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Supporting Community College Students from Start to Degree Completion: Long-Term Evidence from a Randomized Trial of CUNY's ASAP†

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Nationwide, graduation rates at community colleges are discouragingly low. This randomized experiment provides evidence that graduation rates can be increased dramatically. The City University of New York's (CUNY) Accelerated Study in Associate Programs (ASAP) is a comprehensive, integrated, 3-year program that has an estimated 18 percentage point effect on 3-year graduation rates, increases 6-year graduation rates by an estimated 10 percentage points, and helps students graduate more quickly. Graduation effect estimates of this magnitude are exceptional in randomized experiments conducted in higher education, offering hope of what is possible when serving low-income students. (*JEL* H75, I23, I24, I28)

Over the last 40 years the proportion of jobs that require postsecondary education has doubled, and labor market demands for educated workers are expected to continue to grow (Belfield and Bailey 2017; Carnevale, Jayasundera, and Gulish 2016; Carnevale, Smith, and Strohl 2010; Chetty et al. 2017; Kena et al. 2016; Minaya and Scott-Clayton 2017; Ost, Pan, and Webber 2018; Scott-Clayton and Wen 2017). Simultaneously, community colleges have increased their share of postsecondary enrollees. In 2016–2017, they served 9 million students at nearly 1,000 institutions, representing 39 percent of all US undergraduates.[1] Despite providing unprecedented access to postsecondary education, rates of degree attainment remain disappointingly low. Among first-time, full-time students whose first postsecondary school is a 2-year public institution, only 22 percent earn a degree or certificate within 3 years and only 42 percent earn a degree or certificate within 6 years

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[1] See https://nces.ed.gov/pubs2017/2017075.pdf.

(National Student Clearinghouse 2017). These estimates are even lower for students entering community college requiring developmental (remedial) coursework (Bailey, Jeong, and Cho 2010).

Numerous reforms have attempted to improve community college students' rates of persistence and completion (Evans et al. 2017, Hatch 2016). These often include one or a few program components aimed at specific barriers to academic success, and they typically last one or two semesters. Although some of these programs have been found to improve students' academic outcomes in the short term, few have been found to affect graduation rates substantially.

In contrast, one program has been found to increase graduation rates considerably. This paper examines the effects of an uncommonly comprehensive, integrated, three-year program serving low-income community college students requiring remedial courses. The program requires students to attend college full time and encourages them to take remedial courses early, enroll in the summer, and graduate within three years. Students receive frequent advising, enhanced career services, and additional tutoring. Three forms of financial supports alleviate students' financial need: a tuition waiver, free use of textbooks, and a monthly transportation benefit, which is contingent on participation in key program services. Students can also enroll in courses with other program students in convenient schedules.

This paper presents results from a randomized controlled trial evaluating this program's impact on students' academic progress and success. The program produces substantial positive impacts on full-time enrollment and credit accumulation, has an estimated 18 percentage point effect on 3-year graduation rates, increases 6-year graduation rates by an estimated 10 percentage points, and helps students graduate more quickly. To the authors' knowledge, these are the largest intention-to-treat effect estimates among community college RCTs.[2]

I. Background and Program Description

Accelerated Study in Associate Programs (ASAP), created and implemented by the City University of New York (CUNY), is a comprehensive three-year program intended to help more students graduate within three years and help students graduate more quickly than they otherwise would. Launched in 2007 with funding from the New York City Center for Economic Opportunity, ASAP began at six community colleges and has now been implemented at nine CUNY institutions offering associate's degrees. ASAP is designed to simultaneously address multiple potential barriers to student success. Below, we review the literature on barriers to college success for low-income students and then describe the CUNY ASAP intervention.

[2] One notable exception is an evaluation of the effects of early college high schools, a program that targets high school students, but has also been found to increase two-year degree completion dramatically (see Berger et al. 2014).

A. *Background and Barriers to Academic Success*

Community colleges, with their open admissions policies and comparatively low costs, represent a highly accessible pathway for low-income individuals to earn a postsecondary credential. As noted above, however, graduation rates from community colleges are very low. Moreover, a majority of students take longer to complete their degrees than is expected—that is, two years for an associate's degree (Snyder, de Bray, and Dillow 2016). The consequences of this increased time to degree are considerable; the longer it takes a student to graduate, the more likely it is that she or he will encounter personal or financial difficulties that will make it necessary to drop courses, take time off, or stop college altogether.

Scholars have identified a number of student-level challenges and institutional practices that help explain the low rates of persistence and completion at community colleges (for overviews, see Baum, Kurose, and McPherson 2013; Braxton 2000; Calcagno et al. 2008). While it is beyond the scope of this paper to review all the barriers described in the literature, we provide a brief overview of several notable barriers that are directly addressed by CUNY ASAP. These include insufficient preparation for college-level work; a shortage and underutilization of student support services; financial issues; and the competing demands of work, family, and school. These challenges are especially pronounced for low-income, academically underprepared students, such as the ones in this study. These students are less likely to enroll in school full time, which makes it more difficult to accumulate enough credits to stay on track for a timely graduation (Attewell, Heil, and Reisel 2012; Crosta 2014; Klempin 2014).

Large proportions of low-income community college students are referred to remedial coursework, which is associated with poor college performance (Bailey, Jeong, and Cho 2010; Bound, Lovenheim, and Turner 2010; Chen and Simone 2016). In fact, fewer than half of students who test into remedial courses complete the remedial sequence to which they are referred, let alone graduate (Bailey, Jeong, and Cho 2010). There is some evidence that ensuring academically underprepared students pass remedial courses early can improve postsecondary outcomes (Long and Boatman 2013, Scott-Clayton and Rodriguez 2012). A wide variety of reforms have been tried, but being academically underprepared remains a significant barrier to students' academic success (Rutschow and Schneider 2011).

Even before experiencing academic challenges, many low-income community college students struggle navigating an unfamiliar college environment. This challenge may be particularly acute for first-generation college-goers, who are disproportionately represented at two-year colleges compared with four-year colleges (Deil-Amen 2011; Person, Rosenbaum, and Deil-Amen 2006). Upon enrolling in school, students may need help figuring out which courses to take and in what order, how to register for classes and apply for financial aid, and what resources are available to help make the transition to college (Bailey, Jaggars, and Jenkins 2015; Karp 2016; Kolenovic, Linderman, and Karp 2013). Community colleges are rarely able to support the kind of personalized and timely advising that students need (Bound and Turner 2007). The National Academic Advising Association estimates that the median caseload of an adviser at public two-year colleges is 441 students

per adviser—severely limiting the amount of advising students receive. (At CUNY colleges, the caseload is estimated to be higher.) A fairly robust experimental literature on enhanced academic advising interventions finds positive, although often modest, causal effects on students' academic outcomes using a variety of modes of advising (for examples, see Avery, Howell, and Page 2014; Bailey et al. 2016; Barr and Castleman 2017; Bettinger and Baker 2014; Carrell and Sacerdote 2013, 2017; Evans et al. 2017; Oreopoulos and Petronijevic 2016; Scrivener and Weiss 2009).

Finances also present a significant barrier to success for students (Denning 2017). Although tuition and fees at community colleges are about one-third the cost of public four-year colleges and universities, they still constitute a substantial investment for many low-income students, especially when opportunity costs are considered. In addition, financial aid sometimes does not cover the full cost of attendance, leaving students to struggle to afford necessities like textbooks or transportation. To cope, many students take on more work hours or enroll part-time, both of which correlate with reduced academic success (Horn, Berger, and Carroll 2004). Moreover, low-income students have to negotiate a complex financial aid system in order to receive aid (Bettinger et al. 2012). This issue is compounded by community colleges' shortage of on-campus student support services, as noted above. Not only is there a correlation between student success and financial concerns, but multiple studies have produced experimental evidence that finance-related reforms can positively, although often modestly, influence students' academic progress (Angrist et al. 2014, 2016; Angrist, Lang, and Oreopoulos 2009; Angrist, Oreopoulos, and Williams 2010; Bettinger et al. 2012; Cohodes and Goodman 2014; Deming and Dynarski 2009; Goldrick-Rab et al. 2016; Mayer et al. 2015).

Community college students, most of whom commute, have also been identified as less likely to identify with the college community than traditional undergraduates at four-year institutions (Tinto 1997). Colleges have tried many ways to integrate new students, including learning communities and student success courses to foster connections within the classroom (Engstrom and Tinto 2008; Rutschow, Cullinan, and Welbeck 2012; Weiss, Mayer et al. 2015; Weiss, Visher et al. 2015). Other strategies include interventions aimed at helping community college students enroll continuously—including in summer sessions (Attewell and Douglas 2014, Attewell and Jang 2013). Experimental evaluations of these approaches indicate that they can help students acclimate to college and some produce modest improvements on academic outcomes.

Taken together, the numerous barriers that low-income students face contribute to the low success rates found in community colleges. While there is causal evidence about the efficacy of postsecondary interventions across the literature, it seems that short-term or light-touch interventions may not be robust enough to substantially improve a large proportion of students' long-term outcomes. Only a few of the reforms that have been evaluated using a random assignment design have been found to increase graduation rates; those estimated increases are quite modest—4 percentage points or fewer—and many are statistically indistinguishable from 0 by the end of the evaluation (for examples, see Goldrick-Rab et al. 2012; Mayer, Patel, and Gutierrez 2015; Weiss, Mayer et al. 2015). This may suggest that to dramatically increase graduation rates, it is necessary to implement more comprehensive programs that

address many barriers, and to offer those services for a longer time period. CUNY's ASAP does just that.

B. *Program Description and Theory of Action*

CUNY ASAP is a multifaceted, integrated, three-year program that directly addresses many of the barriers to academic success discussed above. At the time of this study, the program comprised the following components:

Student Responsibility and Messages.—ASAP required students to attend college full time each fall and spring semester that they were in the program and encouraged them to take courses during winter and summer sessions, both of which correlate with academic success. ASAP's messages to students included emphasis on taking remedial courses early (to ensure that students mastered basic skills as soon as possible) and graduating within three years.

Student Support Services.—ASAP's requirements and messages were complemented by a set of wraparound services intended to meet students' academic and personal needs. Most centrally, each ASAP student was assigned to a dedicated adviser who provided frequent, comprehensive support. ASAP advisers were trained on a wide variety of academic and personal topics, including academic planning, balancing school with other responsibilities, accessing campus services, interacting with professors, staying on track to graduate, and dealing with personal issues. During the evaluation, advisers typically had caseloads of 60 to 80 students, and students were required to meet with their adviser twice per month. Comprehensive advising was intended to mediate issues for students, leading them to make better decisions and solve problems before they dropped out of school. Additionally, each college had an ASAP Career and Employment Specialist who students were required to meet with at least once per semester. These specialists were there to help students focus on career goals early in their schooling, and they continued to do so as they progressed. ASAP also required weekly tutoring for all students in remedial courses or on academic probation, with the goal of giving students a better chance of learning the material, passing the course, and moving to college-level work. All student support services were offered for the full three years of the program.

Financial Supports.—ASAP provided three forms of financial support to reduce students' financial barriers to full-time attendance and lessen financial stress. The program provided a tuition waiver that covered any gap between federal and state financial aid and college tuition and fees. It also provided monthly MetroCards for use on New York City's public transportation, contingent on participation in key program services (e.g., visiting an adviser two times per month), and free use of textbooks. These services were offered for up to three years.

Structured Course Enrollment.—ASAP provided blocked courses and consolidated schedules throughout students' first year in the program. Seats in courses were reserved for ASAP students with some courses scheduled back-to-back in

convenient blocks or offered as a set. The main goal of the blocked courses was to ensure that ASAP students could take some of their classes with other ASAP students, fostering a sense of community. Consolidated schedules were intended to allow students to make the most of their time on campus and more easily find a way to make enrolling full time in school fit around their other obligations. At the time of the evaluation, the program also included an ASAP seminar during students' first few semesters (the specific number of semesters varied by college), covering topics such as goal-setting and study skills. An addition goal of blocked courses and the ASAP seminar was to increase students' connections with each other and build a sense of community.

Program Management.—ASAP was jointly administered by the centralized CUNY Office of Academic Affairs and the participating community colleges. Program staff members at each college tracked students' participation in a homegrown database, and program directors as well as evaluation staff at CUNY central regularly reviewed student data and outcome trends to ensure the program was operating as intended. ASAP operated with an uncommonly high level of monitoring and internal assessment compared with many college programs.

