Annenberg Institute
BROWN UNIVERSITY

EdWorkingPaper No. 26-1635

Aligned Pathways, Unequal Earnings: Gendered Transitions from Community College to Work

Sade Bonilla
University of Pennsylvania

Daniel Sparks
University of Arkansas

States increasingly use financial aid policy to steer students into designated high-demand workforce fields, yet evidence on whether these fields offer stronger labor-market pathways remains limited. We study Virginia's Get a Skill, Get a Job, Get Ahead (G3) initiative, which provides tuition-free community college to income-eligible students in high-demand workforce areas. Using linked community college and quarterly earnings records, we compare 2016--2020 first-time-in-college entrants in workforce programs that later became G3-eligible with entrants in non-G3 workforce programs. Student fixed-effects event-study models show that initially-designated workforce fields are associated with higher post-entry earnings for men, especially in skilled trades/manufacturing and public safety, but not broad employment gains. Women experience limited earnings gains and employment declines in several future G3 fields. Program-aligned employment increases for both women and men, suggesting more consistent alignment than earnings gains and highlighting gendered transitions from college to work.

VERSION: November 2026

Suggested citation: Bonilla, Sade, and Daniel Sparks. (2026). Aligned Pathways, Unequal Earnings: Gendered Transitions from Community College to Work. (EdWorkingPaper: 26-1635). Retrieved from Annenberg Institute at Brown University: https://doi.org/10.26300/cnf7-mv86

Aligned Pathways, Unequal Earnings: Gendered Transitions from Community College to Work

Sade Bonilla [1] Daniel Sparks [2] *

November 5, 2026

Abstract

States increasingly use financial aid policy to steer students into designated high-demand workforce fields, yet evidence on whether these fields offer stronger labor-market pathways remains limited. We study Virginia's Get a Skill, Get a Job, Get Ahead (G3) initiative, which provides tuition-free community college to income-eligible students in high-demand workforce areas. Using linked community college and quarterly earnings records, we compare 2016–2020 first-time-in-college entrants in workforce programs that later became G3-eligible with entrants in non-G3 workforce programs. Student fixed-effects event-study models show that initially-designated workforce fields are associated with higher post-entry earnings for men, especially in skilled trades/manufacturing and public safety, but not broad employment gains. Women experience limited earnings gains and employment declines in several future G3 fields. Program-aligned employment increases for both women and men, suggesting more consistent alignment than earnings gains and highlighting gendered transitions from college to work.

*1. University of Pennsylvania, sadeb@upenn.edu (corresponding author) 2. University of Arkansas ds197@uark.edu .
Acknowledgments: We are grateful to Catherine Finnegan, Marina Bagreev, Laurie Owens, Aris Bearse, Angela Lawhorne and Carrie Owens of the Virginia Community College System for providing data access, answering our questions, and discussing the implementation of the G3 program; this research would not have been possible without their deep collaboration.

1 Introduction

States increasingly use community college finance policy to pursue workforce development goals. Rather than expanding affordability across all programs equally, many recent initiatives target aid to programs in fields identified as high demand, high wage, or strategically important for regional labor markets (Atwell et al., 2022; Bonilla and Sparks, 2026). This policy design raises the empirical question of whether programs selected as state workforce priorities are associated with stronger employment, earnings, or industry alignment than other workforce programs. These outcomes need not coincide, however. Fields with substantial employer demand may provide clear pathways into related work without generating higher individual earnings.

Workforce-targeted aid differs from general college affordability policy because it directs students toward fields that states have identified as labor-market priorities. Whether those designations identify stronger pathways is increasingly consequential as federal and state governments expand financial incentives for short-term and field-specific workforce programs (Miller-Adams and Iriti, 2025; U.S. Department of Education, 2026). Existing research finds positive average returns to community college credentials, with substantial heterogeneity by credential type, field of study, sex, and time horizon (Dadgar and Trimble, 2015; Jepsen et al., 2014; Minaya and Scott-Clayton, 2022; Stevens et al., 2019). Related research shows that employment in an industry aligned with a student's field of study is associated with higher earnings, though the association varies across fields and by sex (Odle and Russell, 2026). Together, this literature establishes that the labor-market value of community college education varies considerably across programs and student groups. These workforce fields are also sharply sex-segregated, raising the possibility that the same policy may channel women and men into different labor-market pathways with different economic consequences.

We address two research questions. First, how do labor-market trajectories differ between students entering workforce programs subsequently designated as G3 eligible and students entering other workforce programs? Second, how do these differences vary across program areas and between women and men? These questions focus on students' observed labor-market outcomes rather than whether Virginia's designations accurately captured employer demand. Because the

cohorts entered before G3 was implemented, the analysis does not estimate the effects of the policy itself. We examine three outcomes—employment, quarterly earnings, and program-aligned employment—because they represent distinct dimensions of labor-market success. Specifically, employment reflects whether students work, earnings reflect compensation and employment intensity, and program alignment indicates whether students enter an industry related to their field of study. These outcomes may diverge. A program may improve alignment without increasing employment or earnings, and aligned work may pay differently across occupations, fields, and student groups. Examining all three therefore provides a fuller assessment of whether state-designated fields offer stronger pathways from college to work.

Virginia's Get a Skill, Get a Job, Get Ahead (G3) initiative provides a useful setting for examining these questions. Since 2021, G3 has offered tuition-free community college to income-eligible students who enroll in designated programs in health care, information technology, skilled trades and manufacturing, early childhood education, and public safety. Because eligibility is tied to field of study, the program allows an assessment of whether state workforce priorities identify programs associated with stronger labor-market trajectories and program-industry alignment.

The analysis focuses on students who entered Virginia community colleges before G3 was implemented. These cohorts were not exposed to G3 financial aid at entry, so the study does not estimate the causal effect of receiving G3 assistance. Instead, it compares entrants in programs that later became G3-eligible with entrants in other workforce-focused programs. This comparison provides evidence on whether the fields selected for subsidy were already associated with stronger earnings, employment, and program-industry alignment, and whether these patterns differed across fields and by sex.

To answer these questions, we use linked administrative records from the Virginia Community College System (VCCS) and quarterly earnings and employment records from the Virginia Employment Commission (VEC). The sample includes first-time-in-college entrants from the 2016 through 2020 cohorts whose initial program was a certificate or applied associate program. Student fixed-effects event-study models compare within-student changes in earnings, employment, and program-aligned employment before and after first enrollment. The models account for time-

invariant differences across students, calendar-quarter conditions, and local unemployment. Because students were not randomly assigned to fields, the estimates are interpreted as adjusted differences in labor-market trajectories rather than causal effects of G3 aid or field entry.

The results indicate that future G3-designated fields were more consistently associated with program-industry alignment than with earnings or employment gains. Among men, post-entry earnings were higher in skilled trades and manufacturing, public safety, and health. Employment differences were comparatively small, suggesting that the earnings differences did not primarily reflect greater employment. Among women, earnings differences were generally small and imprecise, while employment declined in several future G3 fields. Program-aligned employment, however, increased for both women and men, particularly in health, skilled trades and manufacturing, and public safety.

This study contributes to the literature on community college workforce pathways and the design of field-targeted financial aid. Prior studies have largely examined the returns to credentials or the effects of aid on enrollment and completion. The present analysis instead examines whether fields selected for targeted subsidy were associated with stronger pathways from education into work, and whether these patterns differed by sex. We find that stronger earnings trajectories in several designated workforce fields are concentrated among men, while women entering these same fields do not experience comparable earnings gains, even when they exhibit greater program-industry alignment. More broadly, our findings highlight the distinction between "high-demand," "high-wage," and "high-value" programs. Fields designated as high demand are not consistently associated with stronger earnings trajectories for students, even when they provide clearer pathways into program-related employment. Moreover, differences in earnings trajectories between women and men within designated fields suggest that average outcomes may obscure important variation in economic opportunities. These findings underscore the importance of considering student labor-market outcomes alongside projected workforce demand when determining which programs to prioritize for financial support.

2 Policy Context and Prior Literature

2.1 Workforce-Targeted Financial Aid and Virginia G3

Federal and state governments increasingly use financial aid to encourage enrollment in workforce-oriented postsecondary programs. At the federal level, this is best encapsulated by the recent passage of the One Big Beautiful Bill Act in 2025, which expanded Pell Grant eligibility to short-term workforce programs that prepare students for 'high-skill, high-wage, and in-demand jobs' (US Department of Education, 2026). At the state level, a majority of states have adopted tuition-free college policies, including at least nine that restrict eligibility to students who enroll in designated workforce programs (Miller-Adams and Iriti, 2025; Sparks, 2024).

As one of those states, Virginia implemented its Get a Skill, Get a Job, Get Ahead (G3) program in 2021 with bipartisan support. First proposed in 2019, the policy was designed to incentivize enrollment in community college workforce programs and support students through credential completion and into the labor market. Accordingly, G3 is primarily a last-dollar tuition-free college program for income-eligible Virginia residents enrolled in designated high-demand community college programs. Eligibility was initially limited to programs in skilled trades and manufacturing, early childhood education, healthcare, public safety, and information technology[1]. The legislation defined high-demand fields as those facing shortages of skilled workers to fill current and anticipated job vacancies. The accompanying budget language specified the eligible programs by CIP code and required the Virginia Board of Workforce Development, in consultation with VCCS, the State Council of Higher Education for Virginia (SCHEV), and legislative staff, to recommend subsequent additions or changes (Virginia Economic Development Partnership, 2023; Virginia General Assembly, 2021a,b). Because the policy ties aid eligibility to specific fields, it offers a useful case for examining whether state-designated workforce credentials are associated with stronger labor-market outcomes and greater program-career alignment.

Virginia's designation of high-demand fields emphasized current and anticipated workforce shortages. Whether these fields also offer stronger labor-market outcomes for students is a re-

[1] G3 initially covered five workforce areas. Hospitality and culinary arts were added to the program in academic year 2024–25 and are therefore not included among the original G3-designated fields examined in this study.

lated but distinct question. Our analysis examines the latter using the employment and earnings trajectories of students who entered these programs before G3 implementation, along with their employment in program-related industries. It does not directly measure employer demand or assess the accuracy of the state's workforce projections. Because G3 ties financial aid eligibility to specific workforce fields, its underlying premise is not simply that community college credentials improve labor-market outcomes, but that credentials in state-designated fields provide particularly strong pathways into related work. Evaluating that premise requires situating G3 within the broader evidence on community college workforce education and the substantial variation in labor-market outcomes across credentials, fields, and student groups.

2.2 Community College Workforce Pathways

A substantial literature documents positive labor-market returns to community college course-taking and credential completion, while also showing considerable variation by credential type, field of study, sex, and time since enrollment. Jepsen et al. (2014) used an individual fixed effects approach to estimate returns to community college credentials in Kentucky, finding substantial returns to associate degrees upwards of 50 percent for women and 25 percent for men, though returns to certificates were lower. Bahr et al. (2015) used a similar identification strategy for community college students in Michigan, finding returns to community college credentials of about 30 percent; returns to community college also appear to be positive for non-completers.

Related studies show that returns to associate degrees tend to grow over time, whereas certificate returns are generally smaller and flatter (Liu et al., 2015; Minaya and Scott-Clayton, 2022). Liu et al. (2015) estimated returns to community college credentials in North Carolina over the medium-term, or 4 to 8 years after initial entry; they found strong short- and medium-term returns to associate degrees and more modest gains for certificates. Using fixed effects analysis on data in Ohio, Minaya and Scott-Clayton (2022) found that returns to associate degrees grow over time whereas returns to certificates remain relatively flat over an eleven year post-entry period.

Beyond time horizon, prior research suggests substantial variation in the returns to community college credentials by student demographics and area of study. Dadgar and Trimble (2015), for in-

stance, found substantial employment and wage gains for Washington State community college students who completed an associate degree or long-term certificate but null returns for short-term certificate programs; returns were largest for women who completed an associate degree in nursing. Using nationally representative data, Marcotte (2019) found that women experienced larger employment gains from completing an associate degree relative to men, whereas men saw larger increases in earnings. Stevens et al. (2019) found earnings returns of 15 to 45 percent for community college students in California who completed a CTE credential. Similar work from Bettinger and Soliz (2016) found positive returns to community college vocational credentials in Ohio. Grosz (2020) found large, positive returns to completing community college associate degrees in nursing more specifically.

More recent work shows that education-industry match contributes to earnings premia associated with postsecondary degree completion. Odle and Russell (2026) found that working in an industry matched to one's college field is associated with a 5 to 10 percent earnings premium, with substantial variation by field, gender, degree level, and time in matched industries. Most germane to our analysis, while education-industry match wage premia were positive overall, they were lower for women than men.

The existing evidence therefore establishes that community college labor-market outcomes vary across credentials, fields, and student groups. Less is known about whether the fields governments select for targeted financial support identify stronger pathways into employment, earnings, and program-aligned work. Existing evaluations of workforce-targeted aid primarily examine enrollment and credential completion, with limited evidence on labor-market outcomes. A randomized controlled trial found that students who were offered experimental Workforce Pell Grants were more likely to complete high-demand programs but saw no significant employment or earnings gains (Thomas et al., 2024). At the state level, descriptive and causal analyses found that G3 increased enrollment in eligible programs and led to gains in certificate but not applied associate degree completion, though neither study examined effects on labor market outcomes of students in G3 programs (Bonilla and Sparks, 2026; Sparks and Bonilla, 2026). Descriptive analysis from Darolia et al. (2024) similarly suggests that Kentucky's Work Ready Scholarship, a last dollar schol-

arship for students pursuing certificate and applied associate degrees in high-demand workforce areas, increased program enrollment and number of degrees conferred but, again, lacks estimated effects on labor market outcomes. These gaps motivate a closer examination of the mechanisms through which designation as a high-demand field might translate into labor-market advantage.

2.3 Conceptual Framework

The policy rationale for field-targeted financial aid is that state-designated programs provide clearer and more remunerative pathways into the labor market. State agencies use projected vacancies, wages, and regional workforce needs to identify fields in which employers are expected to face sustained demand for workers. Students entering those fields may therefore be more likely to find employment, move into industries related to their training, and experience higher earnings.

