.271***	0.196***
	(0.0341)	(0.0451)	(0.0224)	(0.0296)	(0.0332)	(0.0510)	(0.0343)
Term 17	0.699***	0.964	0.546***	0.720**	0.632***	0.805	0.695***
	(0.0958)	(0.126)	(0.0563)	(0.0979)	(0.0854)	(0.125)	(0.0959)
Term 18	0.174***	0.246***	0.132***	0.182***	0.164***	0.226***	0.174***
	(0.0323)	(0.0475)	(0.0203)	(0.0438)	(0.0282)	(0.0437)	(0.0326)
Term 19	0.491***	0.674***	0.378***	0.516***	0.475***	0.607***	0.489***
	(0.0651)	(0.0833)	(0.0377)	(0.0730)	(0.0723)	(0.101)	(0.0654)
Term 20	0.114***	0.157***	0.0860***	0.111***	0.124***	0.166***	0.113***
	(0.0186)	(0.0249)	(0.0116)	(0.0211)	(0.0197)	(0.0304)	(0.0187)
Term 21	0.406***	0.558***	0.311***	0.499***	0.364***	0.471***	0.404***
	(0.0543)	(0.0740)	(0.0315)	(0.0699)	(0.0508)	(0.0764)	(0.0546)
Term 22	0.0930***	0.128***	0.0702***	0.0675***	0.0906***	0.130***	0.0926***
	(0.0164)	(0.0223)	(0.0106)	(0.0125)	(0.0154)	(0.0248)	(0.0164)
Term 23	0.293***	0.402***	0.227***	0.332***	0.265***	0.360***	0.291***
	(0.0395)	(0.0518)	(0.0234)	(0.0470)	(0.0352)	(0.0566)	(0.0396)
Term 24	0.0687***	0.0955***	0.0516***	0.0263***	0.0732***	0.103***	0.0683***
	(0.0119)	(0.0150)	(0.00769)	(0.00855)	(0.0117)	(0.0192)	(0.0120)
Term 25	0.233***	0.315***	0.179***	0.281***	0.219***	0.291***	0.232***
	(0.0335)	(0.0412)	(0.0206)	(0.0402)	(0.0293)	(0.0474)	(0.0335)
Term 26	0.0549***	0.0781***	0.0418***	0.0140***	0.0602***	0.0800***	0.0546***
	(0.0108)	(0.0155)	(0.00700)	(0.00659)	(0.00986)	(0.0163)	(0.0108)
Term 27	0.185***	0.253***	0.141***	0.184***	0.173***	0.229***	0.184***
	(0.0316)	(0.0409)	(0.0198)	(0.0334)	(0.0239)	(0.0389)	(0.0316)
Term 28	0.0433***	0.0593***	0.0318***	0.00781***	0.0493***	0.0578***	0.0430***
	(0.00872)	(0.0119)	(0.00509)	(0.00446)	(0.00755)	(0.0105)	(0.00872)
Term 29	0.186***	0.256***	0.146***	0.212***	0.157***	0.217***	0.184***
	(0.0340)	(0.0464)	(0.0224)	(0.0525)	(0.0222)	(0.0373)	(0.0339)
Term 30	0.0362***	0.0478***	0.0278***	-	0.0438***	0.0522***	0.0359***
	(0.00680)	(0.00935)	(0.00448)		(0.00742)	(0.00908)	(0.00679)
Asian	1.072***	1.033	0.981	1.065***	1.081***	1.079***	1.045
	(0.0229)	(0.0286)	(0.0205)	(0.0256)	(0.0168)	(0.0182)	(0.0307)
Black	0.780***	0.774***	0.756***	0.785***	0.807***	0.795***	0.770***
	(0.0230)	(0.0272)	(0.0204)	(0.0257)	(0.0166)	(0.0189)	(0.0319)
White	1.024*	1.015	0.953***	1.023*	1.033**	1.027*	1.026
	(0.0124)	(0.0145)	(0.0102)	(0.0124)	(0.0140)	(0.0152)	(0.0201)

	Baseline	Exclude Health-intending students	Include transfers	Most recent years: First course in 2013-2016	All years: First course in 2000- 2016	Early years only: First course in 2007-2013	No College fixed effects
Multiracial/ other	0.933***	0.922***	0.901***	0.948***	0.915***	0.915***	0.933***
	(0.0142)	(0.0163)	(0.0119)	(0.0176)	(0.0158)	(0.0142)	(0.0200)
Age 25-34 at intending	1.170***	1.141***	1.095***	1.166***	1.210***	1.187***	1.185***
	(0.0191)	(0.0219)	(0.0159)	(0.0225)	(0.0189)	(0.0173)	(0.0258)
Age 35-49	1.300***	1.314***	1.203***	1.301***	1.377***	1.342***	1.316***
	(0.0280)	(0.0345)	(0.0235)	(0.0327)	(0.0281)	(0.0268)	(0.0313)
Age 50+	1.154***	1.169***	1.050	1.106**	1.191***	1.217***	1.160***
	(0.0372)	(0.0440)	(0.0348)	(0.0470)	(0.0272)	(0.0263)	(0.0343)
Male	0.876***	0.921***	0.873***	0.878***	0.865***	0.864***	0.882***
	(0.0133)	(0.0144)	(0.0104)	(0.0145)	(0.0138)	(0.0143)	(0.0160)
Full-time in less than 25% terms	1.840***	1.946***	1.843***	1.824***	1.955***	1.889***	1.845***
	(0.0441)	(0.0485)	(0.0416)	(0.0470)	(0.0405)	(0.0430)	(0.0468)
…in 25-50% terms	1.949***	2.102***	1.993***	1.928***	2.061***	1.999***	1.944***
	(0.0527)	(0.0617)	(0.0497)	(0.0580)	(0.0468)	(0.0494)	(0.0574)
…in more than 50% terms	2.351***	2.601***	2.428***	2.314***	2.469***	2.385***	2.359***
	(0.0734)	(0.0857)	(0.0711)	(0.0775)	(0.0676)	(0.0707)	(0.0836)
Pell recipient in 1+term	1.248***	1.230***	1.273***	1.239***	1.267***	1.287***	1.265***
	(0.0299)	(0.0339)	(0.0276)	(0.0330)	(0.0248)	(0.0289)	(0.0335)
Associates degree prior	1.019	0.977		1.012	0.959*	0.995	0.981
	(0.0259)	(0.0363)		(0.0291)	(0.0240)	(0.0254)	(0.0351)
Bachelor's degree prior	0.986	0.984		0.981	1.065**	1.028	0.990
	(0.0290)	(0.0339)		(0.0443)	(0.0312)	(0.0283)	(0.0356)
IT	0.756***	0.749***	0.557***	0.723***	0.729***	0.807***	0.740***
	(0.0459)	(0.0458)	(0.0367)	(0.0414)	(0.0439)	(0.0561)	(0.0493)
Engineering	1.353***	1.316***	0.993	1.289***	1.396***	1.453***	1.378***
	(0.0583)	(0.0579)	(0.0383)	(0.0603)	(0.0662)	(0.0673)	(0.0776)
Health	2.241***		1.768***	2.086***	2.472***	2.521***	2.253***
	(0.0967)		(0.0687)	(0.100)	(0.0985)	(0.110)	(0.123)
Family & Consumer	1.140***	1.156***	0.918*	1.081	1.241***	1.239***	1.143**
	(0.0538)	(0.0547)	(0.0407)	(0.0520)	(0.0609)	(0.0667)	(0.0637)
Public & Protective	1.203***	1.164***	1.081**	1.122**	1.333***	1.337***	1.222***
	(0.0546)	(0.0518)	(0.0400)	(0.0539)	(0.0581)	(0.0637)	(0.0660)
Constant	0.00640***	0.00553***	0.00921***	0.00731***	0.00696***	0.00799***	0.00730***
	(0.000950)	(0.000910)	(0.00117)	(0.00104)	(0.00116)	(0.00116)	(0.00119)

	Baseline	Exclude Health-intending students	Include transfers	Most recent years: First course in 2013-2016	All years: First course in 2000- 2016	Early years only: First course in 2007-2013	No College fixed effects
Year fixed effects	X	X	X	X	X	X	X
College fixed effects	X	X	X	X	X	X	
Observations	12,040,895	10,367,939	15,557,291	5,948,532	30,461,705	14,031,509	12,040,895

SOURCES: Authors' calculations from MIS.