Program Eligibility.—To be eligible for the program at the time of this study, students had to meet several criteria: had family income below 200 percent of the federal poverty level or were eligible for a Pell grant, required 1 or 2 remedial courses, had earned 12 or fewer credits before entering the program, were New York City residents, were willing to attend college full time, and were in ASAP-eligible majors.[3] Program staff checked students' eligibility prior to their joining the program, and for the purposes of this study (described below), prior to random assignment.

II. Evaluation Design

A. *Identification Strategy*, *Impact Model Specifications*, *and Student Sample*

We used a multi-site individual random assignment research design to identify the causal effects of the opportunity to participate in ASAP. The evaluation's analytic sample includes 896 students who were eligible for the program, signed an informed consent form, and agreed to participate in the evaluation. Two cohorts of students were randomly assigned, one prior to the spring and fall semesters in 2010, at three of the six community colleges that ran ASAP at that time. Random assignment was controlled by the research team. Students were assigned either to the program group, whose members had the opportunity to participate in ASAP, or to the control group, whose members had the opportunity to participate in all of their colleges' programs and services, just not ASAP. Students had an equal chance of being assigned to the program group or the control group. Over 95 percent of program group members were exposed to at least some portion of the program

[3] Approximately five majors were excluded from ASAP (e.g., nursing) because their requirements (e.g., prerequisites and clinical/practicum) make graduating within three years difficult or impossible.

(Scrivener, Weiss, and Sommo 2012), thus we focus analyses on the effect of the program offer (i.e., intention-to-treat).[4] In total, 903 students were randomly assigned. Seven students are not included in any analyses because they withdrew from the study or their consent form was unrecovered, leaving an analytic sample of 896 students.[5]

B. *Impact Model Specifications*

To obtain a regression-adjusted estimate of the causal effect of the opportunity to participate in ASAP, we use the following estimation model:

$$Y_i = \beta Z_i + \boldsymbol{\gamma}\mathbf{RB}_i + \boldsymbol{\delta}\mathbf{X}_i + \varepsilon_i, \tag{1}$$

where Y_i is the outcome for student i; Z_i equals one if student i was assigned to treatment and zero otherwise; $\mathbf{RB}_i$ is a vector of five random assignment block indicators (one for each unique college by cohort in the study); and $\mathbf{X}_i$ is a vector of baseline characteristics included in the model because of their potential to improve the precision of the impact estimator (Bloom, Richburg-Hayes, and Black 2007).[6] Robust (Huber-White) standard errors are used in all analyses. Analyses for all academic outcomes at all time points presented in Section IV include all 896 students, unless otherwise noted. Analyses from a one-year follow-up survey (presented in Section III) include survey respondents only.[7] Sensitivity analyses are conducted excluding the vector of baseline characteristics. A detailed discussion of all data sources is provided in Scrivener et al. (2015, 14–16).

C. *Sample*

Table 1 reports select characteristics of the analytic sample at baseline (several additional baseline characteristics are shown in Appendix Table A1).

Similar to the gender breakdown at community colleges nationwide, more than half of sample members are women.[8] Reflecting the student population served at these three colleges, the sample is racially diverse, with no racial majority. Over three-quarters of the sample are black or Hispanic. Most sample members were of

[4] For those interested in the estimated effect of the treatment offer on those individuals who received at least some portion of the treatment, take our intention-to-treat effect estimates and divide by 0.95, as described by Bloom (1984).

[5] The overall attrition rate is 0.78 percent and the rate of differential attrition is 1.11 percentage points. By "withdrew from the study" we do not mean "withdrew from the program"—this refers to students who revoked consent for data collection.

[6] Baseline characteristics come from the pre-random assignment baseline survey described in Scrivener et al. (2015). Characteristics were selected primarily based on prior evidence of a relationship to academic completion; for example, see Weiss et al. (2015), Mayer et al. (2015), who explore this issue. We include gender, race, age, has any children, single parent, working, depends on parents for more than half of expenses, first in family to attend college, and earned a high school diploma. For each baseline characteristic, a missing indicator is also included in the model as described by Gerber and Green (2012). Puma et al. (2009) shows that this approach does not introduce bias in randomized trials.

[7] The overall survey response rate was 83 percent. Program group students responded at a rate of 85.1 percent and control group students at a rate of 80.8 percent. For more information, see Appendix B of Scrivener et al. (2015).

[8] Source: US Department of Education, National Center for Education Statistics, 2003–04 Beginning Postsecondary Students Longitudinal Study, Second Follow-up (BPS:04/09)

Table 1—Select Characteristics of Sample Members at Baseline

Characteristic (percent)	Control mean	Estimated difference	Observations
Female	60.2	3.7	896
		[3.2]	
Race/ethnicity			
Asian or Pacific Islander	7.9	−0.8	863
		[1.8]	
Black	35.9	−3.2	863
		[3.2]	
Hispanic	42.7	1.5	863
		[3.3]	
White	9.6	1.1	863
		[2.0]	
Other[a]	4.0	1.4	863
		[1.4]	
Age			
19 or younger	57.5	−0.8	896
		[3.3]	
20–23 years	23.8	−2.8	896
		[2.8]	
24 or older	18.7	3.6	896
		[2.7]	
Diplomas/degrees earned[b]			
High school diploma	73.5	0.6	878
		[3.0]	
GED certificate	21.1	−0.5	878
		[2.7]	
Occupation/technical certificate	6.6	−2.1	878
		[1.6]	
Other	1.8	−0.3	878
		[0.9]	
None[c]	6.2	−0.2	878
		[1.6]	
Number of remedial courses needed			
None	2.2	−0.7	896
		[0.9]	
One	32.1	5.8	896
		[3.2]	
Two	46.5	−3.1	896
		[3.3]	
Three or more	7.4	−0.8	896
		[1.7]	
Missing	11.7	−1.2	896
		[2.1]	

(*continued*)

"traditional" college age, which is typical of CUNY community college students. While most students were of traditional college age, around 36 percent of the sample had 1 or more of the following "nontraditional" characteristics: were 24 years old or older, worked 35 or more hours per week, had children, or did not receive

TABLE 1—SELECT CHARACTERISTICS OF SAMPLE MEMBERS AT BASELINE (*continued*)

Characteristic (percent)	Control mean	Estimated difference	Observations
Subject of remedial need			
No need	2.2	−0.7 [0.9]	896
English only	15.3	−0.7 [2.4]	896
Math only	44.9	5.0 [3.3]	896
English and math	25.8	−2.4 [2.9]	896
Missing	11.7	−1.2 [2.1]	896
College at random assignment			
College A	19.1	−0.3 [0.0]	896
College B	44.5	0.5 [0.0]	896
College C	36.4	−0.3 [0.0]	896
Cohort			
Spring 2010	35.7	1.5 [0.0]	896
Fall 2010	64.3	−1.5 [0.0]	896
Currently employed	32.6	−2.5 [3.2]	852
First in family to attend college	32.5	−4.3 [3.2]	852
Nontraditional[d]	33.8	3.7 [3.2]	888

Notes: Missing values are only included in variable distributions for characteristics with more than 5 percent of the sample missing. Estimated differences are adjusted by random assignment blocks only. Standard errors are reported in brackets.

[a] The "Other" category includes students who self-identified as Native American, Alaska Native, or other.

[b] Distributions do not add to 100 percent because categories are not mutually exclusive.

[c] This includes students who were enrolled in high school at study intake.

[d] Nontraditional students are defined as those who were 24 or older, worked 35 or more hours per week, had children, or did not receive a high school diploma and were not enrolled in high school at the time of random assignment. Students are listed as nontraditional if they fit any of these characteristics. Students are considered to be missing in the nontraditional category if they were missing data on 2 or more of these characteristics and have no other nontraditional characteristic; less than 5 percent of the study sample is missing in the nontraditional category.

Sources: MDRC calculations from a Baseline Survey and CUNY Institutional Research Database (IRDB)

a high school diploma and were not enrolled in high school at the time of random assignment. Finally, based on CUNY-administered exams, nearly the entire analytic sample required some form of remedial education (an eligibility requirement), and more than three-quarters required remedial math.[9] In other words, the program

[9] For 11 percent of the sample this information is considered "missing" because those students do not have pre-random assignment CUNY Assessment Test data in all subject areas.

served many at-risk students. Also shown in Table 1 and Appendix Table A1, the background characteristics of program and control group students were very similar at the outset of the study, as is expected in a randomized experiment.[10]

III. Program Implementation and Service Contrast

Implementation research was conducted periodically throughout the first three years of the study. Overall, ASAP was well implemented and the difference between ASAP and regular college services available to the study's control group was substantial. We briefly discuss each program component, in turn—for details see Scrivener et al. (2015).

Messages.—In a 12-month follow-up student survey,[11] program group students reported significantly different experiences in terms of ASAP's planned messaging. Approximately 31 percent of control group students reported often or very often hearing college faculty/staff speak about the importance of taking developmental courses early and obtaining an associate's degree within 3 years. Program group members were 16 and 38 percentage points more likely to report messaging on these topics, respectively ($p < 0.001$ in both cases).

Student Support Services.—Program group students reported vastly different experiences compared with control group students on their usage of support services. Table 2 presents survey findings regarding students' self-reported use of support services. There are large differences in participation in advising, career services, and tutoring outside of class, as well as large differences in the total number of times students partook of these activities. For instance, 95 percent of program group students reported contact with advising, compared with 80 percent of control group students—but even more telling, program group students reported an average of 21 and 17 contacts *per semester* in their first year, compared with control group students' who reported an average of 4 and 2 contacts per semester. This pattern carries through for career services and tutoring, though the differences in the number of contacts are less dramatic.

Financial Supports.—Table 3 presents students' experiences with financial supports. Recall that CUNY ASAP offers students multiple financial supports, including a last-dollar scholarship for tuition and fees, free use of textbooks, and a monthly MetroCard for use on public transportation. We found large differences in students' reported receipt of transportation assistance (panel A) and textbooks (panel B), indicating a dramatic service contrast. Interestingly, panel C indicates

[10] We analyzed whether all baseline characteristics jointly predict research group status, using logistic regression. A likelihood ratio test was performed to assess the joint power of the baseline variables to predict treatment status. The test yields a *p*-value of 0.89, reinforcing that there are not systematic differences in the baseline characteristics of program and control group members (Scrivener et al. 2015). An *F*-test for joint balance yields the same conclusion ($p = 0.88$).

[11] The evaluation included 1 student survey administered 12 months after study entry; program and control group members' service usage during later years was not measured.

Table 2—Use of Student Support Services in Year 1

	Control mean	Estimated effect		Observations
		Covariate adjusted	Unadjusted	
Panel A. Advising				
Ever contacted (percent)	80.4	15.0	14.6	739
		[2.4]	[2.4]	
Number of times				
First semester	3.7	17.5	17.4	718
	(6.1)	[1.4]	[1.3]	
Second semester	2.0	14.5	14.6	718
	(4.0)	[1.0]	[1.0]	
Panel B. Career/employment services				
Ever contacted (percent)	28.9	50.0	50.6	736
		[3.2]	[3.2]	
Number of times				
First semester	1.0	3.8	3.8	719
	(3.5)	[0.4]	[0.4]	
Second semester	0.6	3.6	3.5	721
	(2.7)	[0.4]	[0.4]	
Panel C. Tutoring outside of class				
Ever contacted (percent)	39.4	33.3	34.2	736
		[3.4]	[3.4]	
Number of times				
First semester	4.0	8.5	9.0	724
	(11.4)	[1.1]	[1.1]	
Second semester	2.5	7.6	8.1	730
	(8.7)	[1.0]	[1.0]	

Notes: Covariate adjusted estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Unadjusted estimates are adjusted by random assignment blocks only. Standard deviations for continuous outcomes are reported in parantheses. Standard errors are reported in brackets.

Source: MDRC calculations from the MDRC student survey

that relatively few students (11 percent or less per semester) required a tuition waiver from the program. This is because the vast majority of students received sufficient federal and state need-based financial aid to fully cover their tuition and fees.

Structured Course Enrollment.—In addition to the student survey, we analyzed transcript data to assess the implementation of course enrollments in the ASAP seminar and blocked courses in their first year. Implementation of these components varied by college (some colleges had high compliance in these courses), and at all colleges, a majority of students enrolled in courses with a significant concentration of ASAP students, one goal of the program.

