The Returns to Degree Completion at CUNY's Community Colleges

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Overview

Drawing on over a decade of longitudinal linked administrative and earnings records, this report examines earnings returns for CUNY community college associate degree program entrants using selection-on-observables (OLS) and individual fixed effects (FE) methods, distinguishing between terminal associate degree completion and pathways involving bachelor's attainment, whether earned alone or in combination with an associate degree. Because degree completion is not random, estimated returns depend on the econometric assumptions underlying each approach. We pay particular attention to how returns vary across entry cohorts, major fields (as declared at entry), student demographic characteristics, and eligibility for ASAP (a program that provides intensive advising, financial support, and structured coursetaking to help community college students enroll full-time and graduate on time) as well as how these returns evolve over time after graduation (within a 10-year post-entry follow-up period).

We find substantial and robust earnings returns to associate degree completion for CUNY community college students across multiple estimation approaches and student subgroups. For example, after accounting for a wide range of factors—including early academic performance and pre-college earnings—we estimate substantial earnings gains associated with completing a terminal associate degree by Year 10. Specifically, terminal associate degree completers earned about $2,426 more per quarter (roughly $9,700 annually), representing an increase of about 30% compared to noncompleters. Nearly as many community college entrants completed a bachelor's degree as completed only an associate degree, and bachelor's degree completers saw much larger annual returns—about $16,000 annually relative to noncompleters. Although earnings trajectories vary with timing, demographics, and local labor market conditions, degree completion is consistently associated with improved long-run labor market outcomes.

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1. Introduction

Community colleges represent a large and distinctive segment of U.S. higher education. Public two-year colleges enroll roughly 5.4 million students each fall, about 34% of all undergraduates (Brock et al., 2025). The nation's more than 900 community colleges[1] are charged with a dual mission: to provide pathways to bachelor's degrees through transfer and to prepare students for immediate entry into the workforce. Because they pursue this dual mission and are open-access, conveniently located, and fairly low in cost—charging less tuition than most public four-year and private institutions (National Center for Education Statistics [NCES], 2024a)—community colleges disproportionately enroll part-time, older, low-income, racially minoritized, and first-generation students (Fountain, 2019).

Despite their importance and relative affordability, community colleges have struggled to improve low completion and transfer rates and to address wide gaps in student outcomes by race, income, gender, and age. Nationally, only about 39% of students who start at a community college earn a credential from any institution within six years, and only about 13% successfully complete a bachelor's degree within that time frame—with even lower rates among low-income, Black, and older students.[2] At the same time, research suggests that community college attendance and credentials can yield meaningful wage gains and, in some cases, substantial improvements in intergenerational mobility (Belfield & Bailey, 2017; Chetty et al., 2017; Kane & Rouse, 1995; Mountjoy, 2022).

In this context, the City University of New York (CUNY) has stood out as an engine of economic mobility. Six CUNY campuses ranked among the top 10 colleges nationally in Chetty et al.'s (2017) report on upward economic mobility, and innovations developed on CUNY's community college campuses—most notably the Accelerated Study in Associate Programs (ASAP)—have become national models for improving

[1] Here we include roughly 830 public two-year colleges that confer associate degrees but not bachelor's degrees plus 130 or so colleges that primarily confer associate degrees but also confer small numbers of applied bachelor's degrees (CCRC, 2025). Twenty-four states allow community colleges to offer bachelor's degree programs in limited fields.

[2] Authors' tabulations using Beginning Postsecondary Students 2012/2017 data, via NCES Power Stats (table retrieval code: ubffxx).

academic momentum and degree attainment. The research we discuss in this report complements an ongoing study of the long-term impacts of CUNY's ASAP and serves as a companion piece to randomized controlled trial (RCT) estimates of ASAP's impacts on earnings. Randomized evaluations show that ASAP increased three-year graduation rates by about 18 percentage points at CUNY and 16 percentage points in Ohio (Miller et al., 2020; Scrivener et al., 2015).

CUNY's community colleges enroll approximately 74,000 students each fall; its seven community colleges comprise one of the largest and most diverse two-year college systems in the United States.[3] CUNY's community colleges face completion challenges typical of large urban community colleges. About 26% of first-time full-time associate degree entrants graduate within three years (CUNY Office of Applied Research, Evaluation, and Data Analytics, n.d.), a figure below the national average of 30% (NCES, 2024b).[4] Transfer is a central pathway for CUNY students; more than 70% of CUNY's associate degree graduates transfer to a baccalaureate program within two years of earning the degree (CUNY, Office of Institutional Research and Assessment, 2022).

The combination of scale, diversity, and role both as an engine of economic mobility and of postsecondary innovation makes the CUNY community college system an unusually informative context for studying the economic returns to subbaccalaureate degrees. Prior research has estimated the returns to community college degrees in other states (Bahr, 2016; Carruthers & Sanford, 2014; Dadgar & Trimble, 2015; Jacobson et al., 2005; Minaya & Scott-Clayton, 2022; Xu & Trimble, 2016), but not yet in New York.

Drawing on over a decade of longitudinal linked administrative and earnings records, and guided by a pre-registered analysis plan,[5] in this report we examine earnings returns for CUNY community college associate degree program entrants[6] using selection-on-observables (OLS) and individual fixed effects (FE), distinguishing between terminal

[3] The entire CUNY system includes 26 colleges and schools, including 7 community colleges, 11 senior colleges (four-year institutions), and 8 graduate/professional and other schools.
[4] Both CUNY and national estimates represent averages across the most recent cohorts with available three-year outcomes (2014–2020).
[5] The plan is available at the Registry of Efficacy and Effectiveness Studies, https://sreereg.icpsr.umich.edu.
[6] Students entering credit certificate programs for the first time are excluded from the analytic sample. At CUNY, these students represent a very small share of enrollees—about 2% of the fall 2024 headcount (CUNY, Office of Applied Research, Evaluation, and Data Analytics, n.d.).

associate degree completion (which we often call "AA only" for simplicity) and pathways involving bachelor's attainment, whether earned alone (BA only) or in combination with an associate degree (AA and BA). All estimated returns are suggestive and assumption-dependent. Reassuringly, however, the story is consistent across estimation approaches.

We pay particular attention to how returns vary across entry cohorts, major fields (as declared at entry), student demographic characteristics, and eligibility for ASAP,[7] as well as how these returns evolve over time after graduation (within a 10-year post-entry follow-up period). This research report is designed both to inform broader discussions about the value of community college degrees and to contextualize the long-run earnings impacts estimated for CUNY ASAP (Weiss et al., forthcoming) and the Ohio programs modeled after ASAP (Hill et al., 2023).

1.1 Research Questions

Specifically, this study addresses the following research questions:

- What is the effect of CUNY degree completion, compared with some college and no degree, on earnings (i.e., returns to degree) among first-time community college associate degree program entrants?
- How do the effects of CUNY degree completion on earnings vary across student populations defined by gender, age, entry cohort, field of study at entry, and ASAP eligibility?
- Are the estimated effects of CUNY degree completion on earnings robust across estimation approaches (OLS and individual FE)?

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[7] ASAP eligibility during the randomized evaluation followed the program rules in effect then, including excluding a small set of majors that were difficult to complete within three years (allied health sciences, pre-clinical nursing, forensic science, and engineering science). Since the evaluation, ASAP eligibility rules have evolved, and the program has expanded substantially. Subgroup analysis by "ASAP-eligible" status should be interpreted as conditional on the eligibility rules used in the evaluation.

1.2 Key Takeaways

The following are key findings from the study:

- **Positive returns to associate degrees.** After accounting for a wide range of factors—including early academic performance and pre-college earnings—we estimate substantial earnings gains associated with completing a terminal associate degree by Year 10. Specifically, completers earn about $2,426 more per quarter (roughly $9,700 annually), representing an increase of about 30% compared to noncompleters. These estimates place CUNY near the upper end of prior evidence, while remaining broadly consistent with existing research on the positive returns to associate degree completion.

- **Bachelor's degree returns are substantially larger.** Returns associated with earning a bachelor's degree are much greater than those for an associate degree—and relevant for nearly as many students. Among community college entrants in our sample, about 15% ultimately completed a BA (either in addition to or instead of an AA), compared to 16% who earned an associate degree only. BA completers achieve the highest long-term earnings gains, exceeding $16,000 per year by Year 10. However, their earnings start lower and do not surpass those of AA-only earners until nearly eight years post-entry. Only a small share (3%) of entrants earn a BA without first completing an AA.

- **Returns to a degree are positive for all subgroups that we examine, but they vary by cohort, field, and student characteristics.** The returns to earning a degree are positive for students with a variety of characteristics. Returns are especially large for some (e.g., health majors, older entrants, and men) and positive but smaller for others (e.g., business majors, Great Recession cohorts [2008–2009], younger entrants, women, and ASAP-eligible students/majors).

- **Estimated returns from fixed-effects (FE) models most commonly used in the literature are higher than OLS-estimated returns.** We emphasize estimates from an OLS approach that enables us to estimate returns for the broadest set of community college entrants, including those without any labor market history prior to starting college. When we use FE models to compare students' earnings trajectories before and after college, the estimated returns are substantially larger. This difference is partially due to observable sample differences (the OLS sample is younger, less likely to enter a health field, and has less time in the labor market by Year 10, all of which are associated with lower earnings returns). Even when we apply OLS and FE to the same sample, FE still yields larger estimated returns, though the difference is smaller (about a 15% gap). Our FE estimates are broadly in line with prior evidence on the returns to associate degree completion.

2. Background and Prior Evidence

2.1 Returns to Community College Degrees

The association between community college degrees and increased employment and earnings has been well documented (Belfield & Bailey, 2017; National Center for Education Statistics, 2024b; U.S. Bureau of Labor Statistics, 2025), and studies that exploit natural experiments or admissions cutoffs to estimate the causal effects of college provide further evidence of earnings gains (for reviews, see Lovenheim & Smith, 2023, and Oreopoulos & Petronijevic, 2013). At the same time, this literature shows that returns are highly heterogeneous, varying systematically by institution type and by educational program of study (Lovenheim & Smith, 2023). The most comparable evidence comes from state administrative studies that link community college transcripts to unemployment insurance (UI) records and estimate individual FE models.