NOTES: Robust standard errors in parentheses, clustered by college (if college not included, not clustered). *** p<0.01, ** p<0.05, * p<0.1. Reference categories: Latino, age 24 or less, female, Business, never received Pell, never attended full-time.

TABLE C6

Discrete-time hazard models: completion of second, stacked credential, odds ratios

	Baseline	Exclude Health-intending students	Include transfers	Most recent years: First course in 2010-2013	All years: First course in 2000- 2013	Early years only: First course in 2007-2010	No College fixed effects
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Term 1	15.46***	25.41***	734.8***	19.91***	1,949***	15.43***	15.44***
	(3.368)	(6.489)	(531.1)	(5.802)	(1,958)	(4.750)	(3.214)
Term 2	26.10***	42.17***	1,195***	28.71***	3,319***	33.32***	26.00***
	(7.133)	(12.90)	(884.8)	(9.362)	(3,342)	(12.18)	(6.558)
Term 3	9.078***	14.59***	438.5***	10.70***	1,139***	10.62***	9.067***
	(1.912)	(3.701)	(308.6)	(2.979)	(1,140)	(3.385)	(1.823)
Term 4	39.03***	66.90***	1,767***	45.55***	5,037***	45.15***	38.80***
	(8.254)	(15.06)	(1,282)	(13.68)	(5,074)	(13.38)	(8.254)
Term 5	10.29***	17.24***	494.1***	13.06***	1,380***	10.68***	10.26***
	(1.983)	(3.887)	(357.1)	(3.440)	(1,379)	(3.277)	(1.957)
Term 6	16.86***	28.83***	776.2***	19.57***	2,169***	19.50***	16.79***
	(3.290)	(7.157)	(558.1)	(5.322)	(2,124)	(5.429)	(3.094)
Term 7	3.505***	5.699***	171.6***	3.936***	493.7***	4.029***	3.498***
	(0.705)	(1.350)	(123.7)	(1.055)	(490.2)	(1.153)	(0.690)
Term 8	12.29***	18.44***	592.4***	14.08***	1,698***	13.99***	12.25***
	(2.377)	(4.158)	(426.9)	(3.734)	(1,693)	(3.952)	(2.287)
Term 9	4.881***	7.548***	218.3***	5.695***	583.7***	5.849***	4.869***
	(1.033)	(1.767)	(158.4)	(1.633)	(586.1)	(1.721)	(1.023)
Term 10	7.874***	9.682***	382.5***	9.187***	1,006***	9.242***	7.846***
	(2.553)	(2.256)	(292.7)	(3.196)	(1,020)	(3.861)	(2.413)
Term 11	1.754**	2.497***	85.75***	1.859**	238.7***	2.131**	1.750***
	(0.387)	(0.607)	(61.62)	(0.509)	(238.3)	(0.646)	(0.370)
Term 12	5.918***	8.363***	291.4***	6.601***	789.9***	6.943***	5.901***
	(1.073)	(1.865)	(210.4)	(1.656)	(781.2)	(1.842)	(1.047)

	Baseline	Exclude Health-intending students	Include transfers	Most recent years: First course in 2010-2013	All years: First course in 2000- 2013	Early years only: First course in 2007-2010	No College fixed effects
Term 13	1.963***	2.741***	96.58***	1.992***	251.5***	2.602***	1.958***
	(0.397)	(0.710)	(70.27)	(0.516)	(248.0)	(0.759)	(0.387)
Term 14	3.495***	5.035***	161.6***	3.413***	468.5***	4.591***	3.488***
	(0.619)	(1.163)	(116.8)	(0.955)	(463.5)	(1.151)	(0.593)
Term 15	1.344	1.819**	61.37***	1.615*	163.1***	1.512	1.342
	(0.275)	(0.465)	(42.24)	(0.413)	(164.2)	(0.446)	(0.268)
Term 16	3.613***	4.891***	165.0***	3.767***	459.7***	4.364***	3.606***
	(0.539)	(0.978)	(119.0)	(0.928)	(455.5)	(1.004)	(0.531)
Term 17	1.298	1.807**	63.03***	1.357	189.6***	1.570*	1.295
	(0.234)	(0.416)	(45.86)	(0.367)	(187.4)	(0.409)	(0.232)
Term 18	1.938***	2.713***	93.20***	2.048**	271.5***	2.329***	1.935***
	(0.382)	(0.668)	(67.85)	(0.585)	(269.4)	(0.608)	(0.373)
Term 19	1.028	1.404	46.42***	1.074	117.2***	1.260	1.027
	(0.233)	(0.400)	(33.22)	(0.299)	(116.7)	(0.365)	(0.230)
Term 20	2.272***	3.026***	106.8***	2.291***	340.7***	2.766***	2.270***
	(0.410)	(0.728)	(76.60)	(0.587)	(334.5)	(0.639)	(0.407)
Term 21	0.773	0.984	40.41***	0.842	111.9***	0.915	0.773
	(0.212)	(0.360)	(29.96)	(0.266)	(113.1)	(0.267)	(0.210)
Term 22	1.409	1.936**	64.55***	1.284	181.0***	1.758**	1.405
	(0.301)	(0.518)	(46.69)	(0.371)	(180.7)	(0.437)	(0.297)
Term 23	0.580***	0.743	25.29***	0.687	70.83***	0.630	0.579***
	(0.118)	(0.189)	(18.38)	(0.224)	(71.04)	(0.195)	(0.117)
Term 24	1.468**	2.188***	69.61***	1.745**	199.2***	1.700**	1.465**
	(0.279)	(0.553)	(50.02)	(0.430)	(198.1)	(0.396)	(0.277)
Term 25	0.561**	1.012	27.73***	0.687	89.10***	0.744	0.560**
	(0.141)	(0.275)	(20.62)	(0.270)	(87.09)	(0.220)	(0.141)
Term 26	1.087	1.382	49.73***	0.961	139.8***	1.427*	1.084
	(0.187)	(0.329)	(36.49)	(0.279)	(139.6)	(0.299)	(0.185)
Term 27	0.516***	0.750	21.94***	0.488**	62.51***	0.646	0.516***
	(0.127)	(0.218)	(16.29)	(0.173)	(63.62)	(0.183)	(0.126)
Term 28	1.122	1.364	47.73***	1.087	163.1***	1.279	1.123
	(0.200)	(0.373)	(34.92)	(0.329)	(161.4)	(0.278)	(0.199)
Term 29	0.462***	0.616	24.38***	0.382**	72.37***	0.557**	0.462***
	(0.104)	(0.194)	(18.19)	(0.158)	(72.78)	(0.145)	(0.104)
Term 30	-	-	43.86***	-	117.8***		-
			(32.42)		(118.0)		
Asian	1.167***	1.106***	1.103***	1.150***	1.155***	1.183***	1.239***
	(0.0445)	(0.0356)	(0.0414)	(0.0544)	(0.0374)	(0.0568)	(0.0569)

