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Lights Off: Practice and Impact of  
Closing Low-Performing Schools  
**2017**

Volume II

# Lights Off: Practice and Impact of Closing Low-Performing Schools

## 2017

### Volume II

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## List of Acronyms & Definitions

CCD	Common Core of Data
CREDO	Center for Research on Education Outcomes
ELLs	English Language Learners
FERPA	Family Educational Rights and Privacy Act
NAEP	National Assessment of Educational Progress
NCES	National Center for Education Statistics
SIG	School Improvement Grants
TPS	Traditional Public School
VCR	Virtual Control Record
Growth	The year-to-year change in academic performance relative to one's peers. Growth can be positive or negative.

# Lights Off: Practice and Impact of Closing Low-Performing Schools 2017

## Volume II

### Roadmap to Volume II

This is the second volume of the report on the study of school closures. In Volume I, we explored the national landscape of closures of low-performing schools, illustrating how the closures are distributed across sectors, years, states, grade spans and locales and revealing the lack of equivalence of treatment of similarly performing schools across states, levels of poverty and shares of black and Hispanic students. This volume shifts the focus to students who attend closing schools, looking into those students' transfers before and after their schools closed and post-closure academic progress of students who stayed until the official closure.

As described in Chapter 2, the schools under study came from 26 states and were closed in the period between 2006-2007 and 2012-2013. Data for 2005-2006 and 2013-2014 were also used in some analyses where we tracked the school and student trajectories before or after closure. A school was defined as low-performing if its average reading and math scores were both in the bottom 20 percent (i.e., the bottom four ventiles) in a state in a given year and the previous year. We flagged closures and identified the final year of operation according to the coding of the Common Core of Data (CCD) from the National Center for Education Statistics (NCES).

Volume II focuses on the experience of students who were enrolled in the closed schools in their final years. In Chapter 5, we depict the pre- and post-closure transfers of students from closing low-performing schools, using descriptive analyses and tests of differences in statistics between groups. Many students left in the year before the schools closed. A little less than half of displaced closure students landed in better schools than the closed one in the year after closure. In the second and third years following closure, the majority of displaced students attended a school of the same quality as the one in which they had enrolled in the previous year.

Chapter 6 probes how closures of low-performing schools influenced the academic progress of their students. As explained in Chapter 2, our outcome of interest is the year-to-year growth in state

standardized achievement test scores. We assessed the impact of closure by benchmarking the growth of closure students against that of their virtual control records (VCRs), peers of identical traits and same or very similar baseline test scores, from continuing low-performing schools in the same sector. The quality of the receiving school emerged from our analysis as a crucial factor in post-closure academic success in both TPS and charter settings. Average closure students registered stronger growth as compared to their VCR counterparts in the same sector only when they were placed into superior schools, while relocation to inferior or similar-performing schools was linked to fewer academic gains. The picture was nuanced for students with additional needs, specifically English language learners and special education students.

We conclude the report with Chapter 7, in which we summarize major findings in both volumes and suggest their implications for policymaking and practices related to closure of low-performing schools.

## **5. Flow of Students Who Were Enrolled in Low-Performing Schools**

The focus of preceding chapters has been on low-performing schools and the subset that are eventually closed. In this chapter, the inquiry shifts to the students who were enrolled in low-performing schools in the final years before closure. Unlike planned transfers at the end of elementary and middle schools, closure represents an unplanned disruption in the educational life of students. Affected students' choices are necessarily influenced by the array of alternatives available to them, which in turn may affect the degree of disruption of their schooling experiences.

This chapter explores the fates of students who attended low-performing schools in their last years of operation. We first looked at whether there is a discernible transfer of students from closing schools before the official closure. Our data revealed that some students departed before the final year of a closing school's operation and that these early leavers had different academic profiles compared to students who stayed until the official closure and students attending similarly low-performing schools that were not closed. Then we tracked the post-closure flow of students who were displaced by closure. We observed how many of them moved to the same or a different sector and how likely they landed in superior or inferior schools.<sup>16</sup>

For the students in a closing school's top grade, transfer to another school in the following year is inevitable. For this reason, only rising students were included in our analysis of the pre- and post-

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<sup>16</sup> For the interested reader, Figures 39 through 41 and Table 25 in Appendix A share a brief overview of the distribution of closure students across sectors, states, grade spans and locales. The presentation follows the same course as the descriptions of closing schools in Chapter 3.

