The Net Benefits of Raising Bachelor's Degree Completion through the City University of New York ACE Program

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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 $42,000 over a lifetime per participant from greater earnings and labor force attachment. Including intergenerational benefits for children who grow up in higher-earning families nearly triples this estimate, to over $125,000 net social benefits. 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.

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). And 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). While some amount of noncompletion is to be expected in a healthy postsecondary system that encourages students to try out college (Manski 1989), many students who would like to complete a degree have trouble navigating the process from entry to completion (Scott-Clayton 2015). Students

who do complete bachelor's degrees are also taking 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 do 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

[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.

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 estimate the lifetime benefits accruing to participants' current and future children due to their parent's additional income (Garfinkel et al. 2022). We assess net benefits from the perspective of participants, taxpayers, and society as a whole.

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. While we are agnostic about which of these scenarios is most likely, and we encourage readers to engage with the full range of possibilities, for ease of exposition our primary discussion will focus on the midpoint scenario and will focus on benefits in the current generation.

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. In this scenario, we estimate that every $1 in program spending by taxpayer costs generates $5.79 in net

[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.

social benefits over participants' lifetimes. About 28 percent of participants' additional earnings are returned to taxpayers in the form of participants' higher tax payments, meaning that the program is a net positive for taxpayers over the long term. For society as a whole, CUNY ACE generates net social benefits of $71,681 per participant. It is important to note that our current-generation estimates are focused on earnings benefits and thus underestimate the true social benefits, which may include improvements in participants' health and longevity, reductions in crime, or other social benefits.

Under a midpoint assumption that the degree completion impact attenuates by 50% over time as the control group attains degrees in later years than do participants, $1 in direct taxpayer costs still generates $3.47 in net social benefits. In this midpoint scenario, net social benefits of CUNY ACE are estimated at $42,955 per participant, with most of these net benefits going to participants themselves.

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 $14,000 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 that 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 feature of our analysis is that we further 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 benefit from their parents' higher incomes as a result of ACE. Ultimately, the total social benefits accruing to the second generation are between 1.4 and 2.1 times the earnings benefits in the participants' generation. This is both because, on average, we project 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 attainment are large even under the full catch-up scenario.

A sub-group analysis by gender reveals that earning benefits are larger for men than women. A third of the difference can be explained by men's higher earnings in the labor market, while the remaining two-thirds can be attributable to the larger effect the ACE program has on men's degree completion. This highlights the need for complementary policies and programs that level the playing field for men and women in the labor market.

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-

[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. Evidence regarding the causal effects of college completion is primarily limited to earnings outcomes, making it harder to estimate the value of a broader range of outcomes in the participants' generation.

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;
- 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 the textbook assistance.[4]

[4] Personal communication with Christine Brongniart, University Executive Director, CUNY ASAP|ACE, April 2, 2024.

Also, like CUNY ASAP, the ACE program has both initial and ongoing eligibility restrictions and requirements. For ACE, these requirements vary depending upon whether students enter the program as first-year students or as transfer students (CUNY 2024). Since the available impact evidence pertains to those entering as first-year students, we focus on their eligibility criteria:

- NYC resident and/or eligible for in-state tuition;
- admitted to a participating ACE college;
- pursuing an ACE-eligible major;
- must enroll in 15 credits per semester (more than the standard 12-credit full-time load);
- must enroll in summer/winter terms if they complete fewer than 30 credits per year;
- must submit both a Federal student aid application (FAFSA) as well as the NY state Tuition Assistance Program (TAP) application annually; and,
- must attend the monthly ACE seminar and monthly one-on-one advisory meetings.

ACE-eligible majors may vary by institution. 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 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

[5] Personal communication with Diana Strumbos, CUNY Senior Director of Research and Evaluation, Student Success Initiatives, May 17, 2024.

records (Scuello and Strumbos 2024). 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%).[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 and substantively large 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

[6] 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.

whether we expect a particular benefit to accrue (+) or cost to be incurred (-) for participants, taxpayers, or society overall. Where we expect no benefit or cost, we place a zero in the column (a question mark indicates uncertainty about whether an outcome is expected to be a net benefit or cost). The top panel of Table 1 focuses on benefits and costs for the current generation, while the bottom panel considers additional benefits and costs for the children of current participants. Note that while conventions of BCA differentiate between "participants" and non-participant "taxpayers" as impacted parties, of course ACE participants also pay taxes throughout their lifetimes.

