Beyond Earnings Premia: Debt-Adjusted Returns to Postsecondary Education*

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Abstract

The rising burden of student debt calls for a reassessment of the economic returns to postsecondary education. This study estimates net returns to a range of educational credentials by integrating actual student loan payments into post-completion earnings. Leveraging linked administrative data on postsecondary enrollment and credit records, we examine outcomes for over 22,000 individuals. Using a matched difference-in-differences framework, pairing degree completers with non-completers from the same institution's metropolitan area, major, and enrollment cohort, we estimate the causal impact of credential completion on earnings net of student loan payments. We define loan-adjusted income as gross annual earnings minus observed student loan payments. On average, loan payments account for 23% of gross earnings premium in the years following completion, though this burden declines over time. Despite these costs, we find that postsecondary credentials yield substantial net earnings gains, reinforcing higher education as a worthwhile investment. We close with a discussion of implications for student loan and higher education policies.

Keywords: Returns to Education, Student Debt, Earnings Premium
JEL Codes: I22, I23, J24, J31, H52

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1 Introduction

Post-secondary education has historically been linked to increased earnings (Card, 1999). For instance, in 2022, the median annual income for a year-round worker aged 25-34 with a high school diploma was $41,800, while the earnings for the same age group with a bachelor's degree were $66,600 (National Center for Education Statistics, 2024). In addition to providing opportunities for social mobility, post-secondary education has also been linked to measures of broader community prosperity, such as new business development and job growth (Gottlieb & Fogarty, 2003). Consequently, significant public investments, including federal and state funding, have been directed towards post-secondary education institutions. However, as these investments continue to decline, more of the investments must be made directly by students, which—when accompanied by rising college costs—can lead to different return calculations on post-secondary education (Chakrabarti et al., 2020).

Here, it becomes exceedingly important to consider the opportunity costs associated with post-secondary education, particularly as it relates to time and money. For example, most bachelor's degree programs take four years to complete, and the average cost of attendance over four years for a student living on campus at a public four-year in-state institution is $108,584 (Hanson, 2025). Nearly two-thirds (62%) of college seniors who graduated in 2019 graduated with student debt, with an average of $28,950 in undergraduate student loans, marking a 56% increase since 2004 (Institute for College Access and Success, 2020). Thus, while studies on earnings premia are necessary for understanding the returns to post-secondary education, they are not sufficient. Rather, earnings premia must be considered in light of the opportunity costs. As sticker prices can be misleading (Levine et al., 2023), student debt can provide a detailed understanding the opportunity costs associated with post-secondary education.

Due to data limitations, there exists relatively little work examining the earnings premia of postsecondary education relative to debt obligations imposed on students receiving that education. Instead, much of the research on educational returns on investments use approximations and projections (e.g., internal rate of returns). However, these methods can lead to biased results when assumptions don't hold (e.g., inaccurate sticker prices) and can mask heterogeneities (e.g., various repayment plans) in the data. Our study is one of the first to leverage administrative earnings and administrative student debt data, which captures some of the true costs of post-secondary education (i.e., effective tuition and living expenses). Furthermore, unlike previous research, we examine earnings premia from post-secondary education across different degree levels and programs, ranging from undergraduate certificates and associate's degrees to master's and doctoral degrees. Here, we recognize that students are often choosing between a growing range of post-secondary options, and thus focusing on a particular degree level in isolation can lead to narrow counterfactuals that may not represent the full scope of the returns to post-secondary education. Most notably, by exploring a range of degree levels, we are able to better capture the other opportunity cost consideration–time, as different levels of post-secondary education require different amounts of time to complete (Jabbari et al., 2025). Moreover, given the ways in which the returns to post-secondary education can vary across the type of institution (Dale & Krueger, 2014) and the selected major (Andrews et al., 2024), we leverage administrative education data to match degree completers with comparable non-completers from the same enrollment year, same field of study, and institutions in the same region.

2 Literature Review

Those who attend college can expect to earn more over their careers than workers who do not (Hershbein & Kearney, 2023; Oreopoulos & Petronijevic, 2013), though earnings premia vary by institution, degree level, major, demographic characteristics, economic conditions, and ability. For example, men and those who identify as White or Asian have higher earnings six years after completing college (Blagg & Blom, 2018); those with Bachelor's degrees have higher earnings than those with Associate's degrees; and those with science, technology, engineering, and math (STEM) and business majors have higher than those with other majors (Itzkowitz, 2023; Oreopoulos & Petronijevic, 2013; Webber, 2016). Furthermore, graduates of selective four-year institutions earn more than those of less selective ones (Lovenheim & Smith, 2022), especially Black and Hispanic students and those whose parents have lower educational attainment, though this difference is diminished when controlling for student ability (Dale & Krueger, 2014).

Research examining the relationship between earnings and degree completion are plagued by the problem of selection: those who select into higher education versus not may have underlying differences in motivation, aptitude, and other unobserved factors. Thus, researchers have used a variety of methods such as instrumental variables, regression discontinuity designs, and comparing those who earned a degree to those who did not but had the same amount of education (Lovenheim & Smith, 2022). Indeed, earnings premia tend to be lower when including non-completers (Delisle & Cohn, 2024) and when controlling for student ability. In the following section, we review the literature on educational returns for various degree types.

2.1 Returns to Non-Degree Credentials

There is a small but growing body of research suggesting positive impacts of non-degree credential and certificate programs. Generally, these programs focus on employer-aligned skills and offer credentials or certificates at community colleges. Leveraging a sample of over 230,000 students from 23 community colleges in Virginia and in 58 community colleges in North Carolina, Xu & Trimble (2016) used fixed effects modeling strategies and found positive impacts of sub-baccalaureate certificates on both earnings and employment status. Similarly, leveraging a sample of nearly 51,000 students from technical and community colleges in Ohio, Bettinger & Soliz (2016) found positive impacts of sub-baccalaureate programs on earnings. Bettinger & Soliz (2016) also observed heterogeneous effects across gender: men benefited more from short-duration certificates, while women benefited more from long-duration ones. Leveraging administrative data from Kentucky, (Jepsen et al., 2014), also found heterogenous effects across gender: Associate's degrees had higher earnings returns for women. Finally, in a study of Community College students in Ohio, Minaya & Scott-Clayton (2022) found that while the returns to an associate degree grow substantially over time, the returns to a long-term certificate remained flat.

2.2 Returns to Two-year College Degrees

Research has also examined the returns to two-year colleges. Compared to workers with a high school diploma, workers with an Associate's degree can expect to earn 34% more over their careers compared to high school diploma holder and 15% more compared to those with some college, but no degree (The Hamilton Project, 2020). Earnings premia of associate's degrees vary based on certain factors. Pan (2025) found that working for a higher-paying company accounts for about a quarter of the associate's degree premium while Jacobson et al. (2005) found higher premia for

STEM-related compared to less technical coursework (e.g., humanities, social sciences).

Yet returns to two-year college are not limited to degree completion. Over their careers, workers with some college will earn 17% more than workers with a high school diploma (Hamilton Project, 2020). Liu et al. (2015) found that just completing 1 to 10 credits from a community college was associated with increased earnings compared to having enrolled but not completed any credits, while Jacobson et al. (2005) found increased earnings based on one year of community college attendance among workers who were laid off. Mountjoy (2022) used distance to two- and four-year colleges and universities among high schoolers in Texas as instruments, finding that around age 30, those who attended two-year colleges experienced a 22% earnings premium compared to those who did not attend, with greater outcomes among women and those from lower-income households. However, the author estimates that roughly a third of these attendees were diverted from four-year institutions and thus experienced lower levels of educational attainment. However, earnings premia comparisons between community college degrees and degrees from four-year colleges and graduate programs do not account for the fact that tuition is often much lower at community colleges. There is limited research factoring in the opportunity costs in terms of debt and time to degree completion to estimates of earnings premia from these degrees.

2.3 Returns to Four-Year College Degrees

There is a large body of research that examines the returns to four-year colleges. Over their lifetime, people with Bachelor's degrees can expect to earn double that of workers with high school diplomas and $335,000 more than workers with an Associate's degree (Hershbein & Kearney, 2023). Adjusting for ability and selection, Lobo & Burke-Smalley (2018) estimate a median lifetime earnings increase $739,598 across all college majors. Zimmerman (2014) used a regression discontinuity design around admissions criteria cutoffs to assess earnings premia among marginal students compared to students denied admission but with similar academic profiles, finding that students who attended a four-year college experience 22% higher earnings several years after graduating from high school. Mountjoy (2024) uses a similar design to assess earnings premia around admission cutoffs, but with a much larger sample than Zimmerman (2014). Marginally admitted students experience earnings premia of 5 to 10 percent, relative to rejected peers, though it takes eight years after application for this difference to emerge. Ost et al. (2018) also used regression discontinuity around the Grade Point Average (GPA) cutoff for dismissal from four-year institutions. Dismissed students saw a short-term increase in earnings and tuition savings, but low-performing students who persisted recouped their investment (tuition, deferred earnings) after eight years. Growth in earnings gaps between college and high school graduates have slowed over the past few decades and remained unchanged since 2000 (Valletta, 2018). Indeed, Bleemer & Quincy (2025) found that four-year college earnings premia among low-income students has dropped by half since 1960, which the authors attribute to lower investment and quality in teaching-focused institutions disproportionately attended by low-income students, lower likelihood of enrollment in high-earnings majors relative to higher-income peers, and the diversion of low-income students into for-profit colleges.

Research has also examined variation in earnings premia based on institutional factors. Dale & Krueger (2014) found that earnings premia associated with the selectivity of the institution dissipate after controlling for students' pre-college characteristics such as standardized test scores and family income. Mountjoy & Hickman (2021) compared outcomes among four-year college graduates in Texas who attended different institutions but were admitted by the same set of institutions ("admission portfolios") to assess the roles of selectivity and institutional investment. Within admission portfolios, graduates experience an earnings premium based on selectivity that disappears after the initial few years post-attendance, while earnings premium based on instructional spending per student and faculty characteristics (e.g., proportion who are full-time and/or are tenured or on the tenure track) persisted. While these findings suggest that institution selectivity does not substantially impact future earnings, Ge et al. (2022) find selectivity effects on earning premia for women by their late 30s, but not men.

Given the opportunity costs of four-year college programs—both in terms of time and tuition—there is a recognition that earnings premia should be considered relative to the cost of attending college and the impact of student debt. In this regard, Hershbein & Kearney (2023) found that under standard 10-year repayment plans, loan payments will eat up over 10% of median earnings in the first two years and just under 8% six years after graduation, with higher burdens among those with degrees in the arts and humanities compared to STEM. Correcting for student ability and graduation uncertainty, Webber (2016) estimates that the net present value of a college degree at age 65 range from about $85,000 to $300,000, depending on major, with breakeven points ranging from age 30 to age 50 depending on college costs. However, for students with lower ability who face high college costs the breakeven point will not materialize until much later in life.

Beyond lifetime cost-adjusted earnings, studies also examine internal rates of return (IRRs). As noted by Zhang et al. (2024), the IRR calculation simultaneously considers both the lifetime costs of post-secondary education (e.g., tuition and forgone earnings) and the benefits of post-secondary education (e.g., higher earnings) by discounting future costs and benefits to their present value. In this regard, Lobo & Burke-Smalley (2018) estimate an annual internal rate of return (IRR) of 9.95% for completing a bachelor's degree relative to a high school diploma, factoring in tuition, books, forgone earnings, and student debt. IRRs are higher for those who attended public universities in-state and among certain majors, such as engineering and finance; IRRs are lower when students take longer than four years to graduate. The authors also found a net gain in IRR of 0.84% for debt- versus self-financed post-secondary education. Zhang et al. (2024) found IRRs of 9.88% and 9.06% for women and men, respectively, using median earnings and their preferred set of assumptions regarding cost estimates of tuition and books, as well as a 50% non-tuition costs and a 0.25 selection adjustment. Across majors and student demographic groups, IRRs range from a low of 3.25% for White men in education to a high of 21.01% for Hispanic women in engineering and in general were slightly higher for students of color.

2.4 Returns to Graduate and Professional School

Finally, some research exists on the returns to graduate and professional school. Research evidence broadly suggests that compared to having a bachelor's degree, graduate or professional school results in higher earnings. Median annual earnings in 2022 of workers with a master's, doctoral, and professional degree were $92,000, $126,000, and $130,000, respectively, compared to $78,000 for a bachelor's degree. Annual earnings returns have been estimated at 7%, 13%, and 17% for Master's, Ph.D., and Professional degrees, respectively (Song et al., 2008). Additional research has examined heterogeneities in returns. For example, Minaya et al. (2024) estimated a 14% return for a Master's degree in Ohio, though women and White graduates experienced higher returns than men and Black graduates. Furthermore, Titus (2007) found returns only for certain fields like business and education.

Similar to bachelor's degrees, the cost of attending graduate or professional school should be considered relative to earnings gains. Given relatively high tuition costs, student debt is a particularly important cost consideration in graduation and professional education. Indeed, more than twice the percent of graduate students hold student debt than undergraduate students Hanson (2025). Moreover, net tuition costs for graduate degrees tripled while median student debt rose by 47% from 2000 to 2020 (Gulish et al., 2024). The proportion of student debt held by students in Master's degree programs jumped from 18% in 1996 to 28% by 2016 while the proportion of debt held by students in Bachelor's degree programs declined by six percentage points over this period (Pyne & Grodsky, 2020). Women, Black and Hispanic students, and lower-income students are more likely to take on student loans to pay for graduate education than their counterparts. While earnings premia of graduate relative to undergraduate degrees are higher for Black, and in most cases, Hispanic graduates compared to White graduates, real wages are higher among White and Asian American graduates at all levels of educational attainment (Pyne & Grodsky, 2020).