In sum, CUNY ASAP was well implemented and students offered ASAP had a vastly different experience in college compared to the status quo. We now turn to the program's estimated impacts on students' academic outcomes—effects that are caused by the large differences in experiences reported above, which result from students being offered ASAP.

Table 3—Financial Supports

	Control mean	Estimated effect: Covariate adjusted	Estimated effect: Unadjusted	Observations
Panel A. Transportation				
Received financial support, year 1 (percent)	7.1	86.7 [1.9]	86.3 [1.9]	729
Panel B. Textbooks				
Received all free of charge, year 1 (percent)	5.7	70.7 [2.5]	71.2 [2.5]	729
Panel C. Tuition waiver				
Received ASAP waiver (percent)				
Semester 1	N/A		8.9	451
Semester 2	N/A		9.3	451
Semester 3	N/A		10.4	451
Semester 4	N/A		10.6	451
Semester 5	N/A		4.9	451
Semester 6	N/A		3.3	451

Notes: In panels A and B, covariate-adjusted estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Unadjusted estimates are adjusted by random assignment blocks only. Standard errors are reported in brackets. Panel C presents program group outcome levels.

Sources: MDRC calculations from the MDRC student survey (panels A and B) and the tuition waiver analysis performed by CUNY ASAP office (panel C)

IV. Program Effects on Academic Outcomes

This section presents estimates of the effect of the opportunity to participate in ASAP on students' academic outcomes during the six years after they entered the evaluation—three years when ASAP services were offered to program group members (program semesters) and three years after the program was complete (post-program semesters). We proceed with estimates of ASAP's effects on enrollment, credit accumulation, degree completion, and transfer, followed by estimates of effects for select subgroups of students.

A. *Main Effects on Enrollment*

Figure 1 (Appendix Table A2) presents enrollment rates (y-axis) at any college throughout the United States during the 6 years, or 12 semesters (x-axis), after random assignment. Figure 2 (Appendix Table A3) shows full-time enrollment rates at any CUNY two- or four-year college.[12] In all figures, squares and circles represent the regression-adjusted average when assigned to the program group and control group, respectively, and diamonds represent the estimated effect of the program offer, including a 90 percent confidence interval. The full sample is included at all

[12] Enrollment at and degree receipt from CUNY institutions is based on data from CUNY's Institutional Research Database (IRDB); these are supplemented with enrollment at and degree receipt from non-CUNY institutions, using data from the National Student Clearinghouse. Credit accumulation measures are created using IRDB data only. Detailed information on data sources is provided in Scrivener et al. (2015).

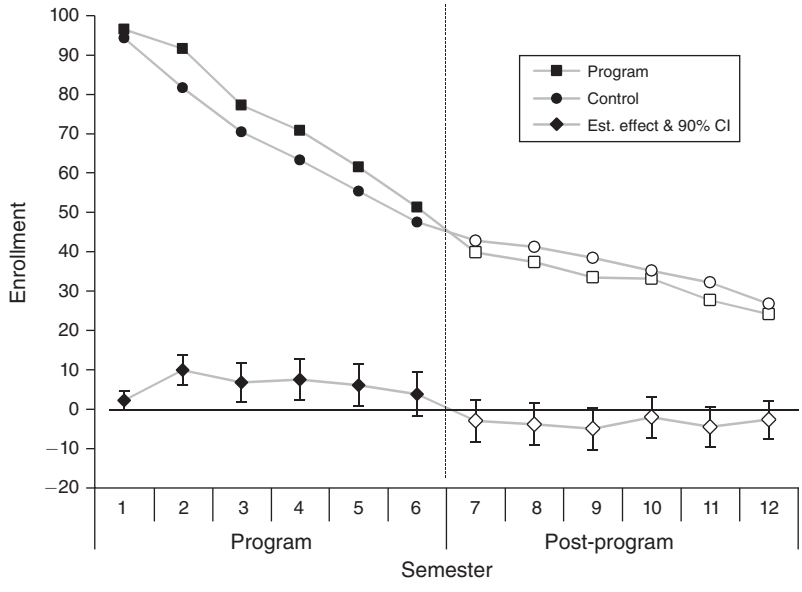

FIGURE 1. ENROLLMENT AT ANY COLLEGE BY SEMESTER

Notes: Estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Enrollment is based on courses that students are enrolled in at the end of the add/drop period.

Sources: MDRC calculations from CUNY Institutional Research Database (IRDB) and National Student Clearinghouse data

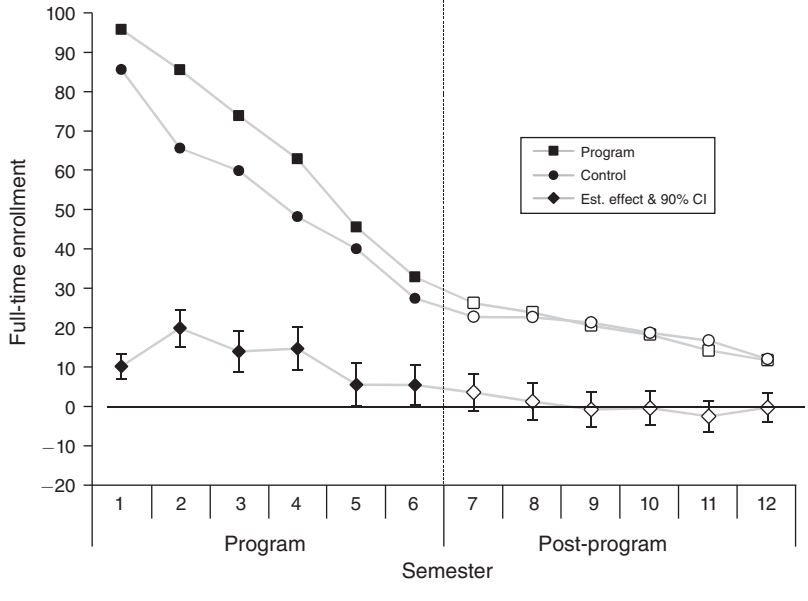

FIGURE 2. FULL-TIME ENROLLMENT AT ANY COLLEGE BY SEMESTER

Notes: Estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Enrollment is based on courses that students are enrolled in at the end of the add/drop period.

Source: MDRC calculations from CUNY Institutional Research Database (IRDB)

time points. Later, in Section IVE, enrollment is broken out by college type (two- and four-year colleges).

Enrolled at Any College.—During the three years when program group students were offered ASAP services, the program reduced dropout rates. In semesters 2 through 6, ASAP increased enrollment by an estimated 10, 7, 8, 6, and 4 percentage points, respectively.

Because of ASAP's large effects on graduation rates, starting in semester five (see below), interpreting enrollment rates in later semesters is complicated. Whereas early non-enrollment generally represents the negative outcome of students dropping or temporarily stopping out, later non-enrollment can also reflect students' having already achieved their goal of a terminal degree. With that in mind, during all 6 post-program semesters the control group's enrollment rates exceeded those of the program group, with impact estimates ranging between 2 and 5 percentage points—all negative effect estimates, none of which are statistically significantly different from 0 at conventional levels. This pattern of positive in-program effects followed by some degree of post-program control group catch-up plays out on marginal credits earned and degree completion (see below).

Interestingly, by the end of six years, on average, program and control group students had enrolled in a similar total number of terms. A simple average of the 12 estimated effects on enrollment reveals that the average enrollment effect is just 1.2 percentage points. As will be shown later, despite having enrolled in a similar number of semesters, program group members graduated at a much higher rate than control group members. This is in part because, as discussed next, ASAP increased full-time enrollment significantly.[13]

Full-Time Enrollment at a CUNY College.—Recall that full-time enrollment (attempting 12 or more credits per semester) is a requirement of ASAP. Moreover, all students who entered the evaluation agreed that they were *willing* to enroll full-time. Figure 2 shows that in the first semester immediately after random assignment, students offered ASAP were already substantially more likely to enroll full-time than their control group counterparts. In fact, during each of the 6 in-program semesters (3 years), ASAP had a positive effect on full-time enrollment, with effect estimates ranging from 6 to 20 percentage points. These results demonstrate that for a substantial number of students who currently enroll part time, if given the right combination of requirements, incentives, and supports, they will enroll full time. This finding is particularly important because nationally around half of community college entrants

[13] Although not shown in the tables, please note that the pattern of effect estimates on enrollment *at any college* is extremely similar to the pattern of estimated effects on enrollment *at CUNY colleges* (the largest difference is 1.7 percentage points). In later semesters, however, the difference in enrollment levels (not estimated effects) *at any college* versus *at CUNY colleges* increases, peaking at a 7.6 percentage point difference in semester 10. We note this because data on full-time enrollment and credit accumulation are available *at CUNY colleges* only. With respect to estimated effects, it is likely that the full-time enrollment and credit accumulation results *at CUNY colleges* are similar to what they would be *at any college*, were the data available. However, with respect to outcome levels, the full-time enrollment and credit accumulation results *at CUNY colleges* are a lower bound of what we would expect *at any college*, were the data available. Fortunately, for the main outcome of interest—degree attainment—data are available *at any college*.

enroll part-time, and part-time attendance is associated with a decreased likelihood of succeeding in college (Attewell, Heil, and Reisel 2012).

During the post-program semesters, there is not clear evidence of a meaningful effect (positive or negative) on full-time enrollment at CUNY colleges. However, unlike the pattern of effects for enrollment of any intensity level, a simple average of the 12 estimated effects on full-time enrollment reveals that the average full-time enrollment effect is 5.9 percentage points (not displayed in the table). In other words, overall, program group students enrolled full-time in more total semesters than did their control group counterparts.

Enrollment and full-time enrollment are important indicators of academic progress. However, degrees are not conferred based on enrollment—for that, students must accumulate credits, which we turn to next.

B. *Main Effects on Credit Accumulation*

Figures 3 and 4 (and Appendix Tables A4 and A5) depict credit accumulation at CUNY colleges during the 12 semesters after students were randomly assigned.[14] Figure 3 displays marginal credits earned, including credits earned in a particular semester only. Figure 4 plots cumulative credits earned, including all credits earned since the first semester after random assignment.

Marginal Credits Earned at Any CUNY College.—Figure 3 shows that, as expected, average marginal credits earned decrease over time, a result that corresponds with some students dropping or stopping out and earning 0 credits. Also corresponding with enrollment trends, ASAP had a large positive effect on marginal credit accumulation during each of the first 4 program semesters, with effect estimates ranging from 1.4 to 2.1 credits. During semesters 5 and 6, effect estimates remain positive, but they drop to 0.5 in both semesters.[15] Throughout the three post-program years, program effect estimates on marginal credits earned hover around zero and are not statistically distinguishable from zero at conventional levels.

Cumulative Credits Earned at Any CUNY College.—The depiction in Figure 4 of average cumulative credit accumulation is illuminating because it is cumulative credits earned that lead to a degree. Throughout the six-year follow-up period, students offered ASAP earned significantly more cumulative credits than their control group counterparts. The gap between the 2 groups peaks at 8.2 credits in semester 7, before dipping to an estimated 7.0 credit effect after 6 years. To put this effect in context, 7.0 credits represent a 13 percent increase over the control group base of 55.6 credits, or 12 percent of the 60 college-level credits required to earn an associate's degree. Relative to ITT effect estimates on credit accumulation in other higher education experiments, ASAP's effect estimates are substantial.

[14] Credits include remedial and college-level credits.

[15] p-values on the effect estimates in semesters 1 through 4 are all <0.001. In semester 5, $p = 0.236$. In semester 6, $p = 0.200$.

