NBER WORKING PAPER SERIES

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Working Paper 33956
http://www.nber.org/papers/w33956

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
June 2025

This work was supported by the Robin Hood Foundation. We are grateful to Christine Brongniart and Diana Strumbos of the City University of New York for providing program information and feedback on early drafts. We are also grateful to Emma Garcia and Douglas Harris for their review and comments. The analysis and conclusions presented here, and any remaining errors of fact or interpretation, are those of the authors alone. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

The Net Benefits of Raising Bachelor's Degree Completion through the City University of New York ACE Program
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NBER Working Paper No. 33956
June 2025
JEL No. D61, I23, I26

ABSTRACT

In 2015, the City University of New York (CUNY) launched a new program— Accelerate, Complete, and Engage (ACE)—aimed at improving college graduation rates. A randomized-control evaluation of the program found a nearly 12 percentage point increase in graduation five years after college entry. Using this impact estimate and national data on earnings by gender, age, and degree status; we estimate incremental expected long-run benefits and costs for participants, as well as intergenerational effects for the children of participants, relative to "business as usual" for the control group. Our main estimate indicates net social benefits of more than $48,000 over a lifetime per participant from greater earnings and labor force attachment, improvements in health, and savings in public transfers. A major contribution of our analysis is the estimation of second-generational benefits. Including intergenerational benefits for children who grow up in newly higher-earning families nearly triples this estimate, to over $130,000 in net social benefits per participant. These results are sensitive to assumptions about whether the impact on graduation after five years persists indefinitely, or whether the control group eventually catches up. Still, net social benefits are strongly positive even under our most conservative assumptions.

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Accessible policy brief based on earlier draft is available at
https://povertycenter.columbia.edu/publication/net-benefits-raising-bachelors-degree-completion-through-cuny-ace-program

Introduction

Bachelor's degree attainment is one of the most reliable predictors of an individual's future economic prospects. Those with a four-year degree are more likely to be employed than those who have not graduated, and four-year college graduates working full-time earn more than 40 percent more, on average, than those with only some college or a two-year degree (College Board 2023). Such college graduates also pay more in taxes and practice healthier behaviors than those without a four-year degree (College Board 2023). While some of these patterns may derive from pre-existing differences in who attends and completes college, numerous studies find that college attendance and completion *causally* impact earnings (Card 1999; Barrow and Malamud 2015; Lovenheim and Smith 2023). Broader evidence suggests that years of schooling causally improve a range of non-financial outcomes, such as health, marital stability, and children's outcomes as well (Oreopoulos and Petronijevic 2013).

Despite the high payoff, bachelor's degree attainment rates remain lower in the United States than in many other high-income countries (OECD 2022), and inequality in degree attainment has widened even as overall rates have risen over time (Bailey and Dynarski 2011). At 28 percent and 23 percent respectively, the bachelor's degree attainment rates for young Black and/or Hispanic Americans in 2021 have only recently approached a level that young White Americans reached 40 years ago (College Board 2023). Fewer than two-thirds of students who initially enroll in postsecondary education (regardless of race and ethnicity) ultimately complete any degree at all (National Student Clearinghouse 2023), and students who complete bachelor's degrees take longer to do so than in previous generations (Turner 2004).

In this context, policymakers and practitioners have long worked to develop programs to help students surmount the obstacles — financial, academic, structural, social — that get in the way of persistence and degree completion. Among the variety of programs that have been studied, comprehensive programs that address multiple barriers to persistence and completion have shown the greatest promise for "transformative" impacts (Dynarski et al. 2023). The City University of New York (CUNY) developed one such program, known as ASAP (Accelerated Study in Associate Programs), which a randomized controlled trial (RCT) found to nearly double Associate's degree completion rates three years after entry, from 22 percent to 40 percent (Scrivener et al. 2015; Weiss et al. 2019). The program's model, which combines tuition assistance with enhanced advising, transportation and book vouchers, and streamlined course scheduling, has since been replicated in seven states, with evidence from Ohio showing large impacts on degrees and earnings persisting six year after graduation (Hill, Sommo, and Warner 2023).

More recently, CUNY launched a parallel program of comprehensive supports for bachelor's degree students known as Accelerate, Complete, Engage (ACE) with the goal of increasing on-time bachelor's degree completion. The program, piloted at CUNY's John Jay College of Criminal Justice in 2015, has since expanded to several CUNY and SUNY campuses. The effects for the 2018 cohort of ACE participants at John Jay College have been evaluated via a randomized-control trial. The most recent results indicate that the program increased bachelor's degree completion by nearly 12 percentage points five years after college entry, from 57% to almost 69% (Scuello and Strumbos 2024).

Despite compelling evidence regarding the individual and social returns to degree attainment, and the rigorous direct evidence that CUNY's ASAP and ACE models increase completion, public funding for these programs is not a foregone conclusion. These programs require additional annual per-student expenditures (about $3,400 for ASAP and $4,000 for ACE) on top of CUNY's standard postsecondary education costs, and program continuity is dependent on annual city and state budget requests, in which the value of programs like ASAP and ACE is weighed against other budget priorities.[1]

To accurately assess the value of any investment, stakeholders need good estimates of both benefits and costs. Yet, compared to the immediate and concrete nature of costs, expected long-term benefits can be much more challenging to assess. Long-term benefits accrue over participants' lifetimes — potentially extending even into subsequent generations — and are diffused across a range of monetary and non-monetary outcomes, and across a variety of stakeholders, including not only the student but the student's eventual offspring, if any, along with both current and future taxpayers.

While previous research has assessed the cost-effectiveness and net benefits of CUNY's ASAP program (Scrivener et al. 2015; Levin & García 2012, 2018; Azurdia & Galkin 2020), ACE has yet to be rigorously studied in this way. The goal of this study is to evaluate the long-term expected benefits and costs of the ACE model by combining existing RCT estimates of ACE's impact on bachelor's degree completion (Scuello & Strumbos 2024) with national data on earnings by age, gender, and degree level.

We focus on estimating incremental benefits and costs relative to the "business as usual" experience of John Jay College students in the CUNY ACE study's control group, based on the incremental impact on degree completion.[2] While our main estimates focus on earnings-related benefits from the current generation of participants, we also draw upon prior work to incorporate

[1] ASAP and ACE cost estimates come from CUNY's internal calculations. For the ASAP estimate, see https://www.cuny.edu/wp-content/uploads/sites/4/media-assets/CUNY-ASAP-and-ACE-Fast-Facts_January-2024.pdf. The ACE estimate comes from personal communication with CUNY administrators; see Section II below for additional details.

[2] We do not estimate the benefits of degree completion per se or the cost per degree completed, as other work has done, though such metrics could be derived from this analysis.

other benefits in the current generation, and most importantly, to estimate the lifetime benefits accruing to participants' current and future children due to their parent's additional income (Garfinkel et al. 2022). In addition to estimating net benefits to society as a whole, we also split out these net social benefits by whether they accrue to participants (and their children) versus to taxpayers more generally.

We also explore the sensitivity of our estimates to assumptions about whether ACE's 12-percentage point impact on bachelor's degrees after five years persists indefinitely, or whether the control group eventually catches up in term of their degree completion rates. In the latter case, ACE benefits participants solely by accelerating their degree attainment, not by changing their lifetime attainment. It is unknown whether the initial 12-point impact of ACE will persist throughout participants' lifetimes, instead will represent strictly an acceleration of degree completion, or something in between. For this reason, we present estimates under three sets of assumptions: fully persistent completion effects, acceleration-only effects, and a "midpoint" scenario in which half of the initial 12-point difference persists throughout participants' lifetimes and half represents an acceleration of degree completion. For ease of exposition our primary discussion will focus on the midpoint scenario.

Given the hefty labor market returns to bachelor's degree attainment, it is perhaps no surprise that we estimate a substantial social payoff to CUNY ACE over participants' lifetimes when we assume that the degree completion impact persists indefinitely into the future. Yet even under a midpoint assumption that the degree completion impact attenuates by 50% over time (if the control group catches up over time), net social benefits of CUNY ACE are estimated at $48,037 per participant. The vast majority of these net benefits derive from participants' earnings: only about 12% are due inclusion of health benefits and reductions in public transfers.

What is perhaps more surprising is that even if we assume that ACE's impact on degree completion eventually fades out entirely — such that ACE participants ultimately complete degrees at the same rate as the control group, but simply do so faster — the program still more than breaks even from a social benefit-cost perspective, with net benefits to society of over $16,000 per participant. Earlier completers not only benefit from the extra years of earnings in the early years before the control group catches up, but those extra years of labor market experience continue to generate a small earnings advantage in later years, compared to those who complete later. This finding of a substantial return to degree acceleration is consistent with other recent work examining the payoff to early versus late college completion (Bárány, Buchinsky, & Corblet, 2023). A sub-group analysis by gender reveals that earning benefits are substantially larger for men than women. Up to two-thirds of this gender difference can be explained by men's higher earnings in the labor market, highlighting the need for complementary policies and programs that level the playing field for men and women in the labor market.

A central contribution of our analysis is that we project ACE's social benefits into the second generation—that is, for participants' children. Even though relatively few ACE participants have children at the time they graduate, most will have at least one child over the subsequent years, and these children will likely benefit from their parents' higher incomes as a result of ACE. Ultimately, the total social benefits accruing to the second generation are between one to two times the earnings benefits in the participants' generation. This is both because, on average, we project that the typical ACE participant will have more than one child — all of whom will benefit from parents' additional income — and because our estimates of intergenerational benefits incorporate not just children's later life earnings but also their reduced use of public services, reduced crime, and improved health.[3] Interestingly, the benefits to the second generation are not as sensitive to assumptions about fade-out of ACE's degree completion effects, because young children are particularly impacted by additional parental income in the early years post-program, when differences in bachelor's degree attainment are large even under the full catch-up scenario.

Below, in Section II, we provide additional background on CUNY's ACE program. Section III describes our conceptual framework, enumerating the potential benefits and costs based on prior research. Section IV describes our methodological approach to estimating long-term benefits, including intergenerational benefits. Section V presents our main results, intergenerational benefits, and sensitivity analyses. Section VI concludes with a discussion of limitations and implications for future policy and research.