Relative to a Bachelor's degree, Gándara & Toutkoushian (2017) estimated an IRR of 4.62%, with a lifetime net present value of $116,000. However, these outcomes improved considerably for students who received financial aid to cover tuition and worked full-time while in graduate school, eliminating opportunity costs of foregone earnings. Altonji & Zhong (2021) controlled for combinations of undergraduate and graduate degrees to examine IRRs across 121 graduate and professional degrees and 18 fields, finding an average IRR of 16.1% and higher returns for medicine, law, and Ph.D. in Pharmacy degrees than for master's degrees in various fields. The authors also found that IRRs are higher for women and vary by undergraduate major. Subtracting tuition from earnings and assuming that students have no earnings while in graduate or profession school, Altonji & Zhong (2021) produce a set of IRR estimates that range from a high of 26.6% for a master's degree in biological, agricultural, environmental or life sciences to a negative IRR for master's degrees in the humanities. Medicine and law degrees had IRRs of 16% and 14.8%, respectively while an MBA had an IRR of only 5.9%.

3 Contribution

There are three major gaps in the literature that our study aims to fill. First, much the research focuses exclusively on a single degree level (e.g., Bachelor's degree), which fails to consider the wide variety of post-secondary options that exist both below and above a bachelor's degree. Indeed, students often choose from a range of post-secondary options throughout the life course. We fill this gap by leveraging administrative data on non-degree credentials, associate's degree programs, bachelor's degree programs, master's degree programs, and doctoral programs from the National Student Clearinghouse. Second, previous research has often employed fixed-effect models that lack a comparison group, which can lead to significant sources of selection bias. This can be particularly problematic given the variations in earnings premia across degree programs. We fill this gap by matching treated students with students from the same region who started, but did not complete a similar degree program. We also include a measure of academic preparation through high school fixed-effects, which can help limit the selection bias associated with non-completion. Third, and most importantly, much of the previous literature considers earnings premia, which can mask the opportunity costs often associated with post-secondary education. While there is a growing body of research that attempts to factor in some of these costs, these are often approximated and projected (e.g., internal rate of returns), which can lead to biased results when assumptions don't hold and may mask heterogeneities in the impacts of degree and credentials. Indeed, sticker prices are often misleading, and other costs can vary across both student and institutional characteristics. We fill this gap by leveraging administrative data on both earnings and student debt from a large credit bureau. This allows us to create an observed, novel measure of debt-adjusted earnings, which—when accompanied by longitudinal earnings—serves as an improved return on investment (ROI) measure. Here, student debt more accurately captures some of the true costs of post-secondary education (i.e., effective tuition and living expenses).

Adding to already high levels of internal and external validity, we leverage a sample of students with employed in four major industries – Manufacturing (NAICS 31–33), Professional, Scientific, and Technical Services (NAICS 54; hereafter STEM), Educational Services (NAICS 61), and Health Care and Social Assistance (NAICS 62) – within nine Metropolitan Statistical Areas representing each region of the U.S. Further, we leveraging advanced modeling strategies that allow for heterogeneities and dynamic effects to be estimated (Sun & Abraham, 2021). This study builds on prior works, which found that earning premia for Bachelor's, Master's, and Doctorate degrees appear to exceed earnings premia for those who completed an Associate's degree beyond the additional time it takes to complete to complete these programs (Jabbari et al., 2025).

4 Data, Sample, and Measurement Construction

Our study draws on two primary data sources: individual-level education records from the National Student Clearinghouse (NSC) and linked credit data—including student loan information—from one of the three major U.S. credit bureaus. The NSC data provide detailed information on individuals' program enrollment and exit dates (whether by completion or discontinuation), the Classification of Instructional Programs (CIP) codes, and the institutions offering the programs. The linked credit data include year-month records of new student loan disbursements from 2013 onwards, as well as detailed information on individuals' income and employment history from

2017 to 2024.

4.1 Analytical Sample

To ensure broad geographic and industry representation, our main sample consists of individuals who were employed in 2023 in one of nine MSAs: San Francisco-Oakland-Berkeley, CA; Denver-Aurora-Lakewood, CO; Austin-Round Rock-Georgetown, TX; St. Louis, MO-IL; Chicago-Naperville-Elgin, IL-IN-WI; Nashville-Davidson-Murfreesboro-Franklin, TN; Boston-Cambridge-Newton, MA-NH; Philadelphia-Camden-Wilmington, PA-NJ-DE-MD; and New York-Newark-Jersey City, NY-NJ-PA. Additionally, we restrict the sample to individuals working in one of four major industries in 2023, as defined by three-digit NAICS codes: Education, Manufacturing, STEM, and Health Care.

Our main sample period spans from 2017 to 2024. To ensure sufficient observation of pre- and post-treatment outcomes, we further restrict the sample to individuals who enrolled no later than the 2018 calendar year and graduated by 2023, allowing for at least one full year of data before and after treatment.

The treated group comprises individuals with a non-missing degree completion date in the NSC data. The comparison group (consideration set) includes individuals who lack a degree completion date following program enrollment and are recorded as having exited the program due to dropping out. To improve the comparability between the treated and comparison groups, we further construct the comparison group using a five-to-one nearest neighbor matching strategy, pairing each non-completer with at most five similar completers. The use of five-to-one matching strategy is due to the relative scarcity of control units (i.e., non-completers), the approach would maximize our treated sample size and thereby enhance the statistical precision and power for detecting treatment effects. The matching criteria are based on the calendar year of program enrollment, the two-digit CIP code, and the MSA of the enrolled institution. The CIP code is a standardized taxonomy used by the U.S. Department of Education to classify academic programs by field of study. We use the two-digit level of the CIP code to approximate students' major fields, enabling us to match individuals enrolled in broadly similar areas of study. This ensures that comparisons are made among individuals pursuing comparable academic tracks, thereby reducing bias due to heterogeneity in program content or labor market alignment. These variables are exact-matched within each stratum, as illustrated in Appendix Figure A1. On average, each comparison individual is matched to two treated individuals. After implementing these steps, we obtain 22,271 unique individuals, consisting of 15,479 degree completers and 6,792 matched non-completers.

Table 1 presents summary statistics on demographic, geographic, industry, and financial characteristics by credential type (UC, AA, BA, MA, and DOC) and treatment status (completers vs. non-completers). Average age varies from 26 years (BA completers) to 32 years (DOC non-completers). White individuals constitute the largest racial group across all credential levels, particularly at higher degrees. Female representation exceeds male in most groups, ranging from 42.82% to 65.97%. Chicago and New York emerge as prominent MSAs, especially among UC and BA/MA recipients. Healthcare is the dominant employment sector, particularly for completers (e.g., 76.21% among UC completers), followed by Education. Student loan prevalence spans from 15.18% (UC completers) to 52.37% (BA completers), with both gross income and loan payments increasing with credential level: from $30,152.67 (UC non-completers) to $73,880.46 (DOC non-completers). Overall, the summary statistics indicate a reasonable degree of covariate balance between treated and control groups within each credential category across most observed characteristics.

4.2 Key Measurement

In this subsection, we briefly describe our key measures, including (1) credential-specific loan amounts, (2) gross annual income, (3) annual student loan payment, (4) loan-adjusted annual income, and (5) other relevant measures.

[Credential-Specific Loan]. From the NSC dataset, we first identify each individual's program enrollment and termination year-month (either degree completion or dropout time). We then identify the timing of each new loan using the *reset* time for the most recent age of the newest student loan from the linked credit bureau dataset. We then map each loan to a credential for each individual, allowing for a tolerance of ± 6 months. Specifically, if a new loan is recorded within 6 months before the enrollment year-month or within 6 months after the termination, it is assigned to that degree.[1] Since multiple loans may be mapped to a single credential, we aggregate the total credential-specific loan amount for each individual.

[Gross Annual Income]. From the credit bureau dataset, we observe each individual's cumulative gross income at the year-month level. This measure includes regular income, bonuses, overtime pay, commissions, and other income from all active jobs. To construct the total gross annualized income, we use the income reported at the end of each calendar year.

[Annual Student Loan Payment.] For individuals with positive credential-specific student loan amounts, we construct two complementary annual payment measures. Our preferred measure is the observed student loan payment, aggregated at the individual-year level using credit bureau data. As a lower-bound estimate, we also calculate an amortized annual payment based on the

[1] This mapping remains largely unaffected when using a tighter time tolerance bandwidth.

following standard formula:

$$M = \frac{r \cdot P}{1 - (1 + r)^{-n}}$$

where M is the monthly payment (with the annual payment equal to $12M$), P is the credential-specific loan principal, r is the monthly interest rate (i.e., annual rate divided by 12), and n is the total number of payments (i.e., years times 12).

Assuming a standard 10-year repayment term ($n = 120$) and an average annual interest rate of 4% ($r = 0.04/12$), we compute the amortized annual student loan payment for each individual. This approach assumes borrowers make minimum payments sufficient to fully repay the loan by the end of year 10. Importantly, for the amortized approach, we assume that repayment begins in the year following graduation.[2]

[Loan-Adjusted Annual Income]. Our preferred measure is calculated as the difference between an individual's observed annual gross income and their observed annual student loan payments, both derived from the credit bureau dataset.

[Other Measures]. High school codes are available for approximately 50% of our sample through the NSC data. We supplement this with information on individuals' industry of employment and geographic location, as well as demographic characteristics (age, gender, and race), all obtained from the credit bureau data. These measures are merged to construct our final analytic dataset.

[2]The average federal student loan interest rate ranged from 3.5% to 4.5% between 2013 and 2018; see Federal Student Aid (2024).

5 Empirical Strategy

We use the matched sample to estimate the return to credentials. Specifically, we estimate a difference-in-differences model to identify whether return to credential changes in response to degree completion compared to non-completion (e.g., dropouts). Define the indicator $D_{icjmthp} = 1$ if the calendar year t is greater than or equal to the credential enrollment year for individuals in the treated group, and $D_{icjmthp} = 0$ otherwise, that is, during the pre-treatment period and for all matched control individuals (this is effectively the treatment-by-post dummy). We then estimate the effect of $D_{icjmthp}$ on individuals with the following model:

$$y_{icjmthp} = \beta D_{icjmthp} + \eta_p + \tau_t + \gamma \mathbf{X_{icjmthp}} + \epsilon_{icjmthp} \tag{1}$$

The outcome variable $y_{icjmthp}$ represents either gross annual income or income adjusted for student loan payments for individual i, who is enrolled in credential program c, employed in industry j, working in MSA m, observed in calendar year t, graduated from high school h, and belongs to matching stratum p. We estimate a two-way fixed effects (TWFE) model that includes matching stratum fixed effects η_p, to control for unobserved, time-invariant heterogeneity within each stratum, and calendar year fixed effects τ_t, to account for aggregate shocks common to all individuals in year t. The vector of covariates $\mathbf{X}_{icjmthp}$ includes fixed effects for: (1) credential program, (2) employment industry (2-digit NAICS code) and employment MSA, to control for industry- and region-specific earnings factors, (3) race and gender, and (4) indicators for degree completion (treated) and for program exit (equal to 1 if the individual graduates or drops out). Our preferred specification also includes a linear control for age. Standard errors are clustered at the matching stratum level to adjust for potential within-group correlation in the error terms.

Our coefficient of interest is β, which estimates the return to credential. The identification assumption requires that, in the absence of enrollment, there are parallel trends in the potential outcomes for degree completers and non-completers.

To explore the validity of this assumption, we estimate an event study design (using Sun & Abraham 2021) to examine whether trends appear similar in the calendar years leading up to enrollment. We define $V_{icjmthp}$ as the treatment indicator for each individual that equals 1 for degree completers. Using the following specification,

$$y_{icjmthp} = \alpha + \sum_{e=-5}^{5} \beta_e (V_{icjmthp} \times \mathbb{1}[E_{icjmthp} = e]) + \eta_p + \tau_t + \gamma \mathbf{X_{icjmthp}} + \epsilon_{icjmthp} \tag{2}$$

we identify a separate coefficient, β_e, for each event-time indicator E that captures the differences in income measures between completers (treatment group) and matched non-completers (comparison group) across six calendar years before and after enrollment. We include the same set of fixed effects as in Equation (1), and standard errors are clustered at the matching strata level.

Although the exact matching procedure yields closely matched groups, a potential concern with using matching stratum fixed effects, rather than individual fixed effects, is that the former may not fully account for unobserved individual heterogeneity. To evaluate the robustness of our main specification, we also estimate a modified TWFE specification that incorporates individual fixed effects, allowing us to control for time-invariant unobserved characteristics at the individual level and assess the sensitivity of our results to alternative identification and estimation strategies.

6 Results

6.1 Descriptive Evidence

Figure 1 displays the distribution of post-graduation and post-dropout income for all individuals in our sample. The average annual gross income is $48,364, while the average loan-adjusted income is $46,645, implying an average annual student loan payment just under $2,000. Appendix Figures A2 through A4 disaggregate the income distribution by degree level, industry, and race. Within the degree breakdown, we observe: (1) a clear upward trend in average income from UC and AA to BA and postgraduate degrees; and (2) negligible differences between gross and loan-adjusted income for UC and AA holders, while BA, MA, and doctoral degree holders show gaps of at least $2,000, with the largest gap among doctoral recipients. In the industry breakdown, Manufacturing and STEM fields yield the highest average incomes, with STEM also showing the highest average student loan payments. Finally, in the racial breakdown, Asians have the highest average income, followed by Whites. However, Whites incur the highest average student loan payments.