These outcomes, however, capture distinct margins of labor-market adjustment and need not move together. Stronger employer demand may increase program-industry alignment without raising overall employment if students would otherwise have worked in unrelated sectors. Likewise, aligned employment may not produce higher quarterly earnings if students work fewer hours or weeks or have less access to overtime. A field may therefore provide a relatively clear pathway into related work without producing comparable gains in employment or earnings.

Labor demand alone may also be insufficient to explain differences in earnings across fields. In some fields, wages may be higher because jobs involve physical risk, irregular schedules, mandatory overtime, or other demanding working conditions for which employers provide compensating wage differentials (Lavetti, 2023). Collective bargaining, formal wage scales, and access to overtime may further support earnings in skilled trades, manufacturing, and public safety. Union representation, for example, is particularly common in protective-service occupations and remains above the private-sector average in construction (U.S. Bureau of Labor Statistics, 2026). Thus, higher earnings in these fields may reflect not only demand for workers, but also the organization of work and the institutions through which compensation is determined.

Other high-demand fields may not offer similar earnings opportunities. Early childhood education operates in a fragmented sector in which providers rely heavily on household payments

and incomplete public subsidies, limiting their ability to raise wages without increasing the price of care (Borowsky et al., 2022; McLean et al., 2024). The field is also staffed largely by women and disproportionately by women of color (Bassok et al., 2026; Cooksey and Thomas, 2024). Sociological research suggests that these patterns of occupational segregation are consequential for pay. Occupations tend to become lower paid as they become more heavily female, and care work carries a wage penalty that is not fully explained by workers' characteristics or conventional measures of skill (England et al., 2002; Levanon et al., 2009). Consequently, even when states accurately identify fields with substantial demand for workers, differences in financing, collective bargaining, occupational composition, and the social valuation of work may produce very different earnings trajectories.

These processes may also operate differently for women and men. Workforce programs are highly sex-segregated, and women and men may enter different occupations, employers, or job assignments even within the same broad field or industry (Blau and Kahn, 2017). Differences in hiring, starting pay, promotion, access to overtime, and assignment to higher-paying tasks may therefore produce distinct earnings trajectories among students with similar levels of program-industry alignment (Benson et al., 2026). These differences may reflect occupational sorting, organizational practices, or discrimination in hiring and pay. Because the available data identify industry but not occupation, hours, job assignments, or employer practices, our analysis cannot distinguish among these mechanisms.

Taken together, these considerations imply that state-designated fields may be associated with stronger program-industry alignment without producing uniform gains in employment or earnings. They also suggest that average differences may conceal substantial variation across program areas and between women and men. The empirical analysis therefore examines earnings, employment, and program-aligned employment separately and estimates each outcome by field and sex.

3 Data

We use student-level administrative records from the VCCS linked to quarterly earnings and employment records from the Virginia Employment Commission. The VCCS records identify students' entry cohort, first program of study, credential completion, demographic characteristics, and program-level classifications. The earnings records allow us to observe students' quarterly employment and earnings in jobs covered by the state's unemployment insurance system. We construct a student-quarter panel that follows first-time-in-college (FTIC) entrants from eight quarters before enrollment through twelve quarters after first enrollment.

To construct the analytic sample, we begin with FTIC entrants from the 2016 through 2020 cohorts. We restrict the sample to students whose first program of study is classified, excluding students whose first program cannot be assigned to one of three broad pathways: certificate, applied associate, or transfer associate. This restriction yields $106{,}067$ classified entrants. Because our main interest is in labor-market pathways connected to workforce education, our core analyses focus on students whose first program of study was either a certificate or an applied associate degree program. We refer to these students as workforce-focused entrants. The workforce-focused sample includes $26{,}278$ FTIC students who enrolled in a program of study linked to a certificate or applied associate degree. These students represent approximately one-quarter of all FTIC students.

We next classify workforce-focused entrants according to whether their first program was later approved for G3 eligibility. We define a program as "future G3" if it appeared on the state-approved G3 credit-program list and led to a certificate or applied associate degree. This definition excludes noncredit workforce training programs, although such programs also became eligible for G3 assistance. The comparison group consists of entrants in other credit-bearing, workforce-focused certificate and applied associate programs that were not included on the G3-eligible credit-program list.

Importantly, the non-G3 comparison group is not composed of transfer-oriented or non-occupational programs. It includes occupational programs in fields such as business and management, visual and performing arts, computer and information sciences, protective services, personal and culi-

nary services, mechanic and repair technologies, and health (see Appendix Table A.1). This composition reflects the structure of the G3 eligibility process: eligibility was assigned to approved programs and CIP codes, often below the broad two-digit CIP level, rather than to every program within a designated field. Some programs in broad fields associated with G3 priorities therefore remained ineligible. Our analysis consequently compares credit-bearing workforce programs that were later selected for G3 eligibility with other credit-bearing workforce programs, rather than comparing workforce programs with transfer-oriented programs.

Our primary outcomes are quarterly earnings, employment, and program-aligned employment. Quarterly earnings are measured in 2023 dollars and are coded as zero in quarters with no observed covered employment. Employment is an indicator equal to one when a student has positive earnings in a covered job in a given quarter. We observe these outcomes both while students are enrolled in VCCS and after they leave the system.

We construct program-aligned employment by linking students' program of study to observed employment sectors. Following Odle and Russell (2026), we use their CIP–NAICS crosswalk that maps Classification of Instructional Programs (CIP) codes to North American Industry Classification System (NAICS) codes using information from the Bureau of Labor Statistics and the National Center for Education Statistics. In our analysis, a student is coded as working in a program-aligned field in a given quarter if the CIP code associated with the student's program of study maps to the NAICS industry code observed in the employment records. This measure captures whether students are employed in an industry related to their field of study, rather than whether they are employed in a specific occupation. Because industry classifications identify employers' industries rather than workers' occupations, this measure may not capture all forms of program-related employment. Measurement error may be particularly consequential for fields such as information technology, where program-related occupations are distributed across industries.

Table 1 reports descriptive statistics for the samples used in the analysis. The first column describes all classified entrants. Most classified entrants begin in transfer-oriented programs: 75.2 percent entered a transfer associate program, compared with 10.2 percent in certificate programs and 14.6 percent in applied associate programs. The second column restricts the sample

to workforce-focused entrants. These students differ from the broader classified entrant population in several ways that are relevant for the empirical analysis. They are less likely to be female, 46.8 percent of workforce-focused entrants compared with 52.9 percent of all entrants. Workforce-focused entrants are also more likely to be Black and less likely to be Hispanic or Asian. Workforce-focused entrants have stronger pre-enrollment labor-market attachment, with average pre-entry quarterly earnings of $2,523 compared to $1,871 among all classified entrants; pre-entry employment is 55.5 percent for workforce-focused entrants compared with 52.3 percent for all classified entrants. Quarterly earnings are higher on average for students in workforce programs compared to the overall sample. Among students employed in a given quarter, annualized earnings (four times quarterly earnings) in quarters 4–12 average about $25,100 for women and $29,900 for men in other workforce programs, and about $24,600 for women and $32,800 for men in future G3 programs. These are unadjusted means and may understate earnings for full-year, full-time workers.

We construct an age-restricted workforce sample for analyses in which pre-enrollment labor-market outcomes are especially important for interpretation. Specifically, we identify workforce-focused entrants who were age 20 or older at first enrollment. This restriction yields $8{,}474$ students. These older workforce entrants have substantially higher pre-entry earnings and employment than the full workforce-focused sample: average pre-entry earnings are $\$5{,}023$ and pre-entry employment is 65.8 percent. They are also more likely to be Black and lower income: 28.8 percent are Black and 55.0 percent are in the 0–200 percent Federal Poverty Level income band. This sample is useful for labor-market trajectory analyses among students with more established pre-entry labor-market attachment, but it changes the target population and is not representative of all workforce-focused entrants.

G3 eligibility is concentrated among workforce-focused students. Only 14.1 percent of all classified entrants entered a future G3-eligible first program, compared with 56.9 percent of workforce-focused entrants and 56.5 percent of age-20-plus workforce-focused entrants. Among workforce-focused entrants, the largest G3 program areas are health, skilled trades/manufacturing, and information technology. Early childhood education and public safety account for smaller shares of the workforce-focused sample.

Finally, we define a completion-conditioned sample of workforce-focused entrants who completed any credential. This sample includes 8,893 students. They are more likely to be White, less likely to be Black or Hispanic, and more likely to have initially entered a future G3-eligible program. They have program-aligned employment at the entry quarter similar to all workforce-focused entrants (0.216 vs. 0.235). These differences are important for interpretation because analyses that condition on credential completion describe a selected subgroup of workforce-focused students rather than the full population of workforce-focused entrants.

Appendix Table A.2 describes the composition of future G3-designated workforce entrants by program area, sex, and first-program type. The future G3 workforce category is highly heterogeneous and sharply sex-segregated. Health and early childhood education are predominantly female, at 84 and 97 percent female, respectively, while skilled trades/manufacturing and information technology are predominantly male, at 93 and 83 percent male, respectively; public safety is more balanced. These patterns mean that pooled comparisons of future G3 and non-G3 workforce programs combine program areas with very different sex composition and credential pathways. The table also shows that credential pathways differ across areas, with health and skilled trades/manufacturing including larger certificate shares and information technology and public safety consisting primarily of applied associate programs.

These descriptive patterns motivate two additional distinctions that we maintain throughout the analysis. First, age restrictions improve the interpretability of pre-enrollment earnings but change the population to which the estimates apply. Second, conditioning on credential completion selects students with different baseline characteristics and therefore describes a selected subgroup rather than the full population of workforce-focused entrants. We distinguish analyses of the full workforce-focused entrant population from models that impose additional age or completion restrictions.[2]

[2] Appendix Table A.3 provides the full crossed sample diagnostics, including all entrants and completers with and without the workforce-focused and age-20-plus restrictions.

4 Methods

We estimate student fixed-effects event-study models that compare labor-market trajectories for entrants in future G3-designated workforce programs with those of entrants in non-G3 workforce programs (Autor, 2003; Jacobson et al., 1993; Baker et al., 2026). The analytic sample includes 2016–2020 first-time-in-college entrants whose first program was a certificate or applied associate program. We estimate models separately by sex for quarterly earnings, covered employment, and program-aligned employment. Earnings are measured in 2023 dollars, and earnings and employment are coded as zero in quarters with no observed covered employment.

The primary empirical challenge is that students do not randomly select into workforce programs. Entrants across G3 program areas and non-G3 workforce programs may differ in prior preparation, work experience, labor-market attachment, financial constraints, family responsibilities, and unobserved earnings potential. Simple cross-sectional comparisons of students across fields would therefore confound program-area differences with pre-existing differences across students. Student fixed effects absorb all time-invariant differences across students, so the estimates are identified from whether outcomes change differently after enrollment for entrants in future G3 programs than for entrants in other workforce programs.

These models do not estimate the policy effects of G3 financial aid and advising support. The cohorts in the analysis entered VCCS before G3 was implemented and were not exposed to the program at entry. The estimates instead assess whether programs later selected for G3 eligibility were associated with different labor-market trajectories than other workforce programs. The analysis therefore speaks to whether fields later designated for subsidy offer stronger outcomes for students rather than to the causal effect of G3 itself.

Our primary specification is the following student fixed-effects event-study model:

$$Y_{it} = \sum_{q \neq -1} \beta_q \left(G3_i \times \mathbb{1}\{Q_{it} = q\} \right) + \alpha_i + \lambda_q + \tau_t + \pi U_{ct} + \epsilon_{it}, \tag{1}$$

where Y_{it} is the labor-market outcome for student i in calendar quarter t, $G3_i$ indicates whether the student's first workforce program was later designated as G3 eligible, and Q_{it} indexes quar-

ters relative to initial enrollment. The omitted event-time quarter is $q = -1$, the quarter immediately before enrollment. The model includes student fixed effects α_i, event-time fixed effects λ_q, calendar-quarter fixed effects τ_t, and the community college-county unemployment rate U_{ct}. Event-time fixed effects account for changes common to students at the same point relative to enrollment, while calendar-quarter fixed effects account for common seasonal and macroeconomic conditions. These effects are separately identified because students enter VCCS in different calendar quarters. Standard errors are clustered at the student level.

The student fixed effects absorb all time-invariant differences between entrants into future G3 and non-G3 workforce programs. The coefficients β_q are therefore identified from differential within-student changes in outcomes over event time. For post-entry quarters, they estimate how changes in earnings, employment, or alignment among future G3 entrants differ from those among non-G3 workforce entrants, relative to the quarter immediately before enrollment. The pre-entry coefficients provide evidence on whether the two groups were already following different labor-market trajectories before enrollment.

The identifying assumption is that, absent entry into a future G3-designated program area, students entering future G3 programs would have experienced the same average changes in labor-market outcomes as students entering non-G3 workforce programs, conditional on student fixed effects, event time, calendar time, and local labor-market conditions. This assumption does not require the two groups to have identical outcome levels. Future G3 and non-G3 entrants may differ in fixed characteristics and baseline labor-market attachment, because those differences are absorbed by the student fixed effects. The remaining concern is whether the groups would have experienced different changes in earnings, employment, or alignment even in the absence of entry into different workforce fields.

We assess this concern using the pre-entry event-study coefficients. As in other difference-in-differences settings, the parallel-trends assumption cannot be tested directly because counterfactual post-entry outcomes are unobserved. The pre-entry coefficients nevertheless provide evidence on whether the two groups were already experiencing differential changes before enrollment. Following recent guidance for interpreting event-study evidence, we evaluate these

coefficients using both formal joint tests and their substantive magnitude, direction, and stability (Baker et al., 2026). We therefore report joint tests of whether the pre-entry interaction coefficients are equal to zero and interpret the post-entry estimates in light of the full pre-entry pattern.

To summarize the dynamic event-study estimates, we also estimate a period-specific version of the model:

$$Y_{it} = \beta_1 \left(G3_i \times EarlyPost_{it}\right) + \beta_2 \left(G3_i \times LaterPost_{it}\right) + \alpha_i + \lambda_p + \tau_t + \pi U_{ct} + \epsilon_{it}. \tag{2}$$

The omitted period is the pre-entry period, defined as quarters -8 through -1 relative to initial enrollment. $EarlyPost_{it}$ denotes quarters 0–3, and $LaterPost_{it}$ denotes quarters 4–12. The coefficients β_1 and β_2 aggregate the post-entry event-time contrasts into early and later post-entry periods. We use this specification to provide a compact summary of the dynamic patterns shown in the event-study figures; the period estimates are not intended to replace but rather supplement the full event-study analysis.