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

	Participants +	Taxpayers =	Total society
A. ACE program expenditures	+	−	−
i. Administrative costs and services	0	−	−
ii. Cash and near-cash transfers	+	−	0
B. Indirect 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
Generational 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	−	−
S. Deadweight loss for participants	?	0	?
T. Excess burden for taxpayers	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.

Row A lists the ACE program expenditures. The administrative portion of the program expenditures (row A.i) 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 (row A.ii) (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 indirect 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)

Bachelor's degree attainment may causally impact other monetary current-generation outcomes as well, either directly (through improved knowledge and/or cognitive or

[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)

socioemotional capacities) or through increases in earnings. For example, college graduates practice healthier behaviors (College Board 2023), and college enrollment rates are negatively associated with crime rates at the state level (Justice Policy Institute 2007). While direct causal evidence on the impact of college attainment on these outcomes is sparse, evidence examining the causal effects of schooling at other levels suggests that improvements in education can improve health and lower crime (Lochner 2011; Oreopoulos and Petronijevic 2013). Based on this empirical evidence, we expect ACE participants to experience increases in health and longevity (row E) and generate reductions 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 know that the vast majority of ACE participants will become parents at some point (Martinez and Daniels 2023).[9] There is extensive research documenting the association between family income and the outcomes of children. There is also a large body of experimental and quasi-experimental studies that provide causal evidence on the impact of increases in household income from 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

[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.

2018); decrease neo-natal mortality (Almond, Hoynes, and Schanzenbach 2011); increase child birth weight (Kehrer and Wolin 1979; Almond, Hoynes, and Schanzenbach 2011; Hillary 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). 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). 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 R)[10]. 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).

We do not count increases in birth weight or increases in educational attainment as benefits, as that would involve double counting: increases in birth weight show up in increases in

[10] Just as, when evaluating ACE, we include in our calculations the cost of the additional coursework that participants take as well as the benefits they gain from their education, here we include the costs of children's additional education for society as well as the benefits that result.

health and decreases in neonatal mortality; similarly, increases in earnings are the principal monetary benefit of increases in education. While increases in education also lead to increases in health, improved health is, again, already counted as a benefit of higher childhood income. We discuss birth weight and education, both because they are mechanisms that help explain other benefits and because they help to present a broader, consistent picture of the benefits of increased income. We do however, count the reduced health expenditures from increases in birth weight and increased expenditures posed by increased education as benefits and costs for the children of ACE participants.

There is also causal evidence for another mechanism of improved child outcomes: that the increases in family incomes from cash and near-cash transfers also lead to improvements in the overall health (Larrimore 2011; Morgan et al. 2020; Evans and Garthwaite 2014) and mental health of mothers (Boyd-Swan et al. 2016; Gangopadhyaya et al. 2020). Improvement in parents' health can also lead to the children's outcomes listed from row J-R, but we do not include estimates of such effects in order to avoid double-counting improvements in children's outcomes due to increased family income.

The benefits discussed above are hypothesized based on ACE's observed causal impact on bachelor's degree completion rates, but the available data only track participants for five years. As discussed in more detail below, we also consider the possibility that 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 complete their degrees sooner are still hypothesized to receive an earnings benefit, 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).[11] As a result, ACE participants are expected to earn more over their lifetimes even if attainment rates in the control group eventually catch up. Moreover, because the additional earnings in this scenario are concentrated during years when participants are most likely to be raising young children, and young children are particularly affected by increased family income, 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 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.[12] Benefits that accrue in the future are discounted using a social discount rate of 2 percent, as recommended in the revision of Office of Management and Budget (OMB) Circular A-4, governing benefit-cost analyses for all Federal agencies (Office of Management and Budget 2023), but we also display results with alternative, higher social discount rates.

[11] 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.
[12] 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.

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. 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 (based on publicly available

completion data up to ten years post-entry). 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. Even if "acceleration only" is not a likely scenario, it can still be a helpful way of quantifying the value of acceleration on its own. Our "midpoint" scenario assumes that 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.

