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# The Effects of Start-Up Charter Schools on Earnings and Academic Milestones

Peter Bluestone  
Nicholas Warner



ANDREW YOUNG SCHOOL  
CENTER FOR STATE & LOCAL FINANCE

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## About the Report

This report follows a three-part series requested by the State Charter Schools Commission in 2016 and performed by the Center for State and Local Finance that analyzed the economic impact of start-up charter schools. That series of studies focused on the economic impact start-up charter schools have on the individuals who attend them, the communities they serve, and the state of Georgia as a whole.

One primary finding missing from those earlier studies were estimates of the impact that start-up charter schools might have on later-life earnings. Data limitations prevented such estimates at the time, but newly available data make these estimates possible. This report updates the previous work by estimating the effect Georgia's start-up charter schools have on students' later-life earnings.

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## Introduction

Since the first charter school opened in 1992, 42 states and the District of Columbia have adopted provisions allowing charter schools to operate (Epple et al., 2015). Advocating reform to struggling public education systems, the proponents of charter schools envisioned that these schools' autonomy would lead to innovation and improved educational outcomes for students. Proponents also hoped that the increased competition for students would spur improvements in traditional public schools (TPS). Improved academic performance in both settings is important, as research has found that it leads to better economic outcomes for both individuals and communities (Hanushek & Kimko, 2000; Card, 1999).

The effect of charter school attendance on students' academic achievement and life outcomes has been long debated and extensively researched; research on whether charter schools improve student achievement has been conducted in at least 27 states (Cremata et al., 2013). Typically, researchers have used changes in test scores, specifically among students in elementary and middle schools, to measure student achievement. This extensive research on the effectiveness of charter schools has yielded mixed results (see Bluestone, 2016, for a review of the literature). Less is known about the impact these schools have on other metrics of student success in either high school or college.

The effect of charter school attendance on students' academic achievement and life outcomes has been long debated and extensively researched.

This report examines the impact of Georgia's start-up charter schools on students' later-life earnings as well as updates previous findings on academic milestones—high school graduation, college enrollment, and degree completion. We use data from Georgia's Academic and Workforce Analysis and Research Data System (GA•AWARDS), housed by the Governor's Office of Student Achievement, for this report. This longitudinal data system starts collecting data on Georgia public school students upon their entrance to Georgia's Pre-K Program, if they participate, all the way through their roles in Georgia's labor market.

We utilize an average treatment effects model to isolate the differences in critical educational outcomes between students who were enrolled in start-up charter high schools and a group of matched students who attended traditional public high schools. All the students studied attended a charter middle school; this sample restriction controls for selection effects, which would otherwise bias the results.

The report is organized as follows: The types of charter schools in Georgia are briefly reviewed. Then, the third section discusses the economic theory on the link between academic achievement and economic impact. The fourth section summarizes the measures used in the literature to assess charter school success. The fifth section examines data and research methods. The sixth section reviews summary statistics, and the seventh section describes model specification, results, and robustness checks. The concluding section suggests areas for future research.

## Charter Schools in Georgia

While charter schools are public schools, they can differ from TPS in many ways, including but not limited to the length of the school day, mandatory summer school, and the instructional methods offered. However, there are two key factors that significantly differentiate them from TPS. First, rather than children being assigned to a specific public school, parents can choose whether to send their children to a charter school. Second, charter schools have increased flexibility in how they educate students in exchange for increased accountability. The flexibility pertains to both state and district regulations that govern operations as well as the nature of the educational programs provided.

Per the 2020-21 *Georgia Charter Schools Annual Report*, 116 charter schools were operating in Georgia at the start of the 2020-21 school year. This total includes state charter schools but not those in charter system districts. These schools may be divided into three broad types (Georgia Department of Education 2020 Types of Charters):

- **Start-Up Charter School:** A new school created by a petition made by a nonprofit governing board. Start-up charter schools may determine their own attendance zones, including priority attendance zones.
- **Conversion Charter School:** A charter school that existed as a local public school prior to becoming a charter school. Entrance into conversion charter schools is usually guaranteed for students residing within the school attendance boundaries as determined by the local school board.
- **Charter System School:** A charter system is a local school district that operates under a charter between the school district as the charter petitioner and the State Board of Education. Schools in a charter system are different from conversion and start-up charter schools. The school district, not the school and school governing board, has the contract with the state. Thus, schools in charter systems are generally more similar to a traditional public school and operate in a comparable manner. For instance, the Atlanta Public School district is now a charter system.

At the start of the 2020-21 school year, students enrolled in charter schools (not including charter systems) represented 4.9% of all K–12 public school students in Georgia. There are considerably more schools in charter systems and thus more students. Due to the similarities conversion charter schools and charter systems have with TPS, we restrict our analysis to start-up charter schools in this report.