6.2 Main Results

Table 2 presents baseline TWFE regression results, with increasing fixed effects stringency from columns (1) to (4). Panel A reports the coefficients on Treat × Post using gross income as the outcome, while Panel B uses loan-adjusted income. Each coefficient comes from a separate regression. The estimated returns to degree completion remain consistent across specifications, suggesting that conditioning on enrollment status yields credible comparison groups. Because we include credential fixed effects, the coefficient represents a weighted average return across the five degrees (i.e., UC, AA, BA, MA, and Doc). In our preferred specification (column 4), the estimated gross return to education is \$10,422.50, while the loan-adjusted return is \$7,987.50—implying that student loan payments account for roughly 23% of total gross returns.

Figure 2 displays event-study plots estimating the dynamic effects of degree completion on gross income and loan-adjusted income, respectively. Using the year prior to degree completion as the treatment onset, the estimates are obtained from Equation (2) and follow the methodology of Sun & Abraham (2021) to account for dynamic treatment bias. The plots indicate that both groups exhibit parallel income trends prior to degree completion. In the year of completion ($t = 0$), the treated group (degree completers) experiences a significant decline in income relative to the matched comparison group (non-completers). Beginning in the year following completion ($t = 1$), the treated group's relative income rises significantly. Consistent with the TWFE results, the post-completion gains in relative income more than offset the temporary dip at $t = 0$, resulting in a positive and statistically significant average treatment effect on the treated (ATT).

6.3 Heterogeneity Analysis

The aggregate TWFE and event-study analyses indicate a statistically significant return to education, with annual student loan payments accounting for approximately 23% of total returns. To deepen our understanding, it is important to examine the heterogeneity of these estimates across observable subgroups. In particular, we explore how returns to education vary by degree type, industry of employment, and race, and whether the share of student loan payments relative to total gross returns differs across these groups.

Tables 3 to 5 present the heterogeneous returns to education by degree type, industry of employment, and race, estimated using both the standard TWFE model and our preferred specification. Appendix Figures A5 to A7 present the event-study plots for each subgroup estimated using Sun & Abraham (2021). Among degree types, we find the highest average return for individuals with an MA degree, followed by those with a BA and then an AA. Due to limited statistical power, the estimated return for UC degrees is positive but not statistically significant. Similarly, we do not find significant returns for doctoral degree completers, which may reflect both the limited sample size and the distinct career trajectories of doctoral graduates. When accounting for student loan payments, the highest loan-adjusted return is observed for BA completers, followed by MA and then AA degree holders. Again, the estimated returns for AA and doctoral degree holders are not statistically significant. On average, student loan payments represent approximately 9% of the gross return for AA completers, 19% for BA completers, and a striking 57% for MA completers.

Across industries of employment, we find consistent evidence—based on both gross and loan-adjusted income—that individuals working in STEM fields experience the highest returns to education. The average gross return in STEM is $23,083.6, with a loan-adjusted return of $18,515.7, more than twice that of the next highest-returning industry, Manufacturing. Workers in Health Care and Education also see, on average, positive returns, even after accounting for student loan payments. On average, student loan payments represent approximately 20% of the gross return for those in STEM, 19% for Manufacturing, 26% for Education, and 22% for Health Care. The relatively high loan burden in the Education sector is not surprising, as individuals in this field are more likely than those in other industries to qualify for federal loan forgiveness programs, which makes them more willing to take on larger loans.

Across racial groups, gross returns to education are relatively similar for White, Black, and Asian individuals, with Asians exhibiting the highest return at $11,981.7. In contrast, Hispanic and individuals categorized as Other report significantly lower gross returns, at \$6,505.4 and \$6,668.4, respectively. On average, student loan payments account for approximately 28% of the gross return for White individuals, 21% for Black, 34% for Hispanic, 23% for Asian, and 20% for Other. Notably, Hispanics face both the lowest gross returns and the highest relative burden from student loan payments—a concerning pattern that suggests potential disparities in educational returns.

6.4 Robustness

In this subsection, we evaluate the robustness of our estimates using three complementary approaches: (1) alternative empirical specifications; (2) alternative sample selections; and (3) alternative outcome measures. In addition, we also report the Sun & Abraham (2021) ATT ($Treat \times Post$ (D, SA) alongside with the standard TWFE estimated coefficients.

Table 6 presents results from three estimation strategies: the baseline specification (columns (1)–(2)), models with individual fixed effects (columns (3)–(4)), and models with high school fixed effects (columns (5)–(6)). Appendix Figures A9 and A10 present the event-study plots for the two alternative specifiations. As discussed in Section 5, replacing matching strata fixed effects with individual fixed effects helps control for unobserved, time-invariant individual-level heterogeneity. The TWFE estimates in columns (3) and (4) remain broadly consistent with the baseline. However, the Sun & Abraham (2021) ATT estimates are nearly twice as large as the corresponding TWFE coefficients, indicating the presence of heterogeneity with growing treatment effects—especially when comparisons are restricted within individuals. This issue is less pronounced when comparisons are made within matching strata. Despite the divergence in estimated returns, the student loan payment burden remains similar across both strategies: approximately 20% of gross returns under TWFE and 25% under the Sun & Abraham (2021) estimator. In columns (5) and (6), we restrict the sample to individuals with matched high school codes and estimate a modified version of equation (1) that includes high school fixed effects, aiming to control for high school quality as a proxy for individual ability. These estimates also align closely with the baseline results.

Table 7 presents results based on three distinct samples: (1) the full baseline sample; (2) a subsample in which both treated and control groups have student loans associated with the enrolled degree; and (3) a subsample in which neither group has student loans. Figure 3 presents the event-study plots for this set of subsample analyses. The purpose of analyzing the "have loan" subsample is to restrict attention to individuals for whom loan-adjusted income is directly relevant. In contrast, the "no loan" group serves as a placebo test, allowing us to assess differences between gross and loan-adjusted returns in the absence of active student loan repayment. Columns (3) and (4) report the gross and loan-adjusted returns to education for individuals with non-negative student loan balances tied to the specific enrolled degree. As expected, the estimated loan burden is higher in this group—approximately 36%—under both the TWFE and Sun & Abraham (2021) specifications. This compares to a burden of 20%–24% in the baseline sample, which includes individuals without student loans. Columns (5) and (6) report the corresponding estimates for the "no loan" group. By construction, the estimated loan burden is negligible; any slight differences between gross and adjusted returns are likely attributable to residual payments from prior student loans unrelated to the degree under analysis.

Table 8 and Appendix Figure A10 present results using an alternative loan-adjusted income measure constructed based on a 10-year amortization schedule. The implied annual payment under this approach reflects a "best-case scenario," in which the individual repays the full loan exactly ten years after graduation at a reasonable interest rate. Conceptually, this amortization-based adjustment should produce estimated returns that lie between the gross return and the observed loan-adjusted return based on actual repayment behavior. As shown in Table 8, this expectation holds: the estimated return based on the amortized loan payment falls squarely between the gross return and the observed loan-adjusted return. These findings reinforce the robustness of our loan-adjusted income measure across alternative repayment assumptions.

7 Discussions

Post-secondary education has been associated with a host of pecuniary (Card, 1999) and non-pecuniary returns (Chun et al., 2024) that extend to both degree earners as well as those in their communities (Russell et al., 2024). However, as public investments in post-secondary education, particularly federal and state funding, continue to decline (Sav, 2016), more of the investments must be made directly by students. When these shifts are accompanied by rising college costs, return calculations on post-secondary education must be re-evaluated (Chakrabarti et al., 2020). Indeed, given the large increase in student debt and the various hardships associated with this debt (Jabbari, Despard, et al., 2023), policy-makers and stakeholders—including the Federal Reserve Bank of New York—have asked if college is still worth the costs (Abel & Deitz, 2025). However, in order to answer this question, we consider both the benefits and costs of post-secondary education.

Thus, we provide one of the first studies that leverages administrative earnings and student debt data from a large credit bureau. Specifically, we create a novel, observed measure of debt-adjusted earnings that, when measured over time, serves as an improved return on investment (ROI) calculation. Furthermore, recognizing that students are often choosing between a growing range of post-secondary options, we do so across a range of different degree levels and programs. As different levels of post-secondary education require different amounts of time to complete, we are able to better capture the other major opportunity cost—time. Moreover, given the ways in which the returns to post-secondary education can vary across the type of institution (Dale & Krueger, 2014) and the selected major (Andrews et al., 2024), we leverage administrative education data from the National Student Clearinghouse to match completers with similar non-completers attending the same institution and pursuing the same major. As non-completers may have various unobserved factors leading them to non-persistence, we also include a measure of academic preparation through high school fixed effects, which can help limit some of the selection bias associated with non-completion. Indeed, high schools have been associated with post-secondary persistence in various studies (e.g., Niu & Tienda 2013).

7.1 Summary of Findings

In general, we find that post-secondary education has substantial returns that far exceed the costs. On average, completers earn roughly $10,400 more than similar non-completers, which drops to roughly $8,000 when factoring in observed student debt payments. While debt-adjusted earnings are still substantial, it's worth noting that student debt accounts for a relatively large proportion of earnings premium, at 23%. Nevertheless, from our event-study results, we also see that the proportion of student debt gets smaller over time, mostly due to increased earnings among completers. Moreover, it's worth noting that over an extended period of time student debt will eventually be paid off, eliminating the earnings adjustment. Our results are robust to a variety of alternative specifications, including a model which includes high school fixed effects, which can be seen as partially accounting for potential selection bias resulting from non-completion (i.e., as high schools have been demonstrated to be strong predictors of post-secondary persistence).

We also examine a variety of heterogeneities through subsample analyses. While sample sizes decrease in our subsample analyses, limiting statistical power in some cases, these analyses provide important insights into earnings premia. Similar to our previous research, we find greater returns for higher degrees (i.e., greater returns for masters degrees, followed by bachelor degrees, and associate degrees). However, the proportion of student debt varies substantially across degree types: student loans represent only 9% of earnings premia for associate's degrees, which is within the suggested range. For bachelor degrees, this proportion roughly doubles to 19%; however, for master's degrees, this proportion is 57%, representing a substantial drag on earnings. However, this drag may be shorter-lived, as masters degree completers appear to close the gap between gross earnings and debt-adjusted earnings more quickly than other groups, seemingly because of increased earnings trajectories. It's also worth noting that while non-degree credentials lack statistical significance, they exhibit some of the smallest proportions of student debt, potentially highlighting their unique value. Additional research is needed to explore these credentials. We observe earnings that differ greatly across industries, as well. STEM earnings are roughly 2-3 times that of manufacturing, healthcare, and education, yet have relative student loan payments that are among the lowest. While education has the largest proportion of student loan payments relative to earnings, it's worth noting that professionals in this field are often eligible for special loan forgiveness programs.

Additionally, concerning racial/ethnic groups, Hispanic students have the lowest earnings premia and the highest portion of student debt, highlighting a troubling inequality. While different major choices and discriminatory practices in the labor market could lead to lower earnings, language barriers and access to information may lead to higher rates of student debt. More research is needed to further unpack these inequalities. Finally, we examine groups based on student loan presence to understand additional comparison groups. While we do observe relatively smaller loan-adjusted incomes when compared to non-completers without student loans, these returns are still substantial, suggesting that the returns for post-secondary education does not only reflect comparisons to non-degreed-debt. Rather, our results suggest that it's better to take on student loans to complete post-secondary education than to not complete post-secondary education without student loans.

7.2 Limitations

While our study offers one of the first nationwide examinations of debt-adjusted earnings premia for a variety of degree and non-degree programs across multiple industries, it is not without limitations. Concerning external validity, our sample originated from a large credit bureau, and although earnings data is extensive, it is not exhaustive, as it is primarily derived from payroll information. In this regard, self-employed individuals may not be adequately represented in our study. It is also important to note that our sample consisted of individuals with observed income in 2024; as this does not include individuals who were unemployed throughout the entire year, it may not be representative of the entire adult population. Our estimates may be considered conservative in this regard, as it examines the debt-adjusted earnings of those who were employed at some point after exiting post-secondary education (thereby excluding individuals who were unemployed throughout the year). In addition, we only consider individuals working in four specific industries, which may not be representative of the broader workforce.

Concerning internal validity, we provide a variety of different estimation techniques, including traditional fixed-effect models, as well as advanced difference-in-difference methods, such as those developed by Sun & Abraham (2021), which can better identify heterogenous and dynamic treatment effects. Our use of high school fixed effects represents an advancement to prior work, as it can help guard against some of the potential selection bias inherent in comparisons with non-completers. Nevertheless, there may be other, unobserved factors related to non-completion that we cannot account for. Thus, future research should leverage additional data (e.g., high school transcripts) to better account for potential biases arising from non-completion.

7.3 Implications

These findings have significant implications for public policy. Our research demonstrates that while student loans can limit the earnings premia associated with post-secondary education, on average post-secondary education is still a worthwhile investment. Thus, policy-makers should consider maintaining, and, in some cases, expanding student loan opportunities. Given our findings on non-degree credentials, student loans should expand to include these programs as well. Furthermore, as debt-adjusted earnings for graduate education were among the largest, greater efforts should be made to expand student loans to graduate students. However, the One Big Beautiful Bill Act (OBBBA) signed into law on July 4, 2025 eliminates the grad PLUS loan program and places borrowing caps loans for graduate and professional degree programs (Cohn, 2025).