	Baseline	Exclude Health-intending students	Include transfers	Most recent years: First course in 2010-2013	All years: First course in 2000- 2013	Early years only: First course in 2007-2010	No College fixed effects
Black	0.858***	0.864***	0.872***	0.831***	0.928*	0.892*	0.866**
	(0.0381)	(0.0429)	(0.0347)	(0.0453)	(0.0375)	(0.0534)	(0.0487)
White	1.085***	1.041	1.048*	1.067**	1.126***	1.118***	1.168***
	(0.0331)	(0.0322)	(0.0284)	(0.0311)	(0.0332)	(0.0444)	(0.0451)
Multiracial/ other	1.035	0.983	1.014	1.047	1.027	1.038	1.098**
	(0.0417)	(0.0403)	(0.0339)	(0.0436)	(0.0345)	(0.0568)	(0.0502)
Age 25-34 at intending	0.889***	0.861***	0.860***	0.869***	0.874***	0.895***	0.876***
	(0.0347)	(0.0269)	(0.0300)	(0.0365)	(0.0266)	(0.0373)	(0.0392)
Age 35-49	1.028	1.017	0.982	0.987	0.999	1.043	0.999
	(0.0346)	(0.0335)	(0.0318)	(0.0353)	(0.0353)	(0.0440)	(0.0370)
Age 50+	0.868***	0.858***	0.826***	0.828***	0.875***	0.877**	0.847***
	(0.0373)	(0.0383)	(0.0342)	(0.0394)	(0.0379)	(0.0479)	(0.0402)
Male	0.860***	0.873***	0.859***	0.875***	0.894**	0.858***	0.861***
	(0.0396)	(0.0319)	(0.0351)	(0.0445)	(0.0503)	(0.0414)	(0.0477)
Full-time in less than 25% terms	1.720***	1.661***	1.707***	1.700***	1.694***	1.793***	1.705***
	(0.0836)	(0.0736)	(0.0851)	(0.0791)	(0.0519)	(0.109)	(0.0865)
…in 25-50% terms	1.750***	1.735***	1.742***	1.807***	1.688***	1.753***	1.705***
	(0.103)	(0.0777)	(0.108)	(0.0858)	(0.0749)	(0.128)	(0.107)
…in more than 50% terms	1.627***	1.748***	1.683***	1.739***	1.583***	1.608***	1.556***
	(0.121)	(0.119)	(0.118)	(0.114)	(0.107)	(0.141)	(0.137)
Pell recipient in 1+term	1.480***	1.439***	1.504***	1.401***	1.492***	1.507***	1.486***
	(0.0576)	(0.0553)	(0.0522)	(0.0517)	(0.0474)	(0.0657)	(0.0595)
Associates degree prior	0.880***	0.801***		0.909	0.867***	0.881***	0.900**
	(0.0389)	(0.0388)		(0.0538)	(0.0275)	(0.0389)	(0.0389)
Bachelor's degree prior	0.891*	0.865**		0.882**	0.874*	0.882	0.797***
	(0.0541)	(0.0570)		(0.0516)	(0.0646)	(0.0705)	(0.0562)
IT	0.863	0.887	0.871	0.846	0.972	0.940	0.867
	(0.131)	(0.130)	(0.111)	(0.126)	(0.0985)	(0.170)	(0.129)
Engineering	1.088	1.033	1.031	1.052	1.076	1.119	1.174**
	(0.0744)	(0.0724)	(0.0660)	(0.0753)	(0.0796)	(0.100)	(0.0955)
Health	0.765*		0.775*	0.677**	0.848	0.856	0.817
	(0.111)		(0.114)	(0.104)	(0.124)	(0.128)	(0.118)
Family & Consumer	0.992	1.035	1.017	0.963	1.026	1.010	1.051
	(0.0545)	(0.0605)	(0.0463)	(0.0577)	(0.0614)	(0.0721)	(0.0701)

	Baseline	Exclude Health-intending students	Include transfers	Most recent years: First course in 2010-2013	All years: First course in 2000- 2013	Early years only: First course in 2007-2010	No College fixed effects
Public & Protective	0.878	0.900	0.896	0.946	0.850**	0.837	0.903
	(0.0705)	(0.0650)	(0.0635)	(0.0749)	(0.0653)	(0.101)	(0.0611)
First award: short term	1.342***	1.275***	1.297***	1.304***	1.379***	1.424***	1.553***
	(0.0860)	(0.0901)	(0.0740)	(0.0814)	(0.112)	(0.119)	(0.125)
First award: local	1.411***	1.300***	1.328***	1.367***	1.437***	1.522***	1.756***
First award: short term	(0.128)	(0.101)	(0.114)	(0.134)	(0.117)	(0.153)	(0.170)
Constant	0.00108***	0.000273***	1.96e-05***	0.000452***	7.81e-06***	0.000934***	0.000837***
	(0.000653)	(0.000135)	(1.80e-05)	(0.000213)	(8.90e-06)	(0.000592)	(0.000489)
Year fixed effects	X	X	X	X	X	X	X
College fixed effects	X	X	X	X	X	X	
Observations	1,250,552	942,562	1,515,119	681,404	2,514,151	761,822	1,250,752

SOURCES: Authors' calculations from MIS.

NOTES: Robust standard errors in parentheses, clustered by college (if college not included, not clustered). *** p<0.01, ** p<0.05, * p<0.1. Reference categories: Latino, age 24 or less, female, Business, never received Pell, never attended full-time, first award was a long-term certificate.

TABLE C7

Predicted probability of completion in each term, and cumulatively, for first career education award: Baseline model

Term	Average Predicted Margin	Cumulative	95% confidence interval: lower bound	95% confidence interval: upper bound
1	0.0133	0.0133	0.0104	0.0162
2	0.00578	0.01908	0.00421	0.0073
3	0.0254	0.04448	0.0224	0.0285
4	0.0117	0.05618	0.0103	0.0131
5	0.0307	0.08688	0.0280	0.0333
6	0.0103	0.09718	0.00885	0.0117
7	0.0443	0.14148	0.0412	0.0475
8	0.0129	0.15438	0.00990	0.0158
9	0.0302	0.18458	0.0285	0.0320
10	0.00723	0.19181	0.00592	0.0085
11	0.0293	0.22111	0.0275	0.0311
12	0.00559	0.2267	0.00457	0.0066
13	0.018	0.2447	0.0169	0.0192
14	0.00391	0.24861	0.00325	0.0045
15	0.0121	0.26071	0.0114	0.0128
16	0.00265	0.26336	0.00221	0.0031
17	0.00934	0.2727	0.00834	0.0103
18	0.00235	0.27505	0.00177	0.0029
19	0.0066	0.28165	0.00598	0.0072
20	0.00154	0.28319	0.00129	0.0017
21	0.00546	0.28865	.00485	0.0060
22	0.00126	0.28991	0.000996	0.0015
23	0.00394	0.29385	0.00350	0.0043
24	0.000929	0.294779	0.000748	0.0011
25	0.00315	0.297929	0.00275	0.0035
26	0.000743	0.298672	0.000543	0.0009
27	0.0025	0.301172	0.00202	0.0029
28	0.000586	0.301758	0.000432	0.0007
29	0.00251	0.304268	0.00191	0.0031
30	0.00049	0.304758	0.000364	0.0006

SOURCES: Authors' calculations from MIS

NOTES: Average predicted probability of completion from Model (1) of Table C5.