Synthesizing eight state studies (in Arkansas, California, Michigan, North Carolina, Ohio, Virginia, Kentucky, and Washington), Belfield and Bailey (2017) summarize FE estimates and conclude that earning an associate degree has positive and persistent effects on quarterly earnings five to nine years after college entry. Across these

states, the average quarterly gain in 2023 dollars is about $1,493 for men and $2,304 for women.[8] Given average quarterly earnings of roughly $9,266 among noncompleters, this corresponds to earnings increases of about 18% for men and 26% for women. As they note, these estimates imply that "completing an associate degree yields on average approximately $5,972–$9,215 per annum [in 2023 dollars[9]] in extra earnings compared to entering college but not completing an award," with the comparison group defined as students who enroll in community college but do not complete any credential. These results are calculated for all individuals, including those with zero earnings in a given quarter (conditional on having at least one quarter of earnings over the analytic period). Across these studies, associate degree returns are systematically larger for women than for men.

Belfield and Bailey (2017) further emphasize that these average effects mask substantial heterogeneity in returns across credentials and fields of study. Using the same eight-state evidence, they show that associate degrees tend to yield larger and more stable gains than shorter-term certificates, particularly short-term certificates in technical and health-related programs, while returns to associate degrees in more academic or transfer-oriented fields are smaller. This is consistent with broader syntheses of the returns-to-college literature, which stress that postsecondary education is highly differentiated—by credential, institution type, program content, and remedial exposure—and that community college labor market outcomes vary widely across program types and majors (Lovenheim & Smith, 2023). Related work similarly documents that returns to subbaccalaureate credentials are far from uniform, varying not only by credential length and field of study but also across cohorts, business-cycle conditions, and local labor markets (e.g., Minaya & Scott-Clayton, 2022; Stevens et al., 2019). This heterogeneity is central for interpreting the labor market implications of comprehensive completion reforms such as CUNY's ASAP.

[8] Belfield and Bailey (2017) report earnings impacts in 2014 dollars; we inflate those amounts to December 2023 dollars using the CPI-U (U.S. city average, all items; 1982–84 = 100) from the U.S. Bureau of Labor Statistics (CPI-U 2014 annual average = 236.736; December 2023 = 306.746).
[9] We again adjust these earnings impacts for inflation.

2.2 Relevance of the ASAP Context for the Study

ASAP is a three-year program that provides intensive advising, financial support, and structured coursetaking to help community college students enroll full-time and graduate on time. Since 2007, the program has served more than 120,000 students at CUNY and has been replicated in multiple states. Randomized evaluations show that ASAP nearly doubles three-year graduation rates—boosting them by about 18 percentage points at CUNY and 16 percentage points in Ohio—while substantially increasing persistence and transfer (Miller et al., 2020; Scrivener et al., 2015; Weiss et al., 2019). Earnings are not the program's direct target, but the program supports many more students to complete their associate degree who otherwise wouldn't, and in the longer run it is anticipated that increased degree completion can raise earnings. In the short run, increased enrollment intensity can reduce time in paid work. Consistent with that timeline, the Ohio replication shows positive earnings impacts by Year 6 (Hill et al., 2023; Warner et al., 2024).

To interpret long-term impacts from ASAP and ASAP-like programs, it is therefore useful to know not just whether completion increases but what the resulting credentials tend to be worth in the labor market—and how that varies across fields and student groups. Interpreting the RCT-estimated earnings impacts of ASAP alongside nonexperimental estimates of returns to degrees can also help illuminate how differences in samples and estimation assumptions, and in what's being estimated, may shape results. For these reasons, in addition to examining standard subgroups by gender, age, cohort, and field, we also examine a subgroup defined by ASAP eligibility criteria (or our best proxies thereof) to facilitate interpretation alongside the findings from the RCT impact evaluation.

3. Data and Methods

We use student transcript and quarterly earnings records provided by the CUNY Institutional Research Database (IRDB) and the New York State (NYS) Department of Labor. The CUNY IRDB includes information on student enrollment, demographics, credentials earned, and transcript-level information about students' course enrollment,

grades, and credits for all students attending CUNY postsecondary institutions. We merge the student record data with NYS Unemployment Insurance (UI) data to be able to observe students' term-over-term earnings while enrolled as well as their quarterly earnings before enrollment in a postsecondary institution, after degree completion, and for those who leave without completing a degree. Our derived dataset includes quarterly earnings, college student enrollment records, credits, grades, and degree outcomes, along with demographic measures. Additionally, we use data from the National Student Clearinghouse (NSC), which collects enrollment, degree, and certificate data from over 3,500 colleges enrolling more than 98% of the nation's college students. NSC data is used to identify individuals who enrolled in any graduate program or in any institution outside of CUNY during our 10-year follow-up window. These individuals are excluded from the analytic sample.

We estimate returns using an OLS specification applied to first-time CUNY community college entrants from fall 2005 through spring 2013. Table 1 reports baseline characteristics for the broad entrant sample. The average age at entry is 23, and 46% of entrants are male; the sample is racially and ethnically diverse (39% Hispanic, 31% Black, 16% White, and 13% Asian). Nearly two thirds (64%) received Pell in the first semester. Most students enrolled full-time in the first term (80%). Students attempted about 12 credits on average in their first term and earned a first-term GPA of 2.7; 35% took more than 6 remedial credit hours in the first term. Arts & humanities is the most common entry major (39%), followed by health (15%) and business (14%). A defining feature of this setting is that degree pathways are not limited to terminal associate degrees. Thirty-two percent of entrants complete an AA, a BA, or both within 10 years. There is substantial BA attainment—15% earn a BA, with or without an AA. Among AA completers, just more than 40% go on to complete a BA at CUNY within 10 years, while a small share (3% of entrants) earn a BA without first earning an AA. This underscores the importance of estimating returns for multiple postsecondary pathways, not just terminal associate degree pathways.

Table 1. Descriptive Statistics of OLS Sample

Earnings outcomes	
Year 10 quarterly earnings	$9,076
Any earnings in Year 10	73%
3rd year pre-entry quarterly earnings	$1,597
1st year pre-entry quarterly earnings	$2,597
Exit quarters to Year 10	24
Demographics	
Age in years (at entry)	23
Male	47%
Asian	13%
Black	31%
Hispanic	39%
White	16%
College entry characteristics	
Received Pell in first semester	64%
High school total GPA	74
Full-time in first term	80%
More than 6 remedial credit hours in first term	35%
Cumulative GPA in first term	2.7
Credit hours attempted in first term	12
Major at entry	
Arts & humanities	39%
Business	14%
Education	3%
Engineering	3%
Health	14%
Law	1%
Natural science & mathematics	9%
Services	6%
Social & behavioral sciences	2%
Trades & repair technicians	2%
Degree completion by end of Year 9	
AA	16%
BA	3%
AA + BA	12%
Number of students	140,850

3.1 Outcome Variable

We are primarily interested in quarterly earnings as an outcome.[10] We follow up with all cohorts for at least 10 years post-college-entry, analyzing the evolution of returns to provide a dynamic view of how outcomes change over time. Quarterly earnings include both earnings records for quarters when individuals are employed (conditional earnings) and zeros for quarters when individuals do not have earnings records in our data (unconditional earnings). The latter measure picks up effects on both the extensive margin (i.e., whether a person works at all in a given quarter) and the intensive margin (how much they earn conditional on any employment) of earnings for a quarter. Because we measure earnings in levels and include observations with zero earnings, the coefficients represent the combined effect of employment (going from zero earnings to positive) and changes in earnings conditional on employment (a change in earnings from one nonzero amount to another). For ease of interpretation, we also summarize results as a "10-year return" by evaluating the estimated degree effect at the 10-year horizon.[11]

It's worth noting that the outcome variable does not correspond to overall employment but is limited to NY state employment. A limitation of UI wage data is that they cover only UI-covered wage-and-salary jobs within the state (excluding, e.g., self-employment) and typically lack information on hours or job type (e.g., full-time vs. part-time).

Consideration of only in-state earnings can result in substantial underestimates of the returns to degrees, although this issue is somewhat less pronounced for community college samples in general and for the New York state context in particular (Foote & Stange, 2022). Foote and Stange (2022) find that in the New York context, restricting analysis to those with positive in-state earnings can come close to replicating the returns estimated using complete, national earnings records. We therefore test alternative

[10] The measure of earnings is capped at the 99th percentile to address outliers in the reported quarterly earnings.

[11] Our regressions generate coefficients representing (1) level increases in earnings for completers at the quarter of degree completion, (2) additional earnings returns that accrue for completers in each quarter after completion, and (3) additional earnings that accrue to the post-college labor market experience in general. We use these coefficients in combination with estimates of the average timing of college exit for completers and noncompleters to compute predicted Year 10 earnings differentials between completers and noncompleters.

specifications that condition on having some in-state earnings in Year 10 post-college-entry.

3.2 Subgroup Definitions

Building on prior literature discussed above, we assess whether returns to CUNY degrees vary based on:

- gender
- age (19 or younger, 20–23, and 24 or older)
- major fields at first entry (based on 2-digit Classification of Instructional Programs [CIP] codes)
- entry cohorts (i.e., year of entry)
- ASAP eligibility (a proxy measure based on the ASAP eligibility criteria that can be reconstructed using administrative records)

Note that our proxy for ASAP eligibility considers students eligible if they: enrolled full-time in their first semester, attempted 1–6 remedial credits in their first term, were awarded a Pell award in their first semester, were New York City (NYC) residents, and were not enrolled in ASAP-excluded majors.[12]

3.3 Methodology

The challenge in any returns-to-degrees analysis is that students who were awarded a degree may be different from students who enrolled but were not awarded a degree in ways that are unobserved and that influence both labor market outcomes and the likelihood of completing a degree. Individuals who choose to enroll and complete a CUNY degree may be more motivated than those who take only a few courses or do not

[12] Excluded majors include health information technology, paramedic, respiratory therapy, nursing, nursing (RN), practical nursing, science for forensics, engineering science, civil engineering science, electrical engineering science, and mechanical engineering science. Note that actual ASAP eligibility (at the time) required students to have at least one but not more than two required remedial courses (though they may not have registered for such courses in their first term). It is worth noting that ASAP eligibility in this report is defined using the eligibility rules in place during the randomized evaluation. Current ASAP eligibility is not limited to students with developmental education needs or Pell receipt.

enroll at all. This could lead to a systematic overstatement of the earnings effects of degree completion.