Concerning institutional accountability, OBBBA establishes the Earnings Premium metric which means colleges and universities whose graduates do not have median earnings greater than those who did not earn a degree will lose access to federal financial aid for students, expanding the Biden-era Gainful Employment rule which was limited to for-profit colleges and universities and certificate programs at any type of institution. Implementation details are left up to the Department of Education, such as how to measure median earnings (McGrath et al.,

2025) and how to measure debt. For example, whether an institution passed or failed the debt-to-earnings test depends on whether non-tuition expenses are included or excluded from debt amounts (Delisle & Cohn, 2025). Our previous research demonstrates that on average graduates' earnings exceed those who did not earn a degree; and our current research lends further support to the value of post-secondary education, given the significant debt-adjusted returns, which account for actual debt amounts that reflect borrowing for living expenses, not just tuition and fees. However, our results also complicate these policies, as earnings trajectories–not levels at a given point of time–appear to be most important in demonstrating the value of post-secondary education. Moreover, our findings demonstrate that the value of post-secondary education is heavily dependent on major (e.g., STEM), which has less to do with institutions.

Concerning institutional accountability, OBBBA establishes the Earnings Premium metric which means colleges and universities will lose access to federal financial aid for degree programs in which graduates do not have median earnings greater than those who did not earn a degree. This provision expands the Biden-era Gainful Employment rule which was limited to for-profit colleges and universities yet exempts undergraduate certificate programs. Implementation details are left up to the Department of Education, such as how to measure median earnings (McGrath et al., 2025) and how to measure debt. For example, whether a degree program passed or failed the debt-to-earnings test depends on whether non-tuition expenses are included or excluded from debt amounts (Delisle & Cohn, 2025). Our findings show significant debt-adjusted returns, accounting for actual (not imputed) debt amounts that reflect borrowing for living expenses, not just tuition and fees. Few degree programs fail to meet the Earnings Premium standard under OBBBA, while over half of students in programs that fail to meet this standard are in undergraduate certificate programs (85% in for-profit colleges) which are exempt from the standard under OBBBA (Caldwell et al., 2025). Furthermore, earnings premia should consider earnings trajectories—not just levels at a given point of time.

Concerning the affordability of federal student loan payments, we find that these payments comprise nearly a quarter of completers' earnings premia suggesting that many borrowers may benefit from income-driven repayment (IDR), which will be limited to one option under OBBBA for loans made on or after July 1, 2026: the new Repayment Assistance Plan (RAP). Through RAP, federal student loan payments will be 1 to 10% of borrowers' monthly adjusted gross income (AGI), depending on AGI level and adjusted for number of dependents over a 30-year repayment period (McGrath et al., 2025; Minsky, 2025). Considering average earnings and debt amounts we found in our study, monthly payments for a household of one under RAP and the current income-based repayment (IBR) plan are similar, yet IBR would result in much greater loan cancelation due to a shorter repayment period which is important for low-balance borrowers (Reber & Calame, 2025). Under RAP, borrowers will repay a much higher principal balance, have higher interest costs, and 10 additional years during which continued loan payments may crowd out saving, investing, and mortgage borrowing and delay family formation (Jabbari, Roll, et al., 2023). Yet, borrowers enrolled in RAP who have robust earnings trajectories could make additional principal payments to shorten the loan term.

To mitigate the negative consequences of student loan repayment burden, greater efforts should be made to increase college affordability. Various proposals, such as free community college and increased Pell grants, deserve serious consideration, given our findings. For example, OBBBA extends Pell Grants to students enrolled in short-term (8 to 15 weeks) credential programs (Carrillo et al., 2025). We also cannot ignore rising college costs. In this regard, technological advancements that can expand post-secondary access and reduce costs should be considered as well.

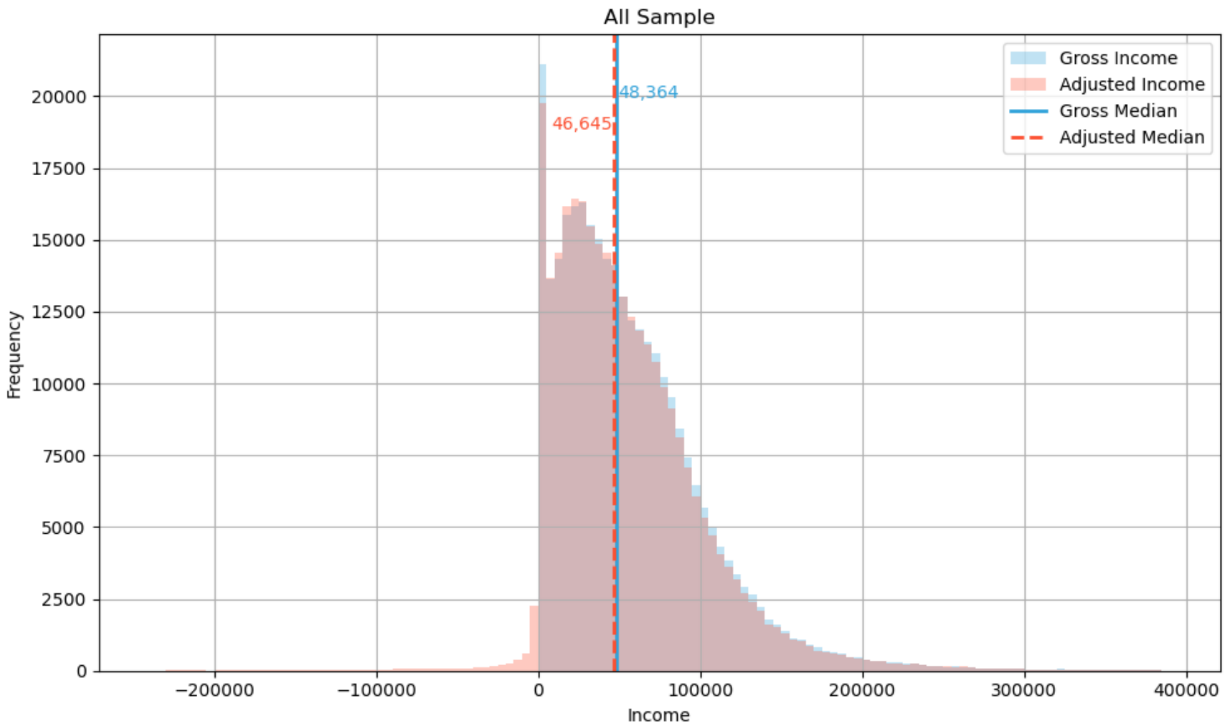
Additionally, our research highlights the missed economic opportunities for those with student loan debt who did not complete a degree. As our previous research demonstrates the negative impacts of non-degreed debt on the material and financial well-being of these doubly-disadvantaged individuals (Jabbari, Despard, et al., 2023), greater efforts should be made to increase college persistence. These efforts should focus on increasing persistence at ones' current institution (e.g., through early warning systems and efforts to reduce unexpected hardships), as well as at alternative institutions (e.g., by making the transfer process easier to navigate). Finally, given some of the variations across institution and industry, more must be done to make the costs and benefits of post-secondary education more transparent. Students need more than projections to make informed decisions about their economic futures.

7.4 Conclusion

Recent research estimates that 72 percent of all jobs will require at least some form of postsecondary education or training by 2031 (Carnevale et al., 2023). With public funding of postsecondary education continuing to regress, students will have to increasingly take on more of the financial costs. Given the rising costs of postsecondary education, the demonstrated burdens of student debt, and the uncertainty in the labor market, it is unsurprising that students are often wondering if college is still worth it. In the first study of its kind, we leverage both observed longitudinal earnings and student debt data to demonstrate that—even when accounting for some of the major opportunity costs—college is still a worthwhile investment. Future research should continue to leverage data on both sides of the balance sheet to better inform policy debates and student decisions on making postsecondary investments.