I. Background on CUNY's ACE program

The philosophy underlying both CUNY ASAP and CUNY ACE is that comprehensive support programs — which address multiple barriers simultaneously and over students' full period of study — have the best chance to materially improve students' academic trajectories. Like the original CUNY ASAP, ACE provides the following core supports (CUNY 2024; Strumbos, Kolenovic, and Gupta 2022; Scuello and Strumbos 2024):

- tuition and fee gap waivers cover any tuition or mandatory fees that remain after financial aid, for students who receive any need-based state or Federal grant aid;
- textbook assistance is provided every semester (approximately $250 per term);
- a free unlimited monthly MetroCard is provided for NYC public transportation;

[3] Our intergenerational estimates take advantage of a robust evidence base regarding the impacts of additional family income on young children's later life outcomes across a variety of dimensions. Evidence regarding the causal effects of college completion is primarily limited to earnings outcomes, making it harder to estimate the value for a broader range of outcomes in the participants' generation.

- students receive enhanced, structured advising, with reduced caseloads (capped to 150 students per advisor) and the same advisor paired with a student for all four years;
- students receive enhanced orientation, tutoring, and career guidance; and,
- students are granted priority course registration.

For ACE participants entering as first-year students, these supports are provided for up to eight semesters of study. CUNY estimates that the program costs are about $4,000 per participant per year, on top of baseline per-student expenditures, with 37% of this amount covering dedicated program personnel, 29% attributed to the program's coverage of remaining tuition and fees, 22% for the free MetroCards, and 12% going towards textbook assistance.[4]

Also, like CUNY ASAP, the ACE program has both initial and ongoing eligibility restrictions and requirements. For example, ACE participants must enroll in 15 credits per semester (more than the standard 12-credit full-time load) and must be pursuing an eligible major. Although the program is not designed to explicitly preference specific majors, majors may be excluded at a given campus either because of course sequencing or availability, or because external clinical practicum requirements make it difficult for students to graduate within the required time frame.[5]

Although the ACE model has since been implemented at other CUNY and SUNY campuses, the existing RCT evidence on the program's impact is limited to one CUNY campus: John Jay College of Criminal Justice. The RCT, conducted by CUNY researchers in partnership

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[4] Personal communication with Christine Brongniart, University Executive Director, CUNY ASAP|ACE, April 2, 2024. Note that some of these costs are more accurately described as transfers from taxpayers to students. In our estimates,we assume that program personnel (37%) represent true additional resource costs while the tuition waivers, free metrocards, and textbook stipends (67%) are closer to a pure transfer, as most or all of these costs would otherwise have been paid by the participants

[5] Personal communication with Diana Strumbos, CUNY Senior Director of Research and Evaluation, Student Success Initiatives, May 17, 2024. Additional eligibility requirements are detailed in CUNY (2024).

with Metis Associates, enrolled 570 ACE-eligible incoming first-year students in 2018, and followed their outcomes for five years (through the summer of 2023) using administrative records (Scuello and Strumbos 2024).[6]

Zhu, Scuello, and Strumbos (2023) find that four years after entry, 58.8% of students randomly assigned to ACE had earned a bachelor's degree at any college, compared with 46.4% of the control group — a statistically significant 12.4 percentage point impact.[7] The most recent impact report by Scuello and Strumbos (2024) indicates that this large impact on degree completion attenuates only slightly after five years, to an 11.7 percentage point impact (68.8% for ACE participants, compared with 57.1% of the control group). We use this 5-year impact to assess long-term benefits.

II. Conceptual framework of benefits and costs

Table 1 enumerates the hypothesized benefits and costs of CUNY's ACE program based on prior research examining the causal impacts of college enrollment and attainment, along with research documenting the benefits received by children when their parents have higher incomes. Here, we identify a broad range of expected benefits and costs that are conceptually relevant, though we will not attempt to quantify all of them in our empirical analysis (there, we will focus on those outcomes where the literature provides strongest empirical support for a causal relationship). This table does not provide specific numeric estimates, but simply indicates whether we expect a particular benefit to accrue (+) or cost to be incurred (-) for participants, taxpayers, and society overall. The top panel of Table 1 focuses on benefits and costs for the

[6] Broadly reflecting CUNY's student population, the study sample was about 70% women, 48% Hispanic, 10% Black, 10% Asian or Pacific Islander, 14% White, and 18% multiracial or other race/ethnicity. Over 70% were eligible for a Pell Grant. The most common majors among ACE participants who graduated from John Jay were Criminal Justice (29%), Forensic Psychology (20%), Criminology (15%), Political Science (7%), and Law and Society (7%). See the Year 4 Interim Study Report by Zhu, Scuello, and Strumbos (2023).

[7] The study tracks completion at any college using administrative data from CUNY as well as National Student Clearinghouse data, which cover institutions beyond CUNY.

current generation, while the bottom panel considers additional benefits and costs for the children of current participants.

Row A lists the ACE program expenditures. The administrative portion of the program expenditures are paid by taxpayers. For ACE participants, administrative costs are neither benefits nor costs. For society as a whole, the administrative costs reflect a loss. The portion of the expenditures that go to cash and near-cash transfers (tuition assistance, free metro-cards) are benefits to ACE participants but costs to taxpayers, because a dollar gained by the participants is a dollar lost to the taxpayers, resulting in zero benefits or costs for society. Cash and near-cash transfers from taxpayers to participants thus cancel out, from a societal perspective.[8] In addition to the program expenditures, ACE induces indirect expenditures by increasing enrollment and attainment. These induced costs are represented in row B, and may include additional costs of college and foregone earnings in the labor market.

The projected earnings benefits of bachelor's degree attainment (row C) are central to the projected benefits of ACE. Graduates with a four-year degree are more likely to be employed, and those working full-time earn more than 40 percent more on average than those with only some college or a two-year degree (College Board 2023). While some of these patterns may derive from pre-existing differences in who attends and completes college, numerous studies find that college attendance and completion do *causally* impact earnings (Card 1999; Barrow and Malamud 2015; Lovenheim and Smith 2023). These higher earnings will lead directly to higher tax payments (row D) and lower public assistance expenditures (row H).

[8] Following logic expressed in the recent revision to Federal guidance around benefit-cost analyses, we do not incorporate any marginal cost of raising public funds, given the difficulty of predicting whether and what type of tax policy changes may be made to offset additional taxpayer expenditures, and what the consequences of those taxes might be (Office of Management and Budget, 2023, pp. 60-61)

Bachelor's degree attainment may causally impact other monetary current-generation outcomes through improved knowledge and/or cognitive or socioemotional capacities, *even beyond* any effects due to increases in earnings. For example, college graduates practice healthier behaviors (College Board 2023), and research has demonstrated a causal link between education in general (including at the college level) and improved health (Currie & Moretti 2003; Lochner 2011; Oreopoulos and Petronijevic 2013). While research has also demonstrated a causal link between schooling at younger ages and crime, this evidence does not yet extend to higher education, and recent work suggests caution in presuming one (Bell, Costa, & Machin 2022). Based on this empirical evidence, we expect ACE participants to experience increases in health and longevity (row E), but we remain uncertain regarding changes in criminal justice system expenditures and victimization costs (row G). Health improvements also lead to reductions in healthcare expenditures (row F) and increases in longevity, which then induces higher Social Security payments in old age (row I).

In addition to participants' benefits and costs, we also expect that the vast majority of ACE participants will become parents at some point.[9] The positive impacts of ACE may thus spill over into the next generation. Such intergenerational spillover effects of education have been found for early childhood programs (Garcia, Heckman, Ronda 2023; Barr & Gibbs 2022; Rossin-Slater & Wüst 2020) as well as for college expansions (Currie & Moretti 2003).

These intergenerational spillovers may operate through multiple channels, but an additional body of research extensively documents the association between family income and the outcomes of children, as well as the causal impact of increases in household income from

[9] Martinez and Daniels (2023) document that 82 percent of women and 72 percent of men have at least one biological child by age 40; the percentages are slightly lower for bachelor's degree graduates at 75 percent and 68 percent respectively.

cash and near-cash transfers on children's outcomes. This collection of causal studies tells an integrated and coherent story: that increases in the incomes of low-income parents lead to improvement in a wide range of children's outcomes. More specifically, programs that provide cash and near-cash benefits to low-income families increase children's earnings in adulthood (Aizer et al. 2016; Hilary Hoynes, Schanzenbach, and Almond 2016; Bailey et al. 2024; Bastian and Michelmore 2018); decrease neo-natal mortality (Almond, Hoynes, and Schanzenbach 2011); increase child birth weight (Kehrer and Wolin 1979; Almond, Hoynes, and Schanzenbach 2011; Hoynes, Miller, and Simon 2015; Markowitz et al. 2017); increase child health in childhood (Averett and Wang 2018); increase child health in adulthood (Bailey et al. 2024; Hilary Hoynes, Schanzenbach, and Almond 2016;); increase child longevity (Bailey et al. 2024; Aizer et al. 2016); increase child education attainment (Akee et al. 2010; Maxfield 2015; Aizer et al. 2016; Bastian and Michelmore 2018; Thompson 2019; Michelmore 2013); decrease child involvement in the Child Protective Services system (Berger et al. 2017); and decrease the children's commission of crime (Bailey et al. 2024; Barr and Smith 2024).[10]

Based on these 21 causal studies, we expect increases in parent income to increase their children's future earnings (row J), future tax payments (row K), and health and longevity (row L); reduce their children's healthcare expenditures (row M), and involvement in the child welfare system (row N), in crime, and in the criminal justice system (row O), welfare receipt (row P); and increase their children's longevity and subsequent Social Security payments (row Q) and increased taxpayers expenditures on their children's expected higher level of education (row

[10] Most of these studies are based on Food Stamps and the Earned Income Tax Credit. Only one, as yet unpublished, paper based on a random assignment experiment finds negative effects on adult earnings and health (Price and Song 2018).

R).[11] Prior work estimates that a $1,000 increase in annual household income is associated with $4,812 (per child) of net benefits for society (Garfinkel et al. 2022).[12]

The benefits discussed above are hypothesized based on ACE's observed causal impact on bachelor's degree completion rates five years after college entry, but ACE's impact on completion may attenuate over time if the control group continues to persist in college and eventually catches up in degree completion. If this occurs, the benefits of ACE will be reduced to reflect only the benefits of completing a degree faster, rather than completing a degree at all. Graduates who only complete their degrees sooner are still hypothesized to receive a lifetime earnings benefit (and proportional health benefits), due both to more years of earnings, as well as to the returns to more labor market experience from the extra years they didn't spend in school. Recent work suggests that the lifetime earnings returns to graduating earlier rather than later could be as large as 27 percent of the overall return to completing a bachelor's degree at all (Barany, Buchinsky, and Corblet 2023).[13] Moreover, because the additional earnings in this scenario are concentrated during years when participants are most likely to be raising children, significant intergenerational benefits are expected even in the acceleration-only scenario.