Our primary specification uses an OLS framework that adjusts for a rich set of observed student and program characteristics, comparing the earnings trajectories of degree completers and noncompleters within the broad population of first-time CUNY community college entrants, many of whom are too young to include using alternative estimation approaches that rely on comparing students' earnings before and after college. The OLS results describe earnings differences associated with earning an associate degree (and, separately, a bachelor's degree) while adjusting for a rich set of observed characteristics, including demographics, entry cohort and college, initial academic intentions, early academic performance, and pre-enrollment earnings measures. We also allow returns to evolve with time since exit, recognizing that earnings effects may build as graduates gain time in the labor market.

This approach maximizes representativeness of the overall entrant cohorts, but it cannot rule out bias from unobserved differences between completers and noncompleters and relies on a standard selection-on-observables assumption for causal interpretation. Unobserved factors like motivation and ability likely influence both degree attainment and earnings, introducing bias. While controlling for observed characteristics reduces bias, it cannot fully address it, so our estimates should be interpreted cautiously as reflecting both causal effects and unobserved factors. Within these limitations, this specification is well suited for the CUNY context, where community colleges are a common pathway to bachelor's attainment through transfer. Estimating the model using broad entrant cohorts also allows us to distinguish returns to different postsecondary pathways (no credential, terminal AA completion, and AA-to-BA progression).

To assess the sensitivity of our estimates to concerns about omitted factors causing bias, we also estimate individual fixed-effects models using a narrower sample of entrants with observed pre-enrollment earnings. FE models compare students to themselves over time, netting out time-invariant unobserved characteristics that may be correlated with both completion and earnings. The limitation of this approach is that it necessarily excludes many younger students and those with limited prior work history, which describes a large portion of CUNY community college entrants. The FE sample

includes both terminal AA completers and noncompleters but excludes students who transfer to a senior college (within or outside CUNY) and anyone with enrollment after leaving the associate-level program; accordingly, post-college outcomes are measured after students' last community college enrollment. This design mirrors the dominant approach in administrative-data studies of community college returns and is used in closely related cross-state prior work.

For both approaches, we report the associated 10-year return by evaluating the estimated degree effect at the 10-year horizon. We calculate the estimated effect at 10 years based on the regression coefficients (including both the main effects of degree completion and time since exit, as well as their interaction) and the typical time since exit for completers and noncompleters, respectively.[13] (Full model details, covariate sets, 10-year return estimation, and sample constructions are provided in Appendix A.)

4. Findings

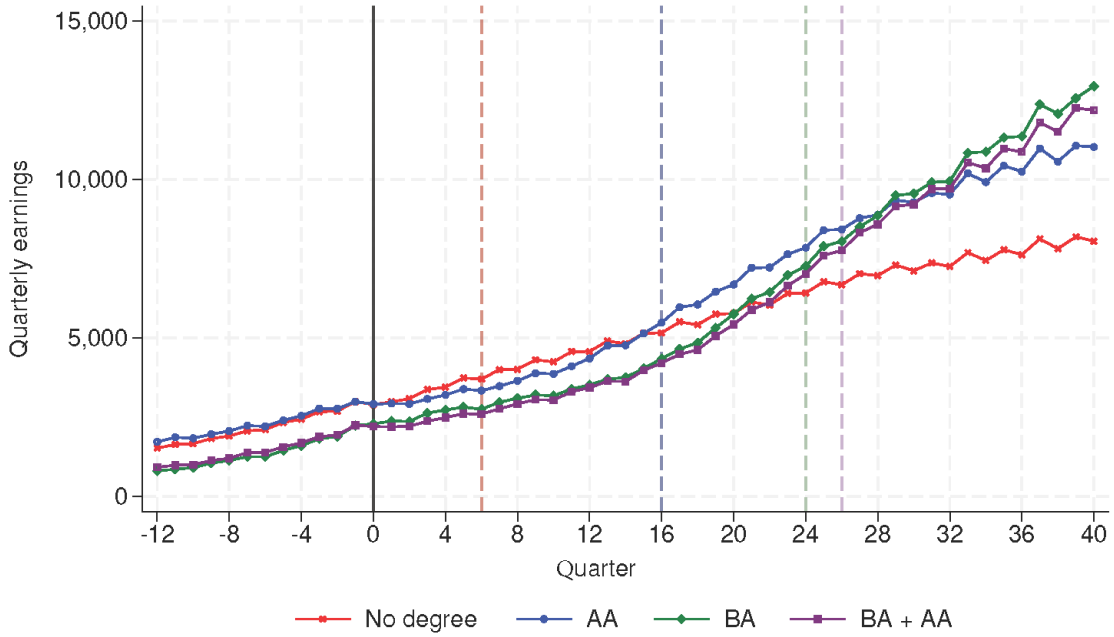
4.1 Effect of Degree Completion on Earnings

Figure 1 illustrates earnings patterns for degree completers and noncompleters before, during, and after enrollment. Vertical dashed lines mark the median quarter of college exit for each group (including leaving college without a credential, earning an AA only, earning a BA only, or earning both an AA and BA). The general pattern is a familiar one. Earnings for completers tend to dip during enrollment relative to noncompleters and then grow more rapidly for completers than for noncompleters after exit. BA completers are also included, and the comparison of their patterns with terminal AA completers is interesting. First, those who ultimately earn a BA have notably lower earnings prior to and during enrollment than noncompleters or terminal AA completers. And while terminal AA completers' average earnings exceed noncompleters' earnings by about four and one-quarter years post-entry, BA completers do not gain an advantage

[13] Specifically, the 10-year effect is calculated as the main coefficient on degree completion, plus the coefficient on the interaction of degree completion and average time since exit multiplied by the average time since exit for completers, plus the main coefficient on time since exit multiplied by the difference in time since exit between completers and noncompleters.

until about five and one-half years post-entry, on average. BA completers do not surpass terminal AA completers until about seven and three-quarters years post-entry.

Figure 1. Earnings Trajectories by Degree Pathway



Note. This figure shows descriptive (i.e., not regression adjusted) median earnings in 2023 dollars for CUNY students who first entered associate degree programs between fall 2005 and spring 2013, followed for 10 years post-entry. The sample corresponds to our OLS estimation sample, which includes NYS residents who attempted at least one credit at entry, were ages 18–60 with nonmissing demographics, had no graduate enrollment, and had at least one quarter of positive NYS earnings after exit; it excludes those who transferred and earned a degree outside CUNY. The figure shows median quarterly earnings by credential type, measured relative to initial college entry (vertical black line) at quarter zero. The other vertical lines indicate median exit quarters by degree completion status.

Figure 2 shows OLS estimates of quarterly earnings gains at Year 10 post-entry. We report returns for those who earned an AA only as well as for those who earned a BA instead of or in addition to an AA. Returns for terminal AA completers are substantial (about $2,426 per quarter at Year 10 (roughly $9,700 per year), which represents a roughly 30% increase relative to the noncompleters' mean of about $8,003 per quarter. Estimated gains are larger for BA completers—whether they earn a BA in addition to an AA or instead of an AA—than for terminal AA completers (note that only 3% of entrants earn a BA without first earning an AA).[14]

[14] Appendix Table B2 reports the 10-year OLS return estimates shown in this figure. Appendix Table B3 reports estimates conditional on any employment in Year 10; these results are qualitatively similar to the unconditional estimates reported here.

Figure 2. Year 10 Earnings Gains Relative to Noncompleters

Note. OLS estimates reflect quarterly earnings gains in 2023 dollars 10 years after AA entry for CUNY students first enrolled between fall 2005 and spring 2013; capped lines represent 95% confidence intervals. Sample includes NYS residents who attempted at least one credit at entry, were ages 18–60 with nonmissing demographics, had no graduate enrollment, and had at least one quarter of positive NYS earnings after exit; it excludes those who transferred and earned a degree outside CUNY. OLS models adjust for demographics, first-semester characteristics, and pre-entry earnings; outcome is average quarterly earnings in Year 10. The 10-year effect is calculated as the main coefficient on degree completion, plus the coefficient on the interaction of degree completion and average time since exit multiplied by the average time since exit for completers, plus the main coefficient on time since exit multiplied by the difference in time since exit between completers and noncompleters. Control means are average Year 10 quarterly earnings for noncompleters: $8,003 (all), $7,408 (women), $8,615 (men), $7,419 (age < 20), $7,443 (age 20–23), $9,914 (age 24+), $7,363 (ASAP-eligible), and $8,217 (non-ASAP-eligible).

4.2 How Returns Vary Across Subgroups

We next examine heterogeneity in OLS estimates across subgroups defined by gender, age, field of study at entry, entry cohort, and our ASAP eligibility proxy. All groups show substantial positive returns to each degree type. However, returns vary meaningfully across entrants, consistent with prior evidence that earnings gains from subbaccalaureate credentials differ by student characteristics and field of study (Lovenheim & Smith, 2023; Minaya & Scott-Clayton, 2022).