TABLE C8

Predicted probability of completion in each term, and cumulatively, for second, stacked career education award: Baseline model

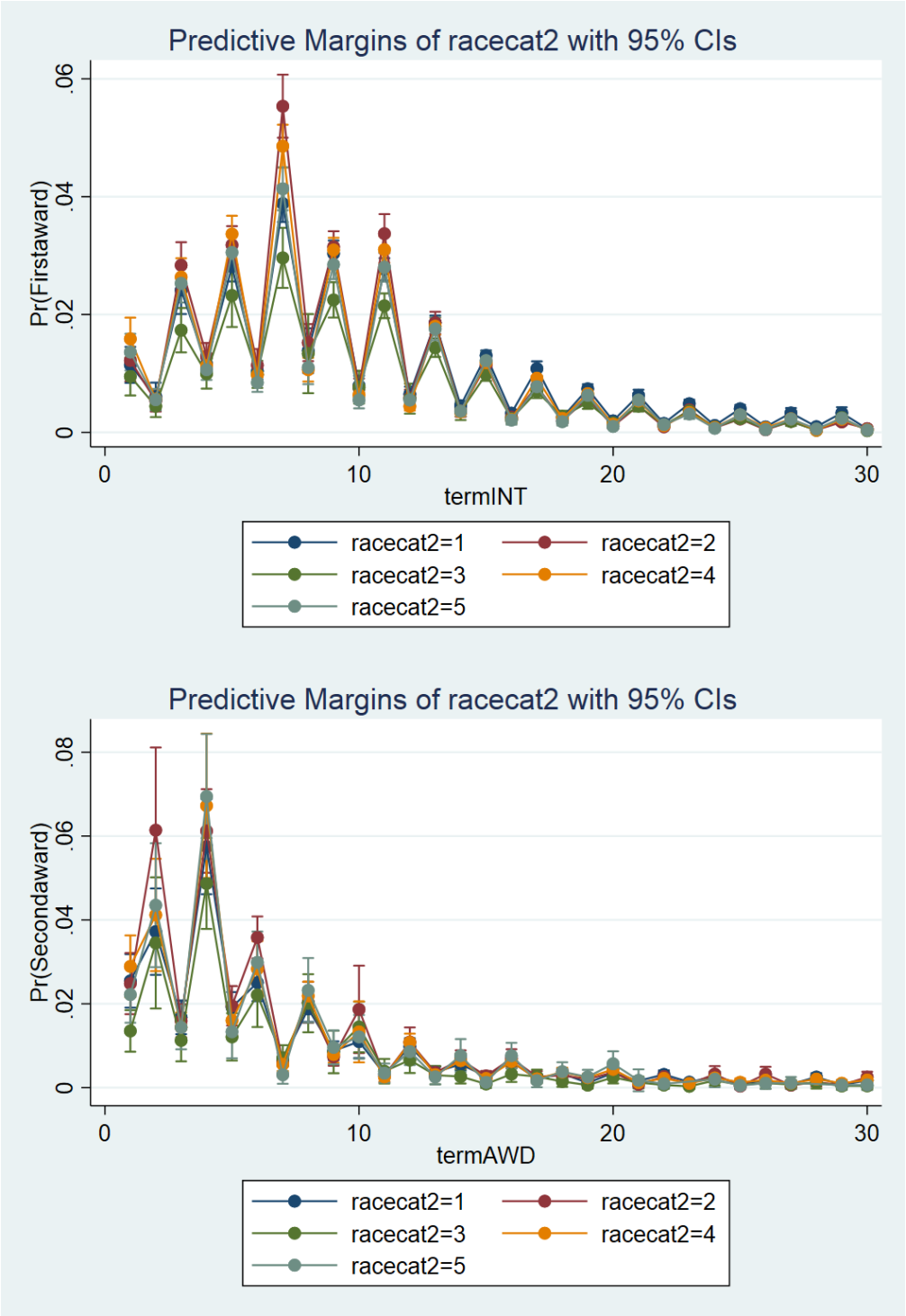
Term	Average Predicted Margin	Cumulative	95% confidence interval: lower bound	95% confidence interval: upper bound
1	0.026	0.026	0.0204	0.0310
2	0.042	0.068	0.0308	0.0540
3	0.015	0.083	0.0123	0.0183
4	0.062	0.145	0.0498	0.0737
5	0.017	0.163	0.0144	0.0202
6	0.028	0.190	0.0233	0.0325
7	0.006	0.196	0.00468	0.0072
8	0.021	0.217	0.0180	0.0231
9	0.008	0.225	0.00667	0.0099
10	0.013	0.238	0.00740	0.0192
11	0.003	0.241	0.00223	0.0037
12	0.010	0.251	0.00873	0.0113
13	0.003	0.255	0.00255	0.0041
14	0.006	0.261	0.00473	0.0071
15	0.002	0.263	0.00166	0.0029
16	0.006	0.269	0.00516	0.0071
17	0.002	0.271	0.00171	0.0027
18	0.003	0.275	0.00254	0.0040
19	0.002	0.277	0.00128	0.0022
20	0.004	0.280	0.00310	0.0046
21	0.001	0.282	0.000773	0.0018
22	0.002	0.284	0.00179	0.0030
23	0.001	0.285	0.000658	0.0013
24	0.003	0.288	0.00185	0.0031
25	0.001	0.289	0.000530	0.0013
26	0.002	0.290	0.00125	0.0024
27	0.001	0.291	0.000537	0.0012
28	0.002	0.293	0.00141	0.0024
29	0.001	0.294	0.000386	0.0012
30	0.002	0.296	0.00109	0.0023

SOURCES: Authors' calculations from MIS

NOTES: Average predicted probability of completion from Model (1) of Table C6.