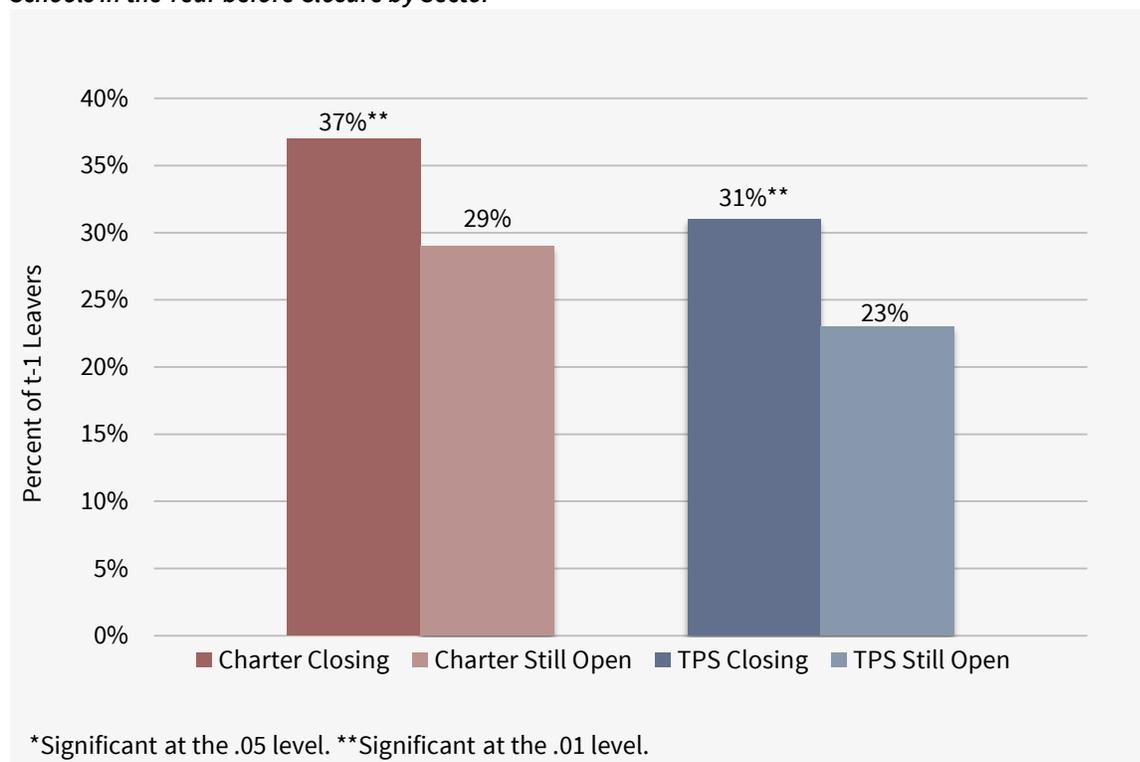
closure movement. For the sake of simplicity, we refer to the non-exit-grade students leaving a closing school in the year before official closure as “early leavers” or “ $t_{-1}$  leavers” and those who stayed until the official closure as “staying students” or “stayers” in the following description of findings.

### Pre-Closure Transfer of Students

As shown in Chapter 3, the academic performance and student enrollment in closing schools kept declining in the final years of operation. Did parents of students attending these schools possibly sense the deterioration and vote with their feet before local education leaders took radical actions?

Figure 27 illustrates that in both the charter and TPS sectors, more than 30 percent of students left closing schools in the year *before* the schools were closed (notated as  $t_{-1}$ ). The percentage of transfer was significantly higher than that for continuing low-performing schools in the same sector in  $t_{-1}$  in the same year, suggesting greater concerns and stronger will of exiting on the part of parents of students enrolled in closing schools. In addition, the percentage of student transfers in the year before closure was significantly higher for closing charter schools than for closing TPS, consistent with the general pattern of parents of charter school students being more proactive in making choices of schools for their children than parents of TPS students.