## The Economic Theory of Academic Achievement and Economic Impact

This report relies on the theory that academic achievement leads to improved job outcomes, which make a positive economic impact on the community. Economic theory has long held that increased business investment in new machines and equipment (capital investment) fosters economic growth. In 1962, economist Gary Becker expanded the concept of capital investment to include schooling and training. Economic theory holds that better-educated workers are more productive, which can lead to both economic

growth, thereby improving the larger economy, and higher wages, an economic benefit to individuals. Spending on schooling and training is now commonly referred to as investing in human capital.

Since Becker published his article, the literature on human capital has grown dramatically and fits into two broad categories: the macroeconomic effects of education on countries' growth rates and the higher earnings associated with individuals' investment in education. While both areas of research have been fraught with debates about appropriate research methods, there is consensus on two broad outcomes. First, in the macroeconomic setting, better schooling, measured by cognitive development in a country, is related to greater economic growth (Hanushek & Kimko, 2000; Hanushek & Woessmann, 2012). Second, from the perspective of individuals, higher educational attainment leads to substantially higher lifetime earnings (Card, 1999; Heckman et al., 2006). This report focuses on the second category, primarily on educational attainment.

## Charter Schools: Measures of Success Used in the Literature

This section explores the empirical literature on charter schools' effects on academic achievement, graduation rates, wages, and other life outcomes. The discussion is relatively brief and limited to high-quality studies that use methods relevant to this report. (For a thorough discussion of this literature, see Bluestone et al., 2016.)

For charter schools to have a measurable economic impact, they need to improve outcomes for students later in life. Charter schools that increase the percentage of students who graduate from high school, attend college, obtain degrees, and earn higher salaries will have positive economic impacts on their communities. A recent stream of the literature examines the potential effects that charter schools have on these outcomes. Additionally, many studies explore the role that charter schools play in academic achievement, which we outline first.

The literature on how charter schools affect student achievement is contentious.

### ACADEMIC ACHIEVEMENT

An extensive body of work explores the effects that charter schools have on academic achievement, as measured by performance on standardized tests. This rich literature has measured charter school effects on academic performance at the elementary and middle school levels. Many of these studies rely on a lottery research design.

The literature on how charter schools affect student achievement is contentious. Many of the studies using the lottery method provide strong evidence that certain charter schools can improve student achievement. Because students and their parents choose to enroll in charter schools, any study that compares charter students to traditional high school students has an inherent selection bias issue. Consequently, many studies

that attempt to pinpoint the impacts of charter school attendance rely on a lottery research design, which takes advantage of the random selection that an attendance lottery provides in oversubscribed charter schools. Researchers compare the performance of students chosen for the charter school to that of students not chosen (and who consequently attend a traditional public school). When schools that operate in varying contexts and areas are studied together, even when using the lottery method as Gleason et al. (2010) did, the effects on average tend to be small or zero. Research shows that this low average effect is due to the variability in effects across schools. More recent studies that have tried to uncover the source of this variation suggest that charter schools which serve disadvantaged students—typically ones in urban settings that focus on strict discipline, tutoring, and longer school days (often referred to as the No Excuses model in the literature)—do improve student achievement. Other types of charter schools have not been found to outperform TPS in any consistently measurable way.

Student achievement has been firmly linked to better life outcomes such as increased high school graduation rates and higher wages; consequently, the effects found in the literature described above are a reasonable predictor of better economic outcomes for students later in life. (For instance, see Angrist et al., 2016; Sass et al., 2016; and Dobbie & Fryer, 2013.)

## OTHER OUTCOMES

Studies testing the effect of attending charter high schools on outcomes that directly relate to economic impacts such as graduation rates, higher education milestones, and wages have been published since 2010. This makes sense because the first classes of charter school students have only recently begun graduating from high school, so there are limited numbers of charter school alumni for which these outcomes can be measured. Also, the data must be available for recent years to capture both attendance at charter schools and observable outcomes post–high school graduation. While the literature is not well established, most of the studies that have been able to track students into the workforce find positive effects from enrollment in a charter school on graduation rates, education outcomes, and wages.

Some studies have found that enrollment in charter high schools increases the chances of high school graduation and college attendance (Booker et al., 2010; Clark et al., 2015). Unlike test scores, high school graduation and earnings immediately after graduation are onetime events; any study of charter schools' effects on these outcomes cannot rely on multiple observations for a student over time to help control for potential charter school selection bias, inherent when families chose whether to attend a charter school. To account for such bias, Booker et al. (2010) considered only students who had previously attended a charter middle school.<sup>1</sup> In a follow-up study, similarly designed except with a matching protocol implemented to further correct for any charter selection bias, the authors found similar results for high school graduation and college attendance. In addition, they found that charter enrollment predicted longer college persistence and higher earnings (Sass et al., 2016).