FIGURE C1

Predicted probability of completion of first and second credential by race/ethnic group

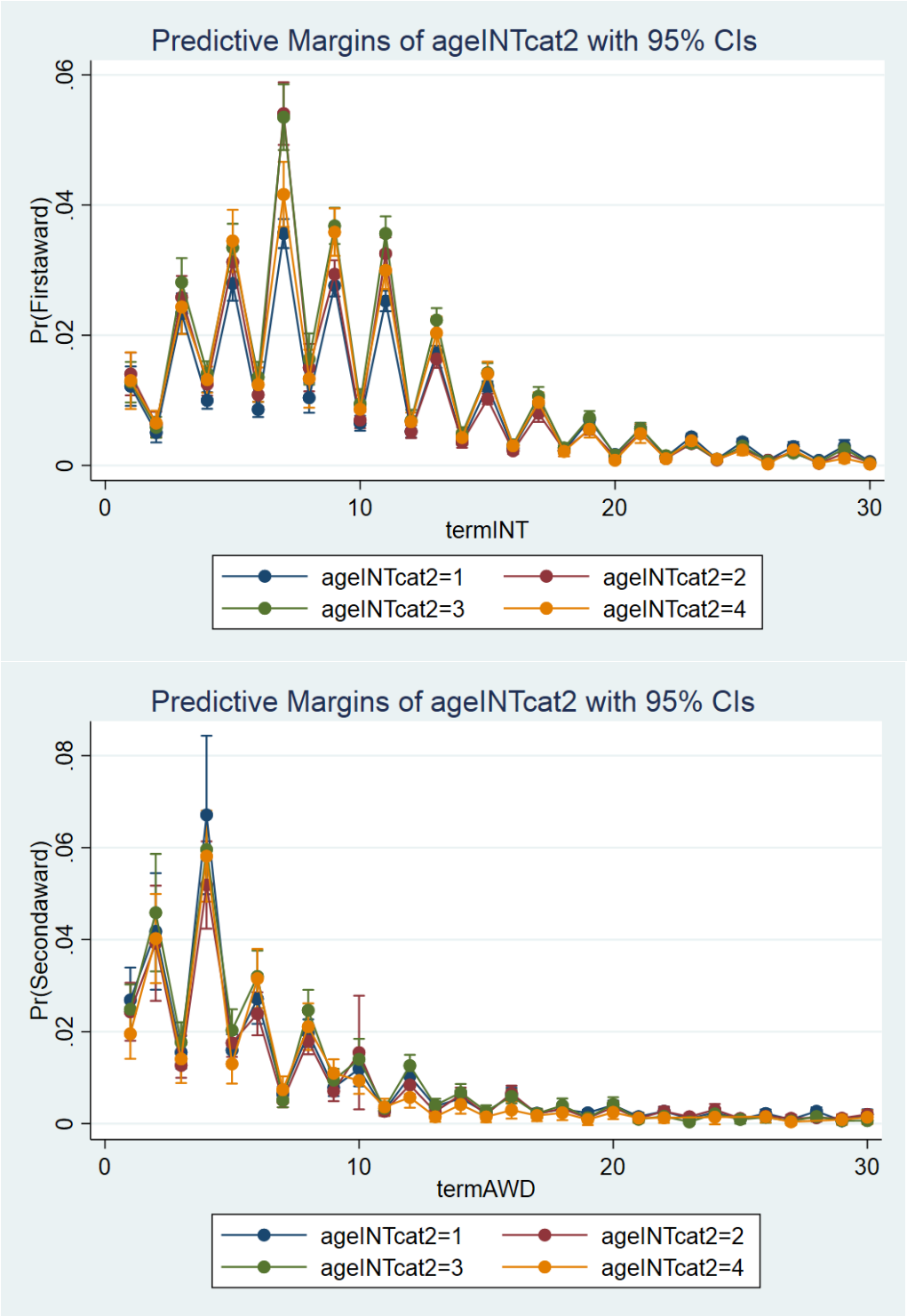


SOURCE: Authors' calculations from MIS.

NOTE: Predicted marginal probabilities estimated from Model 1 of Tables C5 and C6, with covariates interacted with race/ethnicity. Bars denote 95% confidence interval on the predication. "TermINT" refers to the number of terms since a student becomes "intending". "TermAWD" refers to the number of terms since a student earned their first award. Race categories: Latino (1), Asian (2), Black (3), White (4), Multiracial/Other (5).

FIGURE C2

Predicted probability of completion of first and second credential by age group

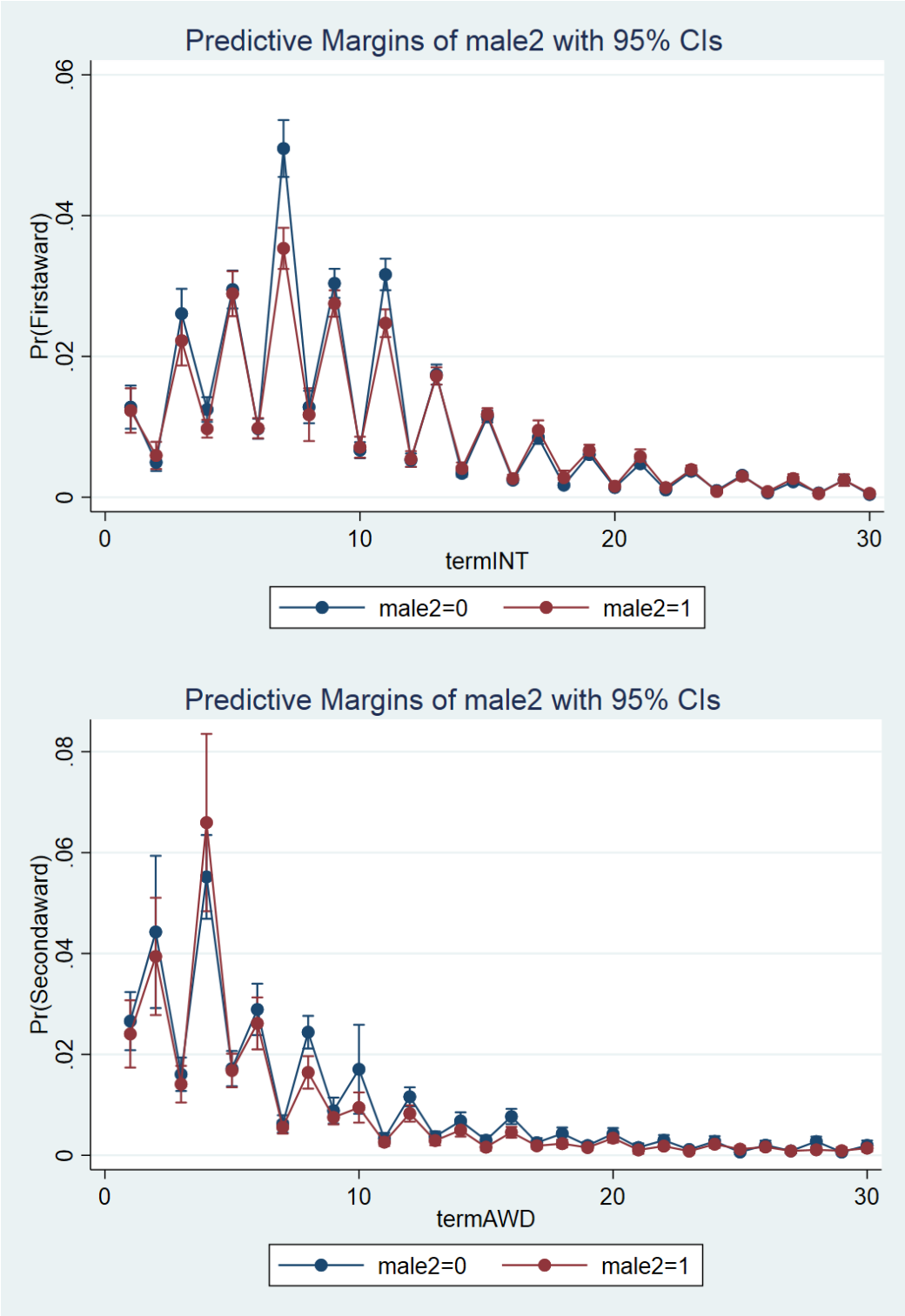


SOURCE: Authors' calculations from MIS.