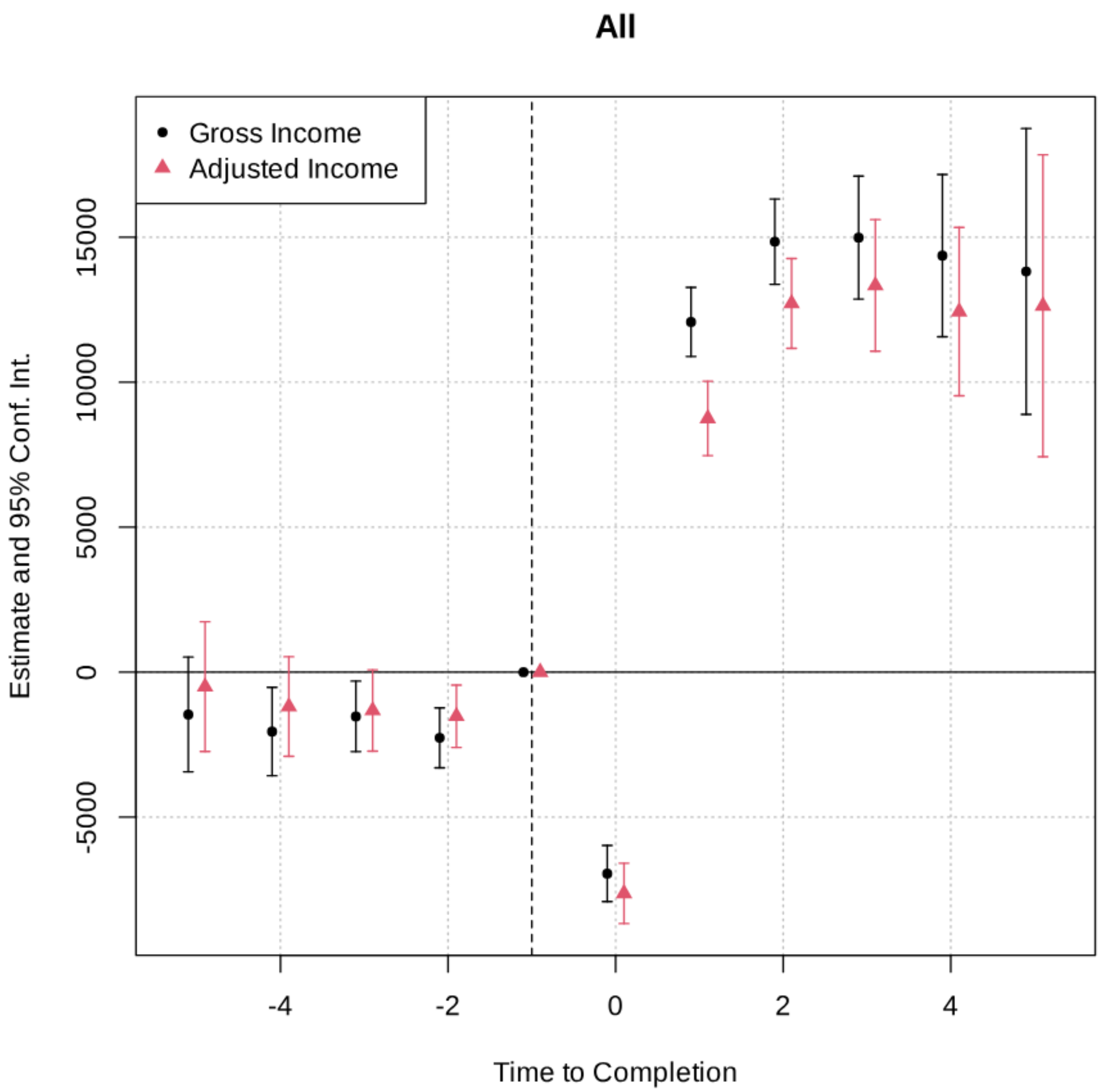
Figures and Tables

Figure 1: Distribution of Post-Completion Income



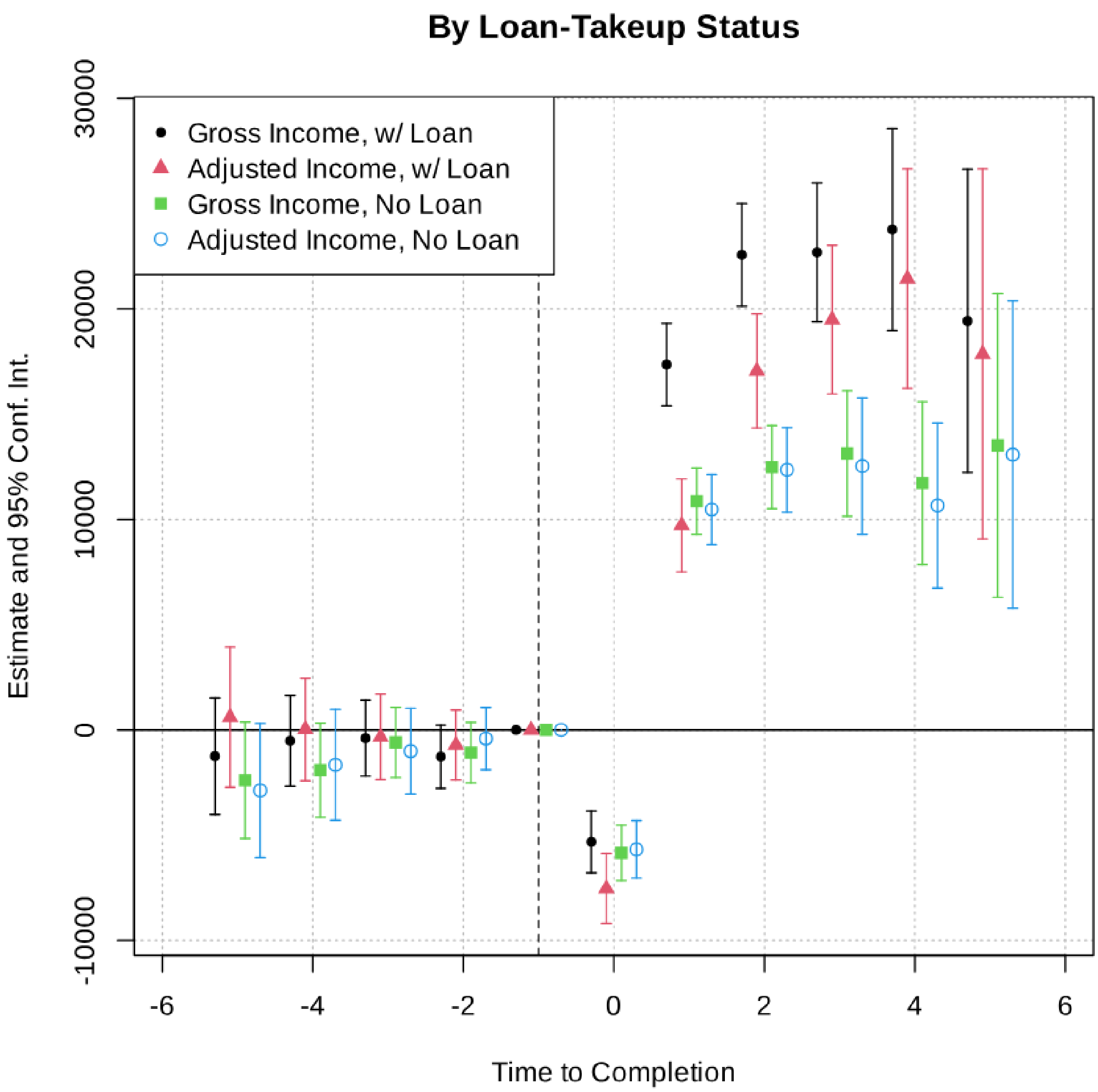
Notes: The figure shows the income distribution after completion (or non-completion) for the full sample, with gross income depicted in blue and adjusted income in red. Vertical lines indicate the median values for each income measure.

Figure 2: Event Study, Effect of Degree Completion on Income, (Sun & Abraham, 2021)



Notes: This figure presents the event-study plot illustrating the effect of degree completion on gross and loan-adjusted income measures. Estimates are based on our preferred empirical specification (equation (2)) and use the methodology of Sun & Abraham (2021) to obtain the coefficients. The Y-axis values are measured in US dollars.

Figure 3: Event Study, Effect of Degree Completion on Income, by Loan-Takeup Status (Sun & Abraham, 2021)



Notes: This figure presents the event-study plot illustrating the effect of degree completion on gross and loan-adjusted income measures. We further split the sample into comparisons with or without student loans associated with the enrolled degree. Estimates are based on our preferred empirical specification (equation (2)) and use the methodology of Sun & Abraham (2021) to obtain the coefficients.The Y-axis values are measured in US dollars.

Table 1: Descriptive Statistics by Credential and Degree

Credential and Degree	UC		AA		BA		MA		DOC	
	Control	Treated	Control	Treated	Control	Treated	Control	Treated	Control	Treated
Panel A: Demographics										
Age	30.00	30.23	28.93	28.68	29.10	26.28	31.52	29.72	32.22	30.50
% White	38.44	31.16	28.76	33.42	34.69	31.60	50.38	50.16	49.82	50.07
% Hispanic	14.55	13.77	13.47	12.55	11.86	9.02	8.46	6.77	8.44	8.67
% Black	11.95	6.52	14.79	7.95	13.60	6.00	9.72	6.74	6.57	5.54
% Asian	1.43	5.04	2.92	3.80	3.44	5.13	7.88	9.43	9.14	9.91
% Other	18.18	23.17	16.01	15.70	13.73	10.77	13.96	9.68	16.18	11.21
% Missing Race	15.45	20.34	24.05	26.59	22.69	37.48	9.60	17.21	9.85	14.60
% Female	65.97	59.31	55.16	53.69	53.44	42.82	62.03	56.91	59.79	58.15
% Male	18.57	19.79	18.92	18.50	22.14	18.74	26.75	24.81	28.02	27.25
% Other Gender	0.00	0.55	1.87	1.22	1.74	0.97	1.61	1.07	2.34	0.00
% Missing Gender	15.45	20.34	24.05	26.59	22.69	37.48	9.60	17.21	9.85	14.60
Panel B: Metropolitan Statistical Area (MSA)										
% Chicago	36.10	32.45	17.36	21.12	26.08	27.08	22.78	24.66	30.13	34.16
% Denver	27.92	44.25	13.53	10.24	11.88	9.86	8.67	5.37	3.05	2.67
% San Francisco	11.04	2.64	6.81	7.85	2.88	3.47	5.15	4.70	6.92	7.76
% St. Louis	9.35	8.91	9.52	10.24	6.97	5.20	3.26	3.41	13.60	6.78
% Boston	7.14	6.82	4.70	5.93	4.19	5.17	8.90	9.99	5.51	5.74
% Philadelphia	4.42	2.46	20.14	16.33	17.00	15.54	18.73	17.01	21.34	18.77
% New York	2.73	2.09	19.03	19.49	26.35	30.20	27.77	30.60	17.12	18.06
% Nashville	1.30	0.37	1.76	2.03	2.19	2.13	2.03	2.25	1.76	1.83
% Austin	0.00	0.00	7.14	6.78	2.46	1.35	2.72	1.99	0.59	4.24
Panel C: Industry (NAICS-2 Digit)										
% Healthcare	51.04	76.21	68.13	70.03	65.35	56.42	57.63	49.18	51.00	65.97
% Education	24.81	16.41	14.82	16.68	17.90	21.87	22.62	25.23	44.31	32.33
% Manufacturing	15.73	6.15	11.84	8.54	10.95	11.05	13.95	13.60	3.52	1.69
% STEM	8.44	1.23	5.21	4.74	5.80	10.66	5.80	11.99	1.17	0
Panel D: Income and Debt										
% Has Student Loan	16.10	15.18	21.66	24.83	43.38	52.37	37.60	42.92	35.87	45.57
Gross Annual Income ($)	30,152.67	34,010.92	30,688.58	36,104.15	39,371.37	40,133.34	71,904.83	72,327.34	73,880.46	68,837.09
Annual Student Loan Payment ($)	1,585.60	515.51	721.33	658.97	994.09	2,734.52	3,859.13	4,499.24	6,476.12	5,502.35
Number of Individuals	102	243	2,113	2,798	2,899	7,672	1,579	4,531	99	235

Notes: This table presents the summary statistics for control (non-completers) and treated (completers) groups within each credential.

Table 2: Effect of Degree Completion on Income

	(1)	(2)	(3)	(4)
	Panel A: Gross Income			
Treat×Post (D)	10,575.0***	10,432.9***	10,380.1***	10,442.1***
	(622.8)	(616.9)	(617.2)	(616.4)
	Panel B: Loan-Adjusted Income			
Treat×Post (D)	8,113.7***	7,983.1***	7,932.8***	7,987.5***
	(646.6)	(640.7)	(643.3)	(642.8)
Matching ID FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Credential FE	Yes	Yes	Yes	Yes
NAICS FE		Yes	Yes	Yes
MSA FE			Yes	Yes
Race FE				Yes
Gender FE				Yes
Observations	132,211	132,211	132,211	132,211

Notes: This table presents the estimated effects of degree completion on income. Each cell reports the coefficient from a separate regression. Panel A uses gross income as the outcome; Panel B uses loan-adjusted income, defined as gross income minus annual student loan repayments. Specifications become increasingly stringent from columns (1) to (4), with column (4) being the preferred model. This model includes fixed effects for matching strata, calendar year, credential type, industry, employment MSA, race, and gender. Standard errors are clustered at the matching strata level. *Significance:* *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 3: Effect of Degree Completion on Income, by Degree

	(1)	(2)	(3)	(4)	(5)
			Panel A: Gross Income		
Treat×Post (D)	6,770.6	7,947.9***	15,833.8***	19,684.2***	1,353.6
	(4,563.9)	(1,435.2)	(1,405.1)	(3,097.7)	(14,116.1)
			Panel B: Loan-Adjusted Income		
Treat×Post (D)	5,068.2	7,262.0***	12,827.1***	8,459.0***	-4,448.7
	(4,632.2)	(1,480.4)	(1,439.7)	(2,228.1)	(14,570.1)
Matching ID FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
NAICS FE	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes
Race FE	Yes	Yes	Yes	Yes	Yes
Gender FE	Yes	Yes	Yes	Yes	Yes
Degree	UC	AA	BA	MA	DOC
Gross Income ($)	42,555	44,327	53,819	79,212	75,365
Observations	1,241	14,602	20,083	18,969	937

Notes: This table presents the estimated effects of degree completion on income separately for each degree: UC, AA, BA, MA, and DOC. Each cell reports the coefficient from a separate regression. Panel A uses gross income as the outcome; Panel B uses loan-adjusted income, defined as gross income minus annual student loan repayments. For reference, we also report the average gross income of completers by degree level (among those with student loans). Standard errors are clustered at the matching strata level. *Significance:* *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 4: Effect of Degree Completion on Income, by Industry

	(1)	(2)	(3)	(4)
	Panel A: Gross Income			
Treat×Post (D)	10,544.5***	23,083.6***	8,640.6***	9,815.9***
	(1,866.1)	(3,770.1)	(1,236.7)	(765.6)
	Panel B: Loan-Adjusted Income			
Treat×Post (D)	8,575.4***	18,515.7***	6,376.2***	7,560.2***
	(2,116.6)	(3,741.8)	(1,395.2)	(803.7)
Matching ID FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Credential FE	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes
Race FE	Yes	Yes	Yes	Yes
Gender FE	Yes	Yes	Yes	Yes
Industry	Manufacture (31-33)	STEM (54)	Education (61)	Health (62)
Gross Income ($)	73,732	72,574	31,736	57,013
Observations	15,138	10,836	27,419	78,818

Notes: This table presents the estimated effects of degree completion on income separately for each industry: Manufacturing (NAICS 31-33), STEM (NAICS: 54), Education (NAICS: 61), and Health (NAICS: 62). Each cell reports the coefficient from a separate regression. Panel A uses gross income as the outcome; Panel B uses loan-adjusted income, defined as gross income minus annual student loan repayments. For reference, we also report the average gross income of completers by industry (among those with student loans). Standard errors are clustered at the matching strata level. *Significance:* *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 5: Effect of Degree Completion on Income, by Race

	(1)	(2)	(3)	(4)	(5)
			Panel A: Gross Income		
Treat×Post (D)	10,653.7***	10,952.8***	6,505.4***	11,981.7***	6,668.4***
	(951.9)	(1,607.2)	(1,439.8)	(3,534.7)	(1,353.1)
			Panel B: Loan-Adjusted Income		
Treat×Post (D)	7,692.3***	8,652.0***	4,293.1***	9,160.2**	5,356.6***
	(1,006.8)	(1,729.4)	(1,498.0)	(3,752.1)	(1,393.3)
Matching ID FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Credential FE	Yes	Yes	Yes	Yes	Yes
NAICS FE	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes
Gender FE	Yes	Yes	Yes	Yes	Yes
Race	White	Black	Hispanic	Asian	Other
Gross Income ($)	66,422	59,054	66,636	73,133	63,846
Observations	50,733	11,627	13,093	7,651	16,789

Notes: This table presents the estimated effects of degree completion on income separately for each race (non-missing): White, Black, Hispanic, Asian, and Other. Each cell reports the coefficient from a separate regression. Panel A uses gross income as the outcome; Panel B uses loan-adjusted income, defined as gross income minus annual student loan repayments. For reference, we also report the average gross income of completers by race (among those with student loans). Standard errors are clustered at the matching strata level. *Significance:* *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 6: Effect of Degree Completion on Income, Alternative Specifications

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline		Individual FE		High School FE	
Income Measure	Gross	Adjusted	Gross	Adjusted	Gross	Adjusted
Treat×Post (*D*)	10,442.10*** (616.4)	7,987.5*** (642.8)	11,804.4*** (640.4)	9,356.6*** (683.2)	12,903.9*** (853.2)	9,666.7*** (923.5)
Treat×Post (*D*, SA)	7,559.67*** (581.816)	5,551.18*** (603.45)	16,559.90*** (618.51)	13,997.20*** (692.42)	17,609.20*** (814.31)	14,972.80*** (994.10)
Matching ID FE	Yes	Yes			Yes	Yes
Individual FE			Yes	Yes		
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Credential FE	Yes	Yes			Yes	Yes
NAICS FE	Yes	Yes			Yes	Yes
MSA FE	Yes	Yes			Yes	Yes
Race FE	Yes	Yes			Yes	Yes
Gender FE	Yes	Yes			Yes	Yes
High School FE					Yes	Yes
Observations	132,211	132,211	132,211	132,211	60,443	60,443

Notes: This table presents the estimated effects of degree completion on income with alternative empirical specifications. Each cell reports the coefficient from a separate regression. We report both standard TWFE coefficients ($Treat \times Post$ (D)) and Sun & Abraham (2021) ATT coefficients ($Treat \times Post$ (D, SA)). Columns (1) and (2) show results from our preferred baseline specification. Columns (3) and (4) use a modified specification that includes individual fixed effects. Columns (5) and (6) restrict the sample to individuals with non-missing high school codes and add high school fixed effects to the baseline specification. Standard errors are clustered at the matching strata level. *Significance:* *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 7: Effect of Degree Completion on Income, Alternative Sample