**Figure 27: Percentage of Non-Exit-Grade Students Transferring from Closing and Not-Closing Low-Performing Schools in the Year before Closure by Sector**



Figures 28 and Figure 29 compare the academic performance of early leavers and staying students from closing charter and traditional public schools. As displayed in Figure 28, across both sectors, early leavers had significantly lower reading and math achievement scores than observed in that same year for staying students. Figure 29 displays the growth scores of early leavers and stayers in closing schools. Recall that growth was measured as the change in achievement from one year to the next, and the zero line indicates the average one-year growth for all the students. Figure 29 shows that reading and math growth scores were negative for both early leavers and stayers in closing schools in both sectors. Nevertheless, only in reading in closing TPS did early leavers have significantly weaker growth than stayers.

**Figure 28: Reading and Math Achievement of  $t_{-1}$  Leavers and Stayers from Closing Low-Performing Schools by Sector**

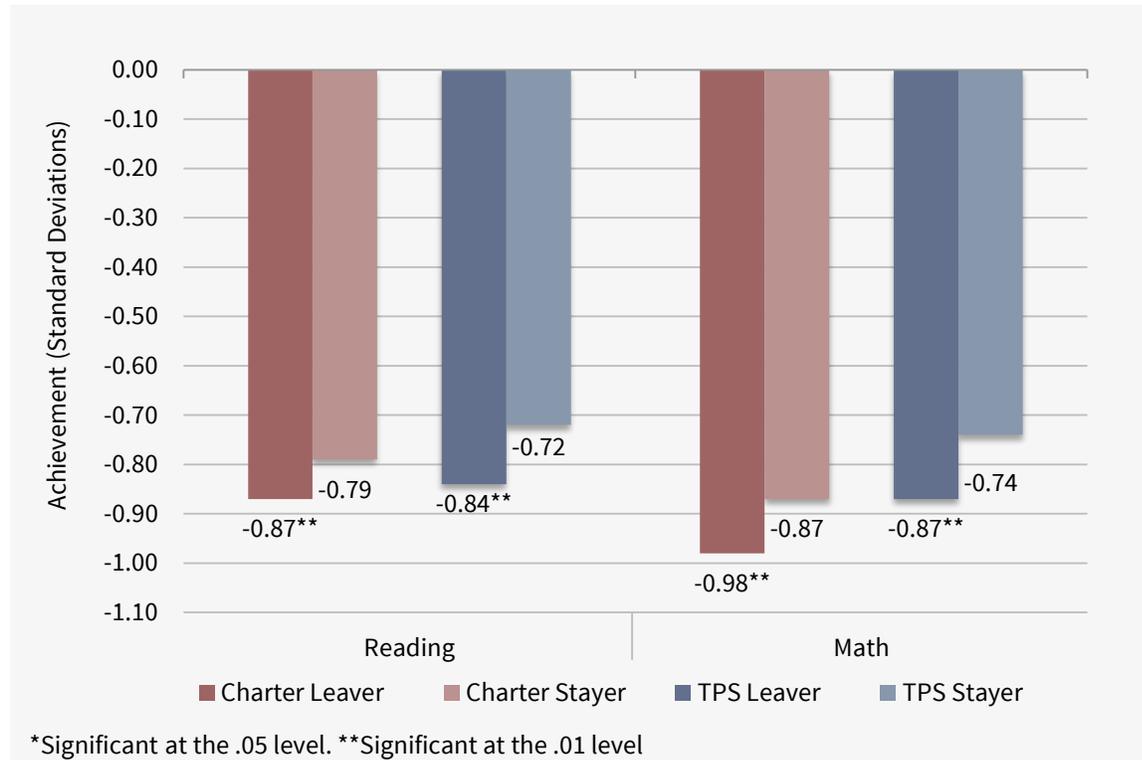
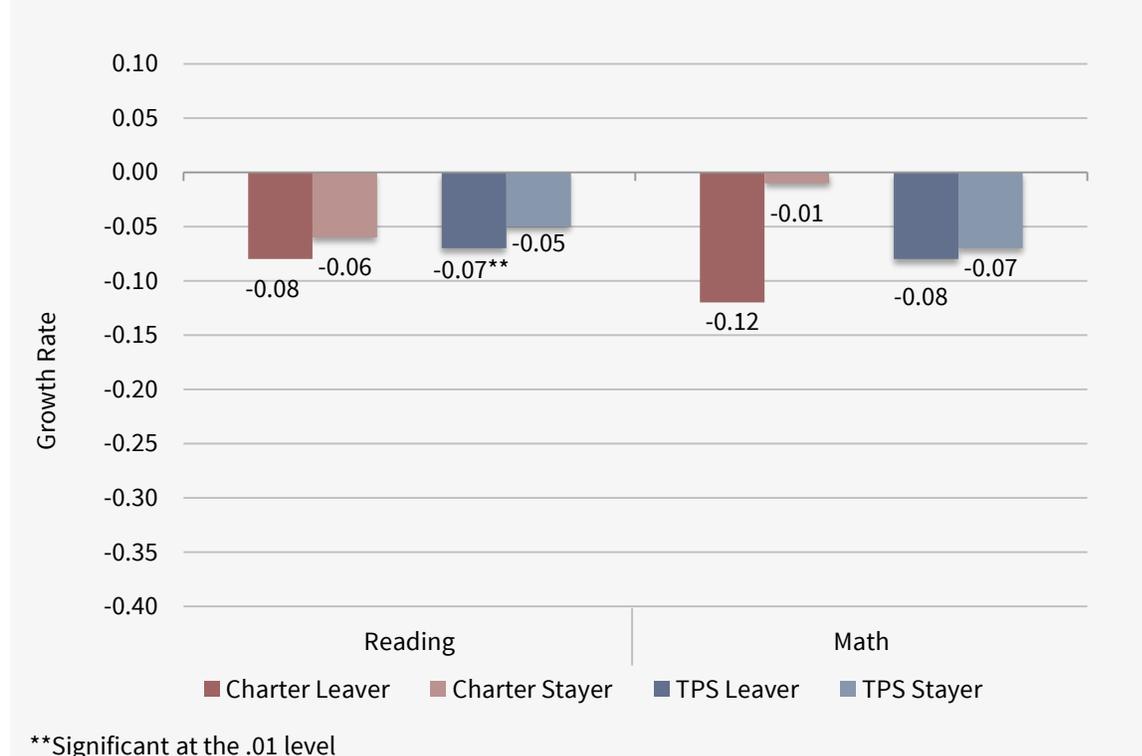
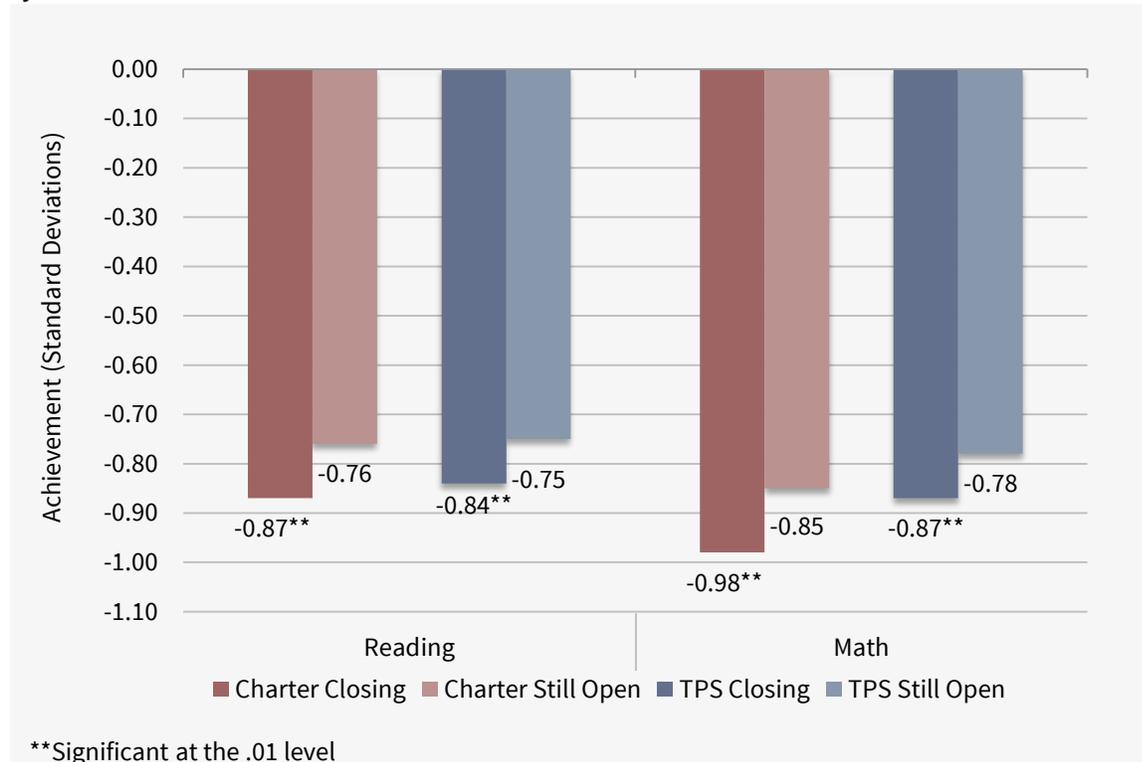