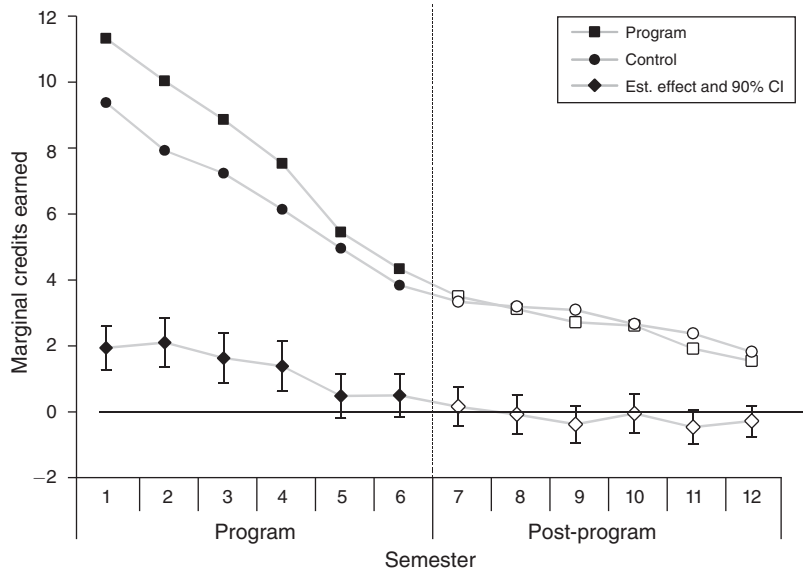

Figure 3. Marginal Credits Earned at CUNY Colleges

Notes: Estimates are adjusted by random assignment blocks and select baseline characteristics (see Section IIB for details).

Source: MDRC calculations from CUNY Institutional Research Database (IRDB)

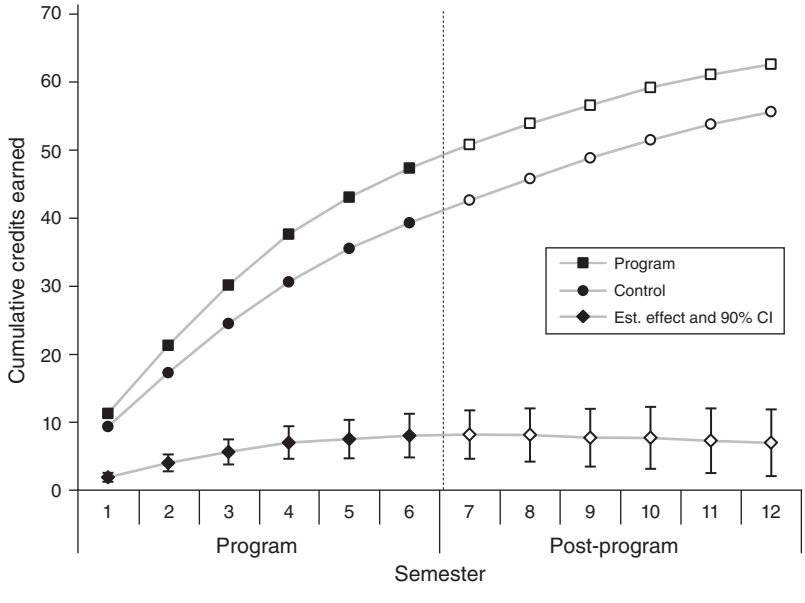

Figure 4. Cumulative Credits Earned at CUNY Colleges

Notes: Estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Measures of cumulative credits earned exclude courses that are passed more than once.

Source: MDRC calculations from CUNY Institutional Research Database (IRDB)

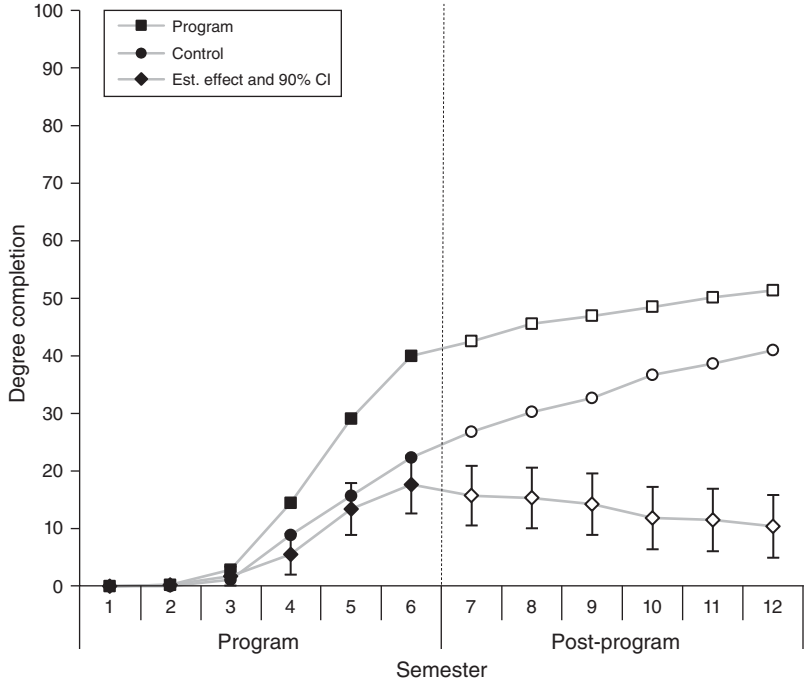

FIGURE 5. DEGREE COMPLETION AT ANY COLLEGE

Notes: Estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Degree receipt is cumulative. Those who earned a degree in an earlier semester are counted as having a degree in subsequent semesters.

Sources: MDRC calculations from CUNY Institutional Research Database (IRDB) and National Student Clearinghouse data

Does this increase in enrollment and credit accumulation translate into degree receipt? That is considered next.

C. *Main Effects on Degree Receipt*

ASAP's explicit goal is to get more students to graduate and to graduate more quickly. Figure 5 (and Appendix Table A6) presents degree completion rates at any college, including two- or four-year degrees at CUNY or non-CUNY colleges.

Degree Receipt at Any College.—As early as the end of the fourth semester after random assignment, ASAP had a positive, statistically significant, and practically meaningful effect on degree completion. By the end of the 3-year program, program group members graduated at a rate of nearly 40 percent and control group members graduated at a rate of 22 percent, for an estimated effect of around 18 percentage points ($p < 0.001$). A 90 percent confidence interval on this effect estimate ranges from 13 to 23 percentage points; thus, we are confident that the true effect is quite large. To our knowledge, 18 percentage points is the largest ITT effect estimate on

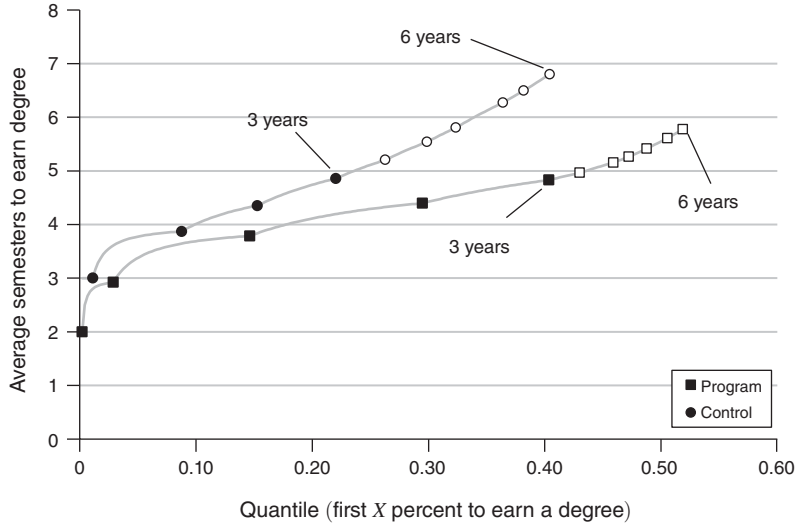

Figure 6. Average Time to Earn a Degree by Quantile (Quickest Degree-Earners)

Notes: Earned a degree estimates are not regression-adjusted. Average semesters to earn degree is calculated as the average number of semesters it took for the first *X* percent of degree earners to earn their first degree.

Sources: MDRC calculations from CUNY Institutional Research Database (IRDB) and National Student Clearinghouse data

3-year graduation rates in any large-scale randomized experiment in higher education to date.[16]

As can be seen on the right half of Figure 5, in the 3 years (semesters 7 through 12) following program completion, the gap in graduation rates between program and control group members begins to narrow. After 6 years, ASAP's estimated effect on earning a degree was 10 percentage points ($p < 0.01$). The narrowing of the gap in post-program semesters implies that part of the 18 percentage point impact on 3-year graduation rates was a result of ASAP getting students who would have graduated in the absence of the program to graduate more quickly. ASAP's remaining 10 percentage point impact on 6-year graduation rates likely reflects a combination of some students who would have graduated beyond 6 years and some students who would not have graduated at all without ASAP.

Time to Degree.—Figure 6 provides another perspective on the extent that ASAP helps students graduate more quickly. In this exhibit, the *y*-axis represents average-time to degree among degree earners. The *x*-axis denotes quantiles, or the first *X* percent of students to have earned a degree.[17] Each point on the graph depicts

[16] One notable exception is a study of Early College High Schools, which finds a similarly large effect estimate (Berger et al. 2014).

[17] Analyses of the effect of a program on students' average time to degree are complicated by the fact that not all students earn a degree. For example, a comparison of the average time to degree among degree earners at a particular follow-up time point is subject to selection bias. A comparison of the average time to degree comparing all program group members to all control group members is not possible because there is no value for those who did not earn a degree. Figure 6 overcomes these challenges by considering the program's effects on the distribution of

the average time to degree at a given quantile. The vertical gaps between the two lines represent ASAP's estimated effect in the average time to degree at a given quantile in the distribution. For example, the 41 percent of control group members who earned a degree within the 6-year follow-up period averaged 6.8 semesters to do so. In comparison, the first 41 percent of program group members who earned a degree averaged under 4.9 semesters to do so—nearly 1 whole year (2 semesters) earlier than the control group. ASAP clearly shifts the distribution of time to degree—an accomplishment that has important potential benefits in the labor market and elsewhere.

A natural additional question is, what percentage of students did ASAP cause to earn a degree who otherwise would not have earned one? This is difficult to determine with certainty at this time point, but we offer relevant context. First, at the end of the follow-up period, many students are still progressing through school: 24 percent of the program group and 27 percent of the control group were enrolled during the final semester of follow-up (see Appendix Table A2). Initially, this could lead one to believe that many additional degrees could be conferred in the future, and estimated effects on degree completion may change substantially. However, most students who enrolled in the final semester of follow-up already had earned a degree. In fact, only 6.5 percent of all program group members and 10.3 percent of all control group members were enrolled during semester 12 *and* had not yet earned any degree.[18] Also, only 1.2 percent of all program group members and 2.3 percent of all control group members earned their first degree at the end of semester 12. The small number of first degrees conferred in semester 12 demonstrates the plateauing of degree receipt that is also seen in Figure 5. Together, this information suggests we should not expect a large number of new degrees to be earned in either research group in the coming semesters. Thus, while ASAP's estimated effect on earning any degree may drop a bit in upcoming semesters, it appears unlikely that it will drop a lot, implying that, overall, ASAP likely causes some students to earn a degree who would not have done so in the absence of the program. Planned longer term follow-up will provide an empirical estimate.

the outcome, an approach similar to quantile regression (e.g., see Friedlander and Robins 1997; Heckman, Smith, and Clements 1997; Abadie, Angrist, and Imbens 2002). Randomization allows unbiased estimation of the effect of a program on a distribution of an outcome.

The approach we take is also similar to the nonparametric approach used by Angrist, Bettinger, and Kremer (2006) to estimate the effect of winning a voucher at different points in the cumulative distribution of test scores in the face of differential missing outcome data. However, we are in a far simpler situation because they had to make assumptions about missing test scores, which, in theory, could be located anywhere in the outcome distribution. In contrast, our missing data (due to time-censoring) is for individuals who have not yet earned a degree within six years. We know that the only possible values for time-to-degree for these nondegree earners are greater than six years or never. Thus, in the control group, they all fall above the forty-first quantile, and in the program group they all fall above the fifty-first quantile. Consequently, we plot the empirical distribution of the outcome up through the known quantiles *without* making a monotone treatment response assumption or a rank-preservation assumption, as required in Angrist, Bettinger, and Kremer (2006). To avoid imputation of unknown points on the empirical cumulative distribution, we focus discussion on quantiles where data are available for the program and control groups.

[18] The 3.8 percentage point difference has a p-value of 0.042.