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline		Have Loan		No Loan	
Income Measure	Gross	Adjusted	Gross	Adjusted	Gross	Adjusted
Treat×Post (D)	10,442.10***	7,987.5***	13,702.7***	8,715.9***	9,146.9***	8,866.8***
	(616.4)	(642.8)	(979.9)	(1,049.2)	(802.7)	(838.8)
Treat×Post (D, SA)	7,559.67***	5,551.18***	12,683.2***	7,893.45***	6,683.05***	6,467.17***
	(581.816)	(603.45)	(959.55)	(1,019.29)	(796.45)	(821.60)
Matching ID FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Credential FE	Yes	Yes	Yes	Yes	Yes	Yes
NAICS FE	Yes	Yes	Yes	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes	Yes	Yes	Yes
Race FE	Yes	Yes	Yes	Yes	Yes	Yes
Gender FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	132,211	132,211	53,520	53,520	78,691	78,691

Notes: This table presents the estimated effects of degree completion on income using alternative samples. Each cell reports the coefficient from a separate regression. We report both standard TWFE coefficients ($Treat \times Post$ (D)) and ATT coefficients following Sun & Abraham (2021) ($Treat \times Post$ (D, SA)). Columns (1) and (2) present results from our preferred baseline specification. Columns (3) and (4) restrict the sample to individuals with non-missing student loan data associated with the enrolled degree. Columns (5) and (6) restrict the sample to individuals with no student loans for the enrolled degree. Standard errors are clustered at the matching strata level. *Significance:* *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 8: Effect of Degree Completion on Income, Alternative Measure

	(1)	(2)	(3)
	Baseline		Amort. Measure
Income Measure	Gross	Adjusted	Adjusted (Alternative)
Treat×Post (D)	10,442.10***	7,987.5***	9,559.4***
	(616.4)	(642.8)	(614.1)
Treat×Post (D, SA)	7,559.67***	5,551.18***	6,703.81***
	(581.816)	(603.45)	(584.40)
Matching ID FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Credential FE	Yes	Yes	Yes
NAICS FE	Yes	Yes	Yes
MSA FE	Yes	Yes	Yes
Race FE	Yes	Yes	Yes
Gender FE	Yes	Yes	Yes
Observations	132,211	132,211	132,211

Notes: This table presents the estimated effects of degree completion on income using alternative income measure. Each cell reports the coefficient from a separate regression. We report both standard TWFE coefficients ($Treat \times Post$ (D)) and ATT coefficients following Sun & Abraham (2021) ($Treat \times Post$ (D, SA)). Columns (1) and (2) present results from our preferred baseline specification. Column (3) adjusts gross income using annual student loan payments implied by a standard 10-year amortization schedule. Standard errors are clustered at the matching strata level. *Significance:* *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

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Internet Appendix for “Beyond Earnings Premia: Debt-Adjusted Returns to Postsecondary Education”

Appendix A Additional Tables and Figures

Figure A1: Covariates Balance Before and After Matching

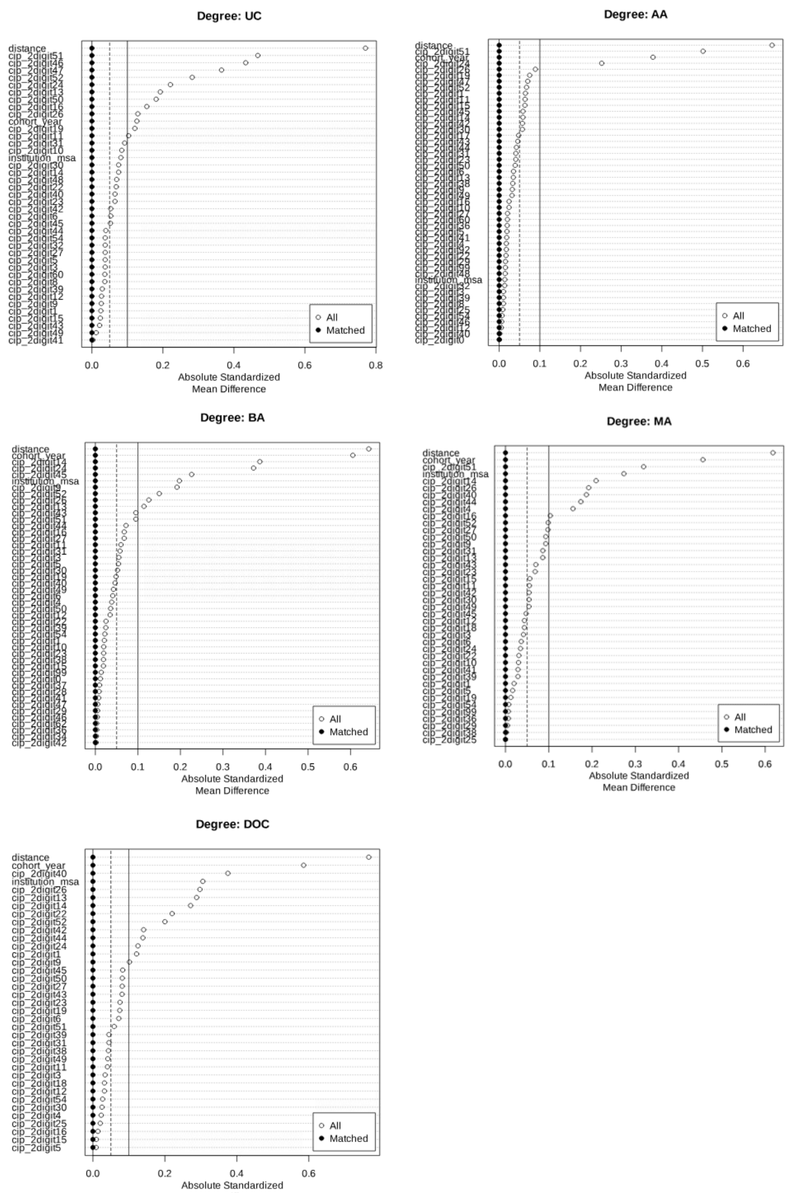
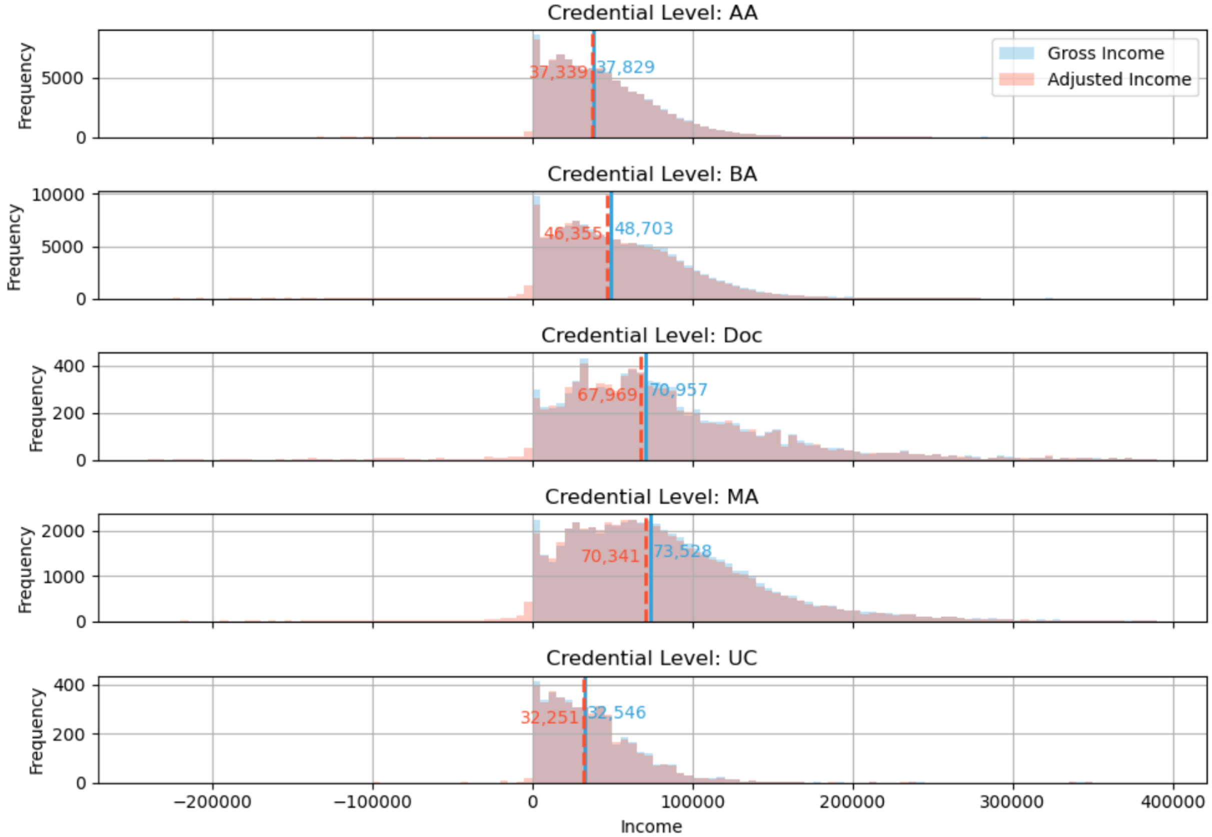
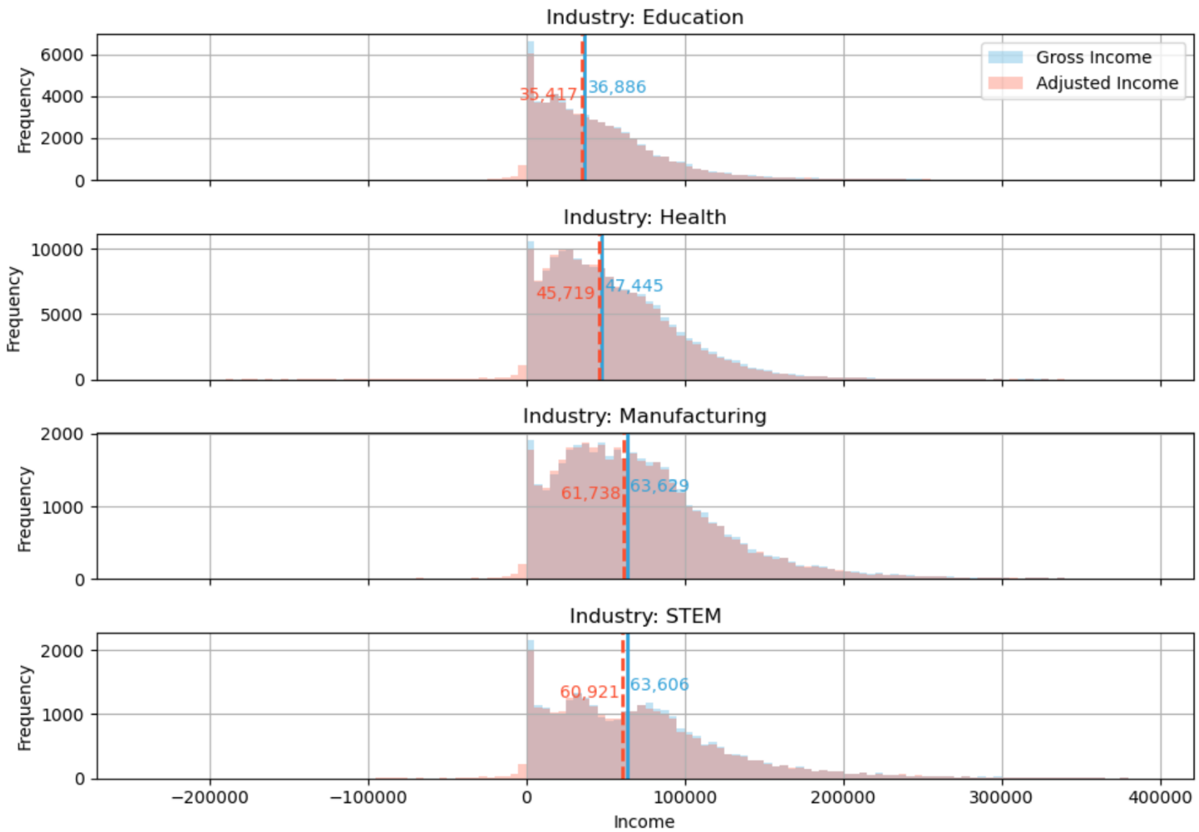