III. Methodology

A. Data and sample

We use publicly available information from the CUNY ACE evaluation (Scuello and Strumbos, 2024), as well publicly available data on persistence and degree completion rates up to

[11] Just as we include in our calculations the cost of the additional coursework that participants take in the first generation, we also include the costs of children's additional education in the second generation.
[12] We do not further value increases in birth weight or increases in educational attainment as benefits for the second generation, as that creates risk of double counting: increases in birth weight already show up in increases in health and decreases in neonatal mortality; similarly, increases in earnings are the principal monetary benefit of increases in education.
[13] The Barany, Buchinsky, and Corblet (2023) paper uses NLSY79 data and defines "early" graduates as those completing by age 24. They measure lifetime earnings only through age 48 due to the age of the NLSY sample.

ten years after college entry for full-time college entrants at CUNY's John Jay College (CUNY OAREDA 2024). For the earnings and intergenerational microsimulation, we use the American Community Survey (ACS) 5-year data from 2015–2019. Our ACS sample includes individuals with a bachelor's degree or higher educational attainment, people with some college experience but no bachelor's degree, and those that are still attending college during the survey period.[14] Benefits that accrue in the future are discounted using a social discount rate of 2 percent, reflecting the average of inflation-adjusted yields on 10-year Treasury bonds over the past 30 years, but we also display results with alternative, higher social discount rates.[15]

B. Modeling ACE impacts on degree completion over time

Our analysis starts with the rates of enrollment and bachelor's degree completion for the treatment and control groups through five years post-entry, taken directly from the publicly available RCT reports (Zhu, Scuello, and Strumbos 2023; Scuello and Strumbos 2024). The 2024 ACE evaluation report provides a regression-adjusted five-year completion rate of 57.1% for the control group and 68.8% for the treatment group. Completion rates and ACE impacts also vary by gender; the unadjusted five-year completion rate for men is 58.1% for the treatment group and 42.4% for the control group, and the five-year degree rate for women is 72.9% for the treatment group and 64% for the control group. We explore the implications of these gender differences in impacts after presenting the main results.

Of course, many students take even longer than five years to graduate, so to estimate benefits over the subsequent decades, we must model how enrollment and completion evolve.

[14] To define education status, we use the variable "educd," which indicates the respondent's educational attainment, and the variable "school," which indicates school attendance during the survey period.
[15] This follows the recommendation of the 2023 revision of OMB Circular A-4, an externally-reviewed guidance document for Federal regulatory benefit-cost analyses (Office of Management and Budget 2023). A 2025 executive order rescinded the 2023 update, returning the guidance to the 3% discount rate advised in the 2003 version of OMB Circular A-4.

One possibility is that ACE permanently increases graduation rates; that is, the treatment group both graduates earlier and is more likely to graduate overall (we refer to this as the "persistent increase" scenario). A second possibility is that ACE purely accelerates graduation and has no long-term impact on the share who graduate; that is, the control group catches up to the treatment group over time (we call this the "full catch-up" or "acceleration only" scenario). We also consider the midpoint between these scenarios to reflect that possibility that the ACE impact on five-year completion reflects a combination of some additional completions and some accelerated completions, if the control group partially catches up to the treatment group (we call this the midpoint or "50% catch-up" scenario).

In all scenarios, we assume that the control completion rate increases from Year 5 through 10 at the same rate as the broader John Jay population. In the "persistent graduation increase" scenario, we obtain the treatment group completion rate simply by adding the ACE impact estimate to the control group completion rate in every year going forward. In the "acceleration only" scenario, we assume that completions grow more slowly in the treatment group than in the control group, so the ACE impact on overall graduation rates attenuates beginning in Year 6 until it eventually reaches zero in year 10. Our "midpoint" scenario assumes that the control group closes half the gap in graduation rates by the end of year 10. Figure 1 below illustrates our projections of control group completion rates, along with projected ACE completion rates under our three scenarios.

Once we have these completion rate projections, we further estimate what proportion of non-completers are still enrolled in each year. This enables us to assign all treatment and control group members to one of three groups necessary for our earnings projections in each year: those leaving college with a bachelor's degree or higher, those leaving college without a bachelor's degree, or those still enrolled in college. We assume that any student who has not graduated by Year 10 exits college without a bachelor's degree. The resulting yearly projections under each scenario and additional technical details can be found in Appendix A.

C. Current generation benefits

C.1. Lifetime earnings

Ideally, we would have causal estimates of ACE's impact on earnings at every age post-treatment. Even if such estimates eventually become available at least for early-career earnings, however, assessing benefits over an entire lifetime and into the next generation still requires making projections. We use simple projections of pre-tax earnings trajectories for the ACE treatment and control groups using the ACS data. Our median earnings estimates are not conditioned on employment, as the employment margin itself may be an important source of earnings differences across groups. There is no guarantee that these projections will match up with actual impacts on earnings, once such estimates are available, even though the causal literature on the returns to education supports the plausibility of such projections (Lovenheim & Smith 2023).

Since the ACE evaluation sample is predominately (70%) women, we estimate earnings profiles separately by gender. We begin by calculating the median annual pre-tax earnings of ACS sample members by gender at each age from 22 to 65 (including those with zero earnings) in each of the following three categories:[16] 1) those with bachelor's degrees or higher who are not currently enrolled in school, 2) those with some college education but no bachelor's degrees who are not currently enrolled, and 3) those without bachelor's degrees who indicate that they

[16] As explained further in Section F below on program costs, for the years between 18 and 21 (years 1-4) we incorporate differences in earnings for students and dropouts as part of the opportunity cost of enrollment. Whether such differences are included as costs or reductions in benefits does not affect estimates of net benefits.

are attending college during the ACS survey period. We then construct weighted averages of median earnings by gender, age, and educational status in each year to project lifetime earnings trajectories for the ACE treatment and control groups given their projected degree completion trajectories (see Table A.1 of Appendix A).

While we focus on the earnings benefits of obtaining a college degree, there may also be earnings benefits associated with incremental increases in college credits, regardless of degree attainment. In this analysis, we are not modelling the benefits associated with incremental college credits beyond their effects on completion, both because the literature on returns to credits is outdated, and because it is not possible to separate which additional credits led to additional degrees and which did not. ACE participants enrolled for more terms and completed more credits on average than their control group counterparts, but is not clear whether all of these increases were among the new degree completers, or whether non-completers also completed more credits.[17] Omitting returns to additional credits that did not result in degrees could bias our benefit estimates downward.

We make several additional assumptions when creating these lifetime earnings profiles. First, we assume people enroll in college at age 18, in line with the average age at entry for the ACE study sample (Scuello and Strumbos 2024). Second, for those still enrolled in college, we assume that any earnings for these individuals can be approximated by the median earnings of those observed attending college in the ACS, regardless of age and unconditional on employment status. Third, we project lifetime earnings under the assumption that anyone leaving college, whether with or without a bachelor's degree, will approximately follow the earnings trajectory of

[17] The ACE five-year impact evaluation did not report impacts on cumulative credits; however, the four-report notes increases in enrollment term-by-term through Year 4, and an impact of 7.8 credits accumulated at the end of three years (see Zhu, Scuello, & Strumbos, 2023, Table A2).

individuals observed in the ACS from age 22 onward based on their reported graduation status. This means that the next year, they are assigned the median earnings of a 23-year-old representing one year of potential labor market experience, and so on.[18] For those that leave college after age 22, this essentially delays their lifetime earnings trajectory by the same amount as they are delayed in leaving college (relative to age 22).[19] To compute total lifetime earnings, earnings from ages 22–65 are discounted to age 18 using a social discount rate of 2%, although we test the sensitivity of these estimates to alternative discount rates.

C.2. Tax revenues from earnings

The lifetime earnings trajectories projected above are pre-tax. Some of these earnings will ultimately return to the government as tax revenue, while post-tax earnings may generate a stream of additional benefits for participants and their children. For this reason, it is useful to estimate the proportion of earnings that go towards tax revenue. To estimate the effect on tax revenue following the treatment effect on earnings, we use the income-group specific tax rates summarized by Wamhoff and Gardner (2019), applied separately to each gender-specific earnings profile. For instance, Wamhoff and Gardner found that taxes were about 20% of annual income for families with less than $23,000 of annual income. For those in our ACS sample with family income less than $23,000, we thus multiply the treatment effects they experience on gross earnings by 20% to derive the treatment effects on tax revenue. Of course, tax rates are higher

[18] The ACS data do not allow us to capture the number of years a person has worked. We assume the median earnings of those aged 22 in the ACS data are representative of the median earnings of those that start working after leaving college. Likewise, we assume the median earnings of those aged 23 in the ACS data, higher than the median earnings of those aged 22, reflect the additional one year of potential work experience accumulated.

[19] Our simulated earnings trajectories follow this pattern until age 50, at which point we give all sample members the median earnings of their age/education level regardless of when they leave college. At age 50, earnings begin to drop due to retirement. Our model assumes that those who graduate college early still retire at the same time, allowing them to benefit from additional years of peak earnings.

for higher-income groups.[20] We follow the same procedure for other income groups. In the section below, we describe how we calculate other benefits of ACE and the tax revenues derived from these other benefits.

C.3. Other current generational benefits

We use Garfinkel et al. (2022) to estimate the causal impact of increases in adult income on increases in adult health and reduction in public transfers. The causal impact in Garfinkel et al. (2022) on health is estimated from experimental and quasi-experimental studies that examine the causal effects of cash and near cash programs on adult health. Being healthier is valuable in and of itself and there is a large literature on the value of better health. Unfortunately, we do not have a direct measure of health improvement from CUNY ACE, so we apply the ratio of improvements in the value of health to earnings increases as found in Garfinkel, et al. (2022) to our projected earnings to estimate the value of improved health. The impact on public transfers in Garfinkel et al. (2022) is estimated using data from the 2014 Survey of Income and Program Participation and a linear regression model. Given our focus on the earning benefits for the current generation (and the relatively small magnitude of these estimated benefits in comparison), full details on how we calculate these other current generational benefits are reserved for Appendix A.2 and A.3.

D. Intergenerational benefits

For our main analysis, we use the estimated average earnings projections, by age, to estimate the income gains from ACE for the children of ACE participants. Although relatively few ACE participants may have children at the time they graduate, on average we project they will have approximately 1.4 children over their lifetime. Considering the second-generation

[20] For example, the rate rises to 27.5% for family incomes between $66,000 and $113,000, and rises to a maximum rate of 32.9% for families above $252,000. See Appendix A for more details.

effects of parental earnings alone will likely underestimate the full second-generation impact of ACE, because earnings are only one of the mechanisms through which parental education positively affects children.