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 for the treatment and control group under each scenario, along with additional technical details supporting these projections, 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. In the future, such estimates may become available at least for the early years post-college. Even then, however, assessing the program's benefits over an entire lifetime and into the next generation would require making projections. In the absence of causal impact estimates, we

use simple projections of pre-tax earnings trajectories for the ACE treatment and control groups using the ACS data. 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 and then obtain weighted averages of earnings for each age to reflect the gender composition of the ACE sample. We begin by calculating the median annual pre-tax earnings of ACS sample members at each age from 22 to 65 (including those with zero earnings) in each of the following three categories:[13] 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 are attending college during the ACS survey period. We then use these median earnings by age and educational status to project lifetime earnings trajectories for the ACE treatment and control groups given the degree completion trajectories we estimated for the study sample (see Table A.1 of Appendix A).

We make several 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

[13] 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.

without a bachelor's degree, will approximately follow the earnings trajectory of 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. [14] 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).[15]

To estimate the impact of CUNY ACE on lifetime earnings, we then construct a weighted average of estimated lifetime earning profiles based on the distribution of education status by year implied for each treatment group. For example, the treatment group has a larger share of those graduating with bachelor's degrees and leaving college earlier with degrees, so the lifetime earnings for this group is weighted more strongly towards the ACS earnings profiles observed with higher earnings and more return to experience relative to the control group. 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. The cumulative difference between the discounted earnings of the treatment and the control group from ages 22–65 is the treatment effect of ACE on lifetime earnings.

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

[14] 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.

[15] 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.

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 20.2% of annual income for Americans with less than $23,000 of annual income. For those in our ACS sample with income less than $23,000, we thus multiply the treatment effects they experience on gross earnings by 20.2% to derive the treatment effects on tax revenue. Of course, tax rates are higher for higher-income groups.[16] 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.

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, who may particularly benefit from their parents' higher earnings while they are young. Using parental earnings will lead to an underestimate of the second-generation impact of ACE, because earnings are only one of the mechanisms through which parental education positively affects their children.

[16] For those with family income less than 23k, we use a tax rate of 20.2%. For those with family income equal and greater than 23k but lower than 41k, we use a tax rate of 22%. For those with family income equal and great than 41k but lower than 66k, we use a tax rate of 25.2%. For those with family income equal and greater than 66k but less than 113k, we use a tax rate of 27.5%. For those with family income equal and greater than 113k but less than 252k, we use a tax rate of 29.9%. For those with family income greater than 252k, we use a tax rate of 32.4%.

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.[17] 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. At some level of income, the effects on children of another $10,000 approach zero assuming that family investments are not credit-constrained. 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. In their benefit-cost analysis of child allowances, Garfinkel et al. (2022) utilize this evidence to assume children in families with incomes above $100,000 receive no benefits from further increases in income. Children in families with 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.[18]

[17] In theory, the effect from earnings might be either higher or lower than the effect from cash transfers. It might be higher if earnings were more highly valued than transfers. It might be lower because earnings require work in the market rather than in the home and more time in the home might be more valuable than more time at work. Given the lack of empirical evidence, assuming the effects of cash and earnings are the same is a logical starting point.

[18] 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.

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.[19] 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.[20] 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. To be conservative, 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 household 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 based on evidence that children's gains from family income increases are greatest when initial income is below $50,000 and are negligible when initial income is above $100,000. 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.

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

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

E. Other benefits not modeled

While we focus on the benefits of obtaining a college degree, there may also be benefits associated with incremental persistence in years of education, that is, an increase in credits obtained without differences in degree attainment. In this analysis, we are not modelling the benefits associated with incremental persistence beyond its effects on completion, in part because the literature on returns to credits is outdated, but also because it is not possible to separate in the ACE sample 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.[21] Omitting returns to additional credits that did not result in degrees could bias our benefit estimates downward.

In addition, as previously noted, for the current generation we focus only on earnings benefits. Although the returns to education literature suggests college completion may improve participants' health and longevity, reduce crime and social service use, or have other societal benefits, in practice, most of this literature is based on additional years of education at the high school level rather than on bachelor's degree completion. While a related literature also suggests that increases in income (whatever the cause) improve adults' health, the magnitude of health-related benefits are modest in comparison with the direct effects on lifetime earnings. We thus focus our energy on estimating earnings benefits in the current generation, although we will return to this limitation in our discussion.

[21] 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).