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<sup>1</sup> Middle school enrollment grades can vary between school districts. For the purposes of this report, middle school includes grades 6 through 8.

It is worth noting that not all studies have found a positive effect of charter schools on student outcomes. A recent study on Texas charter schools found that at the mean, charter schools have no impact on test scores and a negative impact on earnings. For some types of charter schools, the No Excuses charters, the results were more in line with the existing literature, finding an increase in test scores and four-year college enrollment. But, again, there was no statistically significant impact on earnings (Dobbie & Fryer, 2020). Due to the structure of Texas charter schools as well as data limitations, the authors used a cohort-fixed-effects approach to ensure their results were causal. This approach, while necessary given the circumstances, differs in important statistical ways from that used by Sass et al. (2016).

Two lottery-style studies conducted on oversubscribed charter schools in Boston and Harlem found positive effects of charter enrollment on some noncognitive outcomes (Angrist et al., 2016; Dobbie & Fryer, 2013). Charter schools were found to increase the chances that a student would enroll in a four-year rather than two-year college, but the researchers found no evidence that the charter schools increased the likelihood of high school graduation (Angrist et al., 2016). The students who attended Harlem's charter schools were more likely to enroll in college, girls were less likely to become pregnant as teens, and male students were much less likely to be incarcerated than students who participated in the lottery but attended Harlem's TPS (Dobbie & Fryer, 2013).

The few studies that look at broader outcomes such as graduation rates and earnings are recent and focus only on schools in Chicago, New York, Boston, and Florida (e.g., Angrist et al., 2016; Dobbie & Fryer, 2013; Sass et al., 2016). However, these studies might provide the best evidence that charter schools are having positive economic impacts on communities and individuals through improved academic achievement.

## Data and Research Methods

This analysis attempts to establish a causal relationship between ninth-grade attendance at a start-up charter school in Georgia and higher earnings in the job market. We rely on the GA•AWARDS data set. These data, first established through the Race to the Top statewide longitudinal data system grant, are generated by many state education and workforce agencies and university systems. The data, which are housed and maintained by the Governor's Office of Student Achievement, include information on Georgia's students from enrollment in pre-K through their entrance into the labor market for the years 2007–20. The student-level data set contains information on students' test performance, demographics, teachers, graduation outcomes, college and technical school enrollment, postsecondary degree attainment, and any employment records.<sup>2</sup>

The data follow Georgia students throughout the full calendar years of 2007–19. Many start-up charter schools serve only elementary and middle school-aged students, so the data system currently contains limited labor market outcomes for these students. Our analysis centers on the students the data allow us to

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<sup>2</sup> College enrollment includes out-of-state colleges and universities.

follow, from a start-up charter school through high school graduation and beyond, to measure the effects that start-up charter schools have on these outcomes.

Isolating a causal relationship between attending a charter school and later life outcomes requires methods that account for the potential selection (empirical) bias from more interested students and families selecting into charter schools. To do so, we estimate average treatment effects within matched ninth-grade students attending start-up charter high schools (treatment) and TPS or conversion charter high schools (control)—all of whom attended a start-up charter school for eighth grade. This method, frequently used in the literature, reduces the likelihood that neither selection into a charter school nor student population differences are influencing the findings. Our control group, therefore, is students who attended eighth grade at a charter middle school and then attended a traditional public high school; our treatment group consists of students who attended a charter middle school and continued into a start-up charter high school. This model assumes equal geographic access to charter ninth grade across the charter eighth graders studied, an assumption we examine in depth in the appendix.

Individual charter schools differ in the legal framework under which they operate, complicating our analysis. Each school has its own curricular focus, instructional style, and teachers. The schools follow different schedules and serve different communities. Because of these variations, much of the research on charter schools has been specific to a school or small set of schools within a given state, making it difficult to generalize the findings to other charter schools.

Individual charter schools differ in the legal framework under which they operate, complicating our analysis.

All the differences across charter schools create methodological complications when attempting to evaluate the performance of an individual school. Comparing the outcomes of students who attended a charter school to those who attended a traditional public school suffers from potential sample selection bias. By choosing to enroll, or attempting to enroll, in a charter school, a family and student are indicating intrinsic motivation and a potentially higher value placed on education than families and students who do not attempt to enroll. Any effect found in a study that does not correct for this possible selection bias could just be capturing the effect of the higher levels of motivation and value placed on education rather than the charter school's impact on the student. (For a full review of the literature on the effect of charter schools on student achievement and other life outcomes, see Bluestone et al., 2016.)