Some further assumptions are required, however, in order to translate the strong causal evidence regarding the effects of cash and near cash transfers for children of low-income families into the context of parental earnings increases brought by CUNY ACE. First, we assume that increases in family income *from earnings* have the same effects on children as increases in income *from cash transfers*. The true effect from earnings might be either higher or lower than the effect from cash transfers. For example, benefits from earnings could be less than benefits from cash because more work involves more time apart from the child. On the other hand, increases in income from work may be more valued socially than increases from transfers. Given the lack of empirical evidence on that question, assuming the effects of cash and earnings are the same is a logical starting point. Second, we assume that the benefits to children of increases in family income diminish as family income increases. Intuitively, the same increase of $10,000 in family income is expected to have less effect on the long-term development of children in families with incomes of $200,000 compared to children in families with incomes of only $20,000. In their benefit-cost analysis of child allowances, Garfinkel et al. (2022) assume children in families with incomes above $100,000 receive no benefits from further increases in income, based on available evidence from the Norwegian context.[21] Children in families with

[21] There is no empirical evidence on this question in the United States, but a quasi-experimental study of the Norwegian oil boom provides evidence that benefits of increases in parental income to children diminish the higher the initial incomes of the parents, and that at a certain level of income the benefits decline to zero.

incomes up to $50,000 receive full benefits and benefits for children decline smoothly as family incomes increase from $50,000 to $100,000. We assume the same pattern for our results here.[22]

Given these assumptions, we calculate the intergenerational benefits, treating earnings projections as additional family income available for investing in the children of CUNY ACE participants. In our ACS sample, we first assign the estimated annual treatment effect on post-tax earnings by age.[23] We then further use the ACS to estimate the average number of children by age for a sample reflecting the gender and educational composition of the ACE study sample as a whole. By doing this, we assume the program has no effect on lifetime fertility, the timing of childbearing, or family structure.[24] Then we calculate the impacts that changes in parental earnings have on children (ages 0-17) throughout their lives (ages 0-78), based on the findings of Garfinkel et al. (2022) regarding the causal relationship between parental earnings and children's outcomes (details of the calculation are included in section A.2 of Appendix A), and discount these lifelong impacts back to when children first experience changes in parental earnings.

We assume that the impact is the same for children of all ages between 0-17. We apply these benefits to all projected children in the family at a given parental age, since the estimates from prior literature reflect average impacts on children across a variety of family sizes. Next, we prorate the intergenerational benefits by family income as described above and in Appendix A. All estimated children's benefits are then discounted again, from the year the parental earnings benefit was experienced, back to the year when their parents are age 18.

[22] There are a few reasons to believe that the $100,000 figure may be too low. Norway has a much narrower income distribution than the United States. Consequently, $100,000 may be much higher up in the income distribution of Norway as compared to the United States. Also, translating Norwegian kroner into U.S. dollars over time is fraught with difficulties. So, $100,000 is a useful starting point.

[23] Note that the tax payments to taxpayers could be generating intergenerational effects for the taxpayers, which we do not count in our analysis.

[24] If future birth rates fall below the current estimates in ACS, intergenerational benefits will be lower all else equal.

E. Modeling Program Costs Per Student

An ideal cost analysis would independently measure and monetize the economic costs of the personnel, materials, and other resources required to run the ACE program. A full application of this "ingredients method" for estimating costs is beyond scope of our project. Instead, we rely upon 1) CUNY's own estimates of the per student, per academic year incremental budgetary cost of running the program relative to business as usual, including personnel, supplies, tuition/fee waivers, and other direct costs, and 2) our own estimates of the incremental induced costs accruing to participants and taxpayers from additional years of college enrollment, including the opportunity cost of foregone earnings for participants who enroll for additional semesters.

As noted above, CUNY estimates the incremental direct costs of ACE to be approximately $4,000 per student per year, or $2,000 per student per regular fall/spring academic term. To calculate the incremental cost of ACE per treated student over their full length of study, we multiply $2,000 by the enrollment rate of the treatment group from years 1 to 4. On average, ACE participants enrolled for about 3.2 academic years during the first four years post-enrollment. Under this calculation, the present discounted value of the cumulative cost per treated student over 4 years is approximately $12,374. We assume that taxpayers shoulder the full cost of $12,374 and that approximately 63%, or $7,795 of costs go to students as cash and near-cash transfers.

We further include the estimated induced educational costs associated with ACE participants' average additional 0.20 years of enrollment at John Jay through Year 5, compared to the control group.[25] We assume that these induced educational costs primarily accrue to

[25] Term-by-term enrollment is provided in the Year 4 evaluation report (Zhu, Scuello, and Strumbos 2023); Year 5 enrollment rates were obtained via personal communication with the Year 5 study authors. The cost of one year of

taxpayers, given the availability of federal and state aid. We estimate an induced educational cost of $6,640 in the "permanent graduation increase" scenario. We include 50% of these costs in our midpoint scenario as the enrollment/attainment gap between the control and the treatment group closes by 50%. We drop these costs completely in our acceleration-only scenario.

The additional 0.2 years of enrollment also induces costs for participants in the form of forgone earnings in the labor market.[26] We estimate the present discounted value of this cost to be approximately $2,265.[27] We include 50% of these costs in our midpoint scenario, and drop them completely in our acceleration-only scenario. Table 2 shows the estimated direct and induced costs for participants, taxpayers, and society as a whole under the three alternative long-run scenarios.[28] We discuss limitations of these estimates after presenting our main results.

IV. Results

A. Main Results: ACE Effects on Participants' Earnings

A.1. Participants' lifetime pre-tax earnings

Figure 2 shows our lifetime earnings estimates for the control group and the ACE treatment group under our three scenarios regarding whether and how the increase in completed

FTE enrollment at John Jay is estimated at $33,123 based on IPEDS 2022 expenditure data. These costs are distributed across the city, state, and Federal government.

[26] We acknowledge that we treat the greater foregone earnings from Year 1 to Year 4 as an incremental cost of ACE, while beginning in Year 5 any differences in projected earnings due to continued enrollment in college show up in our benefit estimates. While such choices can matter for benefit-cost ratios (which we avoid computing in part for this reason), the treatment of foregone earnings will not affect our estimate of net social benefits, nor will it affect our estimate of net social benefits per dollar of direct costs.

[27] To estimate this cost, we first calculate the median earnings of those ages 18-21 by education in our ACS sample. We then take a difference between the median earnings of those ages 18-21 with some college but no degree and the earnings of those ages 18-21 that are enrolled in school but have no degree. We multiply this difference by the 0.2 years of additional enrollment and discount the cost back to age 18.

[28] These costs do not reflect the full economic cost of the program. A full assessment would include any additional financial aid that ACE participants may receive (as compared to the control group) from state or Federal sources. On the other hand, costs may be lower than estimated here to the extent that some program participants lose eligibility for ACE benefits over time (even if they remain enrolled), as is seen in other programs with annual credit requirements. We do not have information on whether any ACE treatment group students may have remained enrolled, but lost ACE eligibility over time; however, CUNY staff indicate that few if any students fell in this category.

degrees persists. As noted above, these earnings estimates are not conditional on employment and thus include some individuals with zero earnings. The figure illustrates our projection that CUNY ACE participants achieve higher earnings earlier, due to their earlier degree completion. Even in the acceleration-only scenario, a small earnings benefit persists into participants' forties, because they benefit from the early entry to the labor market (and thus earlier accrual of work experience that continues to generate higher wages in midlife).

Given the differences in earnings profiles in Figure 2, we next show the aggregated lifetime earnings effects in Figure 3 under varying discount rate assumptions relative to age 18. At our preferred 2% discount rate, assuming a fully persistent increase in graduation, we estimate a lifetime earnings benefit of over $85,000. Even in the acceleration-only scenario, we estimate ACE participants would still earn on average nearly $19,000 more over their lifetimes than non-participants due to their earlier entry into the labor market. This implies that at least 22% (=$19K/$85K) of the overall projected earnings benefit of ACE is due to acceleration of graduation.[29] The choice of discount rate matters more for the no-catch up scenario than for the full-catch up scenario, since the benefits of pure acceleration accrue mostly in the nearer term. Some catch-up is reasonable to expect; unfortunately, prior literature provides little insight regarding how much or how quickly catch-up may occur.[30] Our midpoint scenario, assuming

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[29] If we thought all of the earnings benefits were due to additional BA completions, we could divide the estimated earnings premium ($85,165) by the estimated impact on completion (11.7 percentage points) to obtain an implied lifetime earnings benefit per degree of $728,000. This is at the high end of other available estimates of the earnings premium for Bachelor's degrees compared to some college only. Our higher estimates reflect that 1) ACE's effects also include the effects of accelerating completion; 2) other estimates typically condition on full-time, full-year employment and thus miss any earnings benefits due to increased employment; 3) prior estimates more typically use a 3% real discount rate and Federal guidelines now recommend a 2% rate; and, 4) some other estimates subtract out the estimated costs of attendance and/or exclude the returns to graduate study.

[30] Few studies have tracked impacts on BA completion up to 10 years post-entry. One exception comes from research on West Virginia's PROMISE scholarship, which was designed to both increase and accelerate completion: the bachelor's degree completion impact shrunk by about 58% between year 5 and year 10 (Scott-Clayton [2011]; Scott-Clayton and Zafar [2019]). The WV PROMISE program and population are both quite distinct from CUNY ACE, however, making it difficult to know whether this pattern would generalize.

50% catch-up over 10 years and a discount rate of 2%, indicates a $52,000 lifetime earnings benefit.

A.2. Tax revenues from participants' earnings

Table 3 shows the aggregate lifetime earnings gains of ACE participation, as well as how these gains are allocated between participants and taxpayers. A little over a quarter of projected cumulative earnings gains flow to taxpayers rather than participants.

A.3. Summary of net benefits from participants' earnings

Table 4 combines the estimates of CUNY ACE costs from Table 2 with the earnings estimates in Table 3 to calculate net benefits under our three alternative catch-up scenarios. The top panel restates our estimates of total costs under each scenario for ease of comparison. The middle panel presents our estimated net benefits based on earnings alone, computed as the sum of earnings benefits (+) and program costs (-). As shown, under our midpoint scenario, the program generates substantial net benefits to society from increased earnings: $42,955 per participant in present value. The net earnings benefits of the program to society are strongly positive even under the acceleration-only scenario ($14,219). Table 4 also indicates substantial upside potential: if the completion effect persists fully, the net societal benefits from earnings increase to nearly $72,000 per participant, and taxpayers' investment is more than paid back via increased tax revenue from increased earnings over time.