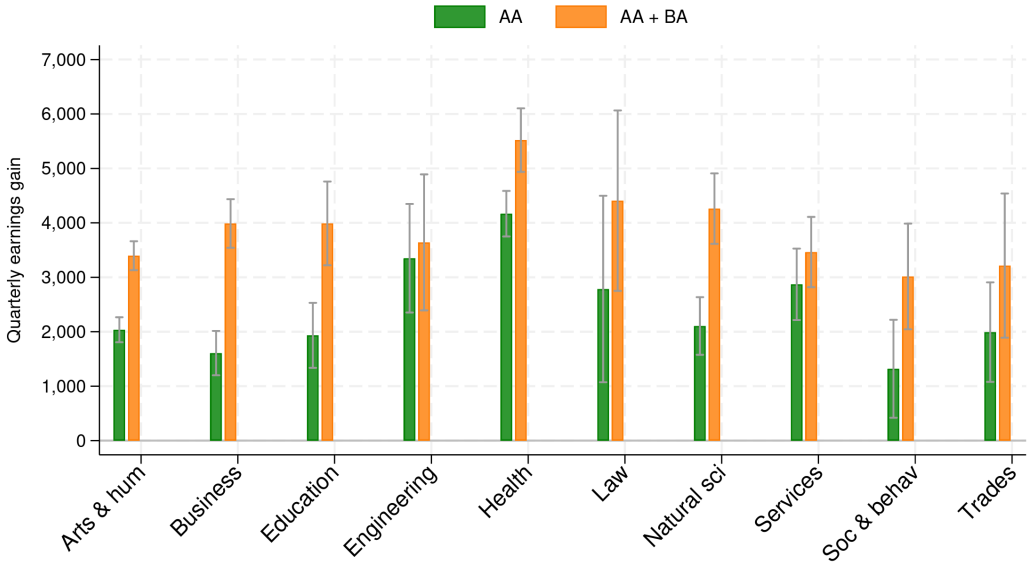
Figure 2 shows that estimated Year 10 earnings gains are positive across all subgroups but vary in magnitude. Estimated Year 10 gains from a terminal AA are smaller for women than for men ($2,284 versus $2,629 per quarter) and substantially smaller for younger entrants than for older entrants ($1,948 per quarter for entrants under age 20 versus $3,263 for entrants age 24+). Returns for ASAP-eligible entrants are also

positive but about $800 per quarter lower than for non-ASAP-eligible entrants. BA pathways show larger gains overall—roughly $3,500–$4,200 per quarter for AA and BA and about $4,100–$4,200 per quarter for BA only—with particularly large estimates for women and for younger entrants in some BA pathways.

As shown in Figure 3, returns also vary meaningfully across entry fields. Health stands out with particularly high Year 10 earnings gains, while the field of business shows lower-than-average gains for AA-only pathways; most other fields fall between these two benchmarks. (We report analogous patterns for students earning both an AA and BA.) Figure 4 shows additional variation by entry cohort. Cohorts entering around 2010–2012 show lower average returns to terminal AA completion, while returns to AA and BA pathways appear to be increasing across cohorts in the period we examine.

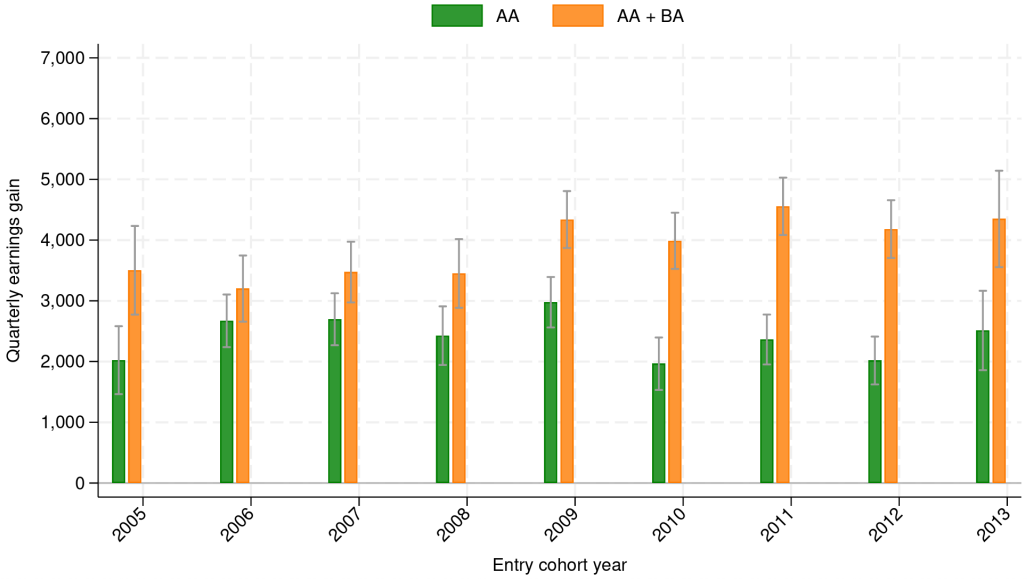
Together, these subgroup patterns help interpret the returns estimates in a setting like CUNY, where transfer and BA attainment are common outcomes for community college entrants—and where the relevant policy question is often not simply "AA or no AA" but which pathway students ultimately follow.

Figure 3. Year 10 Earnings Gains Relative to Noncompleters, by Field



Note. OLS estimates reflect quarterly earnings gains in 2023 dollars 10 years after AA entry for CUNY students first enrolled between fall 2005 and spring 2013; capped lines represent 95% confidence intervals. Fields at entry are defined based on the 2-digit CIP code of the major reported at first entry. Sample sizes by entry field are as follows: arts & humanities (*n* = 54,263), business (*n* = 19,169), education (*n* = 3,805), engineering (*n* = 4,488), health (*n* = 20,422), law (*n* = 732), natural science & mathematics (*n* = 13,178), services (*n* = 7,762), social & behavioral sciences (*n* = 2,244), and trades & repair technicians (*n* = 3,129). Arts & humanities includes transfer-intending students entering in broad fields such as liberal arts & sciences and liberal studies. The 10-year effect is calculated as the main coefficient on degree completion, plus the coefficient on the interaction of degree completion and average time since exit multiplied by the average time since exit for completers, plus the main coefficient on time since exit multiplied by the difference in time since exit between completers and noncompleters.

Figure 4. Year 10 Earnings Gains Relative to Noncompleters, by Cohort



Note. OLS estimates reflect quarterly earnings gains in 2023 dollars 10 years after AA entry for CUNY students first enrolled between fall 2005 and spring 2013; capped lines represent 95% confidence intervals. The 10-year effect is calculated as the main coefficient on degree completion, plus the coefficient on the interaction of degree completion and average time since exit multiplied by the average time since exit for completers, plus the main coefficient on time since exit multiplied by the difference in time since exit between completers and noncompleters.

4.3 Robustness Across Estimation Approaches (OLS versus FE)

After presenting OLS as the primary specification, we assess robustness using an individual FE design estimated in a narrower sample. This FE approach is standard in the returns-to-degree literature and helps address concerns about omitted variable bias in OLS by controlling for time-invariant unobserved differences across individuals. The FE approach focuses on terminal AA pathways and excludes transfer/senior-college enrollment during follow-up, which is a more consequential restriction in CUNY than in many other contexts given the high prevalence of BA attainment among CUNY entrants. We therefore treat FE as a secondary robustness check.

Table 2 shows that FE estimates of terminal-AA returns at Year 10 are larger than OLS estimates—$3,454 per quarter versus $2,426 per quarter, a 30% difference. One likely reason is that the FE analysis is estimated on a narrower, more work-attached sample that differs from the broad entrant cohort used for OLS. As shown in Appendix Table B1, the OLS sample is roughly three times larger than the FE sample, and completion patterns differ sharply: 31% of entrants in the OLS sample complete an AA, BA, or both within 10 years, compared with 13% in the FE sample. In the broad OLS entrant sample, 15% earn a BA (with or without an AA)—and among AA completers, over 40% go on to complete a BA at CUNY within 10 years. This underscores a key limitation of focusing exclusively on *terminal* AA completers, as the FE approach does.

Appendix Table B1 further documents systematic differences in composition that may contribute to higher estimated returns in the FE sample. On average, FE sample entrants are about four years older, have substantially higher earnings in the year prior to enrollment, and—by Year 10—have accumulated one year more post-exit labor-market time (27 versus 24 quarters since exit). The FE sample also has a higher share of entrants in health fields (20% versus 14%), and this gap is larger among terminal AA completers (25% versus 16%). In contrast, the OLS sample includes a larger share of entrants in arts & humanities, which captures many transfer-intending students entering in broad fields such as liberal arts and sciences/liberal studies.

Table 2. Estimated Earnings Gains From AA Completion Using FE Specification

	Year 10 effect	Standard error	10-year control mean	Number of students
All	3,454***	156	8,901	47,018
Female	3,235***	195	8,451	25,968
Male	4,048***	272	9,431	21,050
Age 20–23	2,912***	210	7,693	24,293
Age 24+	3,845***	226	10,305	22,725
ASAP eligible	2,740***	300	7,588	9,843
Not ASAP eligible	3,664***	188	9,244	37,175
Entry field				
Arts & humanities	2,996***	259	8,483	16,563
Business	1,518***	396	9,128	6,084
Education	2,347***	585	6,898	1,440
Engineering	3,815***	876	11,730	1,481
Health	5,928***	374	9,684	9,499
Law	3,437**	1,393	6,940	305
Natural science & mathematics	3,198***	589	9,206	4,471
Services	3,693***	938	7,861	1,892
Social & behavioral sciences	1,216	770	7,567	990
Trades & repair technicians	1,916*	1,029	8,030	950
Entry cohort				
2005	3,588***	577	9,600	3,304
2006	3,852***	437	9,277	6,028
2007	3,858***	413	9,487	5,977
2008	3,792***	491	9,321	5,917
2009	4,120***	446	9,155	6,157
2010	3,015***	567	8,983	5,193
2011	2,641***	454	7,866	5,389
2012	2,586***	417	8,112	6,006
2013	3,729***	620	8,227	3,047