We also estimate analogous event-study and period models that replace the single future-G3 indicator with indicators for each future G3 program area: health, skilled trades and manufacturing, information technology, public safety, and early childhood education. These models compare entrants in each future G3 program area with entrants in non-G3 workforce programs. We estimate these models separately by sex, following prior work showing that labor-market returns to community college credentials vary substantially by sex and field of study (Jepsen et al., 2014; Dadgar and Trimble, 2015; Marcotte, 2019; Stevens et al., 2019; Minaya and Scott-Clayton, 2022). Male early childhood education estimates are omitted because the number of male entrants in that field is too small to support stable estimates.

5 Results

5.1 Descriptive Labor Market Trajectories

Figure 1 plots unconditional earnings and employment trajectories for workforce-focused entrants according to whether their first program was later designated as G3 eligible. Prior to en-

rollment, earnings follow broadly similar patterns among future G3 and non-G3 entrants. After enrollment, however, the trajectories diverge by sex. Earnings remain similar across the two groups among women, whereas men in future G3 programs begin to earn more than men in non-G3 workforce programs. Employment rates are more similar across groups: for both women and men, employment rises before enrollment and remains relatively stable thereafter, with little sustained separation between future G3 and non-G3 entrants.

These descriptive patterns motivate the sex-specific analyses that follow. They also reinforce the importance of comparing students across workforce programs rather than using transfer-oriented entrants as the primary comparison group. As shown in Appendix Figure A.1, transfer associate entrants have substantially different earnings trajectories, particularly among men. The figures are descriptive and do not identify the effect of entering a future G3 program, but they show that the principal post-entry difference is in men's earnings rather than in overall employment.

The composition of future G3 program areas also differs sharply by sex. Health and early childhood education are predominantly female, while skilled trades/manufacturing and information technology are predominantly male. Public safety is the most balanced of the G3 areas. Consistent with this sorting, Appendix Figure A.2 shows substantial sex differences in earnings within several G3 program areas, even where employment rates are similar. These patterns motivate analyses that distinguish both program area and sex.

5.2 Event-Study Estimates and Pre-Entry Trends

Figure 2 presents event-study estimates of adjusted differences between future G3 and non-G3 workforce entrants, separately by sex. The post-entry coefficients describe how these differences evolve following enrollment, while the pre-entry coefficients indicate whether the groups were already following different labor-market trajectories.

The pre-entry evidence is mixed. Employment differences are not jointly significant among women, although the corresponding test is marginally significant among men. For earnings, women entering future G3 programs earned less than women entering non-G3 workforce pro-

grams before enrollment, and the pre-entry coefficients are jointly significant ($F = 2.26, p = 0.027$). Pre-entry earnings differences among men are smaller and are not jointly significant ($F = 1.54, p = 0.148$). Although the pooled pre-entry earnings coefficients are not jointly significant among men, the field-specific tests reveal significant pre-entry differences in skilled trades/manufacturing and public safety, where the largest post-entry earnings differences are observed. These findings suggest that pre-existing differences in labor-market trajectories may contribute to the observed post-entry patterns, particularly in these fields. For employment, female estimates are slightly negative throughout much of the observed window, but the pre-entry coefficients are not jointly significant at conventional levels ($F = 1.34$, $p = 0.229$). Male employment estimates are positive before enrollment and decline as students approach entry; the joint test is marginally significant ($F = 1.99$, $p = 0.053$). More generally, the presence of some differential pre-entry trends means that the estimates should be interpreted as adjusted differences in within-student trajectories rather than as causal effects of entering a future G3 field.

The field-specific event studies show similar variation across outcomes and program areas (Figures 3–5; Appendix Table A.4). Pre-entry differences are especially common for program-aligned employment and appear in selected field-by-sex comparisons for employment and earnings. We use these estimates to assess the plausibility of each comparison and to qualify the period estimates reported below.

5.3 Earnings and employment after enrollment

Table 2 shows that adjusted post-entry earnings differences between future G3 and non-G3 workforce entrants are concentrated among men. Male entrants in future G3 programs earn approximately $164 more per quarter in quarters 0–3 and $331 more per quarter in quarters 4–12. Relative to the corresponding non-G3 means, these estimates imply earnings differences of approximately 4 percent in the early post period and 6 percent in the later post period. In contrast, the estimates for women are smaller and not statistically significant. Employment differences are modest for both groups and do not persist into the later post-entry period. Thus, the pooled results indicate higher post-entry earnings among men without a corresponding sustained increase

in their likelihood of employment.

These pooled estimates conceal substantial variation across fields (Table 3). Among men, earnings differences are concentrated in health, skilled trades/ manufacturing, and public safety. Male entrants in future health programs earn approximately $520 more per quarter in the later post period, or about 10 percent more than the corresponding non-G3 mean. The largest differences appear in skilled trades/manufacturing, where male entrants earn about $226 more per quarter in the early post period and $1,050 more per quarter in the later post period. The later-post estimate is roughly 20 percent of the non-G3 mean. Male entrants in future public safety programs also have substantially higher later-post earnings, with an estimated difference of $967 per quarter, or about 18 percent of the non-G3 mean. Earnings estimates for male information technology entrants are positive in the later post period but smaller and statistically insignificant.

The corresponding estimates for women provide little evidence of higher earnings. Most are small and statistically indistinguishable from zero, while women entering early childhood education earn approximately $253 less per quarter in the later post-entry period, though the estimate is imprecise. Women in health, information technology, and public safety are also 4 to 5 percentage points less likely to be employed during that period. Employment differences among men are generally small across fields.

Taken together, the estimates do not support a uniform earnings advantage for entrants into state-designated fields. Higher earnings are concentrated among men in skilled trades/manufacturing, public safety, and health. The absence of similarly large employment differences suggests that these earnings patterns do not arise primarily because men in future G3 fields are more likely to be employed. The event-study diagnostics suggest that these differences should not be interpreted as fully causal program-area effects. However, the sex-specific pattern is informative: male earnings differences do not appear to be driven by a general increase in employment, while weaker female earnings results coincide with lower employment in several fields.

5.4 Program-aligned employment

The designation of high-demand programs is intended not only to improve employment and earnings, but also to create clearer pathways from education into related work. Table 4 shows that future G3 entrants are increasingly likely to work in industries aligned with their programs of study. During quarters 4–12, aligned employment is 6.2 percentage points higher among women and 7.0 percentage points higher among men. These estimates are sizable relative to non-G3 means of approximately 31 percent for women and 25 percent for men.

The gains are concentrated in health, skilled trades/manufacturing, and public safety (Table 5). Women entering health programs are 11.3 percentage points more likely to work in an aligned industry during the later period. Among men, the largest estimate is in skilled trades/manufacturing, at 14.8 percentage points, followed by public safety at 11.5 percentage points. Female entrants in skilled trades/manufacturing also show a later-post alignment gain of 6.5 percentage points, although the estimate is less precise. Public safety shows a similar pattern: later-post aligned employment increases by 11.5 percentage points for men and 6.2 percentage points for women. By contrast, information technology and early childhood education show little evidence of increased alignment for either sex.

Comparing the alignment and earnings estimates reveals an important distinction. Among men, the fields with the largest increases in alignment also produce the largest earnings differences. Among women, increased alignment in health, skilled trades/manufacturing, and public safety is not accompanied by comparable earnings gains. Program-industry alignment therefore appears to be a more common outcome of entering future G3 fields than higher earnings, but the earnings associated with that alignment differ markedly by field and sex. This suggests that weaker female earnings results are not explained simply by a lack of program alignment.

The null information-technology estimates should be interpreted cautiously. Because the measure identifies alignment through employers' industries rather than workers' occupations, it may fail to classify IT positions embedded in health care, education, government, or other sectors as program related. Students working in IT support, systems administration, or network roles in those sectors may be using program-related skills even if their employer's industry is not classi-

fied as an IT industry. This measurement problem is likely more consequential for information technology than for fields that map more directly onto concentrated industry sectors.

5.5 Robustness Checks

The robustness analyses distinguish the study's more stable findings from those that depend on sample construction. These checks are important because the analytic window spans both pre- and post-entry quarters, and many entrants are young enough that observed pre-entry earnings may reflect teenage employment rather than stable adult labor-market attachment. Estimates from a balanced panel closely resemble the main results: higher earnings remain concentrated among men, while program-aligned employment remains higher for both women and men (Appendix Table A.5).

The earnings estimates are less stable when the sample is restricted to entrants age 20 or older. In this group, later-post earnings differences are smaller and statistically insignificant for both sexes, whereas alignment remains 3.5 percentage points higher among women and 4.0 percentage points higher among men (Appendix Table A.6). Conversely, coding earnings observed before age 20 as zero produces somewhat larger post-entry earnings estimates, including a positive later-period estimate among women (Appendix Tables A.7 and A.8). The estimated earnings differences therefore depend in part on how the labor-market histories of younger entrants are represented.

Appendix Table A.6 restricts the sample to workforce-focused entrants age 20 or older at first enrollment. This restriction provides a sharper comparison among students with more established pre-entry labor-market attachment, but it also changes the target population. In this older sample, the earnings results attenuate substantially: later-post earnings estimates are smaller and statistically insignificant for both women and men. By contrast, later-post alignment estimates remain positive for both sexes, at 3.5 percentage points for women and 4.0 percentage points for men. These results suggest that the earnings differences are sensitive to sample age composition, whereas alignment differences are more stable across age groups.

Appendix Tables A.7 and A.8 follow Stevens et al. (2019) by setting pre-entry earnings to zero

in quarters when students are younger than age 20. This specification addresses the concern that earnings observed during adolescence may be less informative about subsequent adult labor-market attachment. The pooled estimates remain broadly consistent with the main results and become somewhat more positive. Among men, the estimated earnings difference increases from \$164 to \$218 per quarter in the early post-entry period and from \$331 to \$383 in the later post-entry period. Among women, the later-post estimate increases from \$41 to \$205 and becomes statistically significant. The program-area estimates show a similar pattern: positive earnings differences among men remain concentrated in skilled trades/manufacturing, public safety, health, and information technology, whereas the estimates for women continue to vary across fields. These results indicate that the main earnings patterns are not driven by treating low adolescent earnings as directly comparable to adult pre-entry earnings.

Differences in program selection within the broad G3 areas provide another possible explanation for the sex-specific results. Women and men often enter different programs even within the same G3 field. In health, for example, women are more likely to enter registered nursing programs, whereas men are more likely to enter emergency medical technician and paramedic programs. Table A.9 therefore reports estimates for selected six-digit CIP programs that enroll substantial numbers of both women and men. The sex differences generally persist within these more narrowly defined programs. Among nursing entrants, for instance, the later-post earnings difference is approximately \$920 per quarter for men and \$558 for women. These comparisons suggest that sorting across broad G3 areas or six-digit programs does not fully account for the larger earnings differences observed among men. They cannot, however, rule out sorting into different occupations, employers, job assignments, or wage levels after entry into the same program.

Differences in credential completion could also contribute to the results if women and men complete programs at different rates. In the analytic sample, however, completion rates are similar: 35 percent among women and 33 percent among men. Tables A.10 and A.11 restrict the analysis to students who completed a credential. Within this selected group, men entering future G3 programs continue to show larger post-entry earnings differences than women, while completers of both sexes are more likely to work in program-aligned industries. The persistence of

the sex-specific pattern among completers suggests that differential completion rates are unlikely to be its primary explanation. Because credential completion is a post-entry outcome, however, these estimates describe a selected subgroup and should not be interpreted as causal returns to completion.

Taken together, the robustness checks sharpen rather than overturn the main findings. The earnings estimates are sensitive to the age composition of the sample and to the treatment of pre-entry earnings, indicating that younger entrants contribute importantly to the pooled pattern. At the same time, the larger earnings differences among men persist in analyses that compare students within more narrowly defined programs and among credential completers though imprecisely estimated. The program-alignment results are more stable: they remain positive in the balanced panel, the age-20-plus sample, and the completer sample. The evidence therefore provides stronger support for the proposition that several future G3 fields offer clearer pathways into program-related industries than for the proposition that they generate uniformly higher earnings. The earnings associated with those pathways vary substantially by field, sex, and age at entry and are not fully accounted for by completion rates or sorting across observed programs.

6 Discussion

These findings speak to, but do not resolve, the question of how well field-targeted workforce policies identify programs that lead to stronger labor-market outcomes. Future G3-designated fields are not a homogeneous category: the relationships among post-entry earnings, employment, and program alignment vary substantially across fields and by sex. In skilled trades/manufacturing and public safety, stronger earnings trajectories among men coincide with increases in aligned employment. Among women, by contrast, alignment gains in several fields do not translate into comparable earnings gains. Because future G3 and non-G3 workforce entrants were not always following identical labor-market trajectories before enrollment, these estimates should be interpreted as adjusted trajectory differences rather than causal effects of entering a future G3-designated program.

These findings also highlight a broader challenge for workforce-targeted postsecondary poli-

cies: programs that address state workforce priorities may not provide equally strong economic opportunities for students. The distinction between workforce demand and individual economic value is especially important when states use program eligibility rules to direct financial aid toward selected credentials. Our findings suggest that the relationship between measured program-industry alignment and earnings varies considerably across fields and by sex, underscoring the limitations of treating these outcomes as interchangeable indicators of program value.

One notable result is the relatively strong pre-entry labor-market attachment of women entering several future G3-designated fields. In the employment event studies, women entering fields such as health and information technology have higher employment probabilities than women in non-G3 workforce programs during parts of the pre-entry period. This relative advantage declines as enrollment approaches and, in some cases, becomes negative after entry. This pattern complicates a simple interpretation that weaker female earnings trajectories reflect lower baseline labor-market attachment. Rather, many women enter future G3 fields with substantial prior work attachment but subsequently experience weaker relative employment trajectories and limited earnings growth.