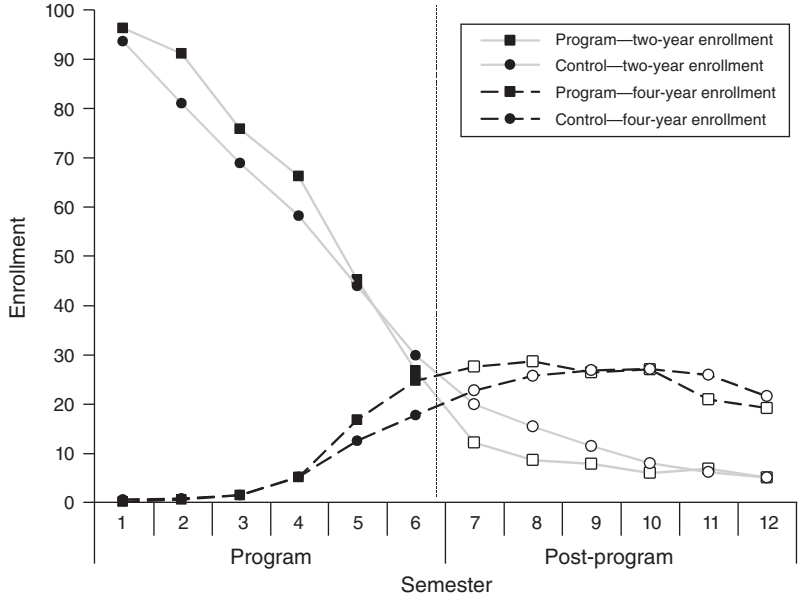

Figure 7. Enrollment at Two- and Four-Year Colleges

Notes: Estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Enrollment is based on courses that students are enrolled in at the end of the add/drop period.

Sources: MDRC calculations from CUNY Institutional Research Database (IRDB) and National Student Clearinghouse data

D. *Main Effects on Transfer to and Graduation from Four-Year Colleges*

While transfer to a four-year college is not the primary aim of ASAP, the program's large effects on earning an associate degree, coupled with its intensive advising services, has the potential to yield increased enrollment in and attainment at four-year colleges. Figure 7 (and Appendix Table A7) displays enrollment rates at any colleges throughout the United States, separated into two-year and four-year colleges (Figure 1 focused on enrollment at *any* college).

Enrollment at Two- and Four-Year Colleges.—During the first four semesters of the program, ASAP increased the enrollment rate at two-year colleges. Then, because ASAP students earned associate's degrees sooner than their control group counterparts, they enrolled at four-year colleges sooner too (semesters five through eight). During semesters six through nine control group enrollment at two-year colleges surpassed program group enrollment at two-year colleges, allowing the control group to start catching up with respect to progress and completion of associate's degrees. This catch-up occurred because far more program group members had already earned an associate's degree (semesters six through nine). Similarly, toward the end of the follow-up period, the control group began catching up with respect to enrolling at four-year colleges.

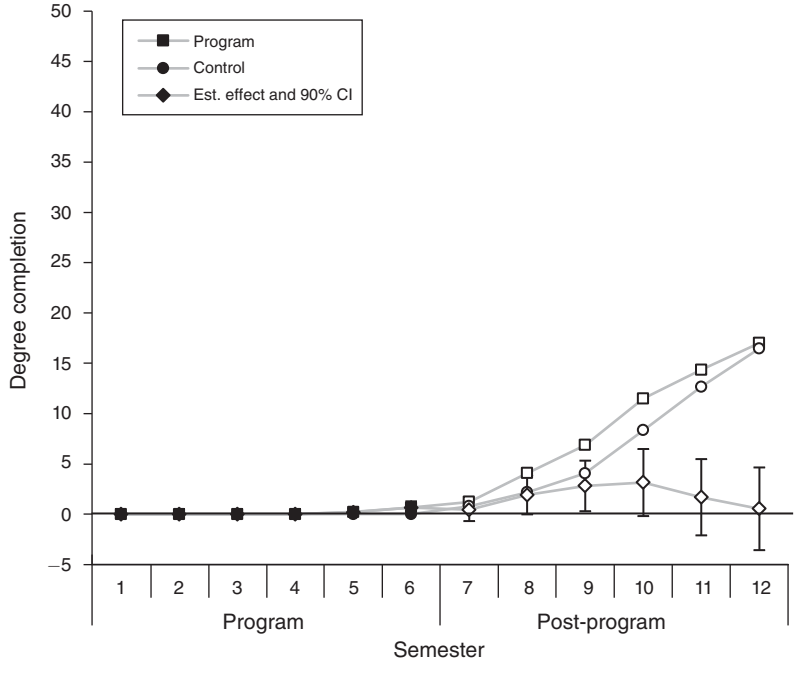

FIGURE 8. BACHELOR DEGREE COMPLETION AT ANY COLLEGE

Notes: Estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Degree receipt is cumulative. Those who earned a degree in an earlier semester are counted as having a degree in subsequent semesters.

Sources: MDRC calculations from CUNY Institutional Research Database (IRDB) and National Student Clearinghouse data

Degree Receipt at Two- and Four-Year Colleges.—Figure 8 presents bachelor degree completion at any college throughout the United States. Appendix Table A8 presents degree completion at any college throughout the United States separated by associate's and bachelor's degrees (unlike Figure 5, which does not distinguish between these degrees). The most notable new finding is that there is some evidence (in semesters eight through ten) that ASAP had a small, positive effect on bachelor's degree completion. This finding aligns with the program's effects on enrollment at four-year colleges, which were largest in semesters five through seven. Notice that the estimated effect on earning a bachelor's degree is near zero by the end of the follow-up period. This suggests that ASAP helped a small proportion of students earn a bachelor's degree more quickly than they would have otherwise, but we do not find evidence that ASAP caused students who otherwise would not have earned a bachelor's degree to do so.

E. *Subgroup Effects*

The above findings show that ASAP, on average, has a positive effect on earning a degree as of the three- and six-year marks. We conducted analyses to explore if these findings hold up for a variety of subgroups of students. These analyses

are considered *exploratory* (i) due to limited statistical power to detect differential effects; (ii) because of no clear, strong, directional hypotheses why ASAP's effects would vary by measured characteristics; (iii) because of no prior empirical evidence that ASAP's effects vary by observed characteristics (a condition suggested by Bloom and Michalopoulos 2013); and (iv) to reduce the multiple testing problem (Schochet 2009). These analyses may nonetheless be fruitful in suggesting that ASAP is effective for a wide variety of student types. Moreover, should evidence of differential effects arise, this information may be used to generate hypotheses that could then be rigorously tested in the ASAP demonstration project in Ohio (described later) or other future evaluations of ASAP or ASAP-like programs.

Tables 4 and 5 present three- and six-year graduation rates at any college, by subgroup. We discuss three-year rates first because the explicit goal of ASAP is to get students to graduate during the three-year program. For all subgroups explored, estimated effects on earning any degree at the three-year mark are large and positive.[19] In other words, the evidence suggests ASAP is benefiting students with a variety of measured background characteristics.

Table 5, which provides six-year degree results by subgroup, tells a fairly similar story. The key differences are that the effect estimates are smaller across the board (as expected given the main findings) and that more of the positive effect estimates for subgroups are not statistically distinguishable from zero, which is unsurprising given the relatively small sample size for each subgroup. Generally, it appears that ASAP is having positive effects for a variety of subpopulations of students.

For the race subgroup, at the 3-year mark there is evidence of variation in program effects ($p = 0.040$), with very large positive effect estimates for black and white students, compared with the relatively smaller (but still large) positive effect estimates for Hispanic students. The effect estimate for Hispanic students is near zero at the six-year mark. It is possible that, compared with other students, Hispanic students respond differently to ASAP, given that their needs and barriers to success may be different. However, CUNY's internal propensity score matching analyses of ASAP's effects (including additional cohorts and all implementing colleges), do *not* find a similar pattern (Strumbos and Kolenovic 2016). Moreover, we examined 10 subgroups and found one *p*-value below 0.10—just what we would expect due to chance. Consequently, at this point we are cautious about over interpreting this result.

V. Discussion

CUNY ASAP's estimated effects on 3- and 6-year graduation rates, 18 and 10 percentage points, respectively, are exceptionally large. To put this study and these findings in context, consider the overall dearth of causal evidence on the effectiveness of strategies that substantially improve graduation

[19] In three instances (white students, students without a high school diploma at baseline, and students randomly assigned at college A) the *p*-value for the subgroup's estimated effect on three-year degree completion was above 0.10, a conventional level of statistical significance. For white students, the effect estimate is very large, but the sample included only 86 white students. For students without a high school diploma, the effect estimate was 9 percentage points, which is also quite large. At college A, the effect estimate was 6 percentage points, the smallest of all effect estimates.

Table 4—Three-Year Degree Completion at Any College (by Subgroup)

	Control mean	Estimated effect	Observations	*p*-value difference in effects
Gender				0.790
Female	24.6	17.1	556	
		[4.0]		
Male	18.1	18.8	340	
		[4.9]		
Race				0.038
Black	18.2	27.4	296	
		[5.3]		
Hispanic	23.0	9.4	376	
		[4.6]		
White	26.8	17.1	86	
		[10.1]		
Age				0.338
19 or younger	24.6	16.5	512	
		[4.2]		
20 to 23	17.9	13.7	201	
		[6.7]		
24 or older	19.3	27.0	183	
		[7.1]		
Earned high school diploma at baseline[a]				0.129
Yes	22.9	19.8	669	
		[3.6]		
No	19.5	9.1	227	
		[6.0]		
Number of remedial courses needed				0.420
1 or fewer	27.5	21.7	331	
		[5.4]		
2 or more	19.6	16.2	466	
		[4.1]		
College				0.127
College A	21.2	6.0	170	
		[6.8]		
College B	21.7	21.5	401	
		[4.6]		
College C	22.8	21.6	325	
		[5.3]		
Cohort				0.498
Spring 2010	20.8	20.0	327	
		[5.2]		
Fall 2010	22.7	15.6	569	
		[3.8]		

(*continued*)

rates for community college students requiring developmental education. The US Department of Education's What Works Clearinghouse (WWC), the largest repository of scientific evidence on the effectiveness of education

Table 4—Three-Year Degree Completion at Any College (by Subgroup) (*continued*)

	Control mean	Estimated effect	Observations	*p*-value difference in effects
Employed at baseline				0.487
Yes	22.5	20.2	267	
		[5.8]		
No	22.1	15.4	585	
		[3.8]		
First in family to attend college				0.615
Yes	23.4	20.5	258	
		[6.0]		
No	22.1	16.9	594	
		[3.8]		
Traditional				0.948
Yes	22.9	17.3	571	
		[3.9]		
No	20.1	17.7	317	
		[5.1]		

Notes: Estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Standard errors are repoted in braces. The "*p*-value difference in effects" column presents the *p*-value for a test of variation in treatment effects among the categories shown for each subgroup, based on the H_T statistic as described in Greenberg, Meyer, and Wiseman (1994).

[a] Students shown as not having a high school diploma include those who earned no degrees, those who earned a General Educational Development (GED) certificate, and those who are missing degree information. Students shown as having a high school diploma are those who earned a high school diploma, an occupational or technical certificate, or another, unspecified higher degree.

Sources: MDRC calculations from a Baseline Survey, CUNY Institutional Research Database (IRDB), and National Student Clearinghouse data

programs, recently published a practice guide of strategies to help postsecondary students in developmental education (Bailey et al., 2016). After reviewing 25,697 studies, only 10 studies met the WWC evidence standards with or without reservations (primarily randomized trials). Of the guide's six recommended practices, only three were supported by evaluations meeting the WWC evidence standards (one of the studies/practices is ASAP). This suggests that causal evidence on strategies that improve graduation rates for students placing into developmental education is desperately needed by college administrators and policymakers.

Moreover, among all WWC postsecondary evaluations that meet their evidence standards, only six examine college graduation rates (Scrivener and Weiss 2009, Rodríguez-Planas 2010, Patel and Rudd 2012, Berger et al. 2014, Bettinger and Baker 2014, Scrivener et al. 2015). Across these studies, the estimated effects on graduation rates are 4 percentage points or smaller with one exception: the Early College High School initiative, a lauded model that has estimated effects on earning an Associate's degree that are similarly as large as compared with ASAP.