NOTE: Predicted marginal probabilities estimated from Model 1 of Tables C5 and C6, with covariates interacted with age group. Bars denote 95% confidence interval on the predication. "TermINT" refers to the number of terms since a student becomes "intending". "TermAWD" refers to the number of terms since a student earned their first award. "AgeINT" refers to the age at intending and categories are: Less than 24, 25-34, 35-49, 50+.

FIGURE C3

Predicted probability of completion of first and second credential by gender

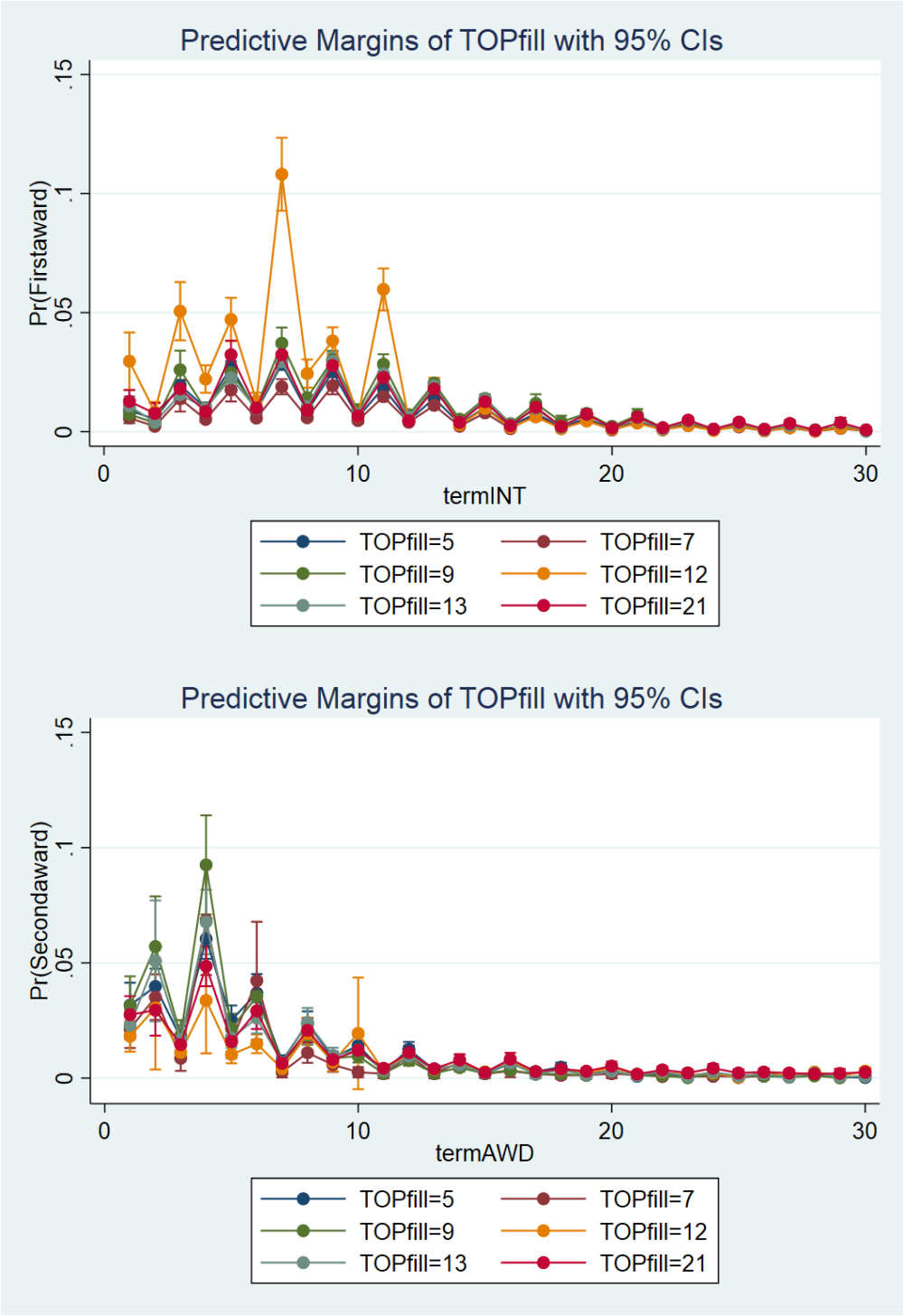


SOURCE: Authors' calculations from MIS.

NOTE: Predicted marginal probabilities estimated from Model 1 of Tables C5 and C6, with covariates interacted with gender. Bars denote 95% confidence interval on the predication. "TermINT" refers to the number of terms since a student becomes "intending". "TermAWD" refers to the number of terms since a student earned their first award. "Male2" 0 refers to women, "Male2" 1 refers to men.

FIGURE C4

Predicted probability of completion of first and second credential by discipline

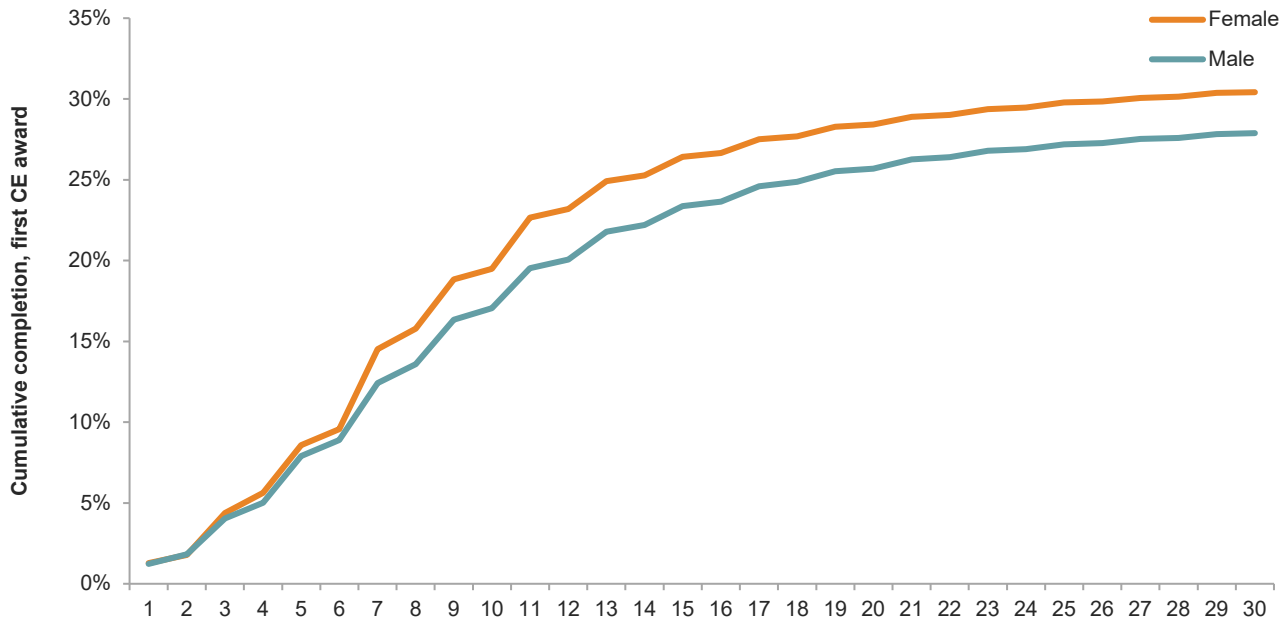


SOURCE: Authors' calculations from MIS.