The alignment results sharpen this finding. Women entering several future G3 fields become more likely to work in industries related to their programs of study, yet these gains in alignment do not produce earnings increases comparable to those observed among men. The weaker earnings trajectories among women therefore cannot be explained solely by a failure to enter program-related industries. They may instead reflect reduced employment or hours, lower wages within aligned industries, sorting into different occupations, employers, or job assignments, and unequal access to higher-paying work or advancement opportunities. Although the available data cannot identify discrimination directly, the results are consistent with labor-market processes that distribute the benefits of program alignment unevenly between women and men.

Our analyses address one potential source of these differences: sorting across programs of study. Women and men often enter different programs even within the same broad G3 field. In health, for example, women were more likely to enter registered nursing programs, whereas men were more likely to enter emergency medical technician and paramedic programs. Estimates

within selected six-digit CIP programs show that the adjusted post-entry earnings differences remain larger among men than women even within more narrowly defined fields of study. Among nursing entrants, for instance, the later-post earnings difference is approximately $920 per quarter for men and $558 for women. These comparisons suggest that sorting across broad fields or observed programs does not fully account for the sex-specific pattern. They cannot, however, rule out sorting into different occupations, employers, assignments, or wage levels after students enter the same program.

Differences in credential completion also appear unlikely to provide the primary explanation. Women and men in the analytic sample have similar completion rates, at 35 and 33 percent, respectively. Among the selected group of credential completers, men entering future G3 programs exhibited larger earnings and employment differences than women, while completers of both sexes were more likely to work in program-aligned industries. These results reinforce the conclusion that the sex-specific post-entry trajectories are not primarily explained by differential credential completion. Because completion is itself a post-entry outcome, however, these estimates describe a selected subgroup and should not be interpreted as causal returns to credential completion.

The industry-based alignment measure also captures some forms of related employment more precisely than others. It identifies alignment by linking students' programs to employers' industries rather than to workers' occupations or job tasks. This distinction is especially important for information technology, where IT work is distributed across many industries. Students may hold IT support, network administration, or systems roles in schools, hospitals, universities, law firms, or public agencies, yet these jobs would be observed in education, health care, professional services, or public administration rather than in an information-technology industry. The alignment measure may therefore understate program-related employment for IT students and should be interpreted more cautiously for this field than for fields that map more directly onto a concentrated set of industries.

The linked administrative data provide strong measures of quarterly earnings, covered employment, and employers' industries, but they do not distinguish several mechanisms that may produce the observed sex differences. Quarterly earnings combine wage rates, hours, and weeks

worked, and the records do not separately identify hours, union representation, occupations, job assignments, or promotion opportunities. They also do not capture employment outside Virginia or subsequent enrollment outside VCCS. Available evidence suggests that out-of-state employment is unlikely to explain most of the observed patterns because more than 80 percent of Virginia community college students remain employed in state (US Census Bureau, 2026). Restricting the analysis to workforce-focused rather than transfer-oriented programs also reduces, although it does not eliminate, concerns that continued education mechanically suppresses post-entry earnings.

Union representation may contribute to field-level differences in compensation, particularly in protective services and construction. Although aggregate union membership rates are now similar for women and men, women and men remain concentrated in different occupations and industries with different levels of union coverage (US Bureau of Labor Statistics, 2025). Hours worked are also consequential because quarterly earnings combine both wage rates and labor supply. Women may earn less because they work fewer hours or weeks, including as a result of caregiving responsibilities. At the same time, well-documented differences in pay, promotion, job assignment, and access to higher-paying work may generate unequal earnings even among women and men with similar training and industry alignment (Cukrowska-Torzewska and Matysiak, 2020). The present analysis cannot separate these mechanisms, but the results indicate that entry into a related industry does not ensure equal remuneration.

Our analysis focuses on short-term labor-market outcomes, and earnings, employment, and program-alignment trajectories may change beyond three to four years after initial enrollment. Longer-run analysis is therefore needed to assess whether the observed differences widen, narrow, or persist. At the same time, an explicit goal of the G3 program was to help students quickly acquire workforce skills and enter or advance in the labor market. The early post-entry period examined here is therefore central to the policy's stated rationale rather than merely an incomplete view of longer-run outcomes. Because these comparisons are based on cohorts entering before G3 implementation, the observed relationships do not necessarily generalize to students entering under G3 or to labor-market conditions prevailing after the policy was introduced.

7 Conclusion

This study examines whether credit-bearing workforce programs that were later selected for Virginia's G3 initiative were associated with stronger labor-market trajectories than other credit-bearing workforce programs. Using linked VCCS enrollment records and Virginia unemployment-insurance earnings data, we follow first-time-in-college entrants from eight quarters before enrollment through twelve quarters after entry. We compare students whose initial certificate or applied associate program was later designated as G3 eligible with students entering other workforce-focused programs and estimate sex-specific student fixed-effects event studies and period models for earnings, employment, and program-aligned employment. Because some future G3 and non-G3 entrants followed different labor-market trajectories before enrollment, the estimates are interpreted as adjusted within-student trajectory differences rather than causal effects of entering a future G3 field.

The findings provide the strongest support for one dimension of student outcomes: students entering several future G3-designated programs were more likely to move into industries related to their fields of study. These alignment differences were positive for both women and men and were especially pronounced in health, skilled trades/manufacturing, and public safety. In this respect, fields later designated were more consistently associated with employment in program-related industries.

The evidence is less consistent, however, that these programs produce uniformly stronger employment or earnings trajectories. Higher earnings are concentrated among men and in selected fields, while women often experience increased alignment without comparable earnings gains. Moreover, average annual earnings remain modest across both future G3 and non-G3 workforce programs, generally between $25,000 and $32,000 during the observed period. Robustness analyses indicate that the alignment results are more stable than the earnings estimates, which vary with age at entry and the treatment of pre-entry earnings. Larger earnings differences among men also persist in comparisons within more narrowly defined programs and among credential completers, although these analyses cannot eliminate sorting into different occupations, employers, or job assignments.

Field-targeted financial aid is designed to reduce information and financial barriers and encourage students to enter fields that policymakers identify as economically important. Yet increasing entry into high-demand fields is not sufficient when the jobs available within those fields remain low paid or offer unequal opportunities for advancement. The results suggest the importance of not only encouraging enrollment in high-demand programs, but also improving compensation, advancement opportunities, and working conditions within those fields. This concern is especially salient for occupations with high social value but persistently low wages, such as early childhood education.

Future research should further examine whether the sex differences documented here arise from within-industry occupational sorting, differences in hours and job assignments, unequal access to promotion and overtime, or discrimination in pay and hiring. Such evidence is needed to determine when field-targeted state and federal policies create broadly shared opportunities for economic mobility and when they primarily increase entry into industries whose economic rewards remain unevenly distributed.

8 Bibliography

Atwell, A., Ecton, W., Klein, S., D'Amico, M. M., and Sublett, C. (2022). Community college responses to align career and technical education programs with changing labor markets. *New Directions for Community Colleges*, 2022(197):45–58.

Autor, D. H. (2003). Outsourcing at will: The contribution of unjust dismissal doctrine to the growth of employment outsourcing. *Journal of labor economics*, 21(1):1–42.

Bahr, P. R., Dynarski, S., Jacob, B., Kreisman, D., Sosa, A., and Wiederspan, M. (2015). Labor market returns to community college awards: Evidence from michigan. Capsee working paper, Center for Analysis of Postsecondary Education and Employment.

Baker, A., Callaway, B., Cunningham, S., Goodman-Bacon, A., and Sant'Anna, P. H. C. (2026). Difference-in-differences designs: A practitioner's guide. *Journal of Economic Literature*, 64(2):498–557.

Bassok, D., Markowitz, A. J., and Cubides Mateus, D. M. (2026). Racial and ethnic wage gaps among early educators. *AERA Open*, 12.

Benson, A., Li, D., and Shue, K. (2026). "Potential" and the gender promotion gap. *American Economic Review*, 116(2):375–417.

Bettinger, E. and Soliz, A. (2016). Returns to vocational credentials: Evidence from ohio's community and technical colleges. Capsee working paper, Center for Analysis of Postsecondary Education and Employment.

Blau, F. D. and Kahn, L. M. (2017). The gender wage gap: Extent, trends, and explanations. *Journal of Economic Literature*, 55(3):789–865.

Bonilla, S. and Sparks, D. (2026). Get a skill, get a job, get ahead? evaluating the effects of virginia's workforce-targeted free college program. *Economics of Education Review*, 112:102798.

Borowsky, J., Brown, J. H., Davis, E. E., Gibbs, C., Herbst, C. M., Sojourner, A., Tekin, E., and Wiswall, M. (2022). An equilibrium model of the impact of increased public investment in early childhood education. NBER Working Paper 30140, National Bureau of Economic Research.

Cooksey, K. and Thomas, E. (2024). Childcare employment—before, during, and after the COVID-19 pandemic. *Monthly Labor Review*.

Cukrowska-Torzewska, E. and Matysiak, A. (2020). The motherhood wage penalty: A meta-analysis. *Social Science Research*.

Dadgar, M. and Trimble, M. J. (2015). Labor market returns to sub-baccalaureate credentials: How much does a community college degree or certificate pay? *Educational Evaluation and Policy Analysis*, 37(4):399–418.

Darolia, R., Zimmer, R., Guo, C., Wilcox, E., and Noh, K. (2024). Effects of work ready kentucky scholarship: Program enrollment and credential completion. Technical report, University of Kentucky.

England, P., Budig, M., and Folbre, N. (2002). Wages of virtue: The relative pay of care work. *Social Problems*, 49(4):455–473.

Grosz, M. (2020). The returns to a large community college program: Evidence from admissions lotteries. *American Economic Journal: Economic Policy*, 12(1):226–253.

Jacobson, L. S., LaLonde, R. J., and Sullivan, D. G. (1993). Earnings losses of displaced workers. *The American economic review*, pages 685–709.

Jepsen, C., Troske, K., and Coomes, P. (2014). The labor-market returns to community college degrees, diplomas, and certificates. *Journal of Labor Economics*, 32(1):95–121.

Lavetti, K. (2023). Compensating wage differentials in labor markets. *Journal of Economic Perspectives*, 37(3):189–212.

Levanon, A., England, P., and Allison, P. (2009). Occupational feminization and pay: Assessing causal dynamics using 1950–2000 U.S. census data. *Social Forces*, 88(2):865–891.

Liu, V., Belfield, C., and Trimble, M. (2015). The medium-term labor market returns to community college awards: Evidence from north carolina. *Economics of Education Review*, 44:42–55.

Marcotte, D. (2019). The returns to education at community colleges: New evidence from the education longitudinal survey. *Education Finance and Policy*.

McLean, C., Austin, L. J. E., Powell, A., Jaggi, S., Kim, Y., Knight, J., Muñoz, S., and Schlieber, M. (2024). Early childhood workforce index—2024. Technical report, Center for the Study of Child Care Employment, University of California, Berkeley, Berkeley, CA.

Miller-Adams, M. and Iriti, J. (2025). The free college handbook. *Upjohn Institute for Employment Research*.

Minaya, V. and Scott-Clayton, J. (2022). Labor market trajectories for community college graduates: How returns to certificates and associate's degrees evolve over time. *Education Finance and Policy*, 17(1):53–80.

Odle, T. and Russell, L. (2026). The role of education-industry match in college earnings premia. *Education Finance and Policy*.

Sparks, D. (2024). A promise to work? an exploration of state free college policies with program eligibility requirements. *Change: The Magazine of Higher Learning*.

Sparks, D. and Bonilla, S. (2026). The role of policy design in free college programs: Evidence from virginia. *Education Finance and Policy*.

Stevens, A. H., Kurlaender, M., and Grosz, M. (2019). Career technical education and labor market outcomes: Evidence from california community colleges. *Journal of Human Resources*, 54(4):986–1036.

Thomas, J., Gonzalez, N., Williams, B., Paxton, N., Hu, J., Wiegand, A., and Hebbar, L. (2024). The effects of expanding pell grant eligibility for short occupational training programs: New results on employment and earnings from the experimental sites initiative. Technical report, Institute for Education Sciences.

US Bureau of Labor Statistics (2025). Union members 2025. Technical report, US Department of Labor.

U.S. Bureau of Labor Statistics (2026). Union members—2025. News Release USDL-26-0229. Released February 18, 2026.

US Census Bureau (2026). Postsecondary employment outcomes explorer. Technical report, US Census Bureau.

U.S. Department of Education (2026). Accountability in higher education and access through demand-driven workforce pell: Pell grant exclusion relating to other grant aid; and workforce pell grants. Final rule, 91 Federal Register 29254–29338. Docket No. ED-2026-OPE-0133.

US Department of Education (2026). U.s. department of education issues final rule to create new workforce pell grant program.

Virginia Economic Development Partnership (2023). Review of the G3 program's alignment to the virginia labor market. Technical Report RD141, Virginia Office of Education Economics, Richmond, VA.

Virginia General Assembly (2021a). An act to establish the get skilled, get a job, give back (G3) fund and program. Commonwealth of Virginia. Acts of Assembly, 2021 Special Session I, Chapter 397; House Bill 2204.

Virginia General Assembly (2021b). Item 221: Virginia community college system, higher education student financial assistance. Commonwealth of Virginia State Budget. House Bill 1800, Chapter 552, 2021 Special Session I.