Table 5—Six-Year Degree Completion at Any College (by Subgroup)

	Control mean	Estimated effect	Observations	*p*-value difference in effects
Gender				0.722
Female	43.3	11.4 [4.2]	556	
Male	36.2	8.9 [5.5]	340	
Race				0.046
Black	35.7	20.6 [5.7]	296	
Hispanic	42.1	1.7 [5.2]	376	
White	39.0	15.0 [11.7]	86	
Age				0.489
19 or younger	43.4	7.3 [4.5]	512	
20 to 23	34.9	11.4 [7.4]	201	
24 or older	38.6	17.8 [7.7]	183	
Earned high school diploma at baseline[a]				0.414
Yes	42.2	11.5 [3.9]	669	
No	35.4	5.2 [6.7]	227	
Number of remedial courses needed				0.784
1 or fewer	47.1	10.6 [5.6]	331	
2 or more	39.2	8.6 [4.7]	466	
College				0.780
College A	37.6	6.1 [7.8]	170	
College B	40.4	12.1 [5.0]	401	
College C	42.0	12.3 [5.6]	325	
Cohort				0.708
Spring 2010	38.4	11.9 [5.7]	327	
Fall 2010	41.6	9.3 [4.1]	569	
Employed at baseline				0.107
Yes	39.1	18.1 [6.0]	267	
No	41.8	6.3 [4.1]	585	

(*continued*)

Table 5—Six-Year Degree Completion at Any College (by Subgroup) (*continued*)

	Control mean	Estimated effect	Observations	*p*-value difference in effects
First in family to attend college				0.831
Yes	39.4	11.8	258	
		[6.4]		
No	41.4	10.2	594	
		[4.1]		
Traditional				0.202
Yes	43.2	6.6	571	
		[4.2]		
No	35.6	15.5	317	
		[5.6]		

Notes: Estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Standard errors are reported in braces. The "*p*-value difference in effects" column presents the *p*-value for a test of variation in treatment effects among the categories shown for each subgroup, based on the H_T statistic as described in Greenberg, Meyer, and Wiseman (1994).

[a] Students shown as not having a high school diploma include those who earned no degrees, those who earned a General Educational Development (GED) certificate, and those who are missing degree information. Students shown as having a high school diploma are those who earned a high school diploma, an occupational or technical certificate, or another, unspecified higher degree.

Sources: MDRC calculations from a Baseline Survey, CUNY Institutional Research Database (IRDB), and National Student Clearinghouse data

Speculating Why CUNY's ASAP Works.—This evaluation was designed to estimate the effect of CUNY's ASAP—a bundled package. The evaluation was not designed to disentangle the effectiveness of the individual program components or to determine which components matter most. Here, we offer speculative commentary regarding what drove the large estimated effects.

ASAP's full-time requirement and strong messaging to enroll during intersessions (summer/winter), coupled with sufficient supports to facilitate that enrollment, were probably central to ASAP's success. Starting in semester one, ASAP had a large positive effect on full-time enrollment and winter/summer enrollment.[20] Through six years, the program caused students to attempt an additional ten credits and earn an additional seven credits. It seems unlikely ASAP's effects would have been nearly as large without the requirement and encouragement to attempt these additional credits.

That said, it is one thing to require full-time enrollment and encourage winter/summer enrollment; it is another to do so while covering students' tuition, books, and transportation, and providing enhanced services to support students to help them achieve this goal. It remains unknown how much support is necessary to yield substantial effects on full-time and intersession enrollment, and for those effects to translate into credits earned. It is possible that at least some additional supports are necessary. An ongoing RCT at ten colleges in Ohio focuses solely on encouraging

[20] See Scrivener et al. (2015) for winter/summer enrollment effect estimates, which represent 28 percent of the total impact on credits earned through 3 years.

additional summer enrollment at a low-cost with minimal additional supports—this may provide further insight into this question.[21] Similarly, increasingly popular "15 to finish" campaigns, which encourage students to attempt 15 credits per semester, may shed light on whether getting students to attempt more credits alone can make a difference, or if unintended negative consequences may outweigh potential benefits, as some have cautioned (Goldrick-Rab 2016).

In addition to the full-time requirement and encouragement to enroll in summer, ASAP requires students to participate in various support services—services that students report to appreciate and find helpful. Students had to meet with an advisor twice per month, a career and employment specialist once per semester, and attend tutoring while taking developmental courses. To encourage students to meet these requirements, ASAP linked receipt of a monthly transportation pass with participation in these services. The intelligent integration of these components is a critical characteristic of ASAP—advising, career guidance, and tutoring are already available at most community colleges (including those in this study), but ASAP's intrusive, monitored, and incentivized approach led to an exceptional service contrast with respect to usage of these services.

In order to link incentives to services, measure articulated service participation benchmarks, and track student-staff engagement, ASAP staff record students' service usage through a management information system (MIS). College ASAP directors and the CUNY Central ASAP management team use this information (along with administrative/academic data) regularly to monitor program implementation, identify areas for improvement, distribute MetroCards appropriately, and measure movement toward graduation goals. This type of MIS is essential for the integration of services and contributed to the strong implementation of ASAP.

Finally, ASAP's effects would not be nearly as large without the advising, which students and staff report are central to ASAP's success. In addition to student survey findings, quantified evidence also supports this conclusion. Most notably, at the 3-year mark, ASAP's 18 percentage point effect on graduation rates is 7 percentage points higher than its estimated effect on earning 60 or more college-level credits, the number of credits typically required to earn an associate's degree. This difference suggests ASAP either led more students to take the right combination of credits to earn a degree or prompted students to take the final steps necessary, such as filing paperwork, to make a degree official. In either case, the ASAP advisor would have played a central role.

No one or two of ASAP's components alone are likely to yield effects of the magnitude estimated in this study. In fact, many of ASAP's components (or conceptually similar components) have been evaluated via one or more RCT in community college settings, and none have found overall average ITT effect estimates of this magnitude. What makes ASAP unique is that its multiple, integrated, and well-implemented services address multiple prevalent barriers to student success, and those services are offered for three full years.

[21] See https://www.mdrc.org/publication/can-we-boost-college-summer-enrollment-using-behavioral-science.

Generalizability of Findings.—A major strength of the present evaluation is that the randomized design allows for an unbiased estimator of the causal effect of CUNY ASAP. As is true of most randomized trials, a limitation is that *statistical* inference beyond the study sample is difficult to justify since sites (and study participants) were not randomly selected from a population. In this case, generalization beyond the study sample requires primarily *logical* inference and uncertainty that is difficult to quantify.

Despite this limitation, we believe there is evidence that ASAP can work for a variety of types of students, in multiple settings, and at a large scale.

With respect to students—recall that we examined 10 different subgroups (e.g., gender, race, age) comprised of 23 types of students (e.g., female, male, black, Hispanic, white). For all student types, ASAP's estimated effect on three-year graduation rates was positive, substantial, and (for all but two) statistically significant. This suggests that this intervention can work for a broad array of student types.

With respect to settings—this study took place at 3 distinct colleges and effect estimates on graduation rates at all 3 colleges are positive (statistically significant at the 2 colleges with larger sample sizes, and an estimated 6 percentage point effect at the third college with a smaller sample size), and there is no discernable variation in effects across the colleges. This provides prima facie evidence that ASAP can work in more than one college, albeit all located in New York City and with centralized administration.

Furthermore, in 2014, MDRC and CUNY partnered to launch the ASAP Demonstration in Ohio, an effort to determine whether CUNY ASAP can be implemented successfully at three community colleges in Ohio and achieve similarly positive academic impacts as in New York City. As part of the demonstration, Cincinnati State Technical and Community College, Cuyahoga Community College, and Lorain County Community College each began operating their own programs based on the CUNY ASAP model. The colleges received technical assistance from CUNY, as well as operational support from MDRC and the Ohio Department of Higher Education. A randomized controlled trial is being conducted at the three colleges and early findings show that the Ohio programs substantially increased first-semester, full-time enrollment and credit accumulation, as well as persistence and full-time enrollment in the second semester (Sommo and Ratledge 2016). The early impact estimates are comparable in magnitude to what was observed in the present evaluation, adding to the evidence that this program can be implemented in a variety of settings and have large effects. Outcomes will continue to be tracked for at least three-years in Ohio.

With respect to scale—since 2010, the time of entry of the two random assignment cohorts discussed in the present paper, CUNY has expanded ASAP dramatically. The program grew from operating in six colleges to operating in nine colleges. In 2017–2018, CUNY reports that ASAP served over 21,000 students, with a goal of expanding to 25,000 students per year by 2018–2019. During this expansion, the program model described in this paper has changed some: it now includes all students regardless of financial aid status, it has created a triage advising model in which students visit advisers based on need, and it has eliminated

the ASAP seminar.[22] Despite the large expansion and program changes, CUNY's internal analyses find that the three-year graduation rates of students in ASAP remain high. In fact, CUNY's internal data tracking show that the three-year graduation rates during the years of the RCT evaluation were lower than for all preceding and subsequent cohorts (through the fall 2014 cohort) at the three colleges in the study.

Beyond New York City and the three locations in Ohio, two additional colleges—Skyline College in San Bruno, California, and Westchester Community College, part of the State University of New York (SUNY) system—were recently awarded grants to receive technical assistance from CUNY to implement programs based on CUNY ASAP. The colleges have begun planning efforts and intend to start operating their programs by fall 2018, following two years of technical assistance from CUNY ASAP. MDRC will conduct a randomized controlled trial to evaluate Westchester's program. Together, this series of experimental evaluations will continue to inform whether CUNY's lauded program can be implemented in other contexts and achieve similarly impressive effects.

Cost and Benefits.—While ASAP's effects are large, they must be considered in the context of the program's cost and benefits. During the 3-year program, we estimated the direct cost of the program offer to be around $4,700 per student per year, or $14,000 over 3 years (see Scrivener et al. 2015 for details), a 54 percent increase over the control group base cost.[23] According to CUNY, these costs have since come down to closer to $3,450 per student per year in fiscal year 2018, owing to economies of scale and program modifications, which were described above. Rough estimates in Ohio place the program's direct costs at around $3,000 per student per year.

To place ASAP's direct cost per student into a broader context, it is useful to consider ASAP's direct costs relative to average expenditures per full-time-equivalent student at various types of degree-granting institutions throughout the United States. The expenditures per full-time-equivalent student at public 2-year institutions are about $13,300 per year. In contrast, total expenditures per full-time-equivalent student are around $19,100 at private nonprofit 2-year colleges, $39,100 at public 4-year colleges, and $50,000 at private nonprofit 4-year colleges.[24] Thus, while ASAP's direct program costs represent a large increase in spending, when added to the base, expenditures remain lower than at private nonprofit two-year colleges and are less than half of those of four-year public or private nonprofit colleges. From this perspective, the costs

[22] For more detail on the program model, see Boykin and Prince (2015).

[23] The direct program costs were calculated using CUNY's expenditure data and do *not* include indirect costs associated with the program's effects on enrollment and credits attempted. Control group base cost was calculated by multiplying the cost per credit by the number of credits attempted per control group member. The cost per credit was estimated by dividing the college's annual total expenses and deductions by total instructional activity (credit and contact hours attempted). From a social cost perspective, it's important to note that some of ASAP's costs are transfers (e.g., tuition subsidies) and others are real social cost (advising).

[24] Source: US Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Spring 2008 through Spring 2014, Fall Enrollment component; and Spring 2009 through Spring 2015, Finance component. (This table was prepared in November 2015.)

are relatively low. Nonetheless, from the perspective of cash-strapped community colleges, this additional investment is a substantial barrier to considering implementing CUNY's program.

Another approach to considering program cost is to calculate the cost per additional outcome, as is done by Carrell and Sacerdote (2017), following Dynarski, Hyman, and Schanzenbach (2013). Their focus is on the cost per additional student induced into college (graduation effect estimates are not presented, presumably due to the shorter follow-up). We consider the cost per graduate, the primary outcome of interest in this study. ASAP spent around $14,100 per student to induce 18 percentage points more students to graduate within 3 years. This translates to a cost of roughly $78,000 ($14,100/0.18) per additional degree within 3 years. Due to a dearth of studies that estimate program effects on three- or six- degree completion *and* estimate program costs, there is little to compare these estimates with.[25]

When considering ASAP's costs (some of which are transfers,[26] like the tuition waiver and textbook voucher, and others of which are real social costs, like the enhanced advising and tutoring), it is also important to consider the economic and social benefits of the program, beyond the direct academic benefits described above. Levin and García (2017) monetize and project such benefits, relying on literature on the estimated returns to an associate degree. Monetized benefits include potentially greater earnings for students, increased tax revenues, reduced public health spending, reduced use of the criminal justice system, and reduced use of public assistance.