F. 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 indirect costs accruing to participants and taxpayers from additional years of college enrollment (including the opportunity cost of foregone earnings for participants who enroll for more semesters due to the program). 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. For instance, according to Zhu, Scuello, and Strumbos (2023), during the fall semester of the first year, 98.6% of the treatment group were enrolled. Multiplying $2,000 by 98.6%, we obtain an average program cost of $1,972 for the first semester. We repeat this exercise for subsequent terms over four years; on average, ACE participants enrolled for about 3.2 academic years during the first four years post- enrollment. Costs accumulated after the first year are discounted using a social discount rate of 2%. 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 ($12374*0.63) of costs go to students as cash and near-cash transfers.

We further include the estimated indirect educational costs associated with ACE participants' average additional years of enrollment at John Jay through Year 5 (they enrolled for approximately an additional 0.20 years compared to the control group).[22] We assume that these indirect educational costs primarily accrue to taxpayers, given the availability of Federal and state aid. We estimate an indirect 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 incurs indirect costs for participants in the form of 0.2 years of forgone earnings in the labor market.[23] We estimate the present discounted value of this cost to be approximately $2,265.[24] We assume that participants shoulder the full $2,265. 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 indirect costs for participants, taxpayers, and society as a whole under the three alternative long-run scenarios. 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

[22] 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 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.

[23] 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.

[24] 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.

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.[25] We discuss the implications of these limitations after presenting our main results.

Table 2. ACE-related transfers and costs per participant

	Participants	Taxpayers	Society
Full catch-up			
Direct costs/transfers	$7,795	-$12,374	-$4,578
Indirect costs	$0	$0	$0
Total	$7,795	-$12,374	-$4,578
50% catch-up			
Direct costs/transfers	$7,795	-$12,374	-$4,578
Indirect 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
Indirect 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.

IV. Results

A. Main Results: ACE Effects on Participants' Earnings

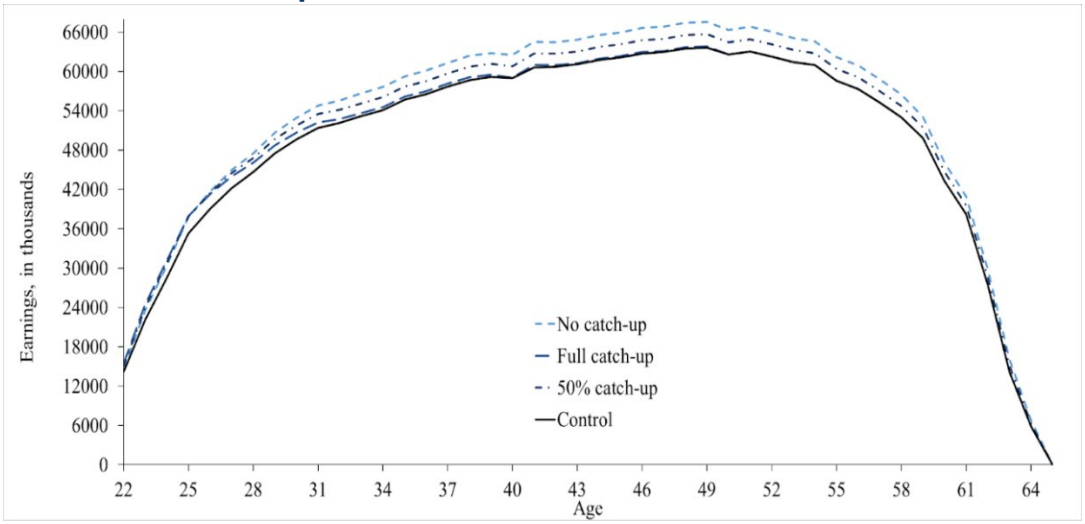
A.1. Participants' lifetime pre-tax earnings

Figure 1 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 degrees persists. As we want to capture both employment and earnings, these earnings estimates are not conditional on employment and thus include some individuals with zero earnings. As the

[25] 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.

figure illustrates, we estimate 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).