9 Tables

Table 1: Characteristics of community college student sample

	Entrants			Completers
	All classified mean	WF mean	20+ WF mean	WF mean
Demographic Characteristics				
Female	0.529	0.468	0.499	0.477
Asian	0.059	0.034	0.040	0.037
Black	0.198	0.227	0.288	0.151
Hispanic	0.153	0.109	0.105	0.095
White	0.512	0.559	0.497	0.655
Race missing	0.016	0.017	0.023	0.016
Age 18–24	0.802	0.733	0.446	0.732
Age 25–34	0.057	0.106	0.328	0.082
Age 35 and over	0.030	0.073	0.226	0.069
Baseline Labor-Market and Income				
Pre-entry quarterly earnings	1870.694	2523.069	5023.385	2270.723
Pre-entry employment	0.523	0.555	0.658	0.529
0–200% FPL	0.402	0.461	0.550	0.400
Entry Program				
Certificate first program	0.102	0.412	0.456	0.440
Applied associate first program	0.146	0.588	0.544	0.560
Transfer associate first program	0.752	0.000	0.000	0.000
G3-eligible first program	0.141	0.569	0.565	0.602
Health	0.076	0.279	0.270	0.290
Skilled trades/manufacturing	0.061	0.246	0.254	0.286
Information technology	0.172	0.247	0.266	0.219
Early childhood education	0.014	0.034	0.050	0.035
Public safety	0.027	0.077	0.051	0.069
Credential Completion				
Ever any credential	0.356	0.338	0.277	1.000
Any certificate within 2 years	0.098	0.130	0.108	0.385
Applied associate within 2 years	0.013	0.048	0.029	0.141
Transfer associate within 2 years	0.097	0.015	0.004	0.045
Employment Outcomes				
Employed	0.684	0.684	0.688	0.647
Quarterly earnings	2813.929	3364.475	5205.815	2981.592
Program-aligned employment	0.111	0.235	0.267	0.216
N students	106067	26278	8474	8893

Notes: Table reports student-level means using the q[-8,12] analytic window for 2016–2020 first-time-in-college (FTIC) entrants with classified first programs. Students whose first program was unclassified are excluded. WF denotes workforce-focused students whose first program was a certificate or applied associate program. 20+ restricts the sample to students age 20 or older at first enrollment. Completers are students who completed any credential within two years of first enrollment. Baseline earnings and employment are averaged over observed pre-entry quarters in the analytic window. G3 denotes Get a Skill, Get a Job, Get Ahead-eligible programs. FPL denotes Federal Poverty Level.

Table 2: Post-entry earnings and employment in future G3 versus other workforce programs

	Earnings		Employment	
	Female	Male	Female	Male
Future G3 × early post	-82.591	164.041**	-0.012	0.018**
	(47.46)	(52.31)	(0.01)	(0.01)
Future G3 × later post	41.030	330.562***	-0.014	0.015
	(69.14)	(81.61)	(0.01)	(0.01)
Non-G3 mean, early post	3614.11	3757.02	0.71	0.69
Non-G3 mean, later post	4505.38	5281.30	0.72	0.71
Observations	242,613	276,681	242,613	276,681

Notes: Each column reports estimates from a separate student fixed-effects model, estimated by sex and outcome. The sample includes 2016–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program. Coefficients compare students in future G3-designated program areas with students in non-G3 workforce programs. Early post denotes quarters 0–3 relative to first enrollment; later post denotes quarters 4–12. The omitted period is the pre-entry period, quarters -8 through -1. All models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls; standard errors are clustered at the student level. Earnings are measured in 2023 dollars. Non-G3 means are calculated among students in non-G3 workforce programs in the estimation sample and are reported for the corresponding post period in each outcome's units. *p<.05 **p<.01 *** p<.001

Table 3: Post-entry earnings and employment by future G3 program area and sex

	Earnings		Employment	
	Female	Male	Female	Male
Health				
Early post	1.075	14.395	-0.006	-0.019
	(67.59)	(114.20)	(0.01)	(0.02)
Later post	-8.702	520.212**	-0.042**	-0.028
	(101.56)	(179.06)	(0.01)	(0.02)
Skilled trades/manufacturing				
Early post	8.252	225.896**	0.007	-0.001
	(140.08)	(82.12)	(0.02)	(0.01)
Later post	329.443	1050.089***	0.001	0.009
	(221.65)	(125.83)	(0.03)	(0.02)
Information technology				
Early post	-52.740	-48.779	-0.015	-0.018
	(82.48)	(83.31)	(0.01)	(0.01)
Later post	-176.077	193.098	-0.044**	-0.012
	(123.38)	(129.06)	(0.02)	(0.02)
Public safety				
Early post	163.470	176.970	-0.008	-0.017
	(109.05)	(109.85)	(0.02)	(0.02)
Later post	158.860	966.938***	-0.051*	-0.016
	(155.79)	(165.54)	(0.02)	(0.02)
Early childhood education				
Early post	-81.609		-0.007	
	(107.75)		(0.02)	
Later post	-253.005		-0.021	
	(149.43)		(0.02)	
Non-G3 mean, early post	3614.11	3756.22	0.71	0.69
Non-G3 mean, later post	4505.38	5280.38	0.72	0.71
Observations	242,613	276,190	242,613	276,190

Notes: Each column reports estimates from a separate student fixed-effects model, estimated by sex and outcome. The sample includes 2016–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program. Coefficients compare students in each future G3-designated program area with students in non-G3 workforce programs. Early post denotes quarters 0–3 relative to first enrollment; later post denotes quarters 4–12. The omitted period is the pre-entry period, quarters -8 through -1. All models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls; standard errors are clustered at the student level. Earnings are measured in 2023 dollars. Male early childhood education estimates are omitted because of the small number of male entrants. Non-G3 means are calculated among students in non-G3 workforce programs in the estimation sample and reported in each outcome's units. *p<.05 **p<.01 *** p<.001.

Table 4: Program-aligned employment in future G3 versus other workforce programs

	Program Aligned Employment	
	Female	Male
Future G3 × early post	0.030***	0.032***
	(0.01)	(0.01)
Future G3 × later post	0.062***	0.070***
	(0.01)	(0.01)
Non-G3 mean, early post	0.32	0.25
Non-G3 mean, later post	0.31	0.25
Observations	242,613	276,681

Notes: Each column reports estimates from a separate student fixed-effects model, estimated by sex. The sample includes 2016–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program. Coefficients compare students in future G3-designated program areas with students in non-G3 workforce programs. Early post denotes quarters 0–3 relative to first enrollment; later post denotes quarters 4–12. The omitted period is the pre-entry period, quarters -8 through -1. All models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls; standard errors are clustered at the student level. Non-G3 means are calculated among students in non-G3 workforce programs in the estimation sample and are reported for the corresponding post period in each outcome's units. *p<.05 **p<.01 *** p<.001

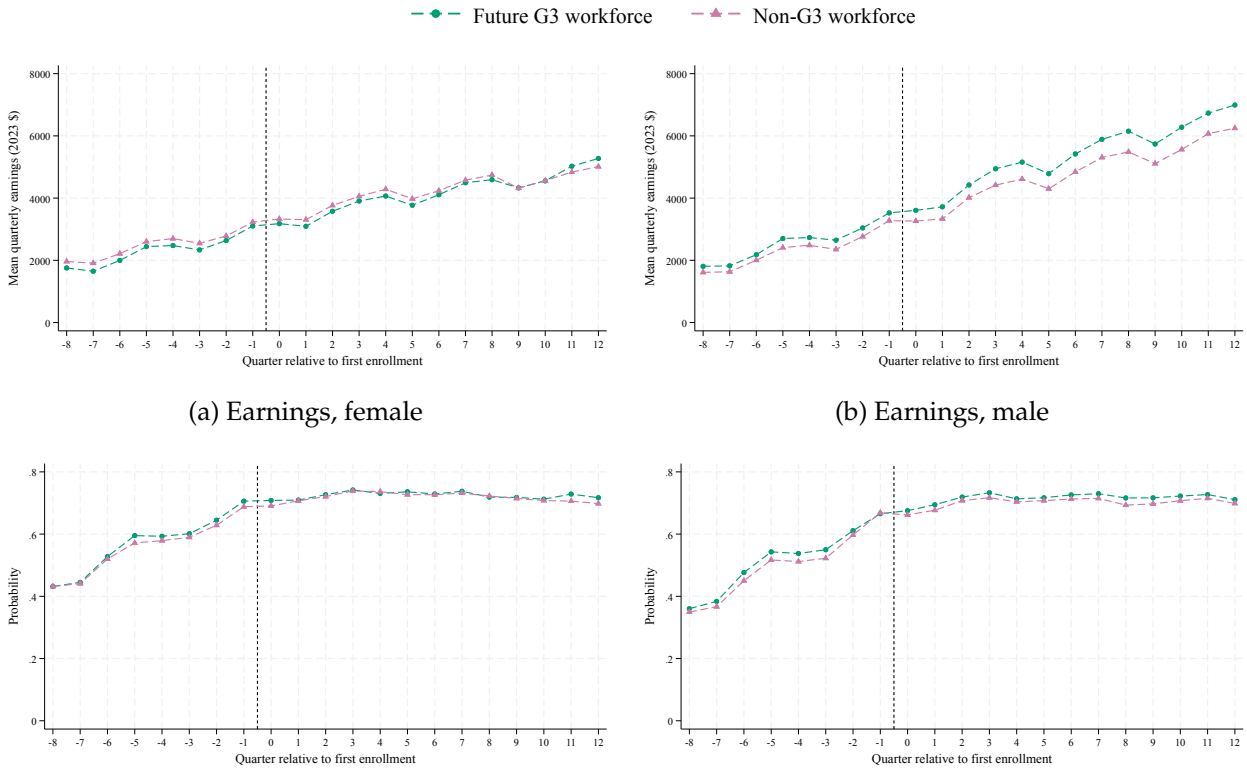
Table 5: Program-aligned employment by future G3 program area and sex

	Program Aligned Employment	
	Female	Male
Health		
Early post	0.060***	0.010
	(0.01)	(0.01)
Later post	0.113***	0.047**
	(0.01)	(0.02)
Skilled trades/manufacturing		
Early post	0.007	0.042***
	(0.01)	(0.01)
Later post	0.065**	0.148***
	(0.02)	(0.01)
Information technology		
Early post	-0.003	-0.012
	(0.01)	(0.01)
Later post	-0.022	0.017
	(0.01)	(0.01)
Public safety		
Early post	0.016	0.012
	(0.01)	(0.01)
Later post	0.062***	0.115***
	(0.01)	(0.01)
Early childhood education		
Early post	0.027	
	(0.02)	
Later post	-0.007	
	(0.02)	
Non-G3 mean, early post	0.32	0.25
Non-G3 mean, later post	0.31	0.25
Observations	242,613	276,190

Notes: Each column reports estimates from a separate student fixed-effects model, estimated by sex. The sample includes 2016–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program. Coefficients compare students in each future G3-designated program area with students in non-G3 workforce programs. Early post denotes quarters 0–3 relative to first enrollment; later post denotes quarters 4–12. The omitted period is the pre-entry period, quarters -8 through -1. All models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls; standard errors are clustered at the student level. Male early childhood education estimates are omitted because of the small number of male entrants. Non-G3 means are calculated among students in non-G3 workforce programs in the estimation sample and reported in each outcome's units. *p<.05 **p<.01 *** p<.001.

10 Figures

Figure 1: Unadjusted earnings and employment trends by future G3 designation and sex



(a) Earnings, female

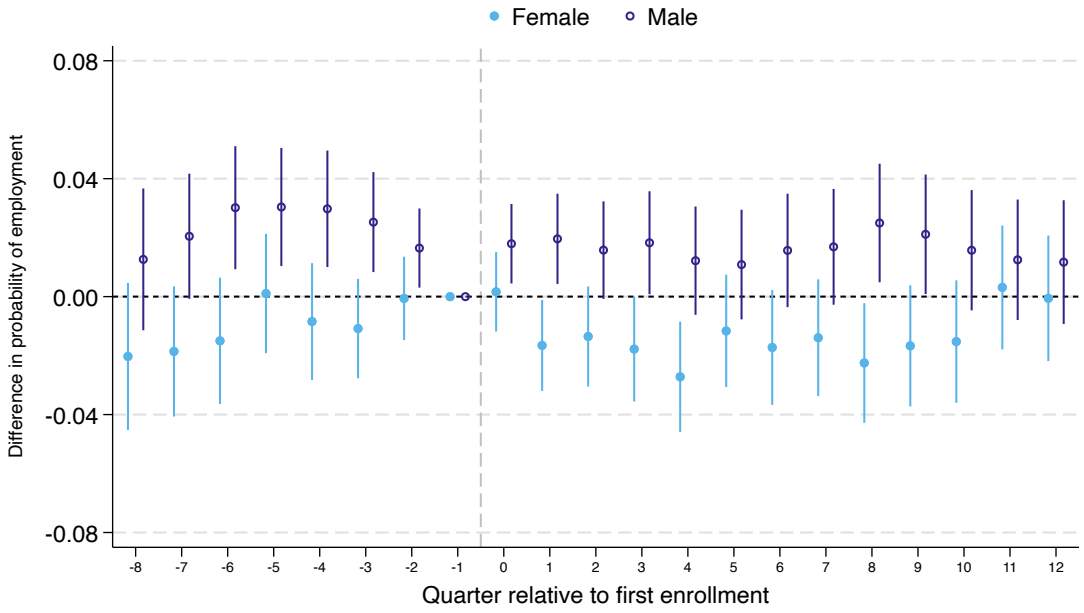
(b) Earnings, male

(c) Employment, female

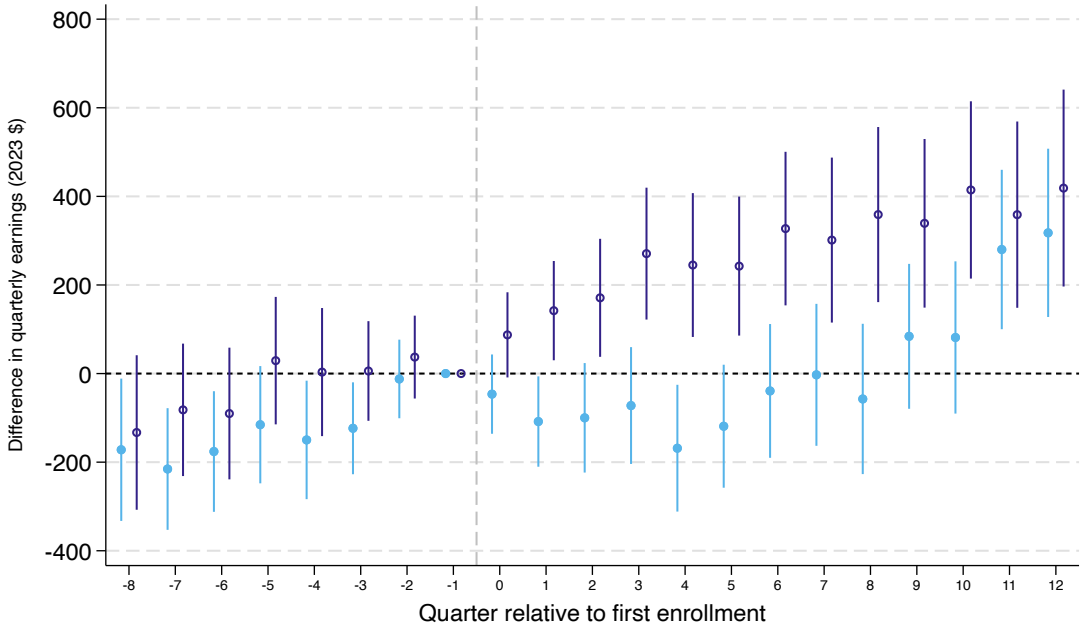
(d) Employment, male

Notes: Figure reports mean quarterly earnings and employment rates by quarter relative to first enrollment, separately by sex and future G3 designation. The sample includes 2016–2020 first-time-in-college entrants in workforce-focused first programs, defined as certificate or applied associate programs. Future G3 workforce denotes programs that became G3 eligible when the policy was implemented; students in these cohorts were not financially eligible for G3 incentives at entry. Non-G3 workforce denotes workforce-focused programs that did not become G3 eligible. Earnings are adjusted to 2023 dollars. The vertical dashed line marks first enrollment.