Figure A2: Distribution of Post-Completion Income, by Degree



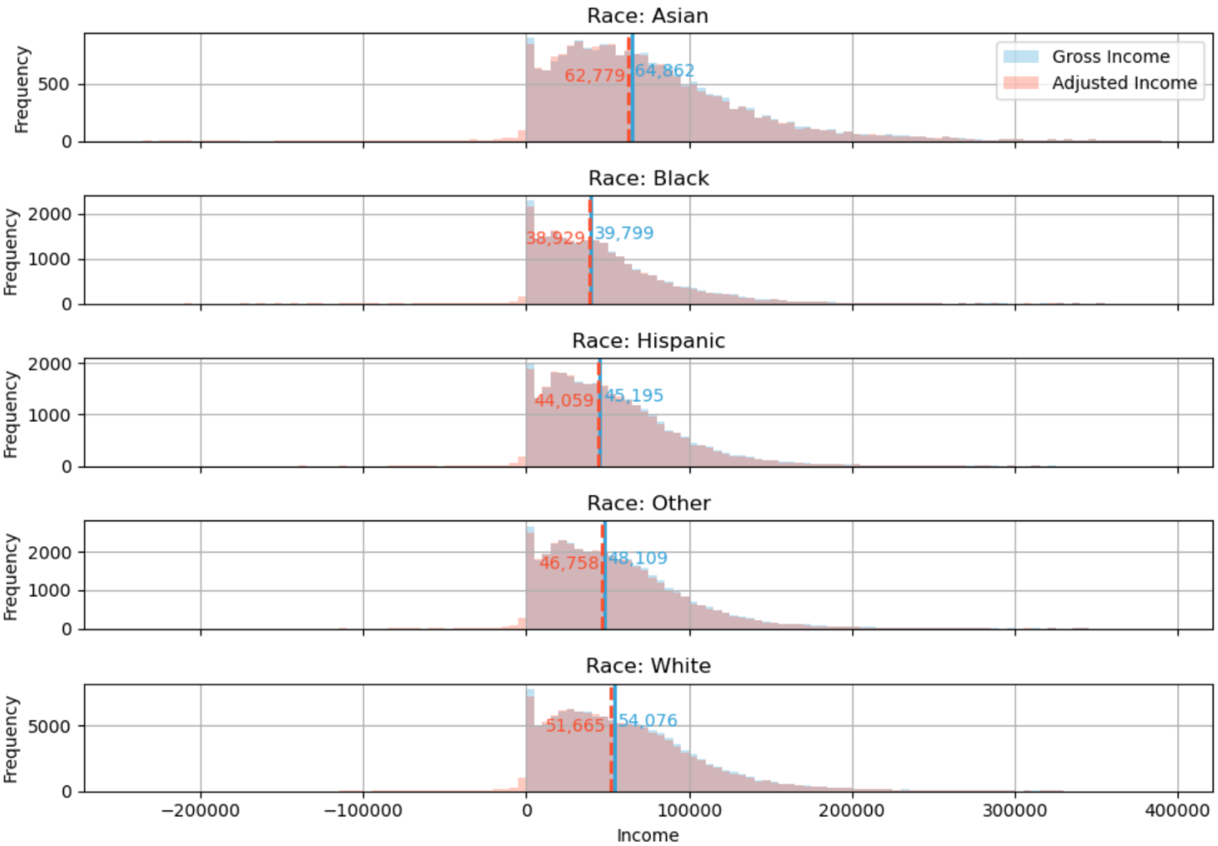
Notes: The figure shows the income distribution after completion (or non-completion) for the full sample, with gross income depicted in blue and adjusted income in red, separately for each degree. Vertical lines indicate the median values for each income measure.

Figure A3: Distribution of Post-Completion Income, by Industry



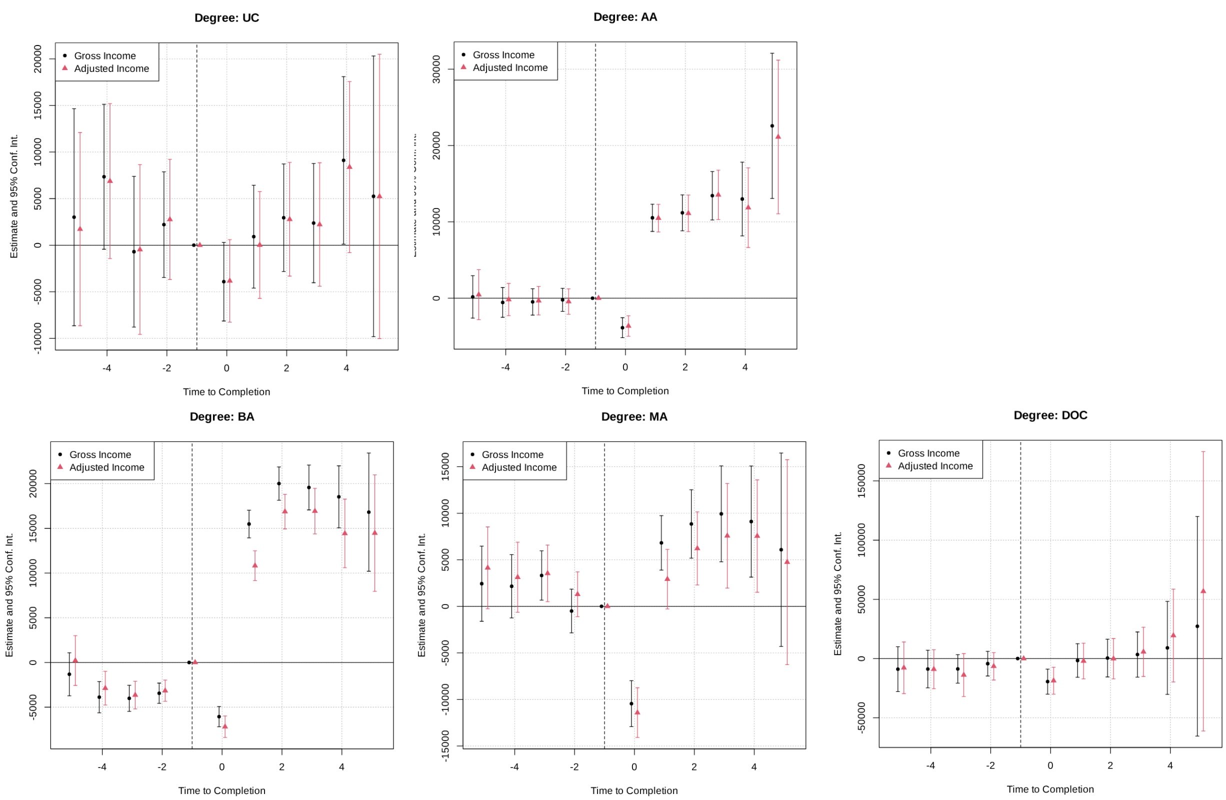
Notes: The figure shows the income distribution after completion (or non-completion) for the full sample, with gross income depicted in blue and adjusted income in red, separately for each industry. Vertical lines indicate the median values for each income measure..

Figure A4: Distribution of Post-Completion Income, by Race



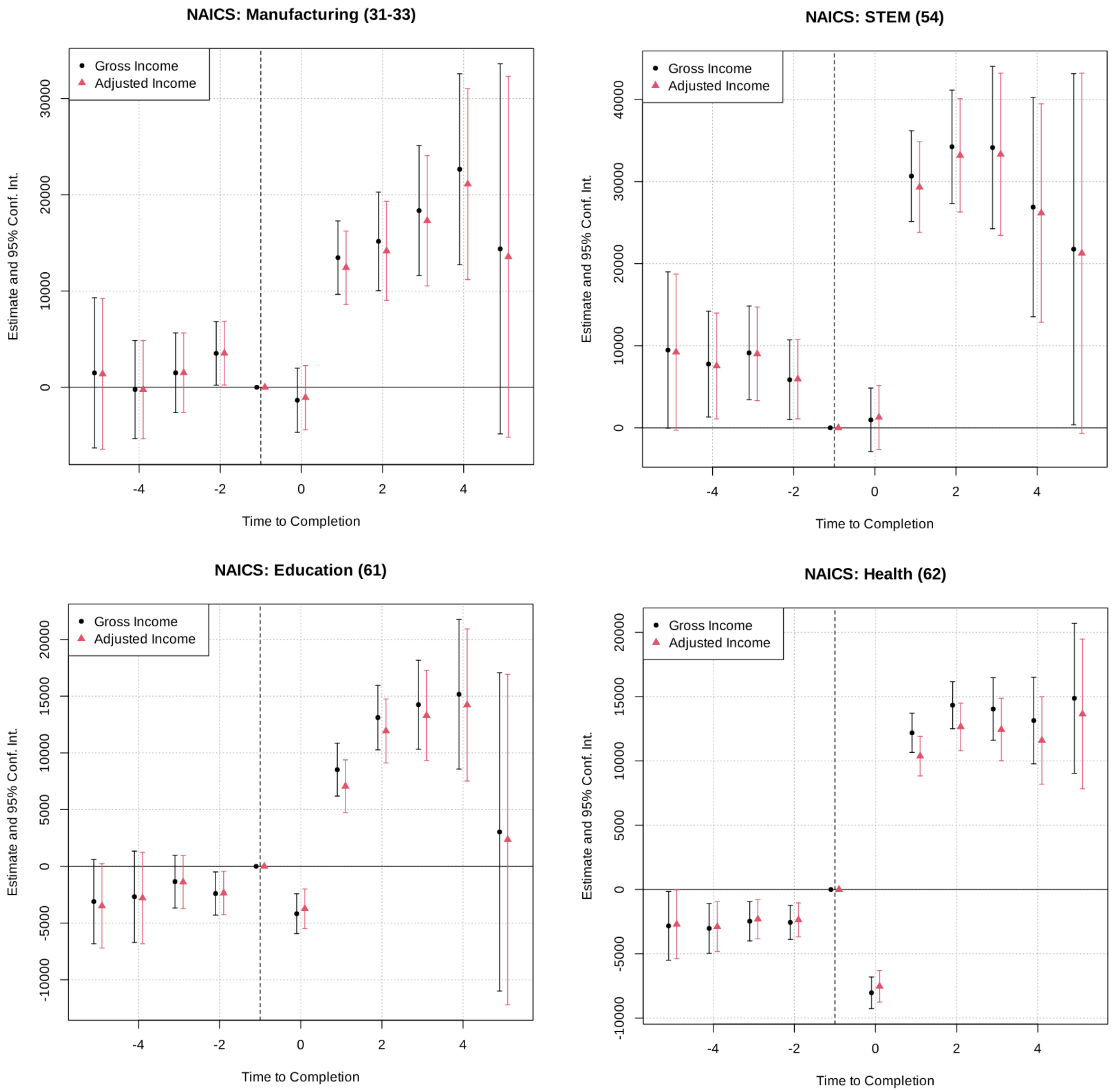
Notes: The figure shows the income distribution after completion (or non-completion) for the full sample, with gross income depicted in blue and adjusted income in red, separately for each race. Vertical lines indicate the median values for each income measure..

Figure A5: Event Study, Effect of Degree Completion on Income, by Degree (Sun & Abraham, 2021)



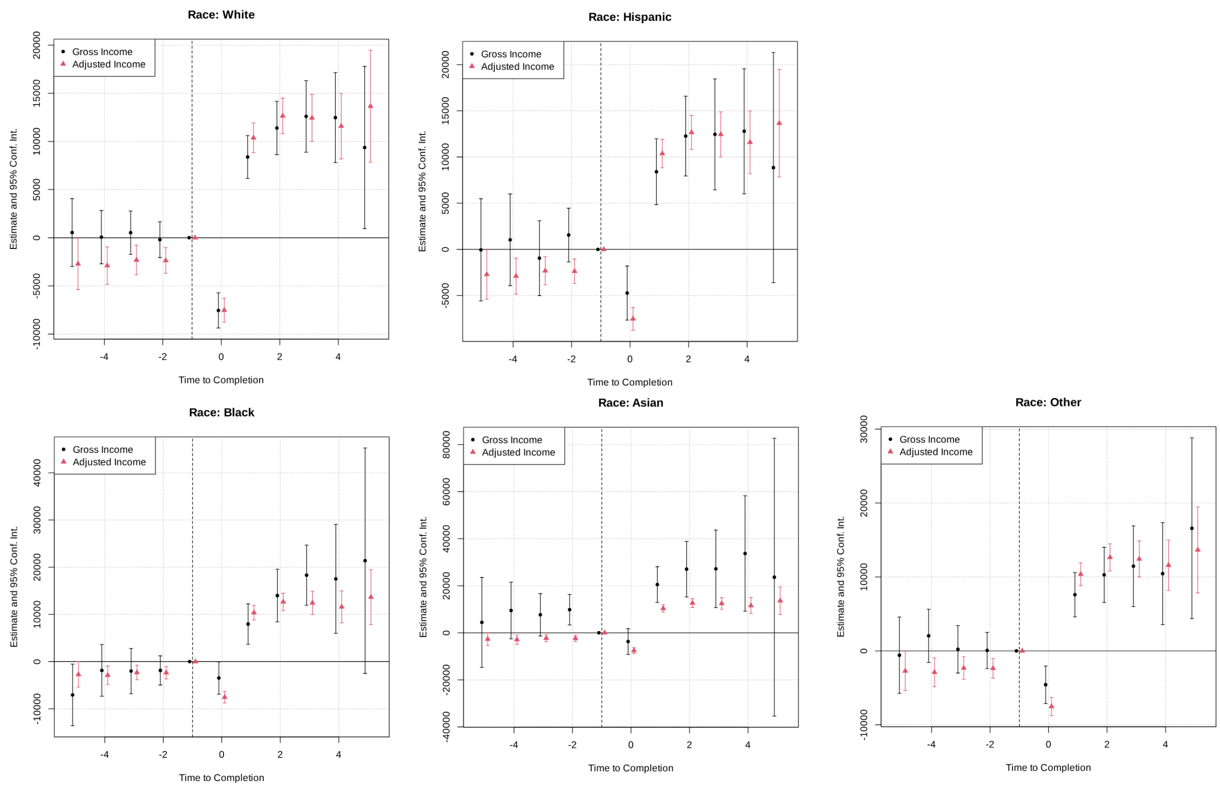
Notes: This figure presents the event-study plot illustrating the effect of degree completion on gross and loan-adjusted income measures, separately for each degree. Estimates are based on our preferred empirical specification (equation (2)) and use the methodology of Sun & Abraham (2021) to obtain the coefficients. The Y-axis values are measured in US dollars.