Figure 1. Lifetime unconditional earnings trajectories, by CUNY ACE treatment status and catch-up scenario



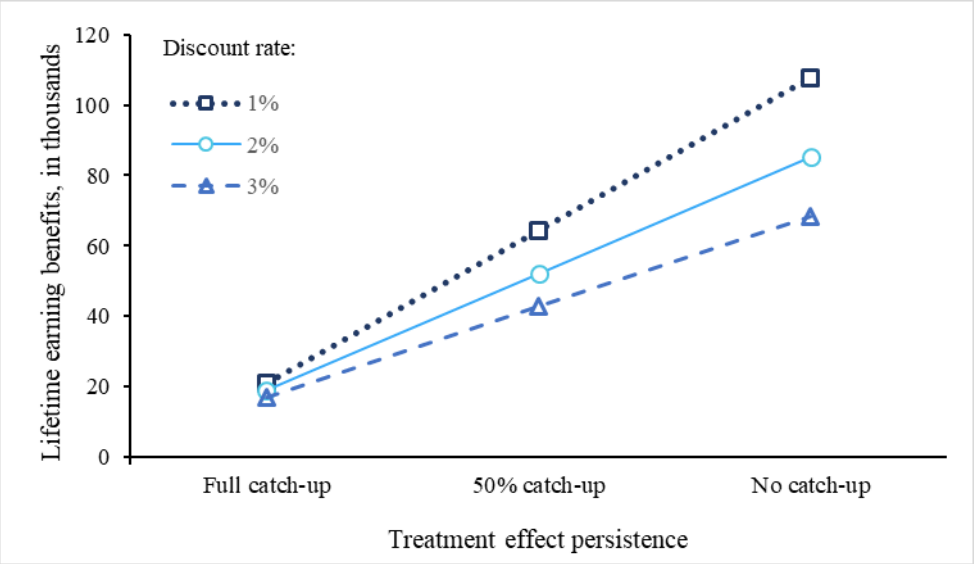
Source: Authors' projections using CUNY ACE (Accelerate, Complete, Engage) evaluation impact estimates and American Community Survey (ACS) 2015-2019 five-year data.

Note: 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.

Given the differences in earnings profiles in Figure 1, we next show the aggregated lifetime earnings effects in Figure 2 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.[26]

Figure 2. Lifetime earnings benefits of CUNY ACE, by catch-up scenario and social discount rate



Note: Estimates represent the mean effects per treated adult.

Some catch-up is reasonable to expect; unfortunately, prior literature provides little insight regarding how much or how quickly catch-up may occur.[27] Our midpoint scenario, assuming 50% catch-up over 10 years and a discount rate of 2%, indicates a $52,000 lifetime earnings benefit.

[26] 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.

[27] 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.

A.2. Tax revenues from participants' earnings

Participants' lifetime earnings increases are shared with taxpayers, as participants pay taxes on their greater 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 cumulative earnings gains flow to taxpayers rather than participants.

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.

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

Table 4 combines the estimates of CUNY ACE costs in Table 2 and the earnings benefits estimated in Table 3 to calculate net benefits under our three alternative catch-up scenarios. The top panel of Table 4 shows how the cost of the program is distributed between participants, taxpayers, and society. The bottom panel of Table 4 computes our main estimates of net social benefits, focusing only on participants' lifetime earnings net of 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 vast majority of which accrues to participants themselves. Expressed another way, every dollar of direct investment by taxpayers generates $3.47 in *net* benefits for society from earnings enhancements ($42,955/$12,374). 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 $71,000 per

participant, and even taxpayers come out ahead as their initial investment is more than paid back via increased tax revenue from increased earnings over time.