Figure 2: Event-study estimates of earnings and employment in future G3 programs, by sex



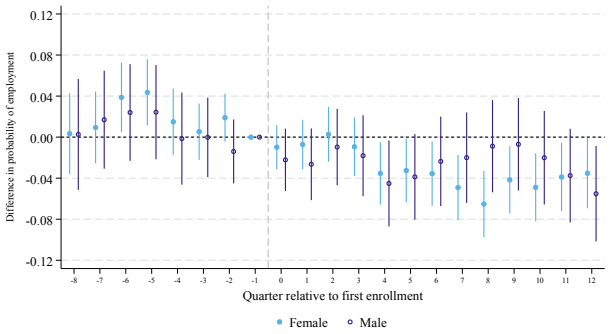
(a) Employment



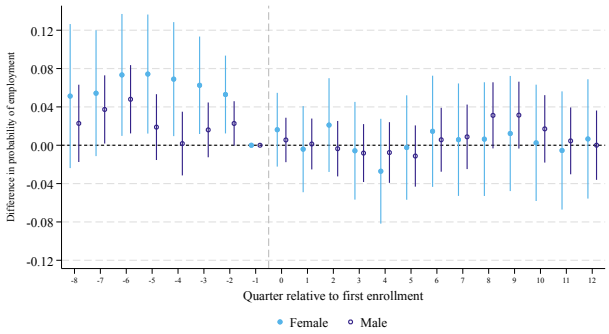
(b) Quarterly earnings

Notes: Figure reports regression-adjusted differences between students in future G3-designated workforce programs and students in non-G3 workforce programs, estimated separately by sex. The sample includes 2016–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program. The sample is not restricted by age or credential completion. Panel a reports differences in the probability of employment, and Panel b reports differences in quarterly earnings adjusted to 2023 dollars. Estimates come from models that interact future G3 designation with quarter relative to first enrollment and include student fixed effects, calendar-quarter fixed effects, and county unemployment controls. Standard errors are clustered at the student level. The omitted reference period is the quarter before first enrollment.

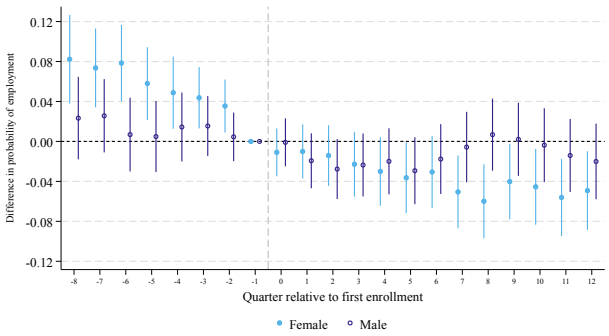
Figure 3: Event-study estimates of employment by future G3 program area and sex



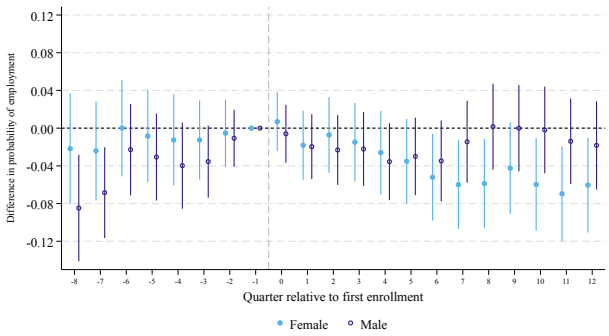
(a) Health



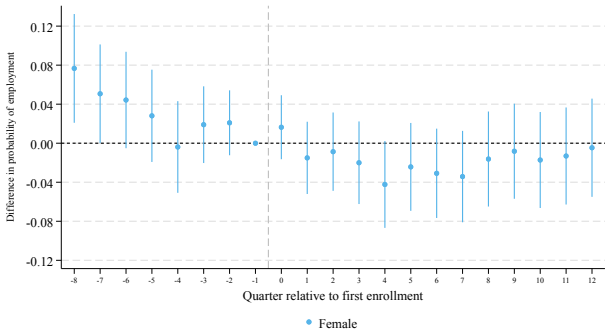
(b) Skilled trades/manufacturing



(c) Information technology



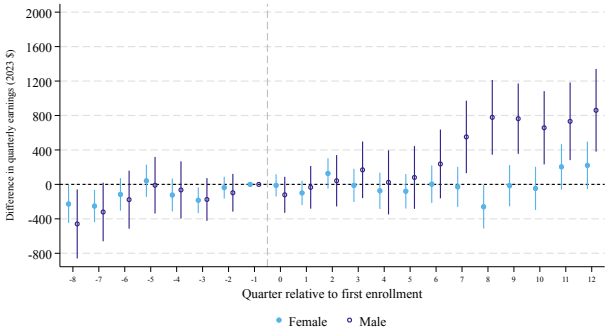
(d) Public safety



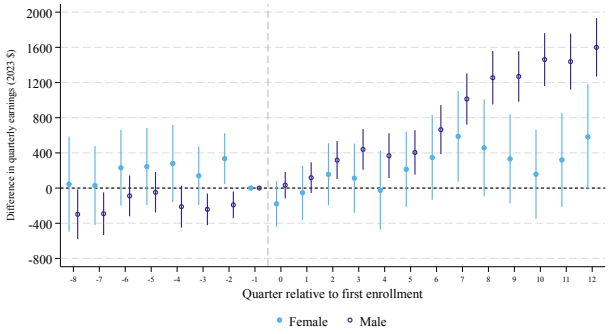
(e) Early childhood education

Notes: Figure reports student fixed-effects event-study estimates of differences in employment between students in each future G3-designated program area and students in non-G3 workforce programs, estimated separately by sex. Each plotted coefficient is an interaction between future G3 program area and quarter relative to first enrollment, with the quarter immediately before first enrollment omitted as the reference period. The male series is omitted in panel e because the number of male entrants in early childhood education is too small to support stable estimates. Joint tests of whether the pre-entry interaction coefficients for quarters -8 through -2 are jointly equal to zero are reported in Appendix Table A.4, panel a.

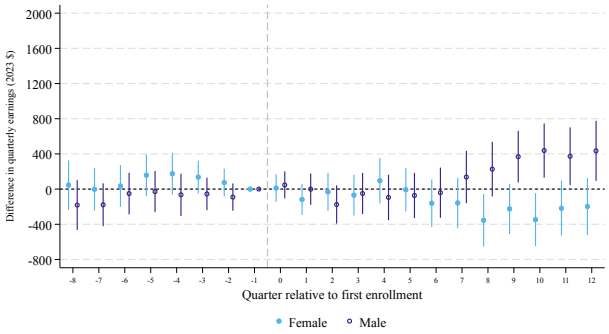
Figure 4: Event-study estimates of quarterly earnings by future G3 program area and sex



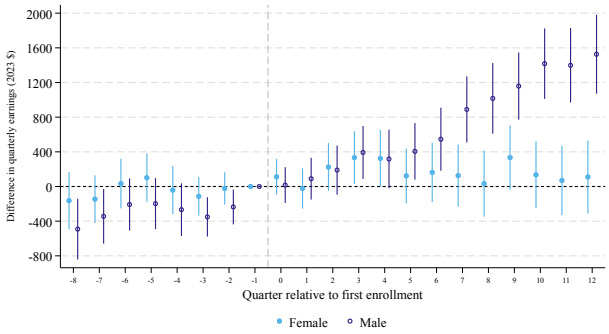
(a) Health



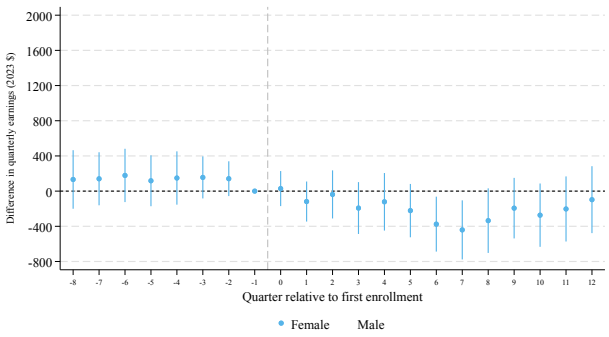
(b) Skilled trades/manufacturing



(c) Information technology



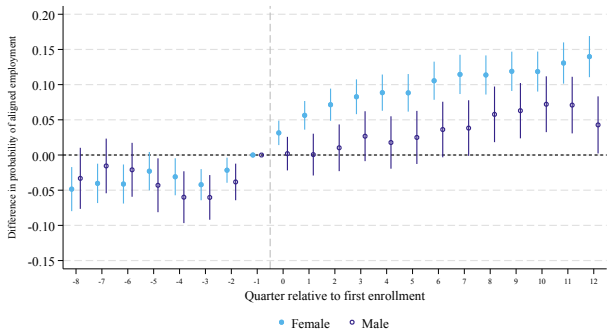
(d) Public safety



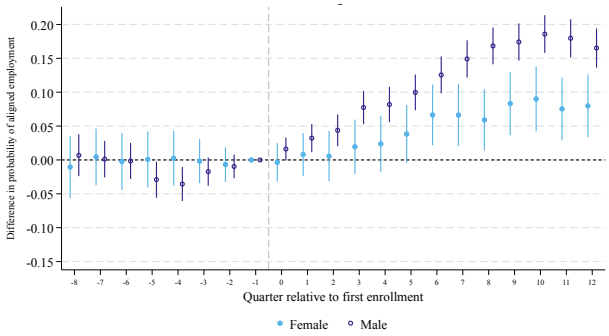
(e) Early childhood education

Notes: Figure reports student fixed-effects event-study estimates of differences in quarterly earnings between students in each future G3-designated program area and students in non-G3 workforce programs, estimated separately by sex. Each plotted coefficient is an interaction between future G3 program area and quarter relative to first enrollment, with the quarter immediately before first enrollment omitted as the reference period. The sample includes 2016–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program. Models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls. Standard errors are clustered at the student level. Earnings are measured in 2023 dollars. The male series is omitted in panel e because the number of male entrants in early childhood education is too small to support stable estimates. Joint tests of whether the pre-entry interaction coefficients for quarters -8 through -2 are jointly equal to zero are reported in Appendix Table A.4, panel b.

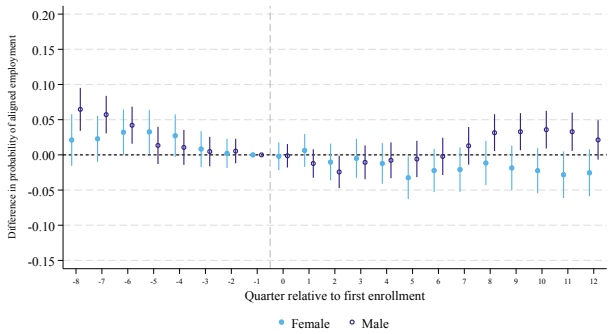
Figure 5: Event-study estimates for program-aligned employment by future G3 program area and sex



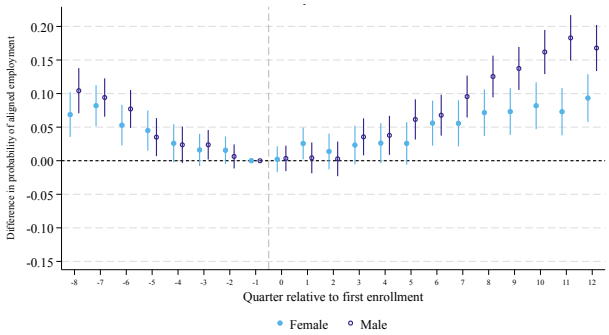
(a) Health



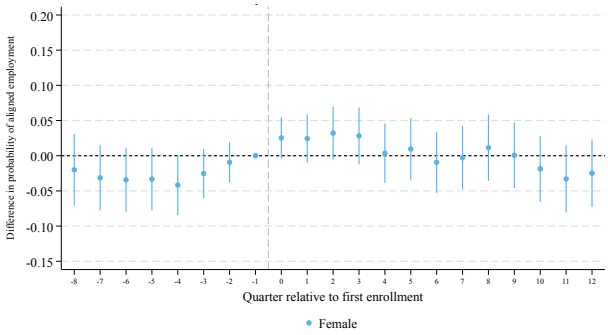
(b) Skilled trades/manufacturing



(c) Information technology



(d) Public safety



(e) Early childhood education

Notes: Figure reports student fixed-effects event-study estimates of differences in program alignment between students in each future G3-designated program area and students in non-G3 workforce programs, estimated separately by sex. Each plotted coefficient is an interaction between future G3 program area and quarter relative to first enrollment, with the quarter immediately before first enrollment omitted as the reference period. The sample includes 2016–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program. Models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls. Standard errors are clustered at the student level. The male series is omitted in panel e because the number of male entrants in early childhood education is too small to support stable estimates. Joint tests of whether the pre-entry interaction coefficients for quarters -8 through -2 are jointly equal to zero are reported in Appendix Table A.4, panel c.