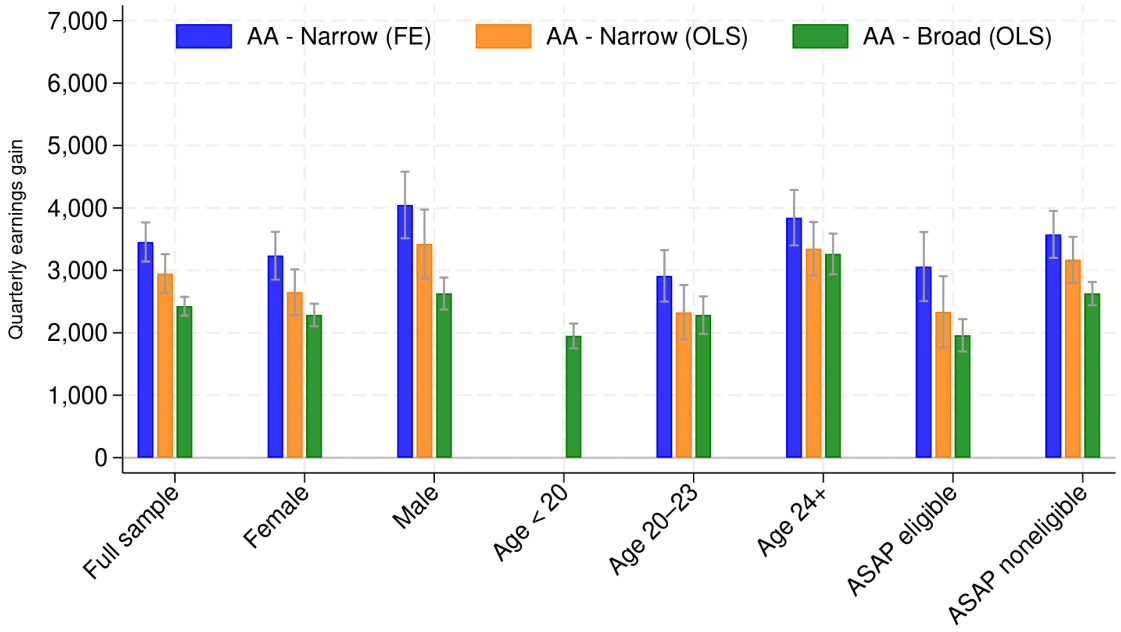
Note. Quarterly earnings gains estimates in 2023 dollars 10 years after AA entry for CUNY students first enrolled between fall 2005 and spring 2013. FE models include individual fixed effects, calendar quarter fixed effects, age at first enrollment interacted with quarter, and four pre-entry quarter indicators; standard errors are clustered at the individual level. The 10-year effect is calculated as the main coefficient on degree completion, plus the coefficient on the interaction of degree completion and average time since exit multiplied by the average time since exit for completers, plus the main coefficient on time since exit multiplied by the difference in time since exit between completers and noncompleters.

*$p < .10$, *$p < .05$, ***$p < .01$.

To separate sample composition from estimation method, we re-estimate the OLS model on the FE analytic sample, as shown in Figure 5. Doing so raises the OLS estimated Year 10 gain to $2,948 per quarter and narrows the OLS FE difference to about 15% (the gain is estimated at $3,454 per quarter under the FE model). This pattern suggests that about half of the original FE-OLS gap is likely driven by sample composition. The remaining difference between FE and OLS estimates within the same sample likely reflects differences in identifying assumptions and in how each approach

weights observations. Reassuringly, both methods yield large positive estimated returns, and they show broadly similar patterns of heterogeneity, including higher returns in health fields and lower returns for later entry cohorts among AA-only completers.

Figure 5. Year 10 Earnings Gains for Terminal AA Degree, by Model



Note. The figure shows estimated earnings gains relative to noncompleters in 2023 dollars 10 years after AA entry for CUNY students first enrolled between fall 2005 and spring 2013; capped lines represent 95% confidence intervals. Bars show estimates of AA-only returns from three approaches. "AA-Narrow (FE)" and "AA-Narrow (OLS)" use different estimators on the same population, while "AA-Narrow (OLS)" and "AA-Broad (OLS)" use the same estimator on different populations. Model details are provided in Appendix A. Broad population (OLS) includes NYS residents who attempted at least one credit at entry, were ages 18–60 with nonmissing demographics, had no graduate enrollment, and had at least one quarter of positive NYS earnings after exit; it excludes those who transferred and earned a degree outside CUNY. Narrow population (FE) sample restricts to entrants age 20+ with at least one quarter of positive earnings in the three years pre-entry and no subsequent enrollment at a CUNY four-year college or outside CUNY during the 10-year follow-up. OLS models adjust for demographics, first-semester characteristics, and pre-entry earnings. FE models include individual fixed effects, calendar quarter fixed effects, age at first enrollment interacted with quarter, and four pre-entry quarter indicators; standard errors are clustered at the individual level. The 10-year effect is calculated as the main coefficient on degree completion, plus the coefficient on the interaction of degree completion and average time since exit multiplied by the average time since exit for completers, plus the main coefficient on time since exit multiplied by the difference in time since exit between completers and noncompleters.

4.4 Comparing FE Estimates to Similar Estimates From Ohio

It is also useful to benchmark our estimates against prior evidence from Ohio, where returns to terminal associate degrees have been estimated using a similar individual FE estimation framework. Ohio is a particularly relevant point of comparison because this report is part of a larger project that evaluates the long-term degree completion and earnings estimates of ASAP programs in both CUNY and replication sites in multiple Ohio community colleges. Given the heterogeneity by cohort observed in Figure 4, we limit the cohorts for this analysis to 2005–2008, which are the four cohorts closest to the Ohio sample (which covered 2001–2004 entrants; see Table 4, Model 3 in Minaya & Scott-Clayton, 2022). Model 1 from the Ohio study includes individual FE but with no allowance for growth in AA returns over time, while Model 2 allows returns to grow over time (by including interactions of degree completion and quarters since college exit).

Table 3 shows the results for CUNY in the top panel and Ohio in the bottom panel. The coefficient on *Degree* represents the immediate earnings bump of earning a degree. The coefficient on *Degree*exit* indicates how much this bump increases with each quarter post-degree-completion (the coefficient on *Quarters since exit* represents the general effect of post-college experience in the labor market, regardless of degree completion). The final row of each panel shows the estimated quarterly gain at Year 10 post-entry, given these coefficients and the average timing of exit for completers and noncompleters, respectively.[15] For Ohio, we assume the same timing of exit as at CUNY since these are not reported in the original paper.

Focusing on Model 2, which is the "preferred model" in the Ohio study and closest to our main specification for our CUNY FE analysis, we estimate a notably lower (but still highly statistically significant) initial earnings bump for terminal AA completers from CUNY versus Ohio. However, growth over time is much larger at CUNY than in Ohio. These patterns are consistent with those observed in Figure 6, which uses Post-

[15] For our regression sample, female and male noncompleters had an average of 29.9 and 31.1 quarters post-exit in Year 10, respectively, compared to 21.9 and 22.1 quarters for female and male AA completers.

Secondary Employment Outcomes (PSEO) data[16] and also indicates steeper earnings growth over time for CUNY associate degree graduates relative to their Ohio peers. After 10 years, our analysis indicates slightly lower quarterly returns overall for CUNY versus Ohio women, but much larger returns overall for CUNY versus Ohio men.

Table 3. Estimated Earnings Gains From AA Completion at CUNY and Ohio

Panel A. CUNY Individual FE Estimates (2005–2008 Entry Cohorts)

	Female	Male
Degree	781***	757***
	(169)	(238)
Degree*exit	139***	151***
	(12)	(21)
Quarters since exit	-43***	-59***
	(7)	(9)
Quarterly gain at Year 10	4,167	4,628
	(272)	(418)

Panel B. Ohio Individual FE Estimates (2001–2004 Entry Cohorts)

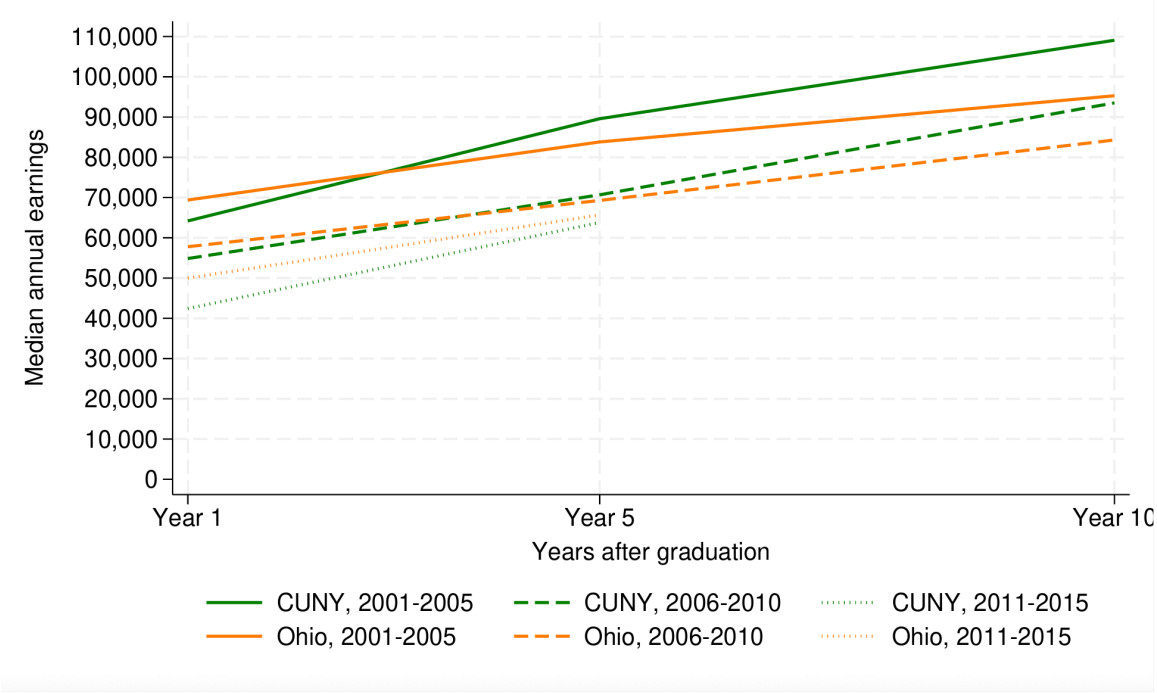
	Female	Male
Degree	2,748***	1,127***
	(71)	(123)
Degree*exit	73***	78***
	(4)	(8)
Quarters since exit	-13***	-55***
	(3)	(4)
Quarterly gain at Year 10	4,447	3,346
	(0–183)	(0–336)

Note. These estimates, in 2023 dollars, should be interpreted as supplementary. Our main estimates for the CUNY sample are reported in Figure 2. The 10-year effect is calculated as the main coefficient on degree completion, plus the coefficient on the interaction of degree completion and average time since exit multiplied by the average time since exit for completers, plus the main coefficient on time since exit multiplied by the difference in time since exit between completers and noncompleters. For women at CUNY, this corresponds to $781 + 139 \times (21.9 + 2.5) - 42.5 \times [(21.9 + 2.5) - (29.9 + 2.5)]$, where the +2.5 term reflects evaluating outcomes at the midpoint of Year 10 (quarter 38.5 post-entry). At Year 10, female and male noncompleters average 29.9 and 31.1 quarters post-exit, respectively, compared with 21.9 and 22.1 quarters for AA completers. For Ohio, we cannot compute the exact standard errors for the 10-year returns because the coefficient covariances are unavailable. We therefore report conservative lower and upper bounds for the Ohio 10-year standard errors using the same formula as for CUNY. Equality tests comparing CUNY and Ohio 10-year returns are not rejected for women even at the lower-bound SE (p = .30), and are rejected for men even at the upper-bound SE (p = .017). Standard errors in parentheses.