Figure A6: Event Study, Effect of Degree Completion on Income, by Industry (Sun & Abraham, 2021)



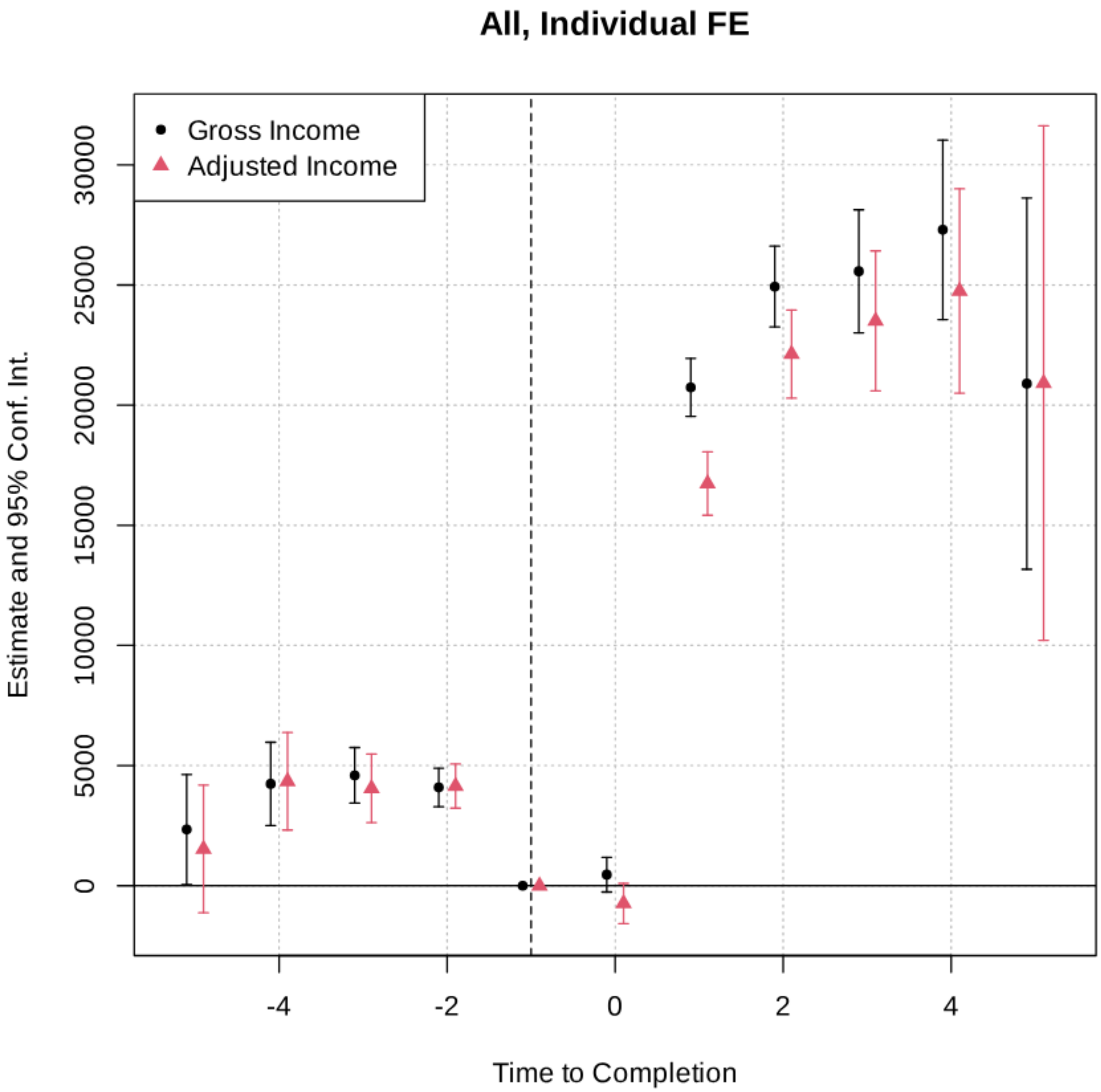
Notes: This figure presents the event-study plot illustrating the effect of degree completion on gross and loan-adjusted income measures, separately for each industry. Estimates are based on our preferred empirical specification (equation (2)) and use the methodology of Sun & Abraham (2021) to obtain the coefficients. The Y-axis values are measured in US dollars.

Figure A7: Event Study, Effect of Degree Completion on Income, by Race (Sun & Abraham, 2021)



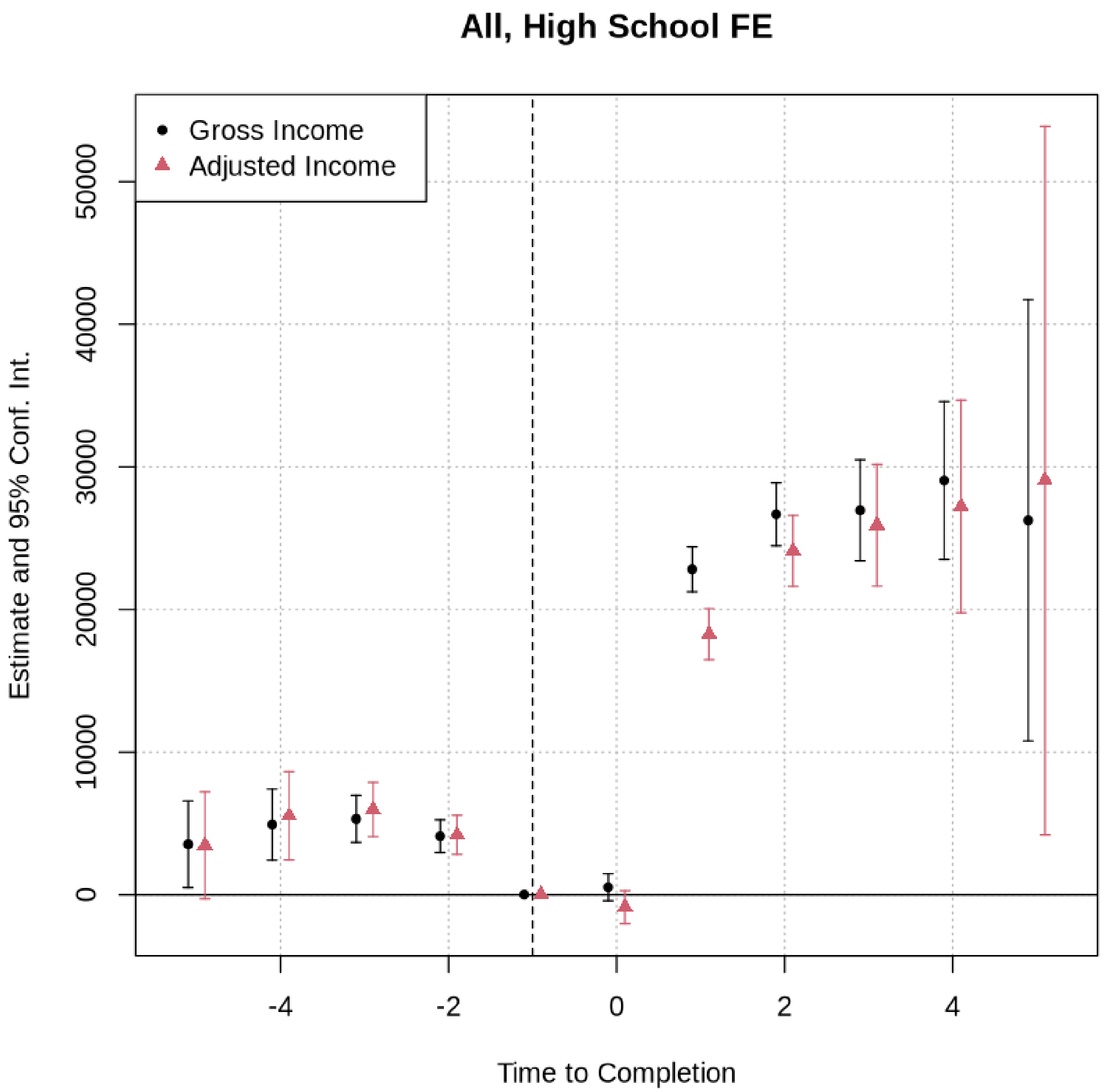
Notes: This figure presents the event-study plot illustrating the effect of degree completion on gross and loan-adjusted income measures, separately for each race. Estimates are based on our preferred empirical specification (equation (2)) and use the methodology of Sun & Abraham (2021) to obtain the coefficients. The Y-axis values are measured in US dollars.

Figure A8: Event Study, Effect of Degree Completion on Income, Individual FE (Sun & Abraham, 2021)



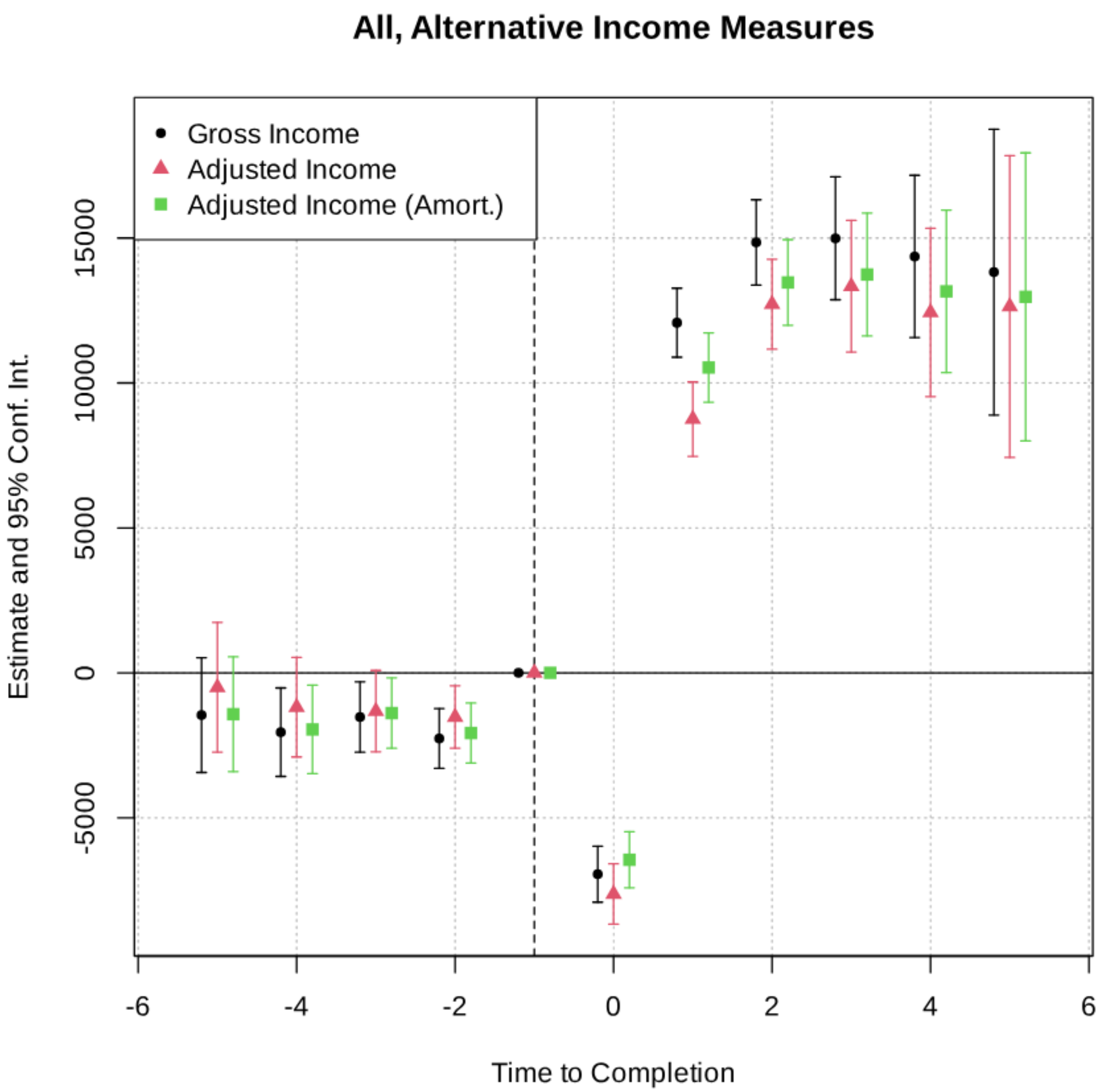
Notes: This figure presents an event-study plot showing the effect of degree completion on gross and loan-adjusted income. Estimates are based on a modified specification of equation (2) that replaces matching strata fixed effects with individual fixed effects. Coefficients are estimated using the approach of Sun & Abraham (2021). The Y-axis values are expressed in U.S. dollars.

Figure A9: Event Study, Effect of Degree Completion on Income, High School FE (Sun & Abraham, 2021)



Notes: This figure presents an event-study plot showing the effect of degree completion on gross and loan-adjusted income. Estimates are based on a modified specification of equation (2) that adds high-school fixed effects. Coefficients are estimated using the approach of Sun & Abraham (2021). The Y-axis values are expressed in U.S. dollars.

Figure A10: Event Study, Effect of Degree Completion on Income, Alternative Income Measures (Sun & Abraham, 2021)



Notes: This figure presents an event-study plot depicting the effect of degree completion on gross income, loan-adjusted income, and amortization-imputed loan-adjusted income. Estimates are based on our preferred specification of equation (2) and employ the methodology of Sun & Abraham (2021). The Y-axis values are reported in U.S. dollars.