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

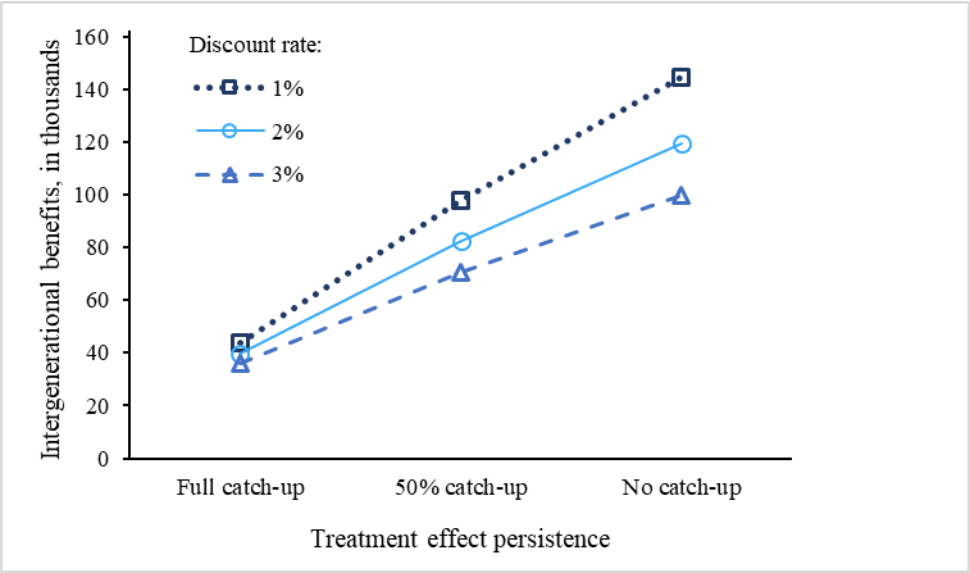
	Participants	Taxpayers	Society
Program costs and transfers			
Full catch-up	$7,795	-$12,374	-$4,578
50% catch-up	$6,663	-$15,694	-$9,031
No catch-up	$5,530	-$19,014	-$13,484
Net benefits			
Full catch-up	$21,585	-$7,367	$14,219
50% catch-up	$44,299	-$1,344	$42,955
No catch-up	$66,927	$4,754	$71,681

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.

B. 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 3 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. These results reflect the lifetime benefits accruing in 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.

Figure 3. Intergenerational effects of CUNY ACE, by catch-up scenario and social discount rate



Note: Estimates represent the mean effects per treated adult.

Table 5 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 two children over their lifetime, and that by accelerating degree completion, CUNY ACE increases household incomes particularly when children are young. 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 household incomes when young (the literature is less clear regarding such effects for bachelor's degree versus some college completion). 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.

Table 5. Intergenerational benefits of CUNY ACE

	Participants	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.

When we incorporate intergenerational benefits into our overall net benefit calculations, the results increase substantially. As we can see from Table 6, under the "permanent graduation increase" scenario, the present discounted of net social benefits per participant are over $191,000. What is perhaps even more striking is the substantial social payoff even in the acceleration-only scenario ($54,000 in net benefits), highlighting the value of accelerating college completions, especially for young families with children. Taxpayers come out ahead in the long term, even in the acceleration-only scenario.

Table 6. Costs, transfers, and net benefits of CUNY ACE, including intergenerational benefits

	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 across both generations			
Full catch-up	$46,019	$7,980	$54,000
50% catch-up	$95,001	$30,502	$125,504
No catch-up	$140,314	$50,849	$191,163

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

C. Net 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, men earn about 70% more in total than women with similar levels of

age and education.[28] In addition, results from the ACE impact evaluation suggest even larger program effects on degree completion for men (who graduated at a rate 15.7 percentage points higher than men in the control group) than for women (who were 8.9 percentage points more likely to graduate than women in the control group). Thus, in this section we examine estimated benefits by gender.

One complication that emerges in conducting our analysis separately by gender is that it is not possible to model an acceleration-only scenario for men without making implausible assumptions. In the overall sample, we model this scenario by allowing the program impact estimate to fade to zero by Year 10. We can do this for the overall sample and for women; however, for men, the ACE participant graduation rate is already higher in Year 5 than what we project for the control group in Year 10. To model "full catch-up" would thus require implausibly high growth in completions in the control group. Rather than do that, we instead model a "maximum catch-up" scenario for men, in which the Year 5 completion rate of the treatment group stays completely fixed over time, attenuating the program impact to 0.9 percentage points at Year 10 instead of to zero.

Table 7 shows the estimated lifetime earnings effects as well as intergenerational 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. These larger earnings benefits carry over to larger intergenerational benefits for male participants, as well.

[28] Said another way, over their full lifetimes we project women earn 59% of men's lifetime earnings. This is notably lower than conventional estimates of gender pay gaps, which typically reflect earnings gaps in a single year, conditional 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/).