NOTE: Predicted marginal probabilities estimated from Model 1 of Tables C5 and C6, with covariates interacted with discipline. Bars denote 95% confidence interval on the predication. "TermINT" refers to the number of terms since a student becomes "intending". "TermAWD" refers to the number of terms since a student earned their first award. "TOPfill" refers to career education discipline: 5=Business, 7=IT, 9=Engineering, 12=Health, 13=Family & Consumer, 21=Public & Protective.

FIGURE C5

Differences in the trajectory to obtain a first CE credential, by gender

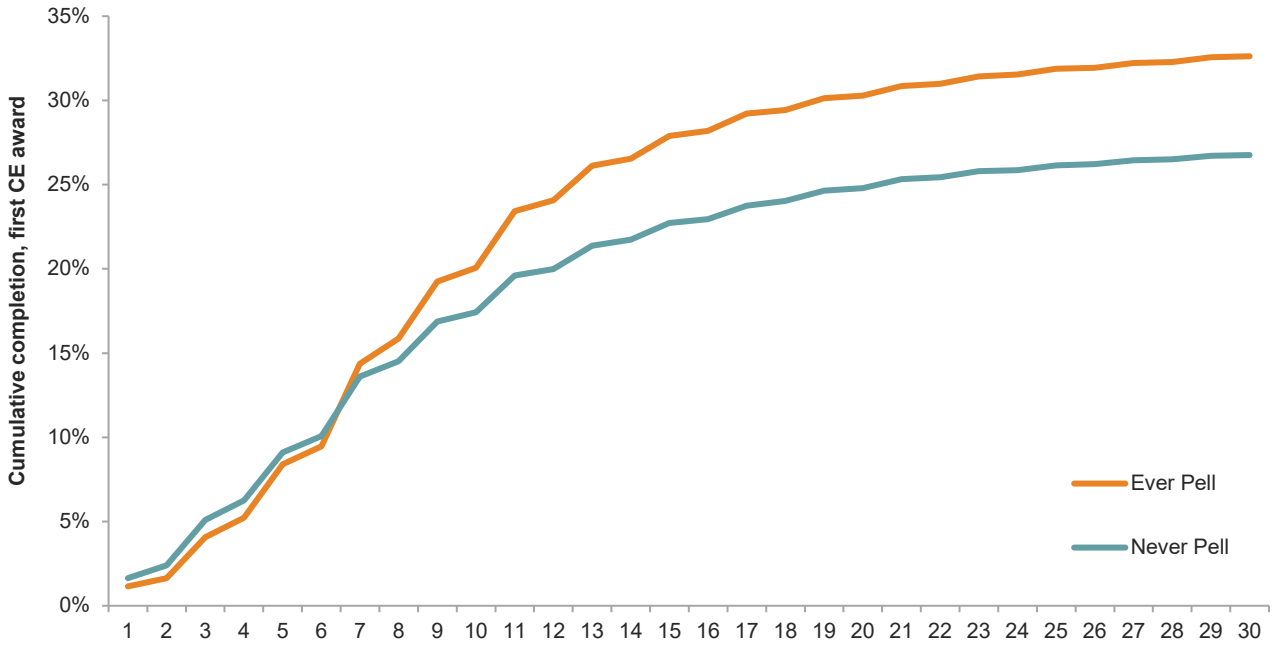


SOURCE: Authors' calculation from MIS data

NOTE: Marginal probability estimates from a dynamic logistic model. Probability represents the likelihood that a student earns a credential in a given term, cumulatively. Model includes all career intending students who began career education coursework between 2010 and 2016. Model includes year, college, and program fixed effects, demographic characteristics (age, race, gender), financial aid receipt, full-time status, and prior education level. Gender is interacted with term, student characteristics, and program. The term counts from when a student reaches the first milestone, being an "intending" student, regardless of what year or term (eg spring, fall, summer) the student reached that milestone.

FIGURE C6

Differences in the trajectory to obtain a first CE credential, by Pell status

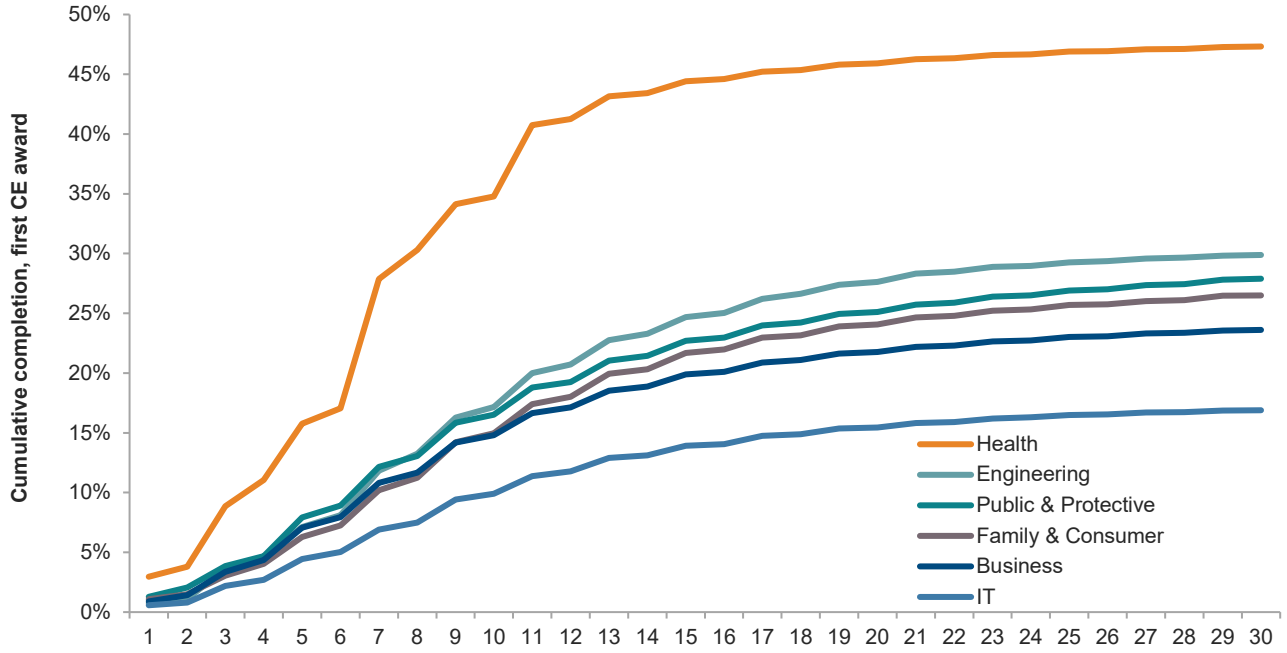


SOURCE: Authors' calculation from MIS data

NOTE: Marginal probability estimates from a dynamic logistic model. Probability represents the likelihood that a student earns a credential in a given term, cumulatively. Model includes all career intending students who began career education coursework between 2010 and 2016. Model includes year, college, and program fixed effects, demographic characteristics (age, race, gender), financial aid receipt, full-time status, and prior education level. Pell status is interacted with term, student characteristics, and program. The term counts from when a student reaches the first milestone, being an "intending" student, regardless of what year or term (eg spring, fall, summer) the student reached that milestone.