The extant research on charter schools has used multiple methods to account for this potential selection bias. The chosen method varies depending on the outcome being measured and the type of data available.<sup>3</sup> Ideally, researchers would be able to select students and randomly assign them to a charter school or a

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<sup>3</sup> An excellent survey of the academic literature on charter schools and the various statistical methods used to correct for selection bias was recently conducted by Epple et al. (2015). They identified five methods used to correct for this potential bias: 1) fixed effect approaches, 2) a random lottery design, 3) matching procedures, 4) an ordinary least squares regression design, and 5) instrumental variable approaches.

traditional public school and then observe the differences in outcomes. However, that is not possible. The next best real-world alternative is referred to as a lottery-style research design. This research design takes advantage of the random selection that an attendance lottery provides in oversubscribed charter schools. Researchers can address selection bias by comparing the performance of students chosen for the charter school to that of students not chosen (and who consequently attend a traditional public school). Thus, the comparisons of student outcomes take place only among individuals who wanted to attend that school, and as both groups are presumably similarly motivated, any difference can be attributed to the effect of attending the charter school. Lottery-style studies are not always practical, particularly if the schools of interest are not oversubscribed or lottery results are not available, as is the case for our study.<sup>4</sup>

Another approach to addressing selection bias is to use longitudinal pretreatment measures, usually test scores, when examining academic achievement. As students take tests repeatedly over many years, the change in test scores for individual students who move between TPS and charters can be used to infer the impact of charter school attendance on student achievement. As individual student outcomes are observed, important student and family characteristics are controlled for. The validity of this method has recently been demonstrated by Furgeson et al. (2012) and Tuttle et al. (2013). This approach is also not possible for our study because we focus on long-term outcomes such as high school graduation, which are onetime events after charter school enrollment.

Researchers have been confronted with these empirical limitations before and have devised a method to deal with them. To create a comparison group, they rely on students who attended a charter school in the eighth grade. The expectation is that this group of students will be similar in terms of unobserved family and student characteristics that would also be present in those who enroll in charter high schools (Booker et al., 2010; Sass et al., 2016).<sup>5</sup>

The treatment students in this type of analysis remain enrolled in charter schools in ninth grade, whereas the control students attend TPS for high school. This type of analysis also addresses selection bias by controlling for baseline student demographics and measures of ability, including eighth-grade test scores. Finally, a matching protocol is used to further control for unobserved characteristics and selection bias. A one-to-one nearest-neighbor covariate matching approach is used in which students in the treatment group are matched based on observable characteristics with a student who attended a traditional public high school in ninth grade.

This matched average treatment effects model is similar to that used in other studies (Booker et al., 2010; Sass et al., 2016). In our analysis, the students who attended a start-up charter in eighth grade represent the group of potentially studied students. The students who also attended a start-up charter in ninth grade are the treatment group, and the students who remain (attending a traditional public high school or conversion

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<sup>4</sup> Additionally, oversubscribed schools often are the top-performing schools, so results may not be applicable to all schools.

<sup>5</sup> Dobbie and Fryer (2020) did not have the ability to control for charter middle school attendance and instead used a cohort-fixed-effects approach to ensure their results were causal based on fourth-grade scores and type of school attended. We can replicate the Sass et al. (2016) approach and thus leave the more restrictive method used by Dobbie and Fryer for future research.

charter school) are the potential matched control group. Any effect found is between students and families who were all interested in and attended a charter school. The matching process ensures that the groups of students compared are similar in all possible ways except for charter high school attendance. We also perform several robustness checks to test the importance of the student-level matching criteria.<sup>6</sup>

## Summary Statistics

GA•AWARDS provides comprehensive data on all students enrolled in Georgia’s public education system as well as their later transition into the workforce. This data set includes where individual students attended eighth and ninth grade and their workforce information years later. Table 1 shows the relevant number of eighth-grade cohorts by type of school based on information in the GA•AWARDS data set. The table also includes the date each cohort reached various academic milestones, such as high school graduation. There has been considerable growth in the size of start-up charter school eighth-grade cohorts from school year 2006-07 to 2010-12. In 2006-07, there were 835 eighth-grade students in start-up charter schools including state commissioned and virtual charter schools; by 2010-12, there were 2,084.

**Table 1**

*Student Enrollment and Milestone Attainment Dates*

EIGHTH-GRADE COHORTS*				ON-TIME EDUCATIONAL ATTAINMENT		
SCHOOL YEAR	CONVERSION CHARTER	START-UP CHARTER	TRADITIONAL PUBLIC SCHOOL	HIGH SCHOOL GRADUATION CLASS	BACHELOR’S DEGREE—SPRING	SCHOOL-YEAR WAGES**
2006-07	1,892	835	129,270	2011	2015	2016
2007-08	1,758	1,337	126,528	2012	2016	2017
2008-09	1,782	1,473	125,321	2013	2017	2018
2009-10	1,898	2,425	126,395	2014	2018	2019
2010-11	1,861	2,084	125,383	2015	2019	2020

Source: GA•AWARDS data.