Table 7. Lifetime earnings benefits of CUNY ACE, by gender

	Participants	Taxpayers	Society
Overall			
Lifetime earnings benefits			
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
Intergenerational benefits			
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
Men			
Lifetime earnings benefits			
Full catch-up	$30,333	$11,221	$41,554
50% catch-up	$67,527	$25,802	$93,329
No catch-up	$109,375	$42,440	$151,815
Intergenerational benefits			
Full catch-up	$46,557	$29,243	$75,799
50% catch-up	$86,784	$54,510	$141,294
No catch-up	$126,331	$79,349	$205,680
Women			
Lifetime earnings benefits			
Full catch-up	$9,822	$3,551	$13,373
50% catch-up	$27,159	$10,351	$37,510
No catch-up	$44,454	$17,195	$61,649
Intergenerational benefits			
Full catch-up	$16,773	$10,535	$27,308
50% catch-up	$35,711	$22,430	$58,141
No catch-up	$52,368	$32,893	$85,261

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

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.1 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.

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, CUNY ACE generates $42,955 in net social benefits per participant over the current generation relative to business as usual, translating to a ratio of $3.47 net social benefits per $1 of initial direct taxpayer cost. This ratio compares favorably to benefit-cost ratios found for college financial aid programs (which range from 1.50 to 2.58, see Harris and Mills 2021), though differences in how such ratios are constructed from study to study can make such comparisons inexact.

Our estimates are consistent with, if not directly comparable to, available estimates for ASAP, for which Levin and García(2018) estimate a benefit-cost ratio of 3.5, though their estimate incorporates additional benefits beyond earnings that our current-generation estimates do not. Their estimate assumes complete persistence of the degree completion effect, so is most comparable to our "permanent completion effect" scenario. Under this scenario, we estimate ACE's net social benefits as $71,681 per participant, with a ratio of $5.79 in net social benefits per $1 of initial taxpayer investment. Even if the control group catches up completely, such that ACE only accelerates degree completion, the net benefits to society in the current generation are over $14,000 per participant ($1.15 in net benefits per $1 of initial taxpayer investment). When

we consider benefits accruing to the next generation (the children of ACE participants) due to greater parental resources, the net social benefits more than double in all scenarios and more than triple in the "acceleration only" scenario.

It is also important to note that our analysis does not attempt to estimate all of the possible benefits of the program that are enumerated in Table 1. In particular, we have not attempted to estimate the potential benefits to participants from increased health and longevity or reduced crime (though we are able to incorporate those benefits in the second generation, thanks to benefit estimates from prior research on parental resources). 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).[29] It is thus possible the true social benefits could be even larger than the largest estimates we present here. Indeed, a back of the envelope estimate of the health benefits for the current generation reveals that such benefits could range from $2,500 for the society in the full catch-up scenario to $7,400 for the society in the no catch-up scenario, further increasing net social benefits.

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 $1,344 per participant), but the long-term cost is still much lower than the initial taxpayer investment, due to increased income tax payments and reductions in public assistance. However, CUNY ACE is projected to generate second-generation benefits that are 1.4–2.1 times the benefits for the current generation, due to the benefits of increased parental income on children's future earnings. When including second-generation benefits, even taxpayers come out ahead, regardless

[29] Note that there are some types of benefits (such as improved health) which we can incorporate for the second generation, making use of prior work that quantifies the benefits for children of increased parental resources.

of the assumptions we make about how much of the degree completion impact persists permanently.

We also project that men will receive higher earnings benefits from CUNY ACE. This is primarily due to the substantially larger impact on degree completion for men, as reported in Scuello and Strumbos (2024). A third of this higher benefit, however, can be attributed to men's higher earnings than women with the same credentials and years of experience. This highlights the need for complementary programs that support women's labor force participation.

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. 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, and thus are inherently uncertain, 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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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.[30] 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.[31]

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.[32]

[30] 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).
[31] 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.
[32] 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.

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 assume no additional treatment group men graduate after Year 5.[33] 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).[34]

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.

[33] 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).
[34] 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

	Control:			Treatment 1: Persistent graduation effect (no catch-up)			Treatment 2: Primarily acceleration effect (full catch-up)		
Year	Overall (1)	Men (2)	Women (3)	Overall (4)	Men (5)	Women (6)	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.

A.2. 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.[35] 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 household income per year from cash and near-cash transfers 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

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

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 household 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 household income from transfers. We thus multiply treatment effects on net earnings by 4.812 per child in the household 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

Table B.1. 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 7 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.

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