11 Appendix Tables

Table A.1: Field composition of the non-G3 workforce comparison group

Two-digit CIP field	Entrants	Share
Business/management	3,113	0.275
Health professions	1,985	0.175
Visual/performing arts	1,447	0.128
Computer/info sciences	976	0.086
Protective services	743	0.066
Personal/culinary services	611	0.054
Mechanic/repair technologies	562	0.050
Precision production	302	0.027
Engineering technologies	294	0.026
All other fields	1,304	0.115
Total	11,337	1.000

Notes: Table reports the two-digit CIP composition of non-G3 workforce program entrants. The sample includes 2016–2020 first-time-in-college entrants observed in the entry quarter whose first program was workforce-focused, defined as a certificate or applied associate program, but not later designated as G3 eligible. Shares are reported as proportions. Fields with smaller counts are grouped in all other fields.

Table A.2: Sex and credential composition of future G3 program areas

	Entrants in area			Distribution across G3 areas		First program type	
Program area	Female	Male	Female mean	Female entrants	Male entrants	Certificate	Applied associate
Health	4,479	872	0.837	0.676	0.105	0.694	0.306
Skilled trades/manufacturing	349	4,737	0.069	0.053	0.569	0.539	0.461
Information technology	414	1,986	0.172	0.063	0.239	0.070	0.930
Public safety	593	700	0.459	0.090	0.084	0.101	0.899
Early childhood education	788	23	0.972	0.119	0.003	0.276	0.724

Notes: Table reports the sex composition and first-program credential pathways of entrants in future G3-designated workforce program areas. The sample includes 2016–2020 first-time-in-college entrants observed in the entry quarter whose first program was workforce-focused and later designated as G3 eligible (N=14,941). Female and male are based on the administrative sex variable. Female mean is the share of entrants in each program area who are female. The distribution columns report the mean all female and male future G3 entrants enrolled in each program area. Certificate and applied associate columns report the share of entrants in each program area whose first program was a certificate or applied associate program.

Table A.3: Sample characteristics across workforce, age, and completion restrictions

	All entrants				Completers			
	All mean	WF mean	20+ mean	20+ WF mean	All mean	WF mean	20+ mean	20+ WF mean
Demographic Characteristics								
Female	0.529	0.468	0.548	0.499	0.563	0.477	0.569	0.516
Asian	0.059	0.034	0.061	0.040	0.077	0.037	0.083	0.044
Black	0.198	0.227	0.271	0.288	0.132	0.151	0.197	0.213
Hispanic	0.153	0.109	0.127	0.105	0.147	0.095	0.112	0.098
White	0.512	0.559	0.468	0.497	0.573	0.655	0.538	0.580
Race missing	0.016	0.017	0.020	0.023	0.016	0.016	0.021	0.023
Age 18–24	0.802	0.733	0.537	0.446	0.800	0.732	0.533	0.428
Age 25–34	0.057	0.106	0.302	0.328	0.037	0.082	0.279	0.311
Age 35 and over	0.030	0.073	0.161	0.226	0.025	0.069	0.188	0.261
Baseline Labor-Market								
Pre-entry quarterly earnings	1870.694	2523.069	4671.640	5023.385	1618.623	2270.723	4633.631	5003.838
Pre-entry employment	0.523	0.555	0.641	0.658	0.495	0.529	0.624	0.641
Income								
0–200% FPL	0.402	0.461	0.544	0.550	0.352	0.400	0.517	0.511
200–400% FPL	0.206	0.187	0.150	0.131	0.244	0.237	0.185	0.175
Above 400% FPL	0.122	0.090	0.049	0.040	0.164	0.128	0.067	0.055
Entry Program								
Certificate first program	0.102	0.412	0.195	0.456	0.104	0.440	0.234	0.496
Applied associate first program	0.146	0.588	0.233	0.544	0.132	0.560	0.238	0.504
Transfer associate first program	0.752	0.000	0.573	0.000	0.765	0.000	0.528	0.000
Workforce-focused first program	0.248	1.000	0.427	1.000	0.235	1.000	0.472	1.000
G3-eligible first program	0.141	0.569	0.241	0.565	0.142	0.602	0.284	0.602
Health	0.076	0.279	0.122	0.270	0.073	0.290	0.134	0.273
Skilled trades/manufacturing	0.061	0.246	0.108	0.254	0.067	0.286	0.133	0.281
Information technology	0.172	0.247	0.210	0.266	0.160	0.219	0.207	0.231
Early childhood education	0.014	0.034	0.025	0.050	0.014	0.035	0.034	0.064
Public safety	0.027	0.077	0.025	0.051	0.024	0.069	0.022	0.042
Credential Completion								
Ever any credential	0.356	0.338	0.251	0.277	1.000	1.000	1.000	1.000
Any certificate within 2 years	0.098	0.130	0.067	0.108	0.274	0.385	0.268	0.391
Applied associate within 2 years	0.013	0.048	0.013	0.029	0.036	0.141	0.051	0.104
Transfer associate within 2 years	0.097	0.015	0.029	0.004	0.272	0.045	0.117	0.014
Employment Outcomes								
Employed	0.684	0.684	0.691	0.688	0.652	0.647	0.659	0.651
Quarterly earnings	2813.929	3364.475	4933.214	5205.815	2467.251	2981.592	4563.875	4840.284
Number of jobs, if employed	1.145	1.152	1.155	1.158	1.123	1.123	1.126	1.122
Degree-aligned employment	0.035	0.073	0.039	0.072	0.098	0.216	0.154	0.260
Program-aligned employment	0.111	0.235	0.154	0.267	0.098	0.216	0.154	0.260
N students	106067	26278	19831	8474	37769	8893	4972	2348

Notes: Table reports student-level means using the q[-8,12] analytic window for 2016–2020 first-time-in-college (FTIC) entrants with classified first programs. Students whose first program was unclassified are excluded. The top panel separates all entrants from completers. Completers are students who completed any credential within two years of first enrollment. WF denotes workforce-focused students whose first program was a certificate or applied associate program. 20+ restricts the sample to students age 20 or older at first enrollment. Baseline earnings and employment are averaged over observed pre-entry quarters in the analytic window. Employment, quarterly earnings, number of jobs, and aligned employment are measured at the entry quarter unless otherwise noted. G3 denotes Get a Skill, Get a Job, Get Ahead-eligible programs. FPL denotes Federal Poverty Level.

Table A.4: Tests of differential pre-entry coefficients by future G3 program area, outcome, and sex

	Female		Male	
Program area	F	p	F	p
Panel A. Employment				
Health	2.59*	0.011	0.71	0.662
Skilled trades/manufacturing	1.31	0.239	2.06*	0.044
Information technology	2.74**	0.008	0.55	0.797
Public safety	0.34	0.933	2.10*	0.040
Early childhood education	1.93	0.061	—	—
Panel B. Earnings				
Health	4.56***	< 0.001	1.55	0.144
Skilled trades/manufacturing	1.43	0.189	2.85**	0.006
Information technology	0.86	0.541	0.95	0.465
Public safety	1.54	0.147	2.19*	0.032
Early childhood education	0.38	0.914	—	—
Panel C. Program Aligned Employment				
Health	3.00**	0.004	2.94**	0.004
Skilled trades/manufacturing	0.26	0.971	2.22*	0.030
Information technology	0.89	0.516	3.78***	< 0.001
Public safety	5.03***	< 0.001	8.62***	< 0.001
Early childhood education	0.63	0.730	—	—

Notes: Table reports program-area-specific joint tests of the pre-entry interaction coefficients from student fixed-effects event-study models. For each program area, sex, and outcome, the null hypothesis is that the coefficients for quarters -8 through -2 are jointly equal to zero, relative to the omitted quarter immediately before first enrollment. Models compare students in the indicated future G3-designated program area with students in non-G3 workforce programs. All models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls. Standard errors are clustered at the student level. Earnings are measured in 2023 dollars. Male early childhood education tests are omitted because the number of male entrants is too small to support stable estimates. See Figures 3, 4, and 5 for event-study coefficients. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A.5: Labor market trajectories in the balanced-panel sample

	Earnings		Employment		Aligned Employment	
	Female	Male	Female	Male	Female	Male
Future G3 × early post	-115.707*	188.802**	-0.023**	0.022**	0.023**	0.035***
	(53.66)	(58.27)	(0.01)	(0.01)	(0.01)	(0.01)
Future G3 × later post	64.052	330.414***	-0.023*	0.016	0.057***	0.070***
	(77.33)	(90.40)	(0.01)	(0.01)	(0.01)	(0.01)
Non-G3 mean, early post	3595.09	3757.13	0.71	0.69	0.32	0.24
Non-G3 mean, later post	4397.11	5235.64	0.71	0.70	0.31	0.24
Observations	194,200	223,460	194,200	223,460	194,200	223,460

Notes: Each column reports estimates from a separate student fixed-effects model, estimated by sex and outcome. The balanced sample includes 2017–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program. Coefficients compare students in future G3-designated program areas with students in non-G3 workforce programs. Early post denotes quarters 0–3 relative to first enrollment; later post denotes quarters 4–12. The omitted period is the pre-entry period, quarters -8 through -1. All models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls; standard errors are clustered at the student level. Earnings are measured in 2023 dollars. Non-G3 means are calculated among students in non-G3 workforce programs in the estimation sample and are reported for the corresponding post period in each outcome's units. *p<.05 **p<.01 *** p<.001

Table A.6: Post-entry labor market trajectories among entrants age 20 or older

	Earnings		Employment		Aligned Employment	
	Female	Male	Female	Male	Female	Male
Future G3 × early post	-269.763*	297.149*	-0.021	0.026*	0.010	0.019
	(111.28)	(139.97)	(0.01)	(0.01)	(0.01)	(0.01)
Future G3 × later post	-20.453	221.128	-0.015	0.008	0.035*	0.040**
	(153.04)	(206.17)	(0.02)	(0.02)	(0.02)	(0.01)
Non-G3 mean, early post	5080.64	5827.19	0.70	0.67	0.32	0.25
Non-G3 mean, later post	5391.47	6661.20	0.68	0.67	0.30	0.24
Observations	67,580	67,360	67,580	67,360	67,580	67,360

Notes: Each column reports estimates from a separate student fixed-effects model, estimated by sex and outcome. The sample includes 2016–2020 first-time-in-college entrants age 20 and above whose first program was workforce-focused, defined as a certificate or applied associate program. Coefficients compare students in future G3-designated program areas with students in non-G3 workforce programs. Early post denotes quarters 0–3 relative to first enrollment; later post denotes quarters 4–12. The omitted period is the pre-entry period, quarters -8 through -1. All models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls; standard errors are clustered at the student level. Earnings are measured in 2023 dollars. Non-G3 means are calculated among students in non-G3 workforce programs in the estimation sample and are reported for the corresponding post period in each outcome's units. *p<.05 **p<.01 *** p<.001

Table A.7: Earnings trajectories with pre-entry earnings set to zero before age 20

	Earnings	
	Female	Male
Future G3 × early post	81.636	218.806***
	(56.35)	(61.02)
Future G3 × later post	204.711**	382.948***
	(73.28)	(87.11)
Non-G3 mean, early post	3614.11	3757.02
Non-G3 mean, later post	4505.38	5281.30
Observations	242,613	276,681

Notes: Each column reports estimates from a separate student fixed-effects model, estimated by sex and outcome. Earnings are set to zero for the pre-entry period for those entrants under 20. The sample includes 2016–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program. Coefficients compare students in future G3-designated program areas with students in non-G3 workforce programs. Early post denotes quarters 0–3 relative to first enrollment; later post denotes quarters 4–12. The omitted period is the pre-entry period, quarters -8 through -1. All models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls; standard errors are clustered at the student level. Earnings are measured in 2023 dollars. Non-G3 means are calculated among students in non-G3 workforce programs in the estimation sample and are reported for the corresponding post period in each outcome's units. *p<.05 **p<.01 *** p<.001

Table A.8: Earnings by future G3 program area with pre-entry earnings set to zero before age 20

	Earnings	
	Female	Male
Health		
Early post	351.194***	351.729**
	(79.26)	(132.27)
Later post	341.934**	859.006***
	(105.37)	(190.07)
Skilled trades/manufacturing		
Early post	-101.602	713.984***
	(161.44)	(94.60)
Later post	219.055	1539.041***
	(227.21)	(133.00)
Information technology		
Early post	-122.879	249.873**
	(97.37)	(95.67)
Later post	-245.792	488.282***
	(130.58)	(135.40)
Public safety		
Early post	561.821***	937.868***
	(129.05)	(128.23)
Later post	556.371***	1732.750***
	(163.22)	(176.21)
Early childhood education		
Early post	-400.827**	
	(123.88)	
Later post	-571.255***	
	(159.01)	
Non-G3 mean, early post	3614.11	3756.22
Non-G3 mean, later post	4505.38	5280.38
Observations	242,613	276,190

Notes: Each column reports estimates from a separate student fixed-effects model, estimated by sex. Wages are set to zero during the pre-entry period when the individual was younger than age 20. The sample includes 2016–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program. Coefficients compare students in each future G3-designated program area with students in non-G3 workforce programs. Early post denotes quarters 0–3 relative to first enrollment; later post denotes quarters 4–12. The omitted period is the pre-entry period, quarters -8 through -1. All models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls; standard errors are clustered at the student level. Earnings are measured in 2023 dollars. Male early childhood education estimates are omitted because of the small number of male entrants. Non-G3 means are calculated among students in non-G3 workforce programs in the estimation sample and reported in each outcome's units. *p<.05 **p<.01 *** p<.001.