\* Non-duplicated student count of eighth-grade students.

\*\* If an eighth grader completed high school and a bachelor’s degree, both within four years, they could start working with a four-year degree the summer of this year.

For this study, we are first interested in the eighth graders who attended start-up charter schools. As the GA•AWARDS data set starts with the full calendar year 2007 and ends with calendar year 2020, it contains a limited number of observations for those eighth-grade cohorts that graduate college and enter the workforce.

<sup>6</sup> The small number of start-up charter high schools has been an issue in previous research. However, due to the Georgia Cyber Academy, students who do not have a bricks-and-mortar charter high school close by now have the option of attending a charter high school. The effects of including the Georgia Cyber Academy in our study as a start-up charter school are discussed later in the report.

Table 2 shows the number of eighth-grade students in the treatment and control group cohorts. The treatment group cohorts are composed of students who were enrolled in a start-up charter school in both eighth and ninth grades. The control group is made up of students who were enrolled in a start-up charter school in eighth grade and in a TPS for ninth grade. The table tracks the cohorts as they reach various academic milestones.

**Table 2**

*Treatment and Control Cohorts*

EIGHTH-GRADE COHORT	TOTAL COUNT		GEORGIA WAGES***	
	CONTROL*	TREATMENT**	CONTROL*	TREATMENT**
2007	749	168	460	105
2008	1,222	147	595	102
2009	1,576	224	806	159
2010	1,209	280	762	185
2011	1,307	399	913	304

Source: GA•AWARDS data.

\* Control are potential control students who attended eighth-grade start-up charter schools. Eighth-grade treatment and control cohorts do not equal eighth-grade cohorts in Table 1 due to missing test scores or other data that do not allow for matching.

\*\* Treatment are eighth-grade start-up charter school students who go on to attend a start-up charter high school for ninth grade.

\*\*\* Wages for that student included indicating Georgia employment.

Table 2 shows that in both the treatment and control groups, sizeable shares of students are not observed working in Georgia nine years after eighth grade. This could be due to either a lack of employment in Georgia or these students having left the state. For instance, of the 749 students in the 2007 control cohort, only 460 of them were working in Georgia in 2016 (61%), and 105 of the 168 start-up charter ninth-grade students were working in Georgia in 2016 (63%).

Table 3 shows the mean value for the various academic achievement and demographic characteristics of the treatment and control groups, after matching. The standardized mean difference indicates that we have good balance in our matches. The last column in the table shows the standardized mean difference before matching.<sup>7</sup> This column shows the difference in the treatment population compared to all potential control candidates. Recall that control students are those that attended a start-up charter school for eighth grade but went on to a TPS high school for ninth grade. We briefly discuss these differences to illustrate the importance of the matching protocol to minimize bias as well as to highlight potential systemic differences between the treatment and control populations that require additional levels of inquiry.

<sup>7</sup> Standardized mean differences are the difference between two observed averages after accounting for the variance in the underlying data used to compute the averages.

**Table 3***Summary Statistics for Treatment and Control Cohorts\**

	TREATMENT AND CONTROL MEANS—AFTER MATCHING		STANDARDIZED PERCENT DIFFERENCE IN MEANS**	
EIGHTH-GRADE MEANS	TREATMENT COHORT	CONTROL COHORT	AFTER MATCHING	BEFORE MATCHING
English Score*	0.63	0.60	0.04%	0.13%
Math Score*	0.60	0.56	0.04%	0.14%
Reading Score*	0.62	0.60	0.02%	0.08%
Free Lunch	0.63%	0.64%	-1.7%	-13.0%
Gifted	11.9%	11.9%	0.00%	0.00%
Limited English Proficient	0.97%	0.97%	0.0%	-1.3%
Black	56.5%	56.2%	0.7%	-21.3%
Female	55.4%	56.0%	-1.3%	0.0%

Source: GA•AWARDS data and authors' calculations.

\* Test scores have been normalized within year and test relative to a distribution with a mean zero and standard deviation of 1. The grade test score was used when available. If an eighth-grade score was missing, the last test score before ninth grade was used.

\*\* Standardized percent difference takes into account the standard deviation of the means.

First, we examine the academic achievement measures before matching. The pool of potential control students on average scored 0.1 standard deviations lower than the treatment students on the Georgia math Criterion-Referenced Competency Test (CRCT). Second, we examine income and race. On average, the treatment group appears to have lower family incomes than the potential control group, with 13% more treatment students receiving free or reduced-price lunch than the potential control group. We note that the treatment group has a lower share of black students than the potential control group. For these demographic and achievement metrics, there does not seem to be any systematic pattern that would cause problems for the matching protocol.