Figure 29: Reading and Math Growth of  $t_{-1}$  Leavers and Stayers from Closing Low-Performing Schools by Sector

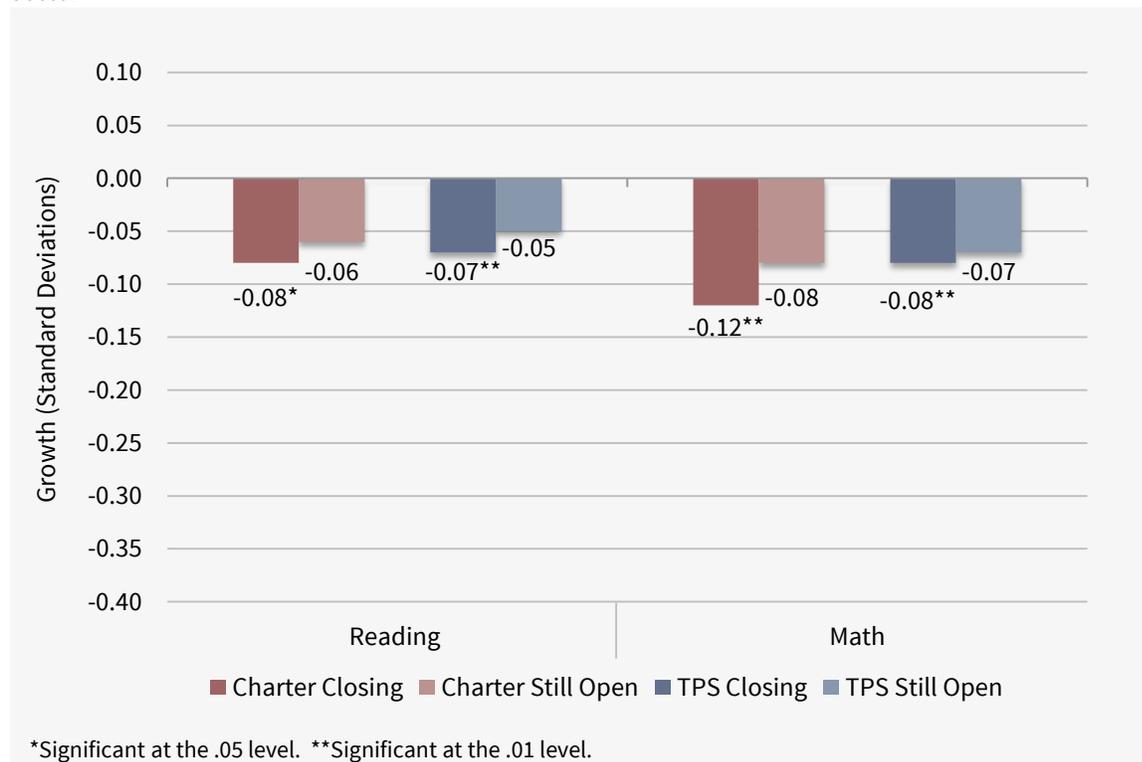


We looked at how early leavers from closing schools performed academically in comparison with students who exited from not-closing low-performing schools in the same academic year. Figure 30 shows that the reading and math achievement scores of early leavers from closing schools were significantly lower than those of students who departed in the same year from continuing low-performing schools; the finding held for both sectors. Figure 31 further indicates that early leavers from closing schools had significantly fewer gains in both reading and math than  $t_{-1}$  leavers from not-closed low-performing schools in both sectors.

**Figure 30: Reading and Math Achievement of  $t_{-1}$  Leavers from Closing and Not-Closing Low-Performing Schools by Sector**



**Figure 31: Reading and Math Growth of  $t_{-1}$  Leavers from Closing and Not-Closing Low-Performing Schools by Sector**



These findings may sound counterintuitive at first glance. We probed the pattern further and through supplementary analysis learned that early leavers from closing schools were skewed to the lower state ventiles of achievement.

We also compared eligibility for free and reduced-price lunch, special education status and English language learner status of early leavers from closing schools with those of stayers as well as with those of students who leave continuing low-performing schools in  $t_{-1}$ . There were no substantial differences in those attributes between student groups.<sup>17</sup>

We probed how students who stayed until the official closure performed in  $t_0$  relative to  $t_{-1}$ . Figure 32 demonstrates significantly lower math achievement in  $t_0$  than in  $t_{-1}$  for stayers in closing charter schools and no significant differences in the other comparisons. Figure 33 exhibits somewhat different patterns in growth by sector and subject. Staying students in closing charter schools had less weak growth in reading but weaker growth in math in  $t_0$  than in  $t_{-1}$ . Stayers in closing TPS achieved greater gains in both subjects in  $t_0$  than in  $t_{-1}$ . However, the absolute growth score was zero or almost zero in the three cases where the gain in  $t_0$  was larger than in  $t_{-1}$ .

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<sup>17</sup> The results are shown in Figures 42 and 43 in Appendix A.

Figure 32: Reading and Math Achievement of Students Who Stay until Closure by Time Period and Sector