B. Summary of net benefits from participants' earnings, health and public transfers

The bottom panel of Table 4 estimates net benefits in the current generation inclusive of health and public transfer benefits (for additional detail on health and public transfer benefits see Table B.1 of Appendix B). The inclusion of health and public transfer benefits increases net social benefits, but not by much (about 12%). While additional net benefits accrue to participants, taxpayers actually receive very slightly lower net benefits when health and public transfers are considered, because of the cost of transfer programs associated with increased longevity. Ultimately, our estimates of net social benefits in the current generation are mainly driven by participants' increased earnings, not by changes in health or public transfers. As noted previously, we do not attempt to quantify any potential reductions in crime due to recent work finding that the crime reduction benefits of education are driven by behavioral changes at much younger ages (Bell, Costa, & Machin 2022).

C. The time flow of net benefits from participants' earnings

So far our results represent the present discounted value of benefits over the participants' lifetime. It can also be instructive to explore how net benefits evolve over time. Figure 4 below presents the time flow of net benefits from participants' earnings under our mid-point scenario for participants, taxpayers and the society. We focus on net benefits from earnings (i.e., the middle panel of Table 4) because those are most straightforward to allocate to a specific point in time.[31] In the first four years after college entry, net social benefits are negative as participants are still in school. Earning benefits start to accumulate once graduates enter the labor market in Year 5. Net social benefits turn positive 9 years after college entry and continue to grow afterwards.

D. Lifetime earning benefits by gender

At all levels of education, men and women have very different lifetime earnings profiles. In our ACS sample, and including both differences in likelihood of employment and earnings conditional on employment, the median woman earns only 60% of the earnings of the median

[31] While projected health and public transfer benefits are "booked" in present value terms in the year in which earnings benefits occur, in this figure we actually care about the time path of when costs and benefits occur, not just their present value at a point in time. This is easiest to do with program costs and earnings benefits, which are the dominant factors in the current generation in any case.

man of similar age and education.[32] In addition, results from the ACE impact evaluation suggest substantially larger program impacts on degree completion for men (15.7 percentage points) than for women (8.9 percentage points). Thus, in this section we examine estimated earnings benefits by gender.

Table 5 shows the estimated lifetime earnings effects by gender, with our overall-sample estimates restated at the top for comparison. Earnings benefits are 2.5 to 3 times larger for men than for women.

To better understand these differences in benefits by gender, we estimated how much larger women's lifetime earnings benefits from ACE would be if they earned as much as men with the same levels of education (or conversely, how much smaller men's benefits would be if they earned as little as women). This exercise (shown in Table B.2 in Appendix B) indicates that men's higher earnings can explain somewhere between one- to two-thirds of the gender gap in overall earnings benefits from ACE. The remainder is explained by the substantially larger ACE impact on completion for men. This highlights the importance of complementary policies and programs to support women's full participation in the labor market.

E. Intergenerational benefit estimates

As discussed above, increasing parents' earnings when children are young can have a profound effect on children's later-life outcomes. Figure 5 shows the intergenerational benefits of ACE participation, scaled per treated adult so that these benefits can easily be integrated with our other per-participant benefit estimates.[33] These results reflect the lifetime benefits accruing in

[32] This is notably lower than conventional estimates of gender pay gaps, which typically condition on employment (for example, a recent report from Pew Research Center estimates working women earned 82% of working men's earnings in 2023; see https://www.pewresearch.org/short-reads/2023/03/01/gender-pay-gap-facts/).

[33] The figure also presents intergenerational benefits under various discount rates, which can be regarded as a sensitivity analysis. This sensitivity analysis only partly captures the effects of changes in the discount rate. These changes will affect our discounting back to the present of the estimated lifetime benefit to children that is "booked" in the relevant year of parental earnings. However, since we draw upon prior work for the estimated lifetime benefit

the next generation thanks to the advantages to children when their participating parents experience higher earnings. Because young children, in particular, benefit greatly from increased family income, and because attaining a bachelor's degree at an accelerated pace allows many participants to receive college graduate earnings during or before their children's first years, these benefits from the program are quite pronounced.

Table 6 splits these benefits by whether they go to participants' children, or to taxpayers. With 50% catch-up and a 2% discount rate, we estimate over $82,549 in benefits to the second generation, 39% of which flows to taxpayers. Notably, the total benefits to the second generation are actually substantially larger than the earnings benefits in the current generation. While this initially may seem surprising, it is less so when considering that the typical sample member is projected to have approximately 1.4 children over their lifetime, and that by accelerating degree completion, CUNY ACE increases family incomes particularly when children are most likely to be in the family. Further, the intergenerational estimates include long-run effects on health, crime, and public benefit receipt that prior literature has found to be causally influenced by children's family incomes. The higher proportion flowing to taxpayers is primarily attributable to reduced costs of crime once children become adults, increased tax payments once children become adults, and reduced healthcare expenditures throughout children's lives.

When we incorporate intergenerational benefits into our overall net benefit calculations, the results increase substantially. As we can see from Table 7, under the "permanent graduation increase" scenario, the present discounted value of net social benefits per participant is over $198,000. What is perhaps even more striking is the substantial social payoff even in the acceleration-only scenario ($56,000 in net benefits), highlighting the value of accelerating

to children itself, this estimate is fixed in our model even though it will also be affected by changes in the discount rate college completions, especially for young families with children. Taxpayers come out ahead in the long term, even in the acceleration-only scenario.

V. Discussion

In this article, we project the incremental net benefits of the CUNY ACE program based on the observed 11.7 percentage-point impact of the program on bachelor's degree completion rates measured five years after college entry (as reported in Scuello and Strumbos, 2024), compared to "business as usual" for this sample of ACE-eligible college enrollees. Estimating incremental net benefits requires assumptions about whether this five-year degree completion impact represents a permanent increase in degree completion versus purely accelerating completion (with the control group potentially catching up over time).

Under our midpoint scenario and inclusive of all modeled benefits in the participants' generation, CUNY ACE generates $48,037 in net social benefits per participant relative to business as usual, translating to a ratio of $3.06 in net social benefits per $1 of initial taxpayer cost. Differences in how benefit-cost ratios are constructed from study to study can make precise comparisons difficult, but our estimates are broadly consistent with available estimates for ASAP, for which Levin and García (2018) estimate a benefit-cost ratio of 3.5, as well as benefit-cost ratios found for college financial aid programs (which range from 1.50 to 2.58, see Harris and Mills 2021). A novel feature of our analysis is the inclusion of benefits projected to accrue to the children of CUNY ACE participants. In the midpoint scenario, net benefits more than double to $130,586 per participant when we include intergenerational benefits, or $8.32 per dollar of initial taxpayer cost.

It is important to note that our analysis does not attempt to estimate all of the possible benefits of the program that are listed in Table 1. In particular, we have not attempted to model any potential benefits in the current generation from reduced crime (though we do incorporate those benefits in the second generation). Nor are we able to estimate the benefits to children that may accrue through non-parental-earnings channels (i.e., the direct benefits children may receive from a parent's additional education, separate from any increase in parental income). It is thus possible the true social benefits could be even larger than the largest estimates we present here.

Considering the taxpayer perspective in isolation, the program may not quite pay for itself in the current generation (under the midpoint scenario, the net cost to taxpayers is $2,170 per participant), but the long-term cost is still much lower than the initial taxpayer investment, due to increased income tax payments, savings in healthcare expenditures, and reductions in public assistance. When we include second-generation benefits, even taxpayers come out ahead, regardless of the assumptions we make about how much of the degree completion impact persists permanently.

All of our estimates are grounded in projections of annual earnings by age, gender, education, and years of labor market experience, using national data from the American Community Survey. It is important to acknowledge that these are just projections, and the true earnings effects may be larger or smaller for a variety of reasons. For example, we use national earnings data but the dynamics of the local labor market relevant for CUNY ACE may generate larger or smaller earnings premia for bachelor's degree graduates. Second, not all college majors are eligible for CUNY ACE. The bachelor's degree premium for CUNY ACE majors may be different than the average across all fields reflected in the ACS data. Third, if declining birth rates mean that ACE participants have fewer children than we project based on current ACS data, this will lower the true intergenerational benefits. More generally, as discussed in our methodology section, there is no guarantee that these projections will match the true causal impacts, when and if such estimates become available in the future.

Finally, it is important to note that the underlying degree completion impact comes from an RCT conducted for a single cohort of participants at a single institution, with the COVID-19 pandemic falling in the spring of students' sophomore year. The impact of ACE on degree completion, and the earnings return to degrees completed in the years following the onset of the pandemic, may be different than what would be observed in a different setting or time period. The program's per-participant benefits and costs could also change if the program were scaled up. Still, the available evidence on CUNY ACE is consistent with the large effects on degree completion found in multiple contexts for the ASAP program, upon which ACE was based.

While these long-term net benefit estimates are projected rather than observed directly, policymakers cannot wait decades to make informed investment decisions. The alternative of relying solely on observed short-term benefits and costs may lead policymakers to de-prioritize long-term investments, even when available evidence suggests they are a very good bet for society.