## Model Specification and Results

In this section, we describe our modeling specification. As discussed earlier, our treatment group consists of students who attended a charter middle school for eighth grade and then a charter high school for ninth grade. The control group attended a charter middle school for eighth grade and then a traditional public high school for ninth grade. Note that our classification is determined only by ninth grade high school attendance and is not affected by whether the student continues on at the charter school for grades 10–12. This choice was made to avoid problems of selection bias associated with students transferring out of the treatment group. Thus, the estimates of charter high school effects are similar to “intent to treat” impact estimates, where treatment is completing high school at a start-up charter high school (by entering ninth grade in a start-up charter high school, students intend to receive the full treatment).

To further control for endogeneity, we follow a matching approach used in previous studies (Booker et al., 2011; Sass et al., 2016). We use a one-to-one nearest-neighbor covariate match in which observable characteristics from the treatment group (start-up charter ninth-grade enrollment) are matched with students attending traditional public high schools to create a control group.<sup>8</sup> We then examine the difference in student outcomes between those in treatment relative to this counterfactual control group.

The causal nature of our treatment relies on an important assertion. The statistical process estimates the difference in the mean value of the outcome of interest for the treatment and control groups, for instance, the likelihood of high school graduation. For the treatment to have a causal relationship to any observed difference, the observable characteristics must be sufficient to make the counterfactual outcome—choosing to attend a traditional public high school—independent of the milestone of interest. To satisfy this condition, we chose only students who had enrolled in a charter school for eighth grade. Put another way, the model can be deemed causal only if upon leaving the charter school after eighth grade, a student’s chance of graduating from high school is independent of their choice to attend a traditional public school, controlling for the observable characteristics using the matching process. For a technical discussion of these criteria, see Smith and Todd (2001). We later conduct a sensitivity analysis using modifications to both the treatment and control groups for the matching analysis approach to provide further evidence of the robustness of our results.

## RESULTS

The previously published Report 3, *The Effects of Start-Up Charter Schools on Academic Milestones*, found that start-up charter high school attendance improved various educational achievement milestones using 2007–2016 data, but data on earnings were not available (Bluestone et al., 2018). The primary purpose of this report is to estimate the effects of start-up charter high school enrollment on future earnings. Table 4 represents updates on those previous findings; it presents the estimated impacts of charter high schools on students’ subsequent achievement of three academic milestones: high school graduation, college entry, and college persistence. For the analysis, we match on student demographics, inclusion in the English as a second language (ESOL) program, special education program participation, and family income (proxied by free/reduced-price lunch status).<sup>9</sup> In addition, we include both student ability and prior educational attainment by matching on eighth-grade math, reading, and English test scores.<sup>10</sup>

Table 4, below, shows estimates of the relationship between charter high school attendance and the probabilities of earning a standard high school diploma within five years of entering ninth grade, enrolling in college within seven years, and earning a college degree or certificate. Our results are similar to those found in the recent literature (Booker et al., 2011; Sass et al., 2016), as well as in our prior report. We find that

<sup>8</sup> This matching protocol is implemented in Stata using the *teffects nnmatch* routine. Robust standard errors are used as recommended by Abadie and Imbens (2006) for this type of matching protocol.

<sup>9</sup> English language skills are measured by participation in an ESOL program.

<sup>10</sup> For test scores, we used the student’s eighth-grade Georgia CRCT scores in reading, math, and English. Note that the CRCT was retired after the 2013–14 school year and replaced by the Georgia Milestones Assessment System beginning with the 2014–15 school year.

charter high school enrollment is positively associated with educational attainment and is statistically significant. Adding three further cohorts of charter eighth and ninth grade students to the previous data boosted the size of the effects slightly. Charter ninth grade students are found to be 7 percentage points more likely to graduate high school on time, 9 percentage points more likely to attend college, and 6 percentage points more likely to receive a college degree or certificate. This compares to our prior findings of charter high school attendance increasing the likelihood of graduating from high school by 4 percentage points, college attendance by 6 percentage points, and college degree or certificate attainment by 2 percentage points.

**Table 4**

*Estimates of Effect of Attending Charter High School on Educational Attainment*

	HIGH SCHOOL DIPLOMA	COLLEGE ATTENDANCE	COLLEGE DEGREE OR CERTIFICATE
Start-Up Charter Ninth Grade	0.0700*** (0.0184)	0.0889*** (0.0208)	0.0602*** (0.0175)
Observations	2,420	2,420	2,420

Source: GA•AWARDS data and authors' calculations.

Robust standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 5 presents the estimated impacts of charter high schools on students' subsequent wages. In this analysis, we wanted to control for observable characteristics that could influence wages as we did with the milestone estimates. The characteristics are the same as those in the milestone analysis and include student demographics, inclusion in the ESOL program, special education program participation, and family income (proxied by free/reduced-price lunch status). Prior educational attainment is also controlled for by matching on eighth-grade math, reading, and English test scores. The results show that students who attend a charter high school in Georgia are estimated to earn \$536 more per quarter than the matched control students. Quarterly wages are used, as that is what is reported by the Georgia Department of Labor's unemployment insurance program. This result was found to be statistically significantly different from zero at the 90% level (see Table 5).