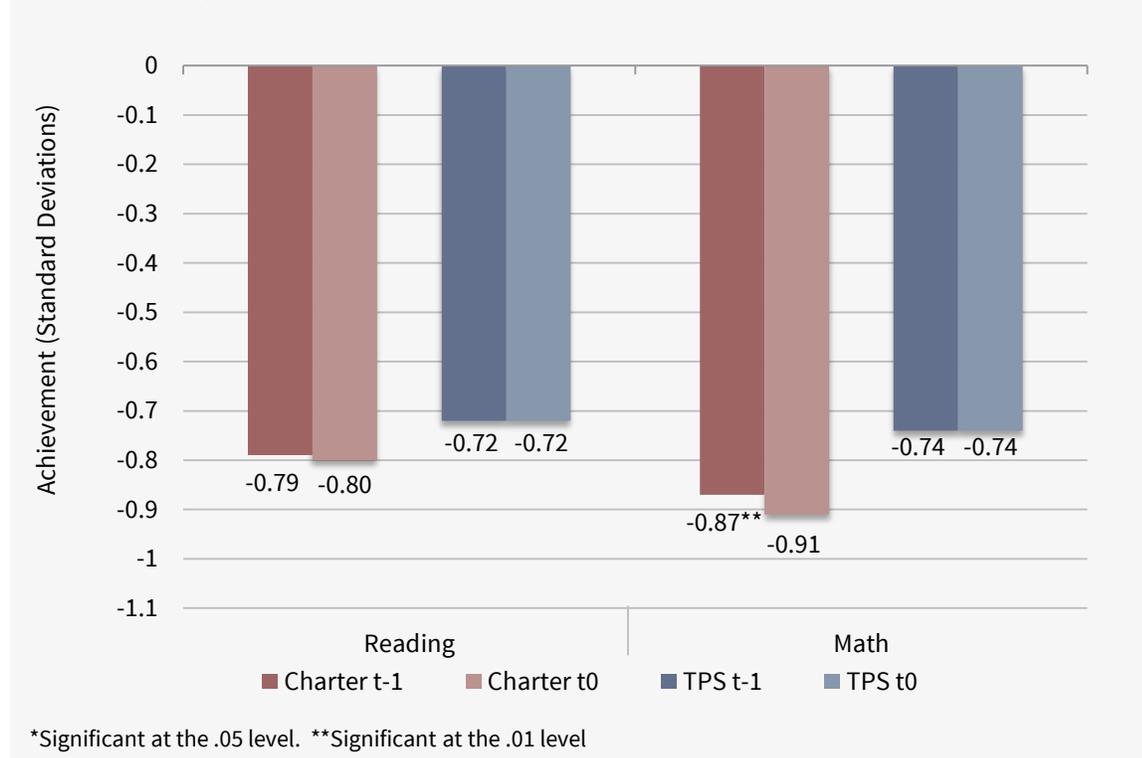
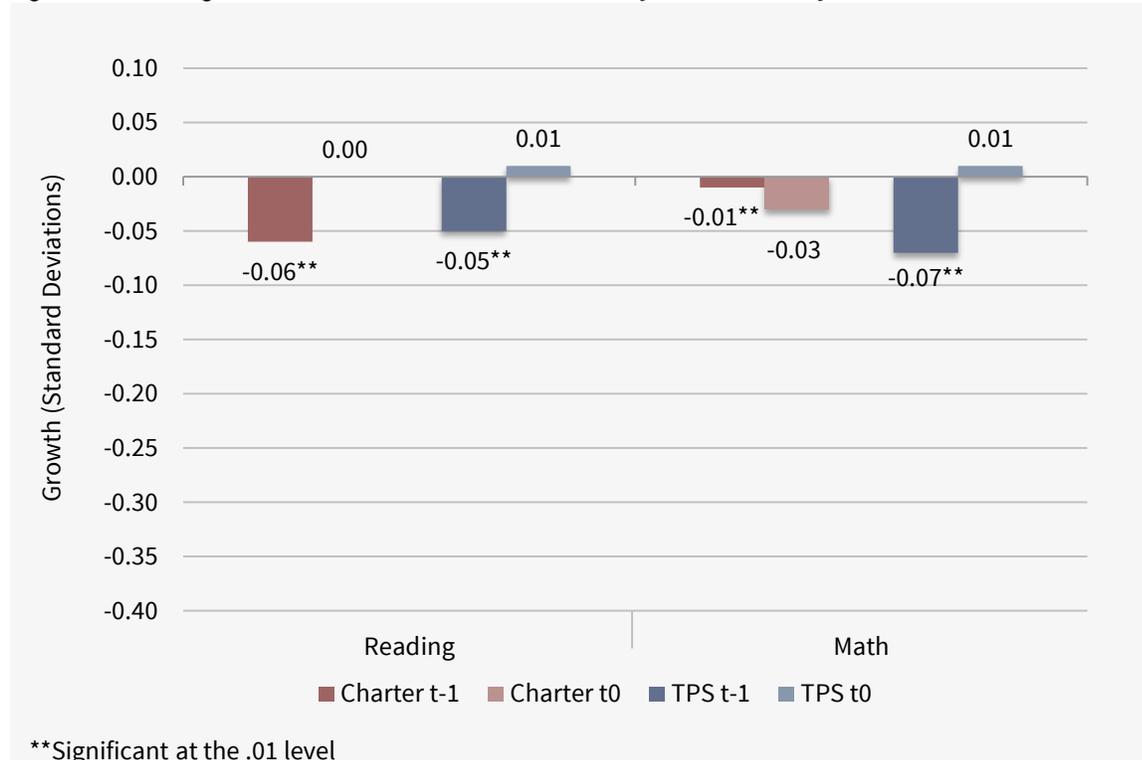


Figure 33: Reading and Math Growth of Students Who Stay until Closure by Time Period and Sector



### Post-Closure Flow of Students

Where did closure students go after they left their closed schools? We examined how many of them stayed in the same sector and how likely they ended up in better or worse schools. We restricted this portion of the study to only those students who attended the closing schools in their final year of operation. For the convenience of presenting findings, we use the notations as shown in Table 8 to refer to the years when and after a school is closed.