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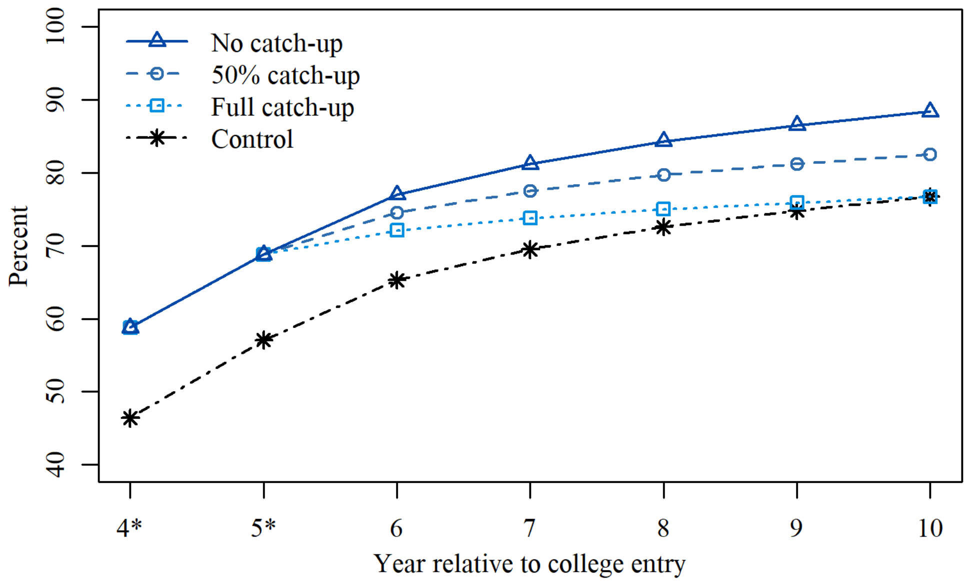
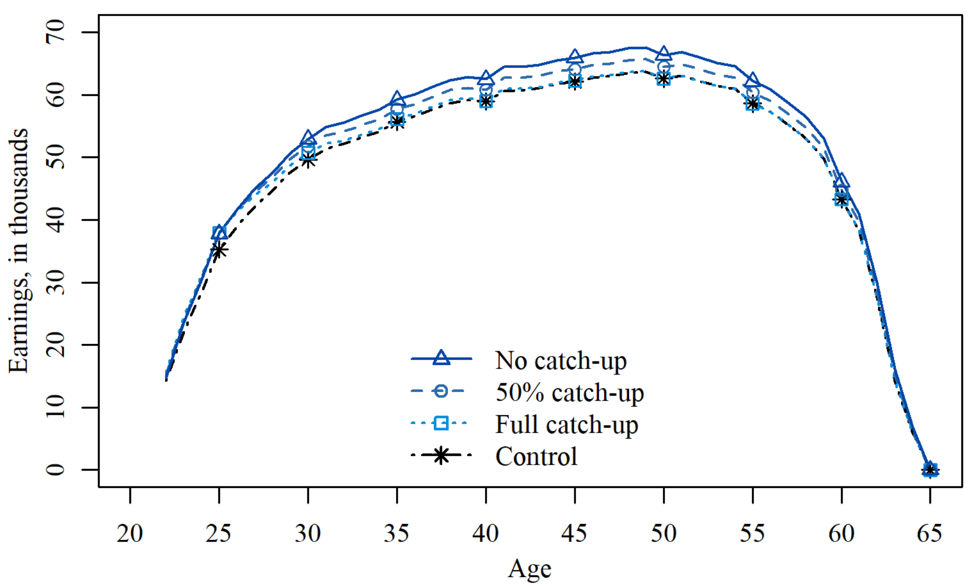
Figures and Tables

Figure 1. Projected completion rates through year 10 by treatment group and scenario



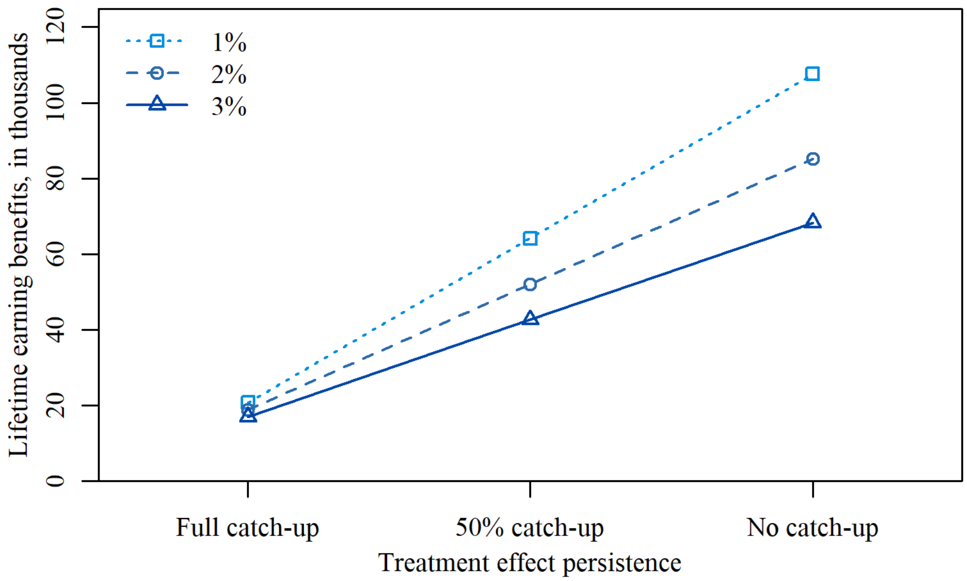
Note: The asterisks at years 4 and 5 indicate that completion rates at years 4 and 5 are observed values. Rates at the rest of the years are projected values.

Figure 2. Lifetime unconditional earnings trajectories, by CUNY ACE treatment status and catch-up scenario



Note: Authors' projections using CUNY ACE (Accelerate, Complete, Engage) evaluation impact estimates and American Community Survey (ACS) 2015-2019 five-year data. ACE provides Bachelor's degree students at CUNY with a range of financial and academic supports, with the goal of increasing and accelerating degree completion. Estimates represent median earnings by age in 2023 dollars, without conditioning on employment.

Figure 3. Lifetime earnings benefits of CUNY ACE, by catch-up scenario and social discount rate



Note: Estimates represent the mean effects per treated adult.

Figure 4. Cumulative net benefits of CUNY ACE for participants, taxpayers, and the society, by years since college entry (50% catch-up), based on current-generation earnings only

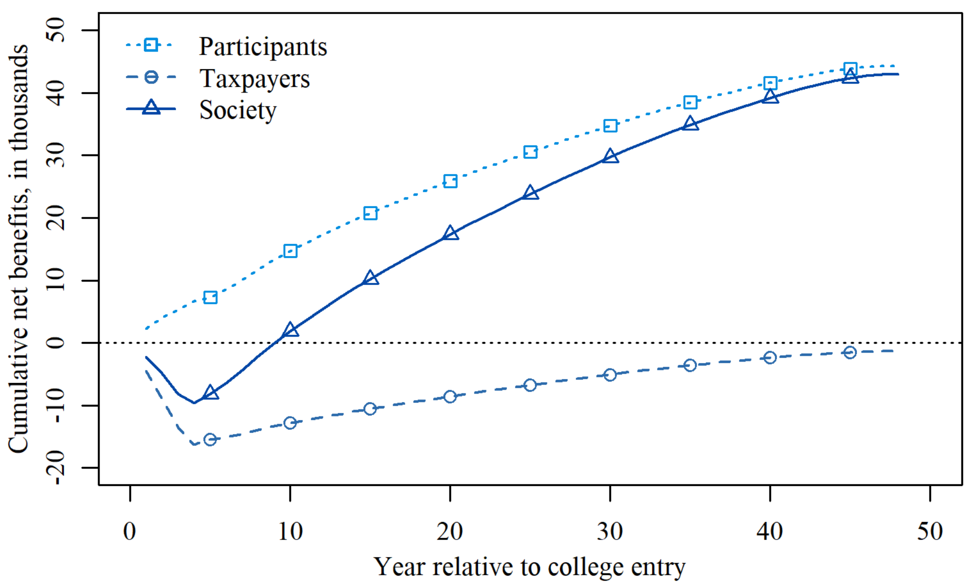
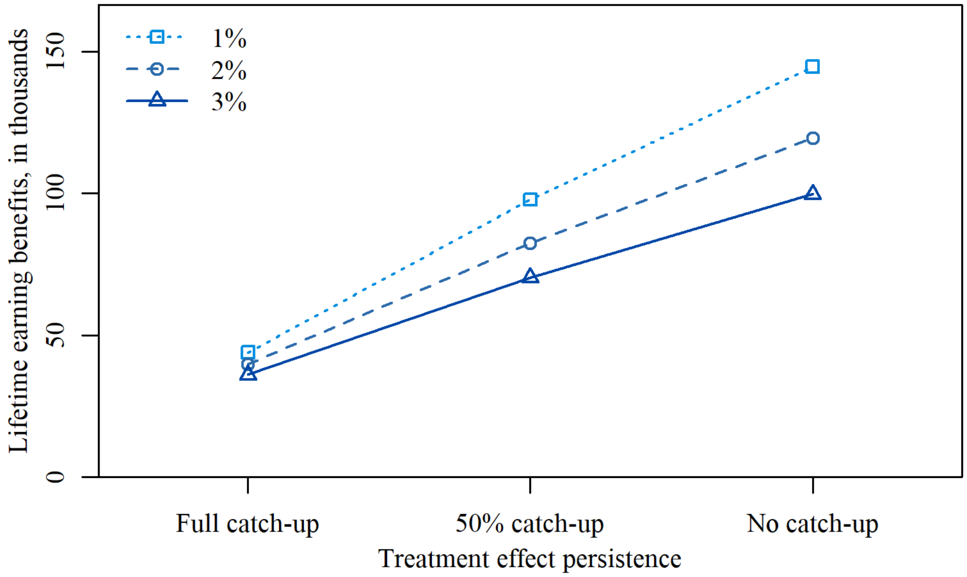


Figure 5. Intergenerational benefits of CUNY ACE, by catch-up scenario and social discount rate



Note: Estimates represent the mean effects per treated adult.

Table 1. Conceptual table of monetary benefits and costs of CUNY ACE program

	Participants +	Taxpayers =	Total society
Current generation costs and benefits			
A. ACE program expenditures	+	−	−
i. Administrative costs and services	0	−	−
ii. Cash and near-cash transfers	+	−	0
B. Induced expenditures generated by ACE enrollment/attainment	−	−	−
C. Increased future earnings	+	0	+
D. Increased future tax payments	−	+	0
E. Increased health and longevity	+	0	+
F. Avoided expenditures on health care costs	+	+	+
G. Avoided judicial expenditures and victim costs of crime	0	?	?
H. Avoided expenditures on welfare	−	+	0
I. Increased social security payment due to increased longevity	+	−	0
Intergenerational benefits to children of program participants			
J. Increased future earnings of children	+	0	+
K. Increased future tax payments by children	−	+	0
L. Increased children's health and longevity	+	0	+
M. Avoided expenditures on children's health care costs	+	+	+
N. Avoided expenditures on foster care	0	+	+
O. Avoided expenditures and victim costs of crime	0	+	+
P. Avoided expenditures on other cash or near-cash transfers	−	+	0
Q. Increased payment due to increased children's longevity	+	−	0
R. Increased expenditures from greater child educational attainment	0	−	−

Notes: Benefits are denoted by +, costs by −, conceptual uncertainty by ?, and completely offsetting benefits and costs or no effect by 0. Of course, in practice participants and taxpayers are not mutually exclusive in the population.

Table 2. ACE-related transfers and costs per participant

	Participants	Taxpayers	Society
Full catch-up			
Direct costs/transfers	$7,795	-$12,374	-$4,578
Induced costs	$0	$0	$0
Total	$7,795	-$12,374	-$4,578
50% catch-up			
Direct costs/transfers	$7,795	-$12,374	-$4,578
Induced costs	-$1,133	-$3,320	-$4,453
Total	$6,663	-$15,694	-$9,031
No catch-up			
Direct costs/transfers	$7,795	-$12,374	-$4,578
Induced costs	-$2,265	-$6,640	-$8,905
Total	$5,530	-$19,014	-$13,484

Note: Estimates expressed in present value using a 2% social discount rate. Numbers may not sum up exactly to total due to rounding. Negative numbers reflect costs or transfers provided, while positive numbers reflect cash or near-cash transfers received by participants. Direct costs and transfers are those explicitly related to delivery of the ACE program model (such as tuition and fee waivers and the cost of enhanced advising), while indirect costs are from induced educational investments (opportunity costs for participants and taxpayer costs for induced college enrollment). Transfers from taxpayers to participants cancel out from Society's perspective.