**Table 5**

*Estimates of the Effect of Earnings*

	QUARTERLY WAGES
Start-Up Charter Ninth Grade	536.5* (275.5)
Observations	1,232

Source: GA•AWARDS data and authors' calculations.

Robust standard errors in parentheses; \* p<0.1

A potential critique of our model is its assumption that access to charter high school is not correlated with any of our other variables of interest. However, if geographic access to charter ninth grade restricts certain cohorts of eighth graders from charter ninth grade in a non-random way, our findings could be over or underestimating the effect start-up charter schools are having on later-life outcomes. We construct an alternate model specification which relaxes the restriction that both treatment and control students attended charter eighth grade. This change allows us to investigate the possibility that our results may be influenced by non-random geographic access to charter ninth grade. We find similar results in that attending charter high school has a positive and statically significant result on earnings. For a thorough discussion of this analysis, please see the appendix.

## Conclusion

This report, updating *The Effects of Start-Up Charter Schools on Academic Milestones*, the third in a series on the economic impact of start-up charter schools in Georgia, provides further evidence that start-up charter schools are having a positive economic impact on the students who attend them and their communities. We find that attending a Georgia charter high school increases quarterly earnings by roughly \$530. Previous findings of improved educational milestones and attainment are also supported.

These results provide evidence that charter schools improve academic outcomes later in life. The increased likelihood of college graduation and degree or certificate attainment suggests that charter high schools are imparting some additional skills to students, rather than just successfully coaching them to high school graduation and then helping them enroll in college.

Additional research is needed to determine how and why Georgia start-up charter schools are improving life outcomes for their students. Bluestone et al. (2016) categorized the educational pedagogy of 50 Georgia start-up charter schools to identify those that use No Excuses methods. Building on this work using future GA•AWARDS data would allow us to test the effects of attending a No Excuses charter school on achievement and later-life outcomes. The inclusion of several future cohort years of GA•AWARDS data also would allow us to test the effects of charter high school on wages.

This research joins a small group of studies that look at broader outcomes such as graduation rates and adds Georgia charter schools to a list of studied localities that included only Chicago, New York, Boston, and Florida. Our findings are significant, as there is an earnings premium associated with reaching the various milestones we assessed.

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## Appendix: Start-Up Charter's Effect on Wages Controlling for Geographic Access

Any model that is attempting to establish causation between charter enrollment and later-life outcomes must address the potential endogeneity created by a non-random set of families choosing charter schools. Our primary model specification addresses these concerns in a direct and reliable way. One issue that this specification may not completely address is potential lack of geographic access to charter ninth grade.

Geographic access to traditional schools is straightforward due to districts' use of attendance boundaries. A student that lives within the established attendance boundary for a school has geographic access to that school, as TPS provide bus transportation to and from school. For start-up charter schools, geographic access is not quite so straightforward. If a district contains a start-up charter high school, any student residing in the district technically has access to that charter school. Those schools may be too far away from a family's home to realistically consider attending, however, as charter schools generally do not provide transportation to and from school. The distance families are willing to travel to attend a charter school is unknown and likely a function of the observed school quality of the zoned TPS, as measured by standardized test scores.

If lack of geographic access to charter ninth grade restricts certain cohorts of eighth graders from charter ninth grade and this lack of geographic access is correlated with other variables of interest in our model, our findings could be over- or underestimating the effect start-up charter schools are having on later-life outcomes. This appendix summarizes an alternative specification which relaxes the restriction that both treatment and control students must have been enrolled in charter eighth grade. This change allows us to investigate the possibility that our results could be influenced by non-random geographic access to charter ninth grade.

In addition, this broadening of the sample size can help us determine whether the larger standard errors in our preferred model (leading to the 90% confidence interval) are due to the small sample size of the treatment group or are an accurate measure of the actual effect start-up charter schools have on wages. If we find a similar size effect that is statistically significant at the 95% confidence interval, that is evidence the preferred model suffered from the small sample size of the treatment group and the positive results are likely representative of the actual effect. If, on the other hand, a smaller effect or no effect is found with the alternative specification, this would suggest that larger standard errors are due to the effect actually being quite small or zero.

To attempt to control for geographic access to start-up charter schools, zip codes are identified by the number of ninth graders who reside in those areas and attended a non-virtual start-up charter in 2007–2012. Zip codes with at least one student resident who attended start-up, in-person charter ninth grade are considered areas of the state that offer geographic access to start-up charter ninth grade.