Levin and García (2017) consider costs and benefits from the perspective of the student and the taxpayer. Since ASAP serves students, the student perspective is of obvious importance. The taxpayer perspective is also worth consideration because CUNY's ASAP is mainly funded from public sources; moreover, Levin and García (2017) note that "On the basis of the program's promise … CUNY considered the expansion of the program … To guide this decision, it was necessary to ascertain whether ASAP was a good investment for the taxpayer by examining whether the benefits of investing in ASAP exceeded the costs." From the taxpayer perspective, a program that benefits its clients and has monetary benefits that exceed the monetary costs to the taxpayer is usually a wise investment. Importantly, the taxpayer is not just trying to make a profit, they are trying to increase social welfare and a program like ASAP could be "worth it" even if the monetary costs to taxpayers exceed the monetary benefits.

Projecting the net monetary benefit to taxpayers requires strong assumptions and the estimates are imprecise. Nonetheless, in an attempt to consider the net benefit to taxpayers, we can utilize Levin and García's (2017) estimate of the taxpayer

[25] Moreover, we are cautious about over interpreting cost per outcome across studies. If a payee (e.g., government, society, etc.) is willing to pay a large amount for additional degrees, then they may be happy to pay more per degree in order to get a lot of additional degrees, rather than pay less per degree to get only a few marginal degrees. That said, with a fixed budget for new programs and many eligible participants, the cost per outcome framework can be a useful way to make decisions on whether to serve more students with a less expensive program or fewer students with a more expensive program.

[26] Transfers, including the tuition waiver, textbook voucher, and monthly MetroCards, account for about 24 percent of ASAP's direct costs.

benefit per additional associate's degree ($205,500 per additional associate degree), Scrivener et al.'s (2015) estimate of the net cost of providing ASAP ($14,000 per student), and the 10 percentage point estimated effects on graduation rates presented here. Applying this "back-of-the envelope" analysis, the total net benefits of ASAP are around $7,300 per student higher than the net benefits for the control group.[27] Applying a 90 percent confidence interval to the estimated effect on 6-year graduation rates yields a range of net benefits from *negative* $6,000 to *positive* $16,000. This range does not consider the uncertainty associated with the estimated benefits projections, which would widen the confidence intervals considerably.[28] In sum, taxpayers likely recoup some, if not all the cost of paying for ASAP, in addition to the increased social welfare for the served students. It will be important to see how these analyses might change—or remain steady—with longer-term follow-up. In the future, we hope to estimate ASAP's effects on *observed* labor market outcomes, rather than projections, which will shed more light on this issue.

From the student perspective ASAP is highly cost-beneficial under weak assumptions. This is because the cost for program group students is lower than the cost for control students due to the savings associated with ASAP's tuition waiver, textbook voucher, and monthly transportation pass.[29] Thus, the projected benefits for students, which rely on strong assumptions regarding the projected returns to a degree, only add to the already positive net benefits for ASAP students.

CUNY ASAP is perhaps the most effective college-completion program in higher education to be rigorously evaluated through a randomized experiment. This evaluation shows that with the right combination of long-lasting supports, requirements, and messages, it is possible to dramatically increase graduation rates at community colleges.

[27] Calculated as $\$205{,}514 \times 0.104 - \$14{,}028 = \$7{,}345$.

[28] Levin and García (2017) state that their taxpayer benefit per associate's degree is "conservative" (meaning downward biased), which could increase the net benefits. Counterbalancing this, we assume that the 10 percentage point graduation effects will be maintained, which likely results in upward bias, given the observed trend in estimated effects on graduation. There is likely additional uncertainty because our basic analyses do not account for the estimate that 41 percent of the ASAP sample earned a degree, on average, 1 year earlier than they would have, which would *increase* the net benefit somewhat. They also do not account for the fact that Levin and García's (2017) taxpayer benefit was derived for 3-year graduation rates for 23-year-olds, rather than 6-year graduation rates for 26-year-olds, which would *decrease* the net benefits somewhat.

[29] While there may be greater opportunity cost for students in ASAP, the one-year follow-up survey does not find clear evidence that control group members are working at a higher rate than program group members.

Appendix A

Table A1—Additional Characteristics of Sample Members at Baseline

Characteristic (percent)	Control mean	Estimated difference	Observations
Highest grade completed			
10th grade or lower	7.9	−1.2 [1.7]	896
11th grade	7.2	1.2 [1.8]	896
12th grade[a]	75.7	0.4 [2.9]	896
Missing	9.2	−0.4 [1.9]	896
Date of high school graduation/GED receipt			
During the past year	47.4	4.0 [3.3]	896
Between one and two years ago	13.9	−1.4 [2.3]	896
Between two and five years ago	13.5	−0.8 [2.3]	896
More than five years ago	13.3	−0.2 [2.3]	896
Has not earned a diploma/GED[a]	6.3	−0.4 [1.6]	896
Missing	5.6	−1.2 [1.5]	896
Student's status			
Incoming freshman	57.3	5.9 [3.0]	896
Returning student	35.1	−3.6 [2.8]	896
Transfer student	7.6	−2.4 [1.6]	896
Highest degree student plans to attain			
Associate's	2.6	0.4 [1.1]	863
Bachelor's	30.2	2.3 [3.2]	863
Master's	41.9	−0.6 [3.4]	863
Professional or doctorate	18.3	−0.8 [2.6]	863
Beyond an associate's, unspecified	7.0	−1.3 [1.7]	863

(*continued*)

TABLE A1—ADDITIONAL CHARACTERISTICS OF SAMPLE MEMBERS AT BASELINE (*continued*)

Characteristic (percent)	Control mean	Estimated difference	Observations
Mother's educational attainment			
Not a high school graduate	20.4	−1.9 [2.6]	896
High school diploma or GED	22.0	−0.5 [2.8]	896
Some college, no degree	16.0	0.0 [2.5]	896
College degree (AA, BA, MA, PhD)	18.9	−0.4 [2.6]	896
Missing	22.7	2.8 [2.8]	896
Language other than English spoken regularly at home	44.2	1.0 [3.3]	885
Lives with parents	73.6	0.3 [3.0]	872
Parents pay $> 1/2$ of expenses			
Yes	40.2	1.5 [3.3]	896
Missing	18.9	−1.9 [2.6]	896
Marital status			
Married	6.3	−0.2 [1.6]	896
Missing	14.6	1.4 [2.4]	896
Has one or more children	13.1	4.3 [2.4]	884
Number of hrs worked per week, among employed			
1–10 hours	6.7	2.9 [3.4]	259
11–20 hours	31.1	6.7 [5.9]	259
21–30 hours	39.3	−16.1 [5.8]	259
31–40 hours	20.7	7.8 [5.3]	259
$>$ 40 hours	2.2	−1.3 [1.5]	259

Notes: Missing values are only included in variable distributions for characteristics with more than 5 percent of the sample missing. Estimated differences are adjusted by random assignment blocks only. Standard errors are reported in brackets.

[a] This number includes students who were enrolled in high school at study intake.

Source: MDRC calculations from a Baseline Survey

Table A2—Enrollment at Any College by Semester

	Control mean	Estimated effect		Observations
		Covariate adjusted	Unadjusted	
Percent of students enrolled				
Semester 1	94.2	2.2 [1.4]	2.5 [1.4]	896
Semester 2	81.6	9.9 [2.3]	10.3 [2.2]	896
Semester 3	70.3	6.8 [3.0]	7.0 [2.9]	896
Semester 4	62.9	7.5 [3.1]	8.3 [3.1]	896
Semester 5	55.1	6.1 [3.3]	6.8 [3.3]	896
Semester 6	47.4	3.8 [3.4]	4.1 [3.3]	896
Semester 7 (post-program)	42.5	−3.0 [3.3]	−2.4 [3.3]	896
Semester 8 (post-program)	40.9	−3.9 [3.3]	−3.2 [3.3]	896
Semester 9 (post-program)	38.2	−5.0 [3.2]	−4.5 [3.2]	896
Semester 10 (post-program)	35.1	−2.0 [3.2]	−1.8 [3.2]	896
Semester 11 (post-program)	31.9	−4.5 [3.1]	−4.0 [3.1]	896
Semester 12 (post-program)	26.5	−2.6 [2.9]	−2.0 [2.9]	896
Number of terms enrolled	6.3 (3.5)	0.2 [0.2]	0.2 [0.2]	896

Notes: Covariate adjusted estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Unadjusted estimates are adjusted by random assignment blocks only. Standard deviations for continuous outcomes are reported in parantheses. Standard errors are reported in brackets. Enrollment is based on courses that students are enrolled in at the end of the add/drop period.

Sources: MDRC calculations from CUNY Institutional Research Database (IRDB) and National Student Clearinghouse data

TABLE A3—FULL-TIME ENROLLMENT AT ANY CUNY COLLEGE

	Control mean	Estimated effect: Covariate adjusted	Estimated effect: Unadjusted	Observations
Percent of students enrolled full time				
Semester 1	85.2	10.2 [1.9]	10.6 [1.9]	896
Semester 2	65.2	19.8 [2.8]	20.4 [2.8]	896
Semester 3	59.6	14.0 [3.1]	14.2 [3.1]	896
Semester 4	47.9	14.7 [3.3]	15.1 [3.3]	896
Semester 5	39.8	5.5 [3.3]	5.9 [3.3]	896
Semester 6	27.4	5.5 [3.0]	5.4 [3.0]	896
Semester 7 (post-program)	22.5	3.5 [2.8]	3.9 [2.9]	896
Semester 8 (post-program)	22.5	1.2 [2.8]	1.5 [2.8]	896
Semester 9 (post-program)	21.1	−0.8 [2.7]	−0.5 [2.7]	896
Semester 10 (post-program)	18.2	−0.4 [2.7]	0.4 [2.6]	896
Semester 11 (post-program)	16.4	−2.5 [2.4]	−2.0 [2.4]	896
Semester 12 (post-program)	11.7	−0.3 [2.2]	0.3 [2.2]	896

Notes: Covariate adjusted estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Unadjusted estimates are adjusted by random assignment blocks only. Standard errors are reported in brackets. Enrollment is based on courses that students are enrolled in at the end of the add/drop period.

Source: MDRC calculations from CUNY Institutional Research Database (IRDB)

Table A4— Marginal Credits Attempted and Earned at CUNY Colleges

	Control mean	Estimated effect		Observations
		Covariate adjusted	Unadjusted	
Panel A. Credits attempted				
Semester 1	13.91	2.09	2.18	896
	(5.04)	[0.32]	[0.32]	
Semester 2	11.23	3.18	3.28	896
	(6.50)	[0.41]	[0.41]	
Semester 3	9.72	2.50	2.56	896
	(7.37)	[0.50]	[0.49]	
Semester 4	8.31	1.71	1.86	896
	(7.58)	[0.51]	[0.51]	
Semester 5	6.71	0.67	0.78	896
	(7.25)	[0.48]	[0.48]	
Semester 6	4.90	0.82	0.83	896
	(6.49)	[0.45]	[0.45]	
Semester 7 (post-program)	4.09	0.30	0.35	896
	(6.05)	[0.41]	[0.42]	
Semester 8 (post-program)	4.03	−0.11	−0.08	896
	(6.22)	[0.41]	[0.42]	
Semester 9 (post-program)	3.67	−0.33	−0.26	896
	(5.87)	[0.39]	[0.39]	
Semester 10 (post-program)	3.31	−0.17	−0.06	896
	(5.91)	[0.40]	[0.39]	
Semester 11 (post-program)	2.84	−0.42	−0.30	896
	(5.45)	[0.36]	[0.36]	
Semester 12 (post-program)	2.20	−0.20	−0.08	896
	(4.86)	[0.33]	[0.33]	
Cumulative credits attempted	74.94	10.04	11.05	896
	(47.36)	[3.08]	[3.08]	

(*continued*)

TABLE A4— MARGINAL CREDITS ATTEMPTED AND EARNED AT CUNY COLLEGES (*continued*)

	Control mean	Estimated effect		Observations
		Covariate adjusted	Unadjusted	
Panel B. Credits earned				
Semester 1	9.31	1.95	2.08	896
	(6.38)	[0.40]	[0.40]	
Semester 2	7.86	2.11	2.25	896
	(6.69)	[0.45]	[0.45]	
Semester 3	7.19	1.63	1.73	896
	(6.77)	[0.46]	[0.46]	
Semester 4	6.06	1.39	1.56	896
	(6.72)	[0.46]	[0.46]	
Semester 5	4.93	0.48	0.55	896
	(6.13)	[0.41]	[0.41]	
Semester 6	3.84	0.50	0.51	896
	(5.62)	[0.39]	[0.39]	
Semester 7 (post-program)	3.31	0.16	0.22	896
	(5.37)	[0.36]	[0.37]	
Semester 8 (post-program)	3.18	−0.08	−0.05	896
	(5.42)	[0.37]	[0.37]	
Semester 9 (post-program)	3.05	−0.38	−0.29	896
	(5.24)	[0.35]	[0.35]	
Semester 10 (post-program)	2.61	−0.05	0.06	896
	(5.09)	[0.36]	[0.35]	
Semester 11 (post-program)	2.32	−0.46	−0.34	896
	(4.74)	[0.31]	[0.31]	
Semester 12 (post-program)	1.76	−0.27	−0.15	896
	(4.27)	[0.29]	[0.28]	
Cumulative credits earned	55.07	7.00	8.14	896
	(45.84)	[2.98]	[3.00]	

Notes: Covariate adjusted estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Unadjusted estimates are adjusted by random assignment blocks only. Standard errors are reported in brackets. Standard deviations for continuous outcomes are shown in parantheses. Measures of cumulative credits earned exclude courses that are passed more than once.