Table A.9: Earnings and employment in selected six-digit CIP programs, by sex

	Earnings		Employment	
	Female	Male	Female	Male
Computer & Information Sciences				
Early post	-213.230	55.678	0.003	-0.016
	(207.61)	(106.79)	(0.03)	(0.02)
Later post	45.366	411.625*	0.016	0.007
	(294.54)	(169.00)	(0.04)	(0.02)
Information Technology				
Early post	-65.178	-35.084	-0.017	-0.018
	(93.66)	(97.77)	(0.01)	(0.01)
Later post	-314.797*	204.126	-0.063***	-0.021
	(136.87)	(148.17)	(0.02)	(0.02)
Computer Science				
Early post	410.028*	122.040	0.024	-0.018
	(181.50)	(154.74)	(0.03)	(0.02)
Later post	592.566*	1245.105***	-0.029	0.006
	(251.87)	(220.59)	(0.03)	(0.03)
Information Systems Security				
Early post	50.685	-5.121	-0.033	-0.006
	(197.09)	(115.64)	(0.03)	(0.02)
Later post	535.672	241.423	-0.066	-0.001
	(379.88)	(191.25)	(0.04)	(0.02)
Engineering Technology				
Early post	330.232	79.816	0.031	-0.019
	(334.69)	(150.61)	(0.06)	(0.02)
Later post	1043.052	382.657	0.043	0.002
	(718.29)	(242.44)	(0.07)	(0.03)
Law Enforcement				
Early post	39.063	310.623*	-0.017	-0.013
	(128.44)	(135.24)	(0.02)	(0.02)
Later post	-37.083	928.861***	-0.055*	-0.023
	(183.30)	(206.61)	(0.02)	(0.02)
Auto Mechanic				
Early post	524.149	423.886**	0.079	0.055**
	(498.79)	(147.93)	(0.07)	(0.02)
Later post	816.863	978.275***	0.068	0.024
	(849.47)	(214.07)	(0.10)	(0.02)
Welding				
Early post	29.484	444.658***	-0.042	-0.007
	(372.99)	(132.91)	(0.05)	(0.02)
Later post	428.805	1163.409***	-0.035	-0.009
	(646.93)	(202.11)	(0.07)	(0.02)
EMT				
Early post	281.307	412.673	0.028	0.013
	(239.99)	(216.58)	(0.03)	(0.02)
Later post	211.284	1544.455***	-0.046	0.036
	(358.43)	(344.27)	(0.04)	(0.03)
Health Professional				
Early post	-92.397	-110.794	-0.002	-0.016
	(80.89)	(159.94)	(0.01)	(0.03)
Later post	-406.685***	-37.798	-0.060***	-0.045
	(121.78)	(257.26)	(0.02)	(0.03)
Nursing				
Early post	27.698	-92.761	-0.022	-0.023
	(98.31)	(273.55)	(0.01)	(0.04)
Later post	558.774***	920.014*	-0.030	-0.082
	(148.60)	(453.72)	(0.02)	(0.05)
Observations	172,259	192,079	172,259	192,079

Notes: Each column reports estimates from a separate student fixed-effects model, estimated by sex and outcome. The sample includes 2016–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program. Coefficients compare students in each future G3-designated program area with students in non-G3 workforce programs using select 6-digit CIP codes. Included 6-digit CIP categories include the most commonly enrolled in programs with future G3-designated programs by both male and female students. Early post denotes quarters 0–3 relative to first enrollment; later post denotes quarters 4–12. The omitted period is the pre-entry period, quarters -8 through -1. All models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls; standard errors are clustered at the student level. Earnings are measured in 2023 dollars. *p<.05 **p<.01 *** p<.001.

Table A.10: Earnings and employment trajectories among credential completers

	Earnings		Employment	
	Female	Male	Female	Male
Future G3 × early post	-53.106	144.149	-0.019	0.017
	(73.71)	(84.41)	(0.01)	(0.01)
Future G3 × later post	147.546	229.668	-0.044**	0.012
	(113.60)	(138.77)	(0.01)	(0.01)
Non-G3 mean, early post	3092.66	3360.90	0.68	0.66
Non-G3 mean, later post	4252.26	5508.55	0.73	0.73
Observations	84,073	92,157	84,073	92,157

Notes: Each column reports estimates from a separate student fixed-effects model, estimated by sex and outcome. The sample includes 2016–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program, and who ever earned a credential. Coefficients compare students in future G3-designated program areas with students in non-G3 workforce programs. Early post denotes quarters 0–3 relative to first enrollment; later post denotes quarters 4–12. The omitted period is the pre-entry period, quarters -8 through -1. All models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls; standard errors are clustered at the student level. Earnings are measured in 2023 dollars. Non-G3 means are calculated among students in non-G3 workforce programs in the estimation sample and are reported for the corresponding post period in each outcome's units. *p<.05 **p<.01 *** p<.001

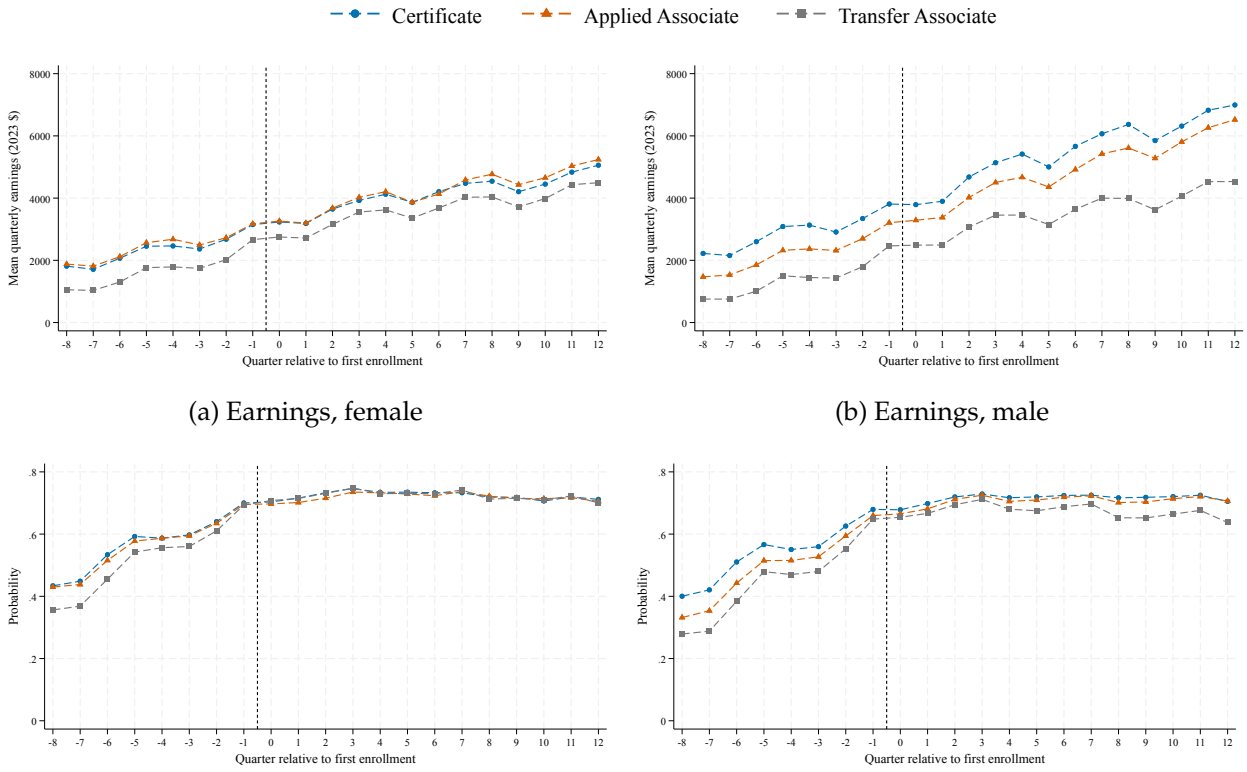
Table A.11: Post-entry program alignment among credential completers

	Program Aligned Employment	
	Female	Male
Future G3 × early post	0.015	0.027**
	(0.01)	(0.01)
Future G3 × later post	0.043**	0.043***
	(0.01)	(0.01)
Non-G3 mean, early post	0.28	0.23
Non-G3 mean, later post	0.33	0.29
Observations	84,073	92,157

Notes: Each column reports estimates from a separate student fixed-effects model, estimated by sex. The sample includes 2016–2020 first-time-in-college entrants whose first program was workforce-focused, defined as a certificate or applied associate program, and who ever earned a credential. Coefficients compare students in future G3-designated program areas with students in non-G3 workforce programs. Early post denotes quarters 0–3 relative to first enrollment; later post denotes quarters 4–12. The omitted period is the pre-entry period, quarters -8 through -1. All models include student fixed effects, calendar-quarter fixed effects, and county unemployment controls; standard errors are clustered at the student level. Earnings are measured in 2023 dollars. Non-G3 means are calculated among students in non-G3 workforce programs in the estimation sample and are reported for the corresponding post period in each outcome's units. *p<.05 **p<.01 *** p<.001

12 Appendix Figures

Figure A.1: Unadjusted earnings and employment by first program type and sex



(a) Earnings, female

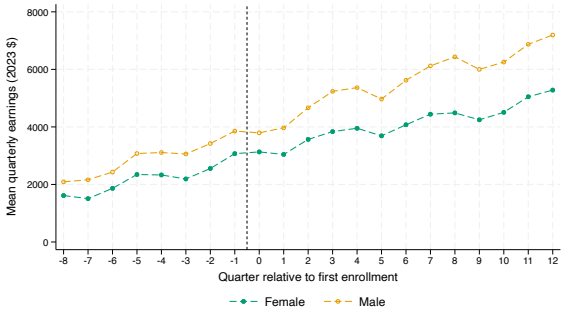
(b) Earnings, male

(c) Employment, female

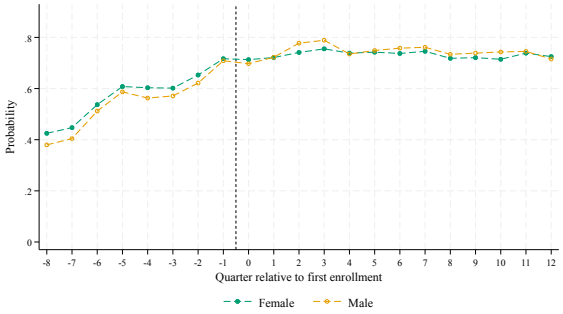
(d) Employment, male

Notes: Figure reports mean quarterly earnings and employment rates by quarter relative to first enrollment, separately by sex and first program type. The sample includes 2016–2020 first-time-in-college entrants with classified first programs. Earnings are adjusted to 2023 dollars. The vertical dashed line marks first enrollment. Certificate and Applied associate programs are workforce-focused pathways; Transfer associate programs are shown as a reference group.

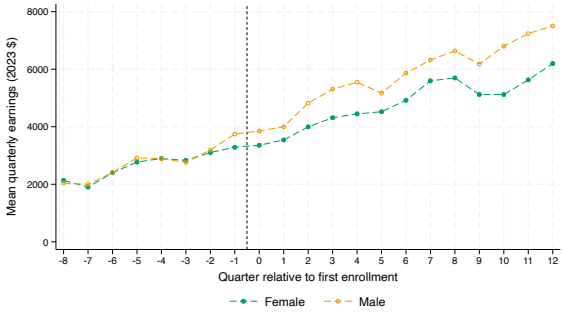
Figure A.2: Unadjusted earnings and employment within future G3 program areas, by sex



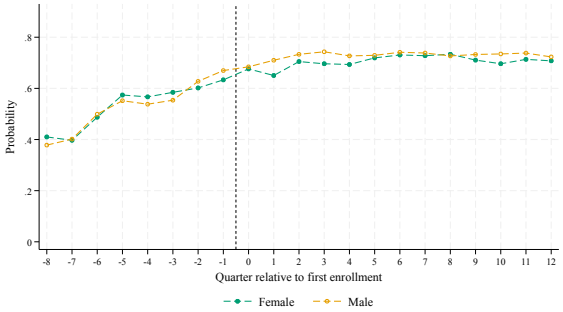
(a) Earnings: Health



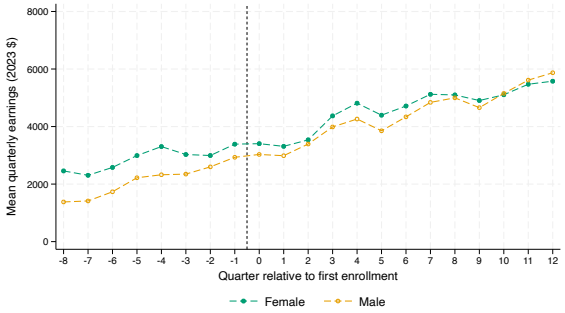
(b) Employment: Health



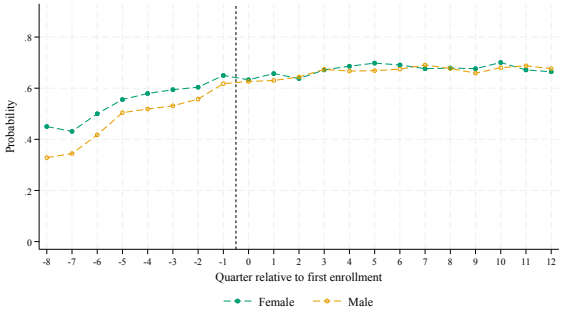
(c) Earnings: Skilled trades/manufacturing



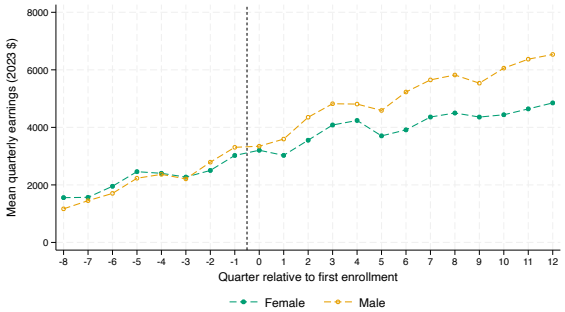
(d) Employment: Skilled trades/manufacturing



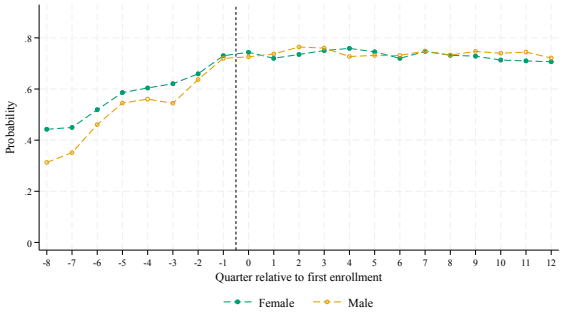
(e) Earnings: Information technology



(f) Employment: Information technology



(g) Earnings: Public safety



(h) Employment: Public safety

Notes: Figure reports mean quarterly earnings and employment rates by quarter relative to first enrollment, separately by sex and G3 program area. The sample includes 2016–2020 first-time-in-college entrants in workforce-focused first programs that later became G3 eligible. Earnings are adjusted to 2023 dollars. The vertical dashed line marks first enrollment. Early childhood education is excluded from sex-specific trajectory figures because the number of male entrants is too small to support stable quarter-specific means.