This method will proceed in two stages. In the first stage, logit probability modeling is applied to students residing in zip codes with geographic access to start-up charter ninth grade to estimate the probability of attending start-up charter ninth grade. This first-stage model includes an indicator for having attended charter school before ninth grade, eighth-grade test scores, average performance of the student's middle school, and demographics information as independent variables.

**Table A1***First-Stage Results*

VARIABLES	Start-Up Ninth Grade = 1
	Within Zip Codes with Access Only
K–8 Start-Up Charter Ever	2.724*** (0.0414)
Eighth-Grade Standardized Math Score	-0.0326 (0.0230)
Eighth-Grade Standardized English Score	0.0896*** (0.0254)
Female = 1	0.00279 (0.0324)
Gifted = 1	0.386*** (0.0484)
American Indian = 1	-0.00948 (0.330)
Asian = 1	0.968*** (0.0548)
Black = 1	-0.118*** (0.0420)
Hispanic = 1	-0.376*** (0.0678)
Native Hawaiian = 1	-0.528 (0.725)
Two or More Races = 1	-0.160 (0.103)

VARIABLES	Start-Up Ninth Grade = 1
	Within Zip Codes with Access Only
Free Lunch Eighth Grade = 1	0.155*** (0.0413)
School Average Sixth-Grade English Score	0.00451* (0.00265)
School Average Seventh-Grade English Score	-0.00806*** (0.00298)
School Average Eighth-Grade English Score	0.0362*** (0.00272)
Zip Code Average Income	-3.12e-06*** (7.48e-07)
Constant	-31.38*** (1.581)
Observations	163,470

Standard errors in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

This first-stage model is then used to predict the baseline probability that all ninth-grade students in the state would have attended charter ninth grade *if they had geographic access*. The second stage matches all start-up charter ninth-grade students with a student from a zip code without start-up charter ninth-grade geographic access that has a similar baseline probability of attending charter ninth grade. This set-up allows for the estimation of the effect start-up charter ninth grade has on later-life earnings for start-up charter ninth-grade students compared to students that had a similar probability of attending a start-up charter ninth grade but lacked geographic access.

**Table A2**

*Start-Up Charter Ninth-Grade Student Quarterly Wages (in Dollars)*

QUARTERLY WAGES	
Start-Up Charter Ninth Grade	810.0*** (268.2)
Observations	64,113

Standard errors in parentheses.

\*\*\* p<0.01

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Table A2 shows that under this specification, start-up charter ninth-grade students earned \$810 more per quarter when compared to the set of matched students. These estimates make some effort to control for potential endogeneity through the matching protocol. However, the matching protocol is deemed to be a less effective control for endogeneity than using charter eighth grade attendance, as in our preferred model specification. The larger effect on wages found here, after controlling for geographic access to charter high school, provides some evidence that our previous positive findings in the body of the report are not determined solely by a non-random set of school cohorts having geographic access to start-up charter ninth grade and creating positively biased estimates. These results also provide some evidence that the larger standard errors in our preferred model (leading to the 90% confidence interval) are due to the small sample size of the treatment group, as was discussed earlier.

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## About the Authors

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**Peter Bluestone** is a senior research associate with the Center for State and Local Finance. His research includes urban economics, static and dynamic economic impact modeling, and state and local fiscal policy. His work comprises modeling state and local impacts of policy changes and economic development using various economic models, including IMPLAN and Regional Economics Models Incorporated (REMI). Bluestone currently serves on the technical advisory committee for the Atlanta Regional Commission. He received his doctorate in economics from Georgia State University.

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**Nicholas Warner**, a research associate II at the Center for State and Local Finance at Georgia State University, specializes in education finance. His recent research has focused on school district expenditure and revenue portfolio analysis, tax expenditure estimation, examination of Georgia's special option sales tax for school facility funding, and school districts' responses to the Great Recession. His work has been published in the *Journal of Education Finance* as well as by the Georgia Department of Early Care and Learning. Warner received his master degree in economics from the Andrew Young School of Policy Studies.

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The State Charter Schools Commission of Georgia is a state-level, independent charter school–authorizing entity. The commission has the power to approve or deny petitions for commission charter schools and renew, nonrenew, or terminate commission charter school petitions in accordance with Georgia law.

While the Commission's duties are set forth in law and extend beyond simply authorizing schools, the Commission's principal obligations include:

- Reviewing charter school petitions for commission charter schools and assisting in the establishment of commission charter schools throughout Georgia;
- Developing and promoting best practices for charter schools and charter school cosponsors to ensure that high-quality charter schools are developed and encouraged;
- Promoting high standards of accountability for commission charter schools; and
- Monitoring and annually reviewing the academic and financial performance, including revenues and expenditures, of commission charter schools and holding the schools accountable for their performance pursuant to the charter.