Table 3. Lifetime earnings benefits of CUNY ACE, by catch-up scenario

	Participants	Taxpayers	Society
Full catch-up	$13,790	$5,007	$18,797
50% catch-up	$37,636	$14,350	$51,986
No catch-up	$61,397	$23,768	$85,165

Note: Estimates expressed in present value using a 2% social discount rate. Numbers may not sum up exactly due to rounding.

Table 4. Costs, transfers, and net benefits of CUNY ACE, current generation only

	Participants	Taxpayers	Society
Program costs and transfers			
Full catch-up	$7,795	-$12,374	-$4,578
50% catch-up	$6,663	-$15,694	-$9,031
No catch-up	$5,530	-$19,014	-$13,484
Net benefits (including earnings benefits only)			
Full catch-up	$21,585	-$7,367	$14,219
50% catch-up	$44,299	-$1,344	$42,955
No catch-up	$66,927	$4,754	$71,681
Net benefits (including health and public transfer benefits)			
Full catch-up	$24,480	-$7,772	$16,709
50% catch-up	$50,207	-$2,170	$48,037
No catch-up	$75,531	$3,551	$79,083

Note: Estimates expressed in present value using a 2% social discount rate. Numbers may not sum up exactly due to rounding. Transfers from taxpayers to participants cancel out from society's perspective.

Table 5. Lifetime earnings benefits of CUNY ACE, by gender

	Participants	Taxpayers	Society
Overall			
50% catch-up	$37,636	$14,350	$51,986
Men			
50% catch-up	$67,527	$25,802	$93,329
Women			
50% catch-up	$27,159	$10,351	$37,510

Note: Estimates expressed in present value using a 2% social discount rate. Numbers may not sum up exactly due to rounding.

Table 6. Intergenerational benefits of CUNY ACE

	Participants' Children	Taxpayers	Society
Full catch-up	$24,434	$15,347	$39,782
50% catch-up	$50,702	$31,846	$82,549
No catch-up	$73,387	$46,095	$119,482

Note: Estimates expressed in present value using a 2% social discount rate. Numbers may not sum up exactly due to rounding.

Table 7. Costs, transfers, and net benefits of CUNY ACE, including intergenerational benefits

	Participants and Their Children	Taxpayers	Society
Program costs and transfers			
Full catch-up	$7,795	-$12,374	-$4,578
50% catch-up	$6,663	-$15,694	-$9,031
No catch-up	$5,530	-$19,014	-$13,484
Net benefits across both generations			
Full catch-up	$48,914	$7,575	$56,490
50% catch-up	$100,909	$29,676	$130,586
No catch-up	$148,918	$49,646	$198,565

Note: Estimates expressed in present value using a 2% social discount rate. Numbers may not sum up exactly due to rounding.

Appendix A. Methodological Appendix

A.1. Modeling ACE impacts on degree completion over time

To estimate the rate at which control group completions increase between Year 5 and Year 10, we draw upon publicly available tabulations of completion rates for first-time, full-time John Jay entrants (CUNY Office of Applied Research, Evaluation, and Data Analytics 2024). These public tabulations suggest that graduation rates are unlikely to increase much beyond 10 years post-enrollment, as only about 3 percent of John Jay first-time, full-time entrants remain enrolled at that point, and graduation increases by less than one percentage point in the tenth year.

Since the ACE study sample is only a subset of the John Jay student population (namely, they enter as first-time, first-year students and meet all of the eligibility requirements for ACE as described above), graduation rates for the ACE study sample are higher overall than the rates for John Jay as a whole. We thus take the *growth rates* of graduation over time from the public John Jay data, and apply those growth rates to the ACE study sample under different assumptions.

We model three main scenarios, by gender: assuming the degree completion impact after five years represents a permanent increase in degree completion ("no catch-up"), assuming it represents acceleration of completion only ("full catch-up"), and a midpoint between these two scenarios ("50% catch-up"). In all scenarios, we assume that the control completion rate increases over time at the same rate as the broader John Jay population, by gender. In other words, we assume that the ratio of Year 6 to Year 5 completion rates is the same for the ACE control group as is observed for the broader John Jay population in publicly available data; the Year 7 to Year 6 ratio is the same as observed in publicly available data, and so on. We use completion growth rates based on the 2009 entry cohort, which can be tracked for a full 10 years prior to the onset of the pandemic.[34] When projecting by gender, we use the unadjusted five-year completion rate, which for men is 58.1% for the treatment group and 42.4% for the control group, and for women is 72.9% for the treatment group and 64% for the control group. When projecting for the overall cohort we use the regression-adjusted five-year completion rate, which is 57.1% for the control group and 68.8% for the treatment group.[35]

In the persistent completion effect scenario, to obtain the treatment group graduation rates, we simply add the regression-adjusted impact estimate to the control group rate in each year (when conducting the analysis by gender, we follow Scuello and Strumbos [2024] which reports the unadjusted impact, which is a 15.7 percentage-point impact for men, and 8.9 percentage points for women), under the assumption that the five-year degree completion impact is maintained in each year until the end of Year 10.

In the acceleration-only scenario, we leave this growth path unchanged for the control group, but assume that the program impact attenuates annually (or, said differently, that completions grow more slowly over time in the treatment group) such that treatment group completion rate matches that of the control group by Year 10. We determine the rate at which program impact attenuates by drawing from public John Jay data on late year graduates (or those graduating in Years 6-10) and estimating the proportion of all late year graduates that complete their degree in each respective year, and attenuate the program impact by the same proportion.[36]

For men, because their completion rate in Year 5 is already higher than the projected control rate in Year 10, it is not possible to attenuate the program impact to zero, even if we

[34] Although the overall *levels* of graduation are higher for more recent graduates, beyond Year 5 the growth rates from year to year are very similar (for as long as cohorts can be tracked).
[35] These choices are consistent with the latest 5-year report (Scuello and Strumbos 2024), which highlights the unadjusted rate by gender in Figure 3 and highlights the adjusted overall rate in the findings section.
[36] So, for example, if 40% of Year 6–10 graduates finish in Year 6, and another 20% finish in Year 7, and so on, we attenuate the Year 5 impact by 40% in Year 6, and an additional 20% in Year 7, and so on through Year 10.

assume no additional treatment group men graduate after Year 5.[37] Thus, for men, our "maximum catch-up" scenario simply holds the Year 5 graduation rate constant until year 10 for the treatment group, which attenuates the impact estimate by about 94% (from 15.7 percentage points to 0.9 percentage points).[38]

Finally, we model a midpoint scenario in which the control group closes half the gap in graduation rates by the end of year 10 using a similar method to that of the acceleration-only scenario discussed above.

Table A.1 presents the projected graduation rates of the control and treatment group under these different scenarios, which we use for subsequent analyses. We note that the acceleration-only scenario seems exceptionally pessimistic, as it assumes that the control and treatment groups have the same outcomes in the program's 10th year. This scenario serves as an extreme lower estimate of the effect of ACE on ultimate degree completion. On the other hand, the assumption of a permanent graduation effect is optimistic, so this scenario serves as our upper estimate of the effect of ACE.

[37] The only way to force this would be to revoke some degrees previously earned in the Treatment group, or to assume that completions in the Control group grow from Year 5 to Year 10 at nearly twice the rate as empirically observed for men at John Jay (we assume an increase of 35% over time while an increase of 57% would be needed).

[38] For men, the observed Year 5 completion rate for the treatment group is higher than the projected Year 10 rate for the control group; thus, it is not possible to attenuate the impact to zero for men unless we assume implausibly high growth in control group completions after Year 5. Therefore, in this case, the "full catch-up" scenario can be interpreted as "maximum catch-up" instead.

Table A.1. Projected graduation rates of CUNY ACE treatment and control groups 5–10 years post enrollment

	Control:			Treatment 1: Persistent graduation effect (no catch-up)			Treatment 2: Primarily acceleration effect (full catch-up)		
Year	Overall	Men	Women	Overall	Men	Women	Overall	Men	Women
4*	46.4%	35.3%	51.0%	58.8%	47.7%	62.8%	58.8%	47.7%	62.8%
5*	57.1%	42.4%	64.0%	68.8%	58.1%	72.9%	68.8%	58.1%	72.9%
6	65.3%	49.5%	71.6%	77.0%	65.2%	80.5%	72.1%	58.1%	77.3%
7	69.5%	51.8%	77.5%	81.2%	67.5%	86.4%	73.8%	58.1%	80.8%
8	72.6%	54.2%	80.7%	84.3%	69.9%	89.6%	75.0%	58.1%	82.7%
9	74.8%	55.6%	83.5%	86.5%	71.3%	92.4%	75.9%	58.1%	84.3%
10	76.7%	57.2%	85.4%	88.4%	72.9%	94.3%	76.7%	58.1%	85.4%

Note: For the overall population, the asterisked Year 4 and 5 graduation rates are the regression-adjusted estimates in Tables C1, C2, and C3 of the Five-Year Evaluation report (Scuello and Strumbos 2024); For men and women, the asterisked Year 4 and 5 graduation rates are the unadjusted estimates presented in Tables C1, C2, and C3 of the Five-Year Evaluation report (Scuello and Strumbos 2024); all other graduation rates are our own projections. The 50% catch-up scenario is the midpoint between estimates presented under Treatment 1 and 2.

Using the projected graduation rates in Table A.1 above, we compute the distribution of individuals by year expected to leave college, with or without a bachelor's degree, shown in Table A.2. We assume that students who do not graduate by Year 10 exit the program without a degree. Since we are modelling three catch-up scenarios, we calculate a distribution for each scenario. For example, consider the overall sample of the control group shown in column (1) of Table A.2. In year 4 since enrollment, 46.4% of the sample graduate with a bachelor's degree, 14.1% leave college without a degree, and the remaining 39.5% are still enrolled in college. In year 5, 10.7% of the overall sample of the control group graduate with a degree and 3.3% leave without a degree; now the remaining enrolled students is 25.5% of the control sample (=39.5-10.7-3.3). Summing up the distribution of college leavers in each column of Table A.2 equals 100% such that by 10 years post-enrollment, every individual has left with or without a degree.