*p < .10, *p < .05, ***p < .01.

[16] PSEO data are produced using the Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program by linking college records to national employment data to track graduates' earnings and employment outcomes by institution, major, and degree level.

Figure 6. Median Annual Earnings by Associate Degree Graduation Cohort



Note. Authors' calculations using PSEO data. Median earnings, in 2023 dollars, represent weighted institutional averages using the number of associate degree graduates per institution as weights. Earnings are reported for 1, 5, and 10 years after graduation, by graduation cohort (2001–2005, 2006–2010, and 2011–2015). Limited to associate degree programs at public community colleges.

Patterns between the two regions may differ due to a different mix of fields of study and to different returns to the same fields. We do not see any obvious explanation here, as CUNY has a slightly higher proportion of health majors among the terminal AA graduates—about 26% in our FE sample compared to about 21% in the Ohio sample. And in both cases, returns are highest for health majors. Instead, the cross-site differences are much larger for men than for women. One possibility is that noncompleter men have relatively better options in Ohio (due to the robust manufacturing/production sector), while noncompleter women may have relatively better options in New York (due to a robust service sector).[17] It's also important to note that in Ohio, only 13% of community

[17] Descriptive American Community Service (ACS) tabulations underscore differences in labor-market structure across the two regions. "Some college" workers are more concentrated in production occupations in Ohio than in NYC (Appendix Figure B1). Among AA workers, Ohio also shows higher concentrations in healthcare and production, while NYC shows higher shares in service-oriented industries such as arts/entertainment/food (Appendix Figure B2). Among women, the AA–some-college difference is associated with a larger shift into healthcare practitioner occupations in Ohio than in NYC (Appendix Figure B3).

college entrants eventually transfer, and only 2.4% eventually earn a BA (Minaya & Scott-Clayton, 2022, footnote 12). In our CUNY sample, about 15% of community college entrants earn a BA within 10 years (with or without an AA), compared to 16% that earn an AA alone. So, the FE approach, which excludes subsequent enrollment after the AA, limits the sample of AA completers in the CUNY context more than in the Ohio context.

5. Conclusion

This research report finds substantial and robust earnings returns to associate degree completion for CUNY community college students across multiple estimation approaches and student subgroups. Although earnings trajectories vary with timing, demographics, and local labor market conditions, degree completion is consistently associated with improved long-run labor market outcomes. Our Year 10 estimates place CUNY toward the upper end of the prior evidence base on earnings gains (Belfield & Bailey, 2017), a pattern that is plausible given the longer follow-up horizon and the New York City labor market context. At the same time, the results align closely with the broader literature. We document meaningful heterogeneity in returns across student characteristics (including gender and age at entry), across fields of study—with especially strong gains in health and weaker AA-only gains in business—and across entry cohorts.

Returns for ASAP-eligible entrants are somewhat lower than for non-eligible entrants. Two patterns are suggestive. First, differences appear to be concentrated in returns to terminal AA completion (where ASAP's limited majors may be more consequential) rather than in BA-inclusive pathways. For example, for students pursuing health majors broadly, the estimated Year 10 return to a terminal AA is $1,802 per quarter for the ASAP-eligible subgroup, compared with $4,167 per quarter in the full sample, while the AA and BA estimates are similar ($5,684 versus $5,513). Second, composition may contribute mechanically. Health is among the highest-return fields in the full sample, yet many health majors were excluded from ASAP eligibility in the original randomized evaluation. As a result, health majors account for only 2% of the ASAP-eligible analytic sample (versus 21% among non-eligible entrants), which may

pull down the subgroup average. Finally, though ASAP eligibility has no age criterion, its other criteria (such as maintaining full-time enrollment) are correlated with entering college at a younger age, and younger entrants tend to have lower returns, which may also contribute to the gap. These descriptive comparisons cannot isolate a single mechanism, but they suggest that the modest difference reflects a combination of pathway mix and differences concentrated among AA-only completers.[18] Overall, these findings provide context for understanding the potential role of completion-focused programs such as ASAP and underscore the economic value of associate degrees in large urban labor markets.

[18] Appendix Table B4 reports field-specific earnings gains estimates for ASAP-eligible entrants. We use the corresponding full-sample estimates as a benchmark, noting that ASAP-eligible entrants comprise about 27% of the analytic sample—the full-sample estimates are thus largely driven by the non-eligible majority.

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Appendix A. Details on Sample and Methods

OLS Specification

Sample definition. Our starting sample includes all first-time undergraduate entrants at one of CUNY's six community colleges that were part of the system at the time of the ASAP evaluation who enrolled and attempted at least one credit upon their initial entry between fall 2005 and spring 2013.[19] These students were pursuing an associate degree, were NYS residents at first enrollment, were aged between 18 and 60 years at the time of first undergraduate enrollment, and had available demographic characteristics. We also restrict the sample to those who did not have graduate enrollment and had at least one quarter of positive earnings in NYS after leaving college.[20]

While students may transfer to institutions outside of CUNY, doing so is less common among community college entrants. To avoid conflating the value of a CUNY degree with that of completing a degree at an outside institution, we exclude from our main specification any individuals who transferred and earned degrees outside of CUNY, accounting for approximately 10,000 students, or 6% of our sample. Our analytic sample consists of 140,850 students, providing at least 10 years of post-entry employment records for all entry cohorts combined.

Estimation. Using this sample, we apply a "selection on observables" approach to compare the earnings of degree completers and noncompleters with similar observable characteristics.

Using a traditional Mincer-type schooling equation and a selection on observables method, this approach aims to address internal validity concerns with a rich set of background characteristics. The cross-sectional model is the following form:

$$Y_i = \beta_0 + \beta_1 Degree_i + \beta_2 Degree_i * QExit_i + \beta_3 QExit_i + \beta_4 Enr_i + \beta_5 Intent_i + \beta_6 Acad_i + \beta_7 PreEarn_i + \pi X_i + \delta_c + \varepsilon_i \quad (1)$$

[19] By first-time undergraduate CUNY entrants, we refer to students enrolling in CUNY as undergraduates for the first time. This definition does not exclude transfer students—students classified as first-time freshmen and transfers are both included.

[20] Students who earned a CUNY associate degree or higher before their first recorded enrollment are excluded from the sample. This exclusion affects approximately 122 students.

The dependent variable Y_i is a measure of average quarterly earnings or employment during the 10th year post-college entry. Presenting the results in terms of quarterly earnings facilitates the comparison of these results with the results from the second approach. $Degree_i$ is a vector of three dichotomous variables equal to one or zero: one variable for having an associate degree as the highest award, one variable for having earned a bachelor's degree as the highest award, and one variable for having earned both an associate degree and a bachelor's degree. We also include a term, $Degree_i * QExit_i$, that interacts the degree vector with a measure of quarters since last enrollment at 10 years post-college entry, which allows for the returns to credentials to evolve over time. $QExit_i$ is defined as the number of quarters between the 36th quarter post-AA entry and the latest degree completion quarter for degree holders and last enrollment quarter for non-degree holders. Enr_i captures college enrollment at 10 years post-college entry. $Intent_i$ is a set of vectors to control for academic intentions at first enrollment (i.e., major, full-time status, Pell Grant status, and developmental education status). $Acad_i$ is a set of vectors to control for academic performance in the first term (i.e., GPA, credits attempted). $PreEarn_i$ controls for individuals' pre-enrollment earnings three years prior to community college enrollment and in each of the four quarters immediately prior to first enrollment ("Ashenfelter's dip" in earnings). X_i is a vector of demographic and pre-college characteristics, such as age at entry, gender, race/ethnicity, and high school GPA. δ_c are fixed effects for entry cohorts. Missing values for demographic and pre-college characteristics are flagged using binary indicators.

The key parameter(s) of interest are β_1 and β_2, which represent immediate returns upon college exit, and the per-quarter growth in returns over time, respectively. We report the estimated average returns to credentials 10 years after college entry. The 10-year effect is calculated as $Degree_i$ coefficient plus the $Degree_i * QExit_i$ interaction coefficient multiplied by the mean number of exit quarters (through the 36th quarter post-entry) for students in that degree category plus the $QExit_i$ coefficient multiplied by the difference in mean exit quarters between completers and noncompleters.[21]

[21] A degree must be earned by Year 9 at the latest to ensure that any estimated impact reflects post-degree earnings and not concurrent enrollment effects.

Fixed Effects Specification

We apply additional sample restrictions for this specification, mirroring those used in prior literature and in the returns-to-associate-degree estimations in Ohio (Minaya & Scott-Clayton, 2022) for comparison purposes. Our individual FE approach compares students' earnings after earning a degree to their own earnings prior to college entry. This approach assumes that pre-college earnings (levels and/or trajectories) provide a useful counterfactual for what a student would earn in the future if not for their degree. The pre-college earnings of students who enter college directly from high school, or who do not work at all between high school and college, are not likely to reflect their longer-term earnings potential (indeed, pre-college earnings for such students may *negatively* correlate with future earnings potential).

Thus, our FE analysis includes only students who meet the following additional criteria:

- must be at least age 20 at the time of first CUNY undergraduate enrollment,
- must have at least one quarter of positive earnings in the three years prior to first enrollment, and
- must not have subsequent enrollment in a CUNY four-year institution or any institution outside of CUNY during our 10-year follow-up window.

These additional sample restrictions substantially reduce the analytic sample to approximately 47,018 students. The primary driver of this reduction is the exclusion of students under 20 years old, which represents about 50% of the initial sample.