FIGURE C7

Differences in the trajectory to obtain a first career education credential, by discipline

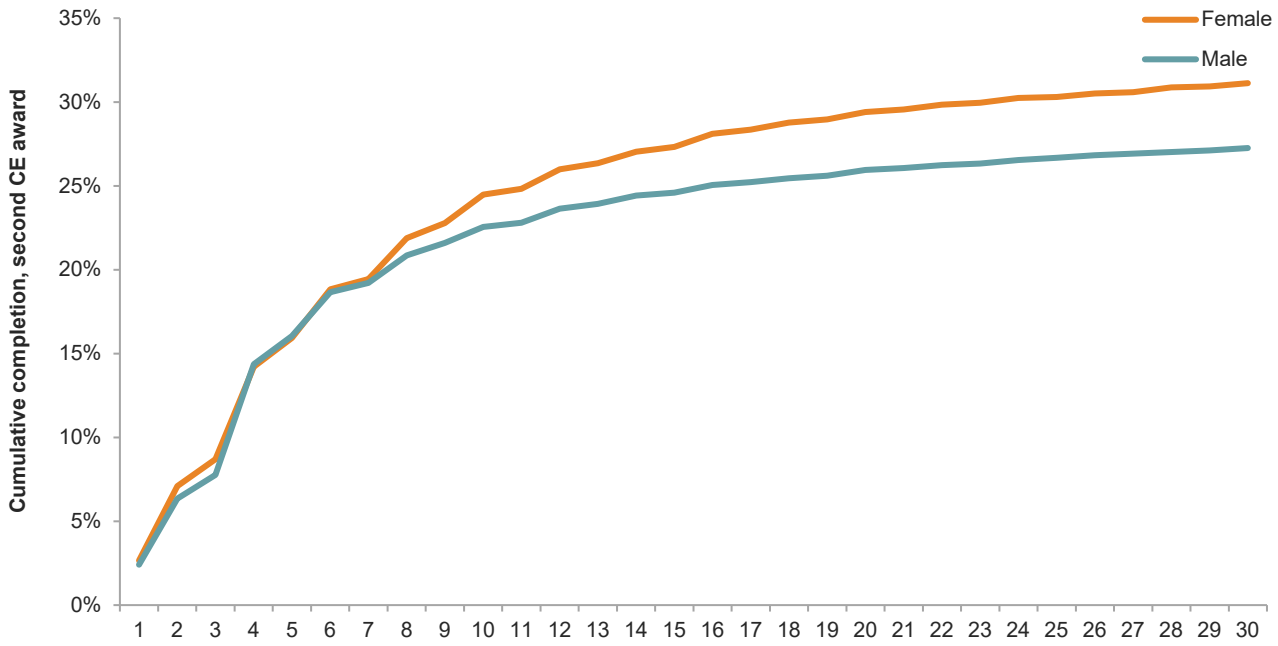


SOURCE: Authors' calculation from MIS data

NOTE: Marginal probability estimates from a dynamic logistic model. Probability represents the likelihood that a student earns a credential in a given term, cumulatively. Model includes all career intending students who began career education coursework between 2010 and 2016. Model includes year, college, and program fixed effects, demographic characteristics (age, race, gender), financial aid receipt, full-time status, and prior education level. Discipline is interacted with term, student characteristics, and program. The term counts from when a student reaches the first milestone, being an "intending" student, regardless of what year or term (eg spring, fall, summer) the student reached that milestone.

FIGURE C8

Differences in the trajectory to obtain a stacked credential, by gender

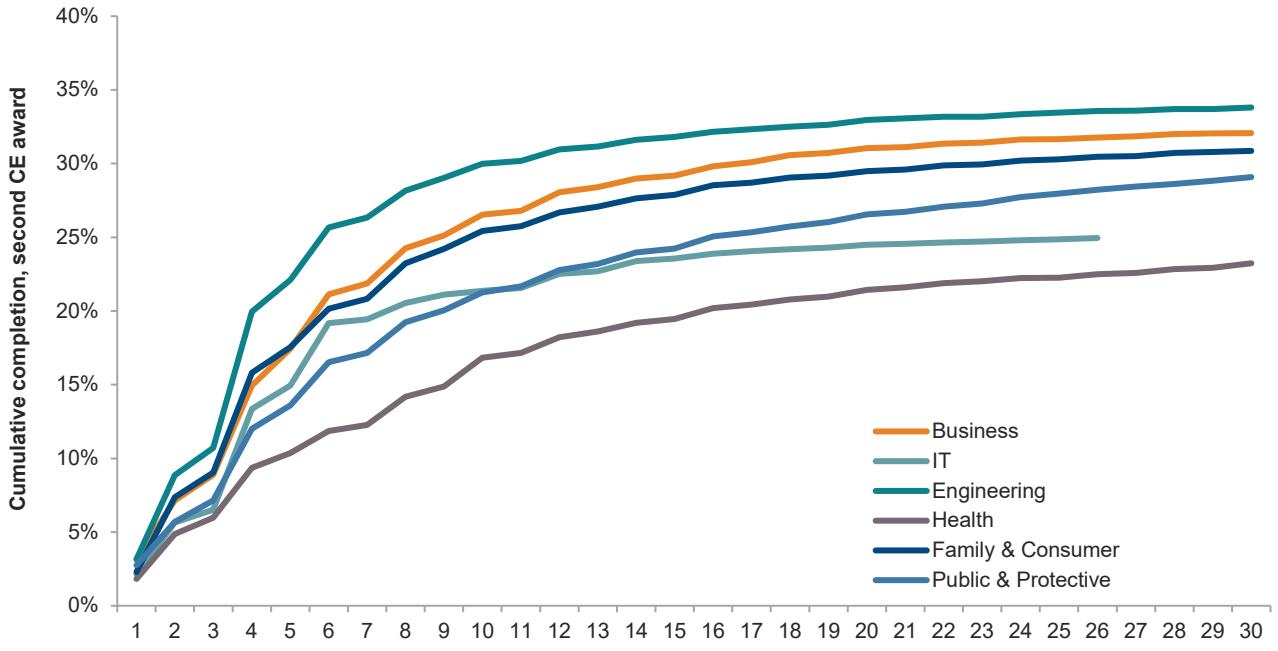


SOURCE: Authors' calculation from MIS data

NOTE: Marginal probability estimates from a dynamic logistic model. Probability represents the likelihood that a student earns a second, stacked credential in a given term, cumulatively. Model includes all career intending students who began career education coursework between 2007 and 2013 and earned a first award within three years. Model includes year, college, and program fixed effects, demographic characteristics (age, race, gender), financial aid receipt, full-time status, length of first award, and prior education level. Gender is interacted with term, student characteristics, and program. The term counts from when a student earns the first award, regardless of what year or term (eg spring, fall, summer) the student reached that milestone.

FIGURE C9

Differences in the trajectory to obtain a stacked credential, by discipline



SOURCE: Authors' calculation from MIS data

NOTE: Marginal probability estimates from a dynamic logistic model. Probability represents the likelihood that a student earns a second, stacked credential in a given term, cumulatively. Model includes all career intending students who began career education coursework between 2007 and 2013 and earned a first award within three years. Model includes year, college, and program fixed effects, demographic characteristics (age, race, gender), financial aid receipt, full-time status, length of first award, and prior education level. Discipline is interacted with term, student characteristics, and program. The term counts from when a student earns the first award, regardless of what year or term (eg spring, fall, summer) the student reached that milestone.

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