Table A.2. Distribution of students leaving college, by CUNY ACE treatment status and years post-enrollment

Year	Control: Overall (1)	Control: Men (2)	Control: Women (3)	Treatment 1: Persistent graduation effect (no catch-up): Overall (4)	Men (5)	Women (6)	Treatment 2: Primarily acceleration effect (full catch-up): Overall (7)	Men (8)	Women (9)
	A. Leaving college with a bachelor's degree								
4*	46.4%	35.3%	51.0%	58.8%	47.7%	62.8%	58.8%	47.7%	62.8%
5*	10.7%	7.1%	13.0%	10.0%	10.4%	10.1%	10.0%	10.4%	10.1%
6	8.2%	7.1%	7.6%	8.2%	7.1%	7.6%	3.3%	0.0%	4.4%
7	4.2%	2.2%	5.9%	4.2%	2.2%	5.9%	1.7%	0.0%	3.4%
8	3.2%	2.5%	3.3%	3.2%	2.5%	3.3%	1.3%	0.0%	1.9%
9	2.2%	1.4%	2.8%	2.2%	1.5%	2.8%	0.9%	0.0%	1.6%
10	1.9%	1.6%	1.9%	1.9%	1.6%	1.9%	0.8%	0.0%	1.1%
	B. Leaving college without a bachelor's degree								
4*	14.1%	26.4%	8.7%	7.0%	16.7%	3.4%	14.1%	25.9%	8.7%
5*	3.3%	5.3%	2.2%	1.6%	3.4%	0.9%	3.3%	5.2%	2.2%
6	2.5%	5.3%	1.3%	1.2%	3.4%	0.5%	2.5%	5.2%	1.3%
7	1.3%	1.7%	1.0%	0.6%	1.1%	0.4%	1.3%	1.6%	1.0%
8	1.0%	1.8%	0.6%	0.5%	1.2%	0.2%	1.0%	1.8%	0.6%
9	0.7%	1.1%	0.5%	0.3%	0.7%	0.2%	0.7%	1.1%	0.5%
10	0.6%	1.2%	0.3%	0.3%	0.7%	0.1%	0.6%	1.1%	0.3%

Note: The columns sum to 100% representing the full distribution of students leaving college 4 to 10 years post-enrollment, whether with a bachelor's degree or not, under the assumption that graduation is completed no greater than 10 years post-enrollment. See Table A.1 graduation rates and note.

We use Garfinkel et al. (2022) to estimate the causal impact of increases in adult income on increases in adult health and reduction in public transfers. The causal impact in Garfinkel et al. (2022) on health is estimated from experimental and quasi-experimental studies that examine the effects of cash and near cash programs on adult health and the causal impact on public transfer is estimated using data from the 2014 Survey of Income and Program Participation and a linear regression model. Given our focus on the earning benefits of the current generation, details on how we calculate these other current generational benefits are presented in the appendix instead.

A.2. Modeling lifetime health benefits of the current generation

We use Garfinkel et al. (2022) to estimate the causal impact of increases in adult income on increases in adult health. The causal impact in Garfinkel et al. (2022) on health is estimated from experimental and quasi-experimental studies that examine the effects of cash and near cash programs on adult health and the causal impact on public transfer is estimated using data from the 2014 Survey of Income and Program Participation and a linear regression model. Based on these studies, Garfinkel et al. (2022) calculated that for each adult, an annual increase in family income of $1,000 from cash and near-cash transfers increases health and longevity by $378. Using observational data, the authors also calculated that the increase in health and longevity reduces healthcare costs by approximately $3 and increases longevity transfer payments by $77.[39]

We then apply this estimate to our analysis, assuming that an increase in earnings has the same effect as an increase in family income from transfers.[40] We assign the estimated CUNY ACE treatment effect on post-tax earnings by age to people in our ACS sample, and then calculate the health effect proportional to the earning effect using the causal relationship estimated by Garfinkel et al. (2022). We multiply treatment effect on post-tax earnings by 0.381 (($378 + $3)/1000) to derive the health effect (per adult) for the society (the $77 of increased longevity transfers payments are reflected in participants' benefits and taxpayers' costs, but wash out from a societal perspective). Finally, following Garfinkel et al. (2022), we assume that the same increase in earnings will generate smaller benefits for those in families with higher income. Garfinkel et al. (2022) estimated the heterogenous effect of increase in family income along the income distribution using an experimental study of the Norwegian oil boom. Following Garfinkel et al. (2022), we assign the full health effect to those in families with income below $50,000, a decreasing portion of the full effect to those in families with income between $50,000

[39] Longevity transfer payments include social security payments and Medicare payments.
[40] The true effect could be smaller, if earnings from work as less beneficial to health than cash transfers, but it could also be larger, if education has direct benefits for health that do not go through income. We also assume that the benefits calculated by Garfinkel et al. (2022) for parents apply to adults in general (both parents and adults without children. In fact, one of the studies that Garfinkel et al. (2022) used examined the impact of cash transfers on both parents and adults without children.

and $100,000, and zero effect to those in families with income above $100,000. All health effects are discounted to age 18.

A.3. Modeling lifetime reduction in public transfers of the current generation

We use Garfinkel et al. (2022) to estimate the impact of increases in adult income on public transfers. Using data from the 2014 Survey of Income and Program Participation and a linear regression model, Garfinkel et al. (2022) found that among adults with less than a college degree, a $1,000 increase in annual earnings would lead to $9.72 reduction in annual cash and near-cash transfers received.[41] Following the same approach described above for the health benefit, we estimate the public transfer effect for participants by multiplying the annual treatment effect on pre-tax earnings by age in our ACS sample by 0.00972 (972/1000). We then prorate the effect by family income and discount to age 18. Less transfers for participants mean greater savings for taxpayers. In the case of public transfers, the gain of taxpayers equal exactly to the loss of participants. This means that the reduction in public transfers has zero effect on net social benefit.

A.4. Modeling intergenerational benefits

To calculate the intergenerational effect, we first assign the estimated annual treatment effect on after tax earnings by age to people in our ACS sample. We use the income-specific tax rates summarized in Wamhoff and Gardner (2019) to calculate after tax earnings gains.[42] Then we calculate children's long-run monetary impacts proportional to changes in parental earnings based on the findings of Garfinkel et al. (2022). The authors found that for every child beneficiary, a $1,000 increase in family income per year from cash and near-cash transfers

[41] Transfers include EITC, housing subsidies, disability, workers' compensation, WIC, unemployment compensation, TANF, SSI, general assistance, and food stamps.

[42] Note that the tax payments to taxpayers could be generating intergenerational effects for the taxpayers, which we do not count in our analysis.

increase the child's future earnings ($1,083), increase future tax payments (-$303), decrease neonatal mortality ($10), increase health and longevity ($2,250), reduce public transfers received (-$20), increase costs of education due to increases in education (-$302), reduce healthcare expenditures ($8), and increase payments received due to increased longevity ($229). Some of these benefits and costs to the child will affect taxpayers. Taxpayers will receive an increase in future tax payments ($303), as well as savings on public transfers ($20), child protective services ($21), expenditures and victim costs of crime ($1,746), healthcare expenditures ($67), and they will see an increase in costs related to increased education of the child (-$72) and an increase in longevity-related payments to the child (-$229).

Summing up benefits and costs to both participants' children and taxpayers, a $1,000 increase in annual family income is associated with $4,812 (per child) of net benefits for society. It is our assumption that increase in parental earnings has the same effect as an increase in family income from transfers. We thus multiply treatment effects on net earnings by 4.812 per child in the family to obtain the intergenerational benefits in each year. Finally, it is our assumption that benefits of increased parental earnings for children decrease with respect to initial family income. We thus further adjust the intergenerational benefits by family income, assuming that children with family incomes below $50,000 receive full intergenerational benefits, those with family incomes above $100,000 receive no benefits and for children in between the benefit declines smoothly till it reaches zero at $100,000. All intergenerational benefits are discounted to the participating parents when they are at the age of 18 years old.

Appendix B. Additional Results

B.1. Lifetime health and public transfer benefits of the current generation

Table B.1 presents the health benefits and savings in public transfers from CUNY ACE and how the benefits are distributed among participants, taxpayers, and the society. Assuming 50% catch-up and a social discount rate of 2%, CUNY ACE leads to $6,079 increase in health per participant in the present value. Improvement of participants' health leads to savings in healthcare costs for taxpayers, but also incurs additional taxpayers' spending on longevity transfer payments, such as Social Security and Medicare. Under the 50% catch-up case, taxpayers incur a loss of $997 per participant. The society as a whole enjoys health benefits of $5,082 per participant.

CUNY ACE increases participants' earnings and leads to reduction in public transfers received. Under our mid-point scenario, participants receive $171 less public transfers, which create $171 savings for taxpayers. The reduction in public transfers washes out from a social perspective.

Table B.1 Lifetime health benefits and public transfer benefits of CUNY ACE, by catch-up scenario

	Participants	Taxpayers	Society
Lifetime health benefits			
Full catch-up	$2,978	-$488	$2,490
50% catch-up	$6,079	-$997	$5,082
No catch-up	$8,853	-$1,452	$7,401
Lifetime reduction in public transfers			
Full catch-up	-$83	$83	$0
50% catch-up	-$171	$171	$0
No catch-up	-$249	$249	$0

Note: Estimates expressed in present value using a 2% social discount rate. Numbers may not sum up exactly due to rounding.

B.1. Lifetime earning benefits of by gender

Table B.2. Disentangling gender gap in lifetime earnings benefits

	Lifetime earnings benefits		Difference	Difference as a percentage of the gender gap
	Baseline estimate	Counterfactual		

Men				
Full catch-up	$41,554	$23,932	-$17,622	63%
50% catch-up	$93,329	$61,926	-$31,403	56%
No catch-up	$151,815	$104,843	-$46,972	52%
Women				
Full catch-up	$13,373	$24,442	$11,069	39%
50% catch-up	$37,510	$57,244	$19,734	35%
No catch-up	$61,649	$90,052	$28,403	32%

Note: The baseline estimates correspond to results by gender shown in Table 5 of the manuscript. The counterfactual estimates represent the lifetime earnings benefits that correspond to attaching men's earnings to women's impacts, and vice versa.

Acknowledgements

This policy brief is made possible with the support of Robin Hood. We are grateful to Christine Brongniart and Diana Strumbos of the City University of New York for providing program information and feedback on early drafts. We are also grateful to Emma Garcia and Douglas Harris for their review and comments. The analysis and conclusions presented here, and any remaining errors of fact or interpretation, are those of the authors alone.