The FE approach allows us to isolate time-invariant student characteristics that may influence both earnings and the likelihood of completing a CUNY associate degree. We estimate the returns-to-degree for CUNY degree earners using a difference-in-differences framework. The model is the following form:

$$Y_{it} = \alpha_i + \beta_1 Degree_{it} + \beta_2 Degree_{it} * QExit_{it} + \beta_3 QExit_{it} + \partial Age_{it} + \tau_t + \varepsilon_{it} \quad (2)$$

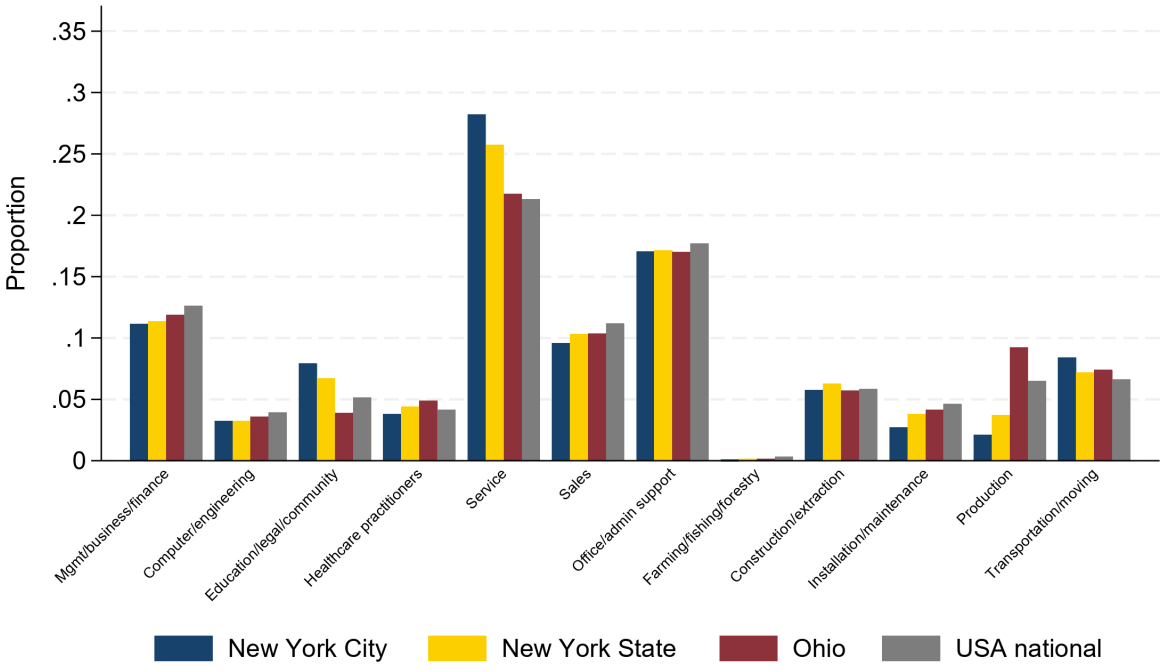
where i indexes individuals and t denotes time in quarters. This model includes individual fixed effects (α_i) so that the effect of earning a CUNY degree is identified from the within-individual changes in labor market outcomes (Y_{it}) from before to after the degree is received. $Degree_{it}$ is a vector of dummy variables that turns to one upon completion of a CUNY associate degree at the beginning of quarter t. $Degree_i * QExit_{it}$ interacts the degree vector with a linear measure of quarters since exit, which allows for the returns to credentials to evolve over time—this is to avoid conflating part-time employment while enrolled with pre-enrollment earnings. The model also includes controls in the form of dummy variables for each calendar quarter (τ_t) and age. Age is entered as an age-at-entry–specific linear time trend. To account for the Ashenfelter's dip, we include indicators for each quarter in the year prior to college entry. β_1 should be interpreted as the initial returns immediately after college exit and β_2 as the quarterly growth in returns to completion relative to noncompleters. We exclude all enrollment quarters from the sample since they are potentially directly affected by studying. We report the estimated average returns to credentials 10 years after college entry, by summing β_1 with $\beta_2\times$ (the average quarters since exit at 38.5 quarters post-entry [= 36 + 2.5]), which captures the midpoint of Year 10 and aligns with the OLS approach, plus the $QExit_{it}$ coefficient multiplied by the difference in mean exit quarters between completers and noncompleters.

A strength of this model is the precision of the estimator, due to the larger number of person-quarter observations. However, relying on within-individual earnings differences requires knowledge or assumptions about pre-enrollment earnings trends for degree completers and noncompleters. The well-known Ashenfelter's dip (Ashenfelter et al., 1985) prior to enrollment is relevant here, because individuals who experience a job separation or an earnings decline may be more likely to subsequently enroll in a CUNY degree program. This would cause a positive bias in the estimates, as pre-enrollment earnings would be artificially low. To address this concern, we restrict our sample to individuals with some labor market attachment before their first enrollment, examine pre-enrollment earnings using an event-study approach, and account for the Ashenfelter's dip in our specification. Another major drawback of using individual fixed effects is that the models require strong assumptions about time trends and earnings trajectories during and

after college. Earnings tend to rise with worker age, which can affect within-individual comparisons over time surrounding enrollment (Lovenheim & Smith, 2023). Additionally, the trajectory of returns varies across degree completion type (e.g., earnings trajectories of associate degree completers are different from the earnings trajectories of noncompleters) and also depend upon patterns of ongoing enrollment. Following Dynarski et al. (2018), we account for time trends in our models to control for unobserved individual factors that change at a constant rate over time (e.g., work experience). Nonetheless, there remain potential concerns and sources of bias if transitory, unobserved shocks affect both the likelihood of completing a degree and subsequent earnings (and are not captured by pre-earnings levels or growth rates). Overall, we believe our ability to control for pre-enrollment earnings and earnings trends allows us to overcome these internal validity concerns and provide a reliable approximation of the causal effects of earning a CUNY degree.

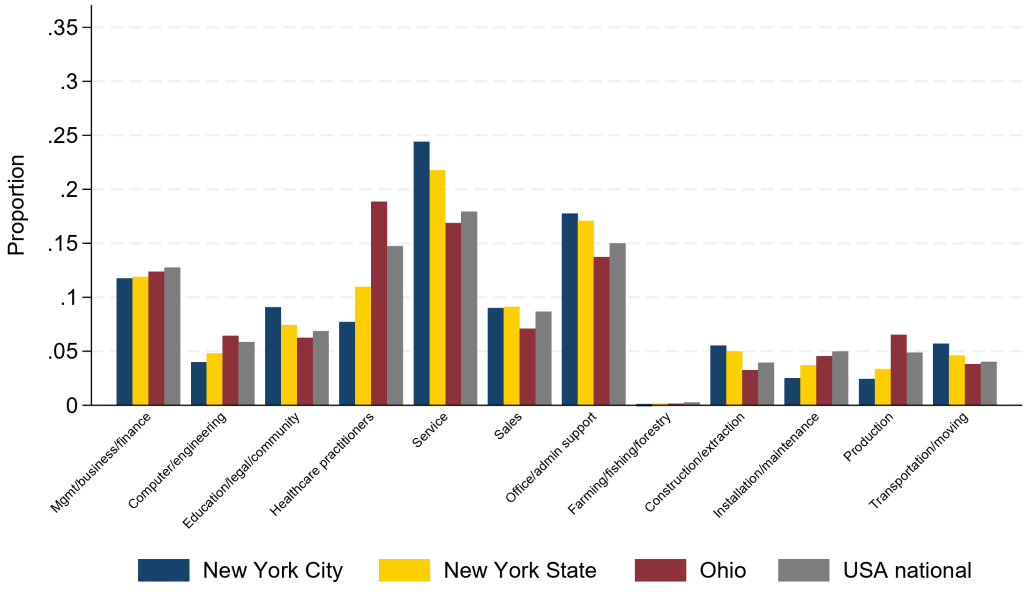
Appendix B. Supplementary Figures and Tables

Figure B1. Occupation Proportions: "Some College" Workers



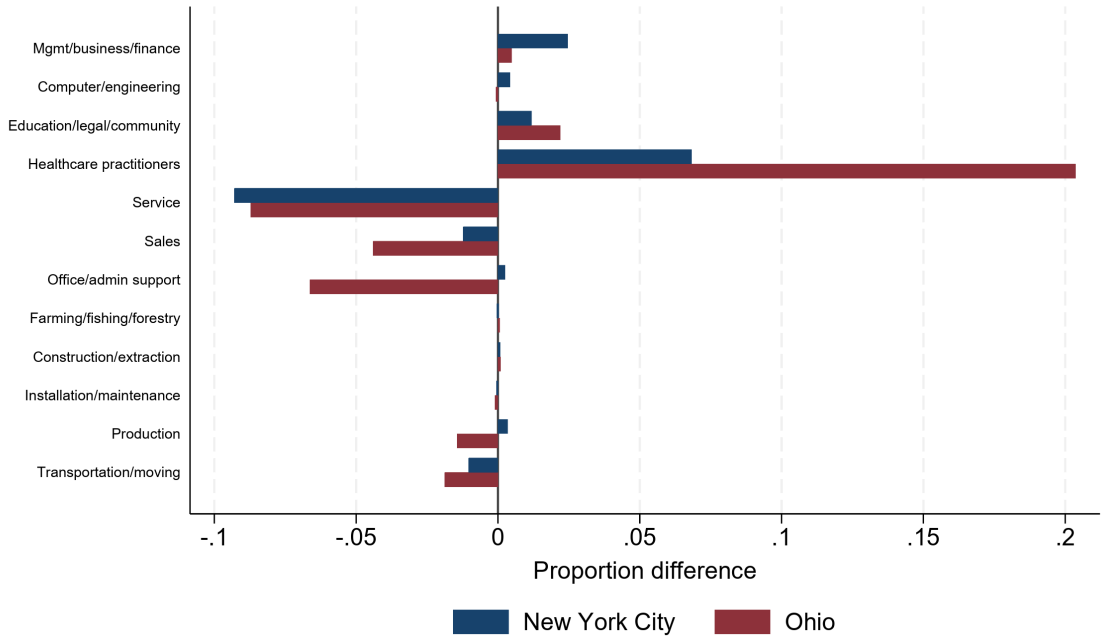
Note. Based on ACS yearly samples (2011–2018), ages 31–39. Military and unemployed excluded. Location defined by place of work.

Figure B2. Occupation Proportions: Associate Degree Workers



Note. Based on ACS yearly samples (2011–2018), ages 31–39. Military and unemployed excluded. Location defined by place of work.