Source: MDRC calculations from CUNY Institutional Research Database (IRDB)

Table A5—Cumulative Credits Attempted and Earned at CUNY Colleges

	Control mean	Estimated effect		Observations
		Covariate adjusted	Unadjusted	
Panel A. Cumulative credits attempted				
Semester 1	13.91	2.09	2.18	896
	(5.04)	[0.32]	[0.32]	
Semester 2	25.15	5.26	5.46	896
	(9.93)	[0.63]	[0.62]	
Semester 3	34.87	7.76	8.01	896
	(15.21)	[0.99]	[0.97]	
Semester 4	43.18	9.47	9.88	896
	(20.81)	[1.35]	[1.34]	
Semester 5	49.89	10.14	10.65	896
	(25.58)	[1.66]	[1.65]	
Semester 6	54.80	10.97	11.49	896
	(29.30)	[1.92]	[1.90]	
Semester 7 (post-program)	58.89	11.26	11.83	896
	(32.67)	[2.15]	[2.14]	
Semester 8 (post-program)	62.92	11.15	11.75	896
	(36.16)	[2.38]	[2.38]	
Semester 9 (post-program)	66.59	10.82	11.50	896
	(39.58)	[2.60]	[2.59]	
Semester 10 (post-program)	69.90	10.65	11.43	896
	(43.05)	[2.81]	[2.81]	
Semester 11 (post-program)	72.74	10.24	11.13	896
	(45.47)	[2.96]	[2.96]	
Semester 12 (post-program)	74.94	10.04	11.05	896
	(47.36)	[3.08]	[3.08]	
Panel B. Cumulative credits earned				
Semester 1	9.31	1.92	2.05	896
	(6.38)	[0.40]	[0.40]	
Semester 2	17.14	4.04	4.31	896
	(11.87)	[0.75]	[0.75]	
Semester 3	24.32	5.65	6.03	896
	(17.24)	[1.12]	[1.12]	
Semester 4	30.36	7.03	7.58	896
	(22.27)	[1.45]	[1.45]	
Semester 5	35.23	7.54	8.15	896
	(26.42)	[1.72]	[1.72]	
Semester 6	39.02	8.05	8.67	896
	(29.86)	[1.95]	[1.95]	
Semester 7 (post-program)	42.29	8.20	8.88	896
	(33.06)	[2.16]	[2.17]	
Semester 8 (post-program)	45.44	8.14	8.84	896
	(36.24)	[2.38]	[2.39]	
Semester 9 (post-program)	48.46	7.74	8.53	896
	(39.43)	[2.58]	[2.60]	
Semester 10 (post-program)	51.04	7.72	8.61	896
	(42.31)	[2.77]	[2.78]	
Semester 11 (post-program)	53.31	7.30	8.31	896
	(44.38)	[2.89]	[2.90]	
Semester 12 (post-program)	55.07	7.00	8.14	896
	(45.84)	[2.98]	[3.00]	

Notes: Covariate adjusted estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Unadjusted estimates are adjusted by random assignment blocks only. Standard errors are reported in brackets. Standard deviations for continuous outcomes are shown in parantheses. Measures of cumulative credits earned exclude courses that are passed more than once.

Source: MDRC calculations from CUNY Institutional Research Database (IRDB)

TABLE A6—DEGREE COMPLETION AT ANY COLLEGE

	Control mean	Estimated effect		Observations
		Covariate adjusted	Unadjusted	
Earned any degree (percent)				
Semester 1	0.0	0.0	0.0	896
Semester 2	0.0	0.2	0.2	896
		[0.2]	[0.2]	
Semester 3	1.1	1.8	1.7	896
		[1.0]	[0.9]	
Semester 4	8.8	5.6	6.0	896
		[2.2]	[2.1]	
Semester 5	15.3	13.4	14.2	896
		[2.7]	[2.7]	
Semester 6	22.0	17.7	18.3	896
		[3.1]	[3.0]	
Semester 7 (post-program)	26.3	15.7	16.7	896
		[3.1]	[3.1]	
Semester 8 (post-program)	29.9	15.3	16.0	896
		[3.2]	[3.2]	
Semester 9 (post-program)	32.4	14.2	14.9	896
		[3.2]	[3.2]	
Semester 10 (post-program)	36.4	11.8	12.4	896
		[3.3]	[3.3]	
Semester 11 (post-program)	38.2	11.5	12.4	896
		[3.3]	[3.3]	
Semester 12 (post-program)	40.4	10.4	11.5	896
		[3.3]	[3.3]	
Earned an associate's degree (percent)	37.1	12.2	13.0	896
		[3.3]	[3.3]	
Earned a bachelor's degree or higher (percent)	16.2	0.5	1.2	896
		[2.5]	[2.5]	
Highest degree earned (percent)				
Certificate	0.0	0.0	0.0	896
		[0.0]	[0.0]	
Associate's	23.8	9.8	10.3	896
		[3.0]	[3.0]	
Bachelor's or higher	16.2	0.5	1.2	896
		[2.5]	[2.5]	

Notes: Covariate adjusted estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Unadjusted estimates are adjusted by random assignment blocks only. Standard errors are reported in brackets. Degree receipt is cumulative. Those who earned a degree in an earlier semester are counted as having a degree in subsequent semesters.

Sources: MDRC calculations from CUNY Institutional Research Database (IRDB) and National Student Clearinghouse data

Table A7—Enrollment by College Type and Semester

	Control mean	Estimated effect: Covariate adjusted	Estimated effect: Unadjusted	Observations
Panel A. Enrolled at any 2-year college (*percent*)				
Semester 1	93.5	2.7	2.9	896
		[1.5]	[1.4]	
Semester 2	80.9	10.1	10.5	896
		[2.3]	[2.3]	
Semester 3	68.8	6.9	7.2	896
		[3.0]	[3.0]	
Semester 4	58.0	8.0	8.6	896
		[3.3]	[3.2]	
Semester 5	43.8	1.2	1.5	896
		[3.3]	[3.3]	
Semester 6	30.1	−3.1	−3.5	896
		[3.0]	[3.0]	
Semester 7 (post-program)	20.0	−7.8	−7.9	896
		[2.5]	[2.4]	
Semester 8 (post-program)	15.5	−6.8	−6.9	896
		[2.2]	[2.2]	
Semester 9 (post-program)	11.5	−3.6	−3.5	896
		[2.0]	[2.0]	
Semester 10 (post-program)	7.9	−2.0	−1.7	896
		[1.7]	[1.7]	
Semester 11 (post-program)	6.1	0.7	1.0	896
		[1.7]	[1.7]	
Semester 12 (post-program)	5.2	0.0	−0.1	896
		[1.5]	[1.5]	
Panel B. Enrolled at any 4-year college (*percent*)				
Semester 1	0.7	−0.5	−0.4	896
		[0.5]	[0.4]	
Semester 2	0.9	−0.2	−0.2	896
		[0.6]	[0.6]	
Semester 3	1.6	0.0	0.0	896
		[0.8]	[0.8]	
Semester 4	5.2	−0.1	0.2	896
		[1.5]	[1.5]	
Semester 5	12.4	4.3	4.8	896
		[2.4]	[2.3]	
Semester 6	17.5	7.0	7.6	896
		[2.7]	[2.7]	
Semester 7 (post-program)	22.5	4.8	5.5	896
		[2.9]	[2.9]	
Semester 8 (post-program)	25.4	2.9	3.7	896
		[3.0]	[3.0]	
Semester 9 (post-program)	26.7	−0.4	−0.1	896
		[3.0]	[3.0]	
Semester 10 (post-program)	27.2	−0.1	−0.1	896
		[3.0]	[3.0]	
Semester 11 (post-program)	25.8	−5.0	−4.8	896
		[2.8]	[2.8]	
Semester 12 (post-program)	21.3	−2.4	−1.7	896
		[2.7]	[2.7]	

Notes: Estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Standard errors are reported in brackets. Enrollment is based on courses that students are enrolled in at the end of the add/drop period.

Sources: MDRC calculations from CUNY Institutional Research Database (IRDB) and National Student Clearinghouse data

TABLE A8—DEGREE COMPLETION AT ANY COLLEGE BY DEGREE TYPE

	Control mean	Estimated effect		Observation
		Covariate adjusted	Unadjusted	
Panel A. Earned an associate's degree (*percent*)				
Semester 1	0.0	0.0	0.0	896
Semester 2	0.0	0.2	0.2	896
		[0.2]	[0.2]	
Semester 3	1.1	1.8	1.7	896
		[1.0]	[0.9]	
Semester 4	8.8	5.6	6.0	896
		[2.2]	[2.1]	
Semester 5	15.3	13.4	14.2	896
		[2.7]	[2.7]	
Semester 6	21.8	17.9	18.5	896
		[3.0]	[3.0]	
Semester 7 (post-program)	26.1	15.8	16.7	896
		[3.1]	[3.1]	
Semester 8 (post-program)	29.4	15.2	15.8	896
		[3.2]	[3.2]	
Semester 9 (post-program)	31.7	14.4	14.9	896
		[3.2]	[3.2]	
Semester 10 (post-program)	34.8	12.0	12.4	896
		[3.3]	[3.3]	
Semester 11 (post-program)	35.7	12.4	13.1	896
		[3.3]	[3.3]	
Semester 12 (post-program)	37.1	12.2	13.0	896
		[3.3]	[3.3]	
Panel B. Earned a bachelor's degree or higher (*percent*)				
Semester 1	0.0	0.0	0.0	896
Semester 2	0.0	0.0	0.0	896
Semester 3	0.0	0.0	0.0	896
Semester 4	0.0	0.0	0.0	896
Semester 5	0.0	0.2	0.2	896
		[0.2]	[0.2]	
Semester 6	0.0	0.7	0.7	896
		[0.4]	[0.4]	
Semester 7 (post-program)	0.7	0.4	0.6	896
		[0.7]	[0.7]	
Semester 8 (post-program)	2.0	1.9	2.2	896
		[1.2]	[1.2]	
Semester 9 (post-program)	3.8	2.8	3.3	896
		[1.5]	[1.5]	
Semester 10 (post-program)	8.1	3.1	3.7	896
		[2.0]	[2.0]	
Semester 11 (post-program)	12.4	1.7	2.3	896
		[2.3]	[2.3]	
Semester 12 (post-program)	16.2	0.5	1.2	896
		[2.5]	[2.5]	

Notes: Estimates are adjusted by random assignment blocks and select baseline characteristics (see section titled "Impact Model Specifications" for details). Standard errors are reported in brackets. Degree receipt is cumulative. Those who earned a degree in an earlier semester are counted as having a degree in subsequent semesters.

Sources: MDRC calculations from CUNY Institutional Research Database (IRDB) and National Student Clearinghouse data

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