Figure B3. Occupation Proportion Differences Between Associate Degree and "Some College" Workers, Among Women



Note. Based on ACS yearly samples (2011–2018), ages 31–39. Military and unemployed excluded. Location defined by place of work.

Table B1. Comparison of Analytic Samples Used in OLS and FE Models

	OLS Broad Population					FE Narrow Population		
	All	Both	BA	AA	None	All	AA	None
Year 10 quarterly earnings	9,075.6	11,997.5	12,565.4	10,910.7	8,003.2	9,474.5	13,108.7	8,914.3
Any earnings in Year 10	0.73	0.84	0.81	0.79	0.70	0.71	0.79	0.69
3rd year pre-entry earnings	1,596.9	981.6	903.8	1,877.1	1,664.8	3,923.4	5,279.5	3,714.4
1st year pre-entry earnings	2,596.5	1,904.5	1,885.7	2,799.6	2,695.0	5,523.3	6,855.6	5,318.0
Exit quarters to Year 10	23.96	11.76	13.45	20.40	27.29	27.18	19.76	28.33
Enrolled in any quarter in Year 10	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.01
Demographics								
Age at entry	22.79	22.21	21.54	23.60	22.75	26.89	28.99	26.57
Male	0.47	0.38	0.43	0.42	0.49	0.45	0.37	0.46
AI/AN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asian	0.13	0.24	0.28	0.15	0.10	0.10	0.13	0.10
Black	0.31	0.23	0.20	0.28	0.34	0.35	0.32	0.36
Hispanic	0.39	0.35	0.24	0.37	0.40	0.38	0.32	0.38
White	0.16	0.18	0.27	0.18	0.15	0.17	0.23	0.16
Intent								
Received Pell in first semester	0.64	0.65	0.56	0.63	0.64	0.61	0.58	0.61
High school GPA	73.63	76.82	77.83	75.30	72.46	72.46	75.08	72.12
Major at entry:								
Arts & humanities	0.39	0.39	0.43	0.38	0.38	0.35	0.31	0.36
Business	0.14	0.18	0.15	0.14	0.13	0.13	0.14	0.13
Education	0.03	0.03	0.01	0.03	0.03	0.03	0.03	0.03
Engineering	0.03	0.02	0.03	0.04	0.03	0.03	0.06	0.03
Health	0.14	0.09	0.09	0.16	0.15	0.20	0.25	0.20
Law	0.01	0.01	0.00	0.01	0.00	0.01	0.01	0.01
Natural science & mathematics	0.09	0.08	0.13	0.09	0.10	0.10	0.08	0.10
Services	0.06	0.06	0.03	0.04	0.06	0.04	0.02	0.04
Social & behavioral sciences	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02
Trades & repair technicians	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.02
Academic (first semester)								
Full-time	0.80	0.86	0.84	0.82	0.78	0.70	0.70	0.70
> 6 remedial credit hours	0.35	0.29	0.21	0.31	0.38	0.37	0.30	0.38
Cumulative GPA	2.66	3.08	3.17	2.96	2.45	2.75	3.23	2.65
Credit hours attempted	12.29	13.76	13.27	13.11	11.80	11.36	12.23	11.23
Number of students	140,850	16,129	4,451	22,812	97,458	47,018	6,279	40,739

Table B2. Estimated Quarterly Earnings Gains, 10 Years Post-Entry

	All	Female	Male	Age < 20	Age 20–23	Age 24+	ASAP eligible	Not ASAP eligible
BA + AA	3,940.3***	4,216.2***	3,508.0***	3,711.8***	4,170.0***	4,137.2***	3,487.4***	4,132.6***
	(90.9)	(106.2)	(160.4)	(117.6)	(183.5)	(210.6)	(155.0)	(112.1)
BA	4,136.5***	4,176.5***	4,095.5***	3,985.3***	5,206.2***	2,971.2***	4,312.2***	3,984.6***
	(181.3)	(225.3)	(297.2)	(213.4)	(414.1)	(459.0)	(302.8)	(225.5)
AA	2,425.3***	2,284.1***	2,628.7***	1,948.1***	2,280.8***	3,262.7***	1,865.0***	2,652.8***
	(77.2)	(92.6)	(130.6)	(101.3)	(153.8)	(166.6)	(135.5)	(93.4)
Control mean	8,003.2	7,408.4	8,614.7	7,418.9	7,443.1	9,913.8	7,363.2	8,217.0
n	140,850	75,242	65,608	68,722	38,557	33,571	38,461	102,389

Note. OLS estimates reflect quarterly earnings gains in 2023 dollars 10 years after AA entry for CUNY students first enrolled between fall 2005 and spring 2013. Sample includes NYS residents who attempted at least one credit at entry, were ages 18–60 with nonmissing demographics, had no graduate enrollment, and had at least one quarter of positive NYS earnings after exit; it excludes those who transferred and earned a degree outside CUNY. OLS models adjust for demographics, first-semester characteristics, and pre-entry earnings; outcome is average quarterly earnings in Year 10. The 10-year effect is calculated as the main coefficient on degree completion, plus the coefficient on the interaction of degree completion and average time since exit multiplied by the average time since exit for completers, plus the main coefficient on time since exit multiplied by the difference in time since exit between completers and noncompleters. Standard errors in parentheses.

*p < .10, *p < .05, ***p < .01.

Table B3. Estimated Quarterly Earnings Gains, 10 Years Post-Entry, Conditional on Employment in Year 10

	All	Female	Male	Age < 20	Age 20–23	Age 24+	ASAP eligible	Not ASAP eligible
BA + AA	2,406.6***	2,714.1***	1,947.0***	2,268.5***	2,878.8***	2,278.6***	2,016.0***	2,566.7***
	(94.1)	(108.0)	(168.8)	(121.9)	(191.4)	(216.0)	(162.3)	(115.2)
BA	3,139.6***	3,288.2***	2,924.8***	2,876.0***	4,599.2***	2,198.6***	3,359.5***	2,961.9***
	(187.0)	(231.6)	(307.9)	(217.1)	(443.2)	(486.3)	(309.7)	(233.6)
AA	1,482.4***	1,511.8***	1,472.5***	1,073.0***	1,402.1***	2,218.3***	1,056.0***	1,651.3***
	(82.8)	(97.9)	(140.6)	(108.7)	(168.2)	(175.9)	(147.1)	(99.1)
Control mean	11,490.3	10,558.7	12,462.6	10,404.9	10,999.8	14,432.1	10,643.1	11,770.9
n	103,187	55,769	47,418	51,741	27,222	24,224	28,229	74,958

Note. OLS estimates reflect quarterly earnings gains in 2023 dollars 10 years after AA entry for CUNY students first enrolled between fall 2005 and spring 2013. Estimates are conditional on any employment in Year 10, defined as positive earnings in at least one quarter during the Year 10 window. Sample includes NYS residents who attempted at least one credit at entry, were ages 18–60 with nonmissing demographics, had no graduate enrollment, and had at least one quarter of positive NYS earnings after exit; it excludes those who transferred and earned a degree outside CUNY. OLS models adjust for demographics, first-semester characteristics, and pre-entry earnings; outcome is average quarterly earnings in Year 10. The 10-year effect is calculated as the main coefficient on degree completion, plus the coefficient on the interaction of degree completion and average time since exit multiplied by the average time since exit for completers, plus the main coefficient on time since exit multiplied by the difference in time since exit between completers and noncompleters. Standard errors in parentheses.

*$p < .10$, *$p < .05$, ***$p < .01$.

Table B4. Estimated Quarterly Earnings Gains for ASAP-Eligible Entrants, 10 Years Post-Entry, by Entry Field

	Arts & Humanities	Business	Education	Engineering	Health	Law	Natural science & math	Services	Social & behavioral sciences	Trades & repair technicians
BA + AA	3,156.1***	3,727.2***	3,319.4***	1,518.5	5,684.4***	5,891.4***	4,085.7***	3,044.6***	2,899.3***	2,830.1**
	(216.8)	(447.1)	(620.6)	(1,048.7)	(1,080.5)	(1,589.8)	(583.2)	(488.9)	(757.7)	(1,287.9)
BA	3,982.7***	4,962.9***	3,329.1	3,916.2*	2,124.62	4,862.8***	4,796.2***	3,795.8**	3,119.6	4,303.2
	(413.1)	(803.8)	(2,183.6)	(2,153.8)	(2,139.1)	(1,730.7)	(941.5)	(1,578.4)	(2,356.0)	(3,861.7)
AA	1,797.8***	1,232.2***	1,003.1**	4,219.5***	1,801.8**	2,213.9	1,618.3***	3,475.4***	1,786.2**	1,269.6
	(189.4)	(391.9)	(508.5)	(1,031.4)	(783.7)	(1,539.6)	(455.8)	(557.9)	(727.7)	(1,031.2)
Control mean	7,241.5	7,736.5	6,403.2	9,056.6	6,544.4	6,398.6	7,534.6	7,499.9	6,923.2	6,747.4
Number of graduates	5,803	1,915	414	304	233	76	1,198	836	259	173
Number of entrants	17,887	5,443	1,353	1,080	672	206	3,817	2,720	894	599

Note. OLS estimates reflect quarterly earnings gains in 2023 dollars 10 years after AA entry for ASAP-eligible CUNY students first enrolled between fall 2005 and spring 2013. Our proxy for ASAP eligibility considers students eligible if they: enrolled full-time in their first semester, attempted 1–6 remedial credits in their first term, were awarded a Pell award in their first semester, were NYC residents, and were not enrolled in ASAP-excluded majors. Sample includes NYS residents who attempted at least one credit at entry, were ages 18–60 with nonmissing demographics, had no graduate enrollment, and had at least one quarter of positive NYS earnings after exit; it excludes those who transferred and earned a degree outside CUNY. OLS models adjust for demographics, first-semester characteristics, and pre-entry earnings; outcome is average quarterly earnings in Year 10. The 10-year effect is calculated as the main coefficient on degree completion, plus the coefficient on the interaction of degree completion and average time since exit multiplied by the average time since exit for completers, plus the main coefficient on time since exit multiplied by the difference in time since exit between completers and noncompleters. Standard errors in parentheses.

*$p < .10$, *$p < .05$, ***$p < .01$.