**Table 8: Notations for the Final Year of Operation and Post-Closure Periods**

Time Period Relative to School Closure	Reference
Final year of operation for the closed schools	$t_0$
The year after closure	$t_1$
Two years after closure	$t_2$
Three years after closure	$t_3$

### Sector of Post-Closure School of Enrollment

Table 9 shows the sector in which displaced closure students enrolled during the year following the closure of their original school, with the color-shaded cells indicating a transfer to the same sector. An overwhelming majority (82 percent) of students displaced by TPS closure landed in a TPS in  $t_1$  while slightly over 40 percent of charter closure students stayed in the charter sector. The difference in the same-sector transfer for charter and TPS displaced students was not necessarily a mere reflection of preference, but was likely to be colored by the availability of the charter and TPS alternatives as well. As a point of reference, there are about a million students on the waiting list of charter schools in the country. Besides, there are no charter options for displaced students in some local systems if the only charter school there is shut down. These constraints make the same-sector transfer hardly a realistic option for many charter closure students.

**Table 9: Sector to Which Students Transferred in  $t_1$  by Sector of Closure**

	Destination Sector in $t_1$	
	Charter Sector	TPS Sector
Charter Closed in $t_0$	41%	59%
TPS Closed in $t_0$	18%	82%

### Quality of Post-Closure Schools

What happens to students after schools close is a matter of deep concern for parents, educators and policymakers. We tracked early leavers and students who remained until a school closed for three subsequent years. The analysis was structured by the quality of the new school relative to the quality of the closed school in each of the three post-closure years, measured by the school's state-specific

ventile of math achievement. A new school was considered superior if its achievement level was two or more ventiles higher than that of the closed school (also referred to as the  $t_0$  school), equivalent if its achievement was in the same ventile or one ventile higher than that of the  $t_0$  school, or inferior if its state ventile of achievement was lower than that of the  $t_0$  school. For closed schools that fell into the lowest ventile, there could only be equivalent or superior transfers for their affected students; for the rest, moves could be inferior, equivalent or superior.

Our analysis addressed two large questions. First, how do students who are affected by closure fare in their next school enrollment? Does the fact that some students remain until closure affect the quality of their next-school placement? Second, is there evidence that students “take what they can get” once they have landed in a new school or do we see continued movement into other settings? We examine each question below.

Table 10 shows that regardless of sector, close to half of the students who were displaced by closure moved to better schools in  $t_1$ , one third or more of these students attended equivalent schools, and fewer than 20 percent of them ended up with inferior placements. In both sectors, a larger percentage of early leavers went to superior schools than students who remained until the official closure, suggesting that lingering in a closing school might reduce the chance of finding a seat in a better school. Compared by sector, both early leavers and staying students from closing charter schools were more likely to get superior placement than corresponding groups of students from closing TPS. This difference is not surprising given that parents of closing charter schools had already had experience in navigating the school choice landscape.<sup>18</sup>

**Table 10: Relative Quality of the  $t_1$  School of  $t_0$  Closure Students and  $t_1$  Leavers**

Sector of Closed School	Category of Students	Relative Quality of $t_1$ School		
		Inferior	Equivalent	Superior
Closed Charter	Early Leavers	10%	33%	58%
	$t_0$ Closure Students	19%	33%	48%
Closed TPS	Early Leavers	12%	38%	49%
	$t_0$ Closure Students	13%	42%	45%

<sup>18</sup> Here is a note of caution about the equivalence of the comparisons: As shown in Table 26 in Appendix A, a higher percentage of early leavers attended schools in the bottom two state ventiles than did students displaced in  $t_0$  in both sectors. In addition, a larger percentage of both categories of students in the charter sector came from closing schools in the bottom two ventiles than in the TPS sector. These differences suggest a possibility that the greater likelihood for early leavers (as compared to students displaced in  $t_0$ ) and charter students (as compared to TPS students) to have better placement in  $t_1$  was partly because they had departed from lower-quality schools.

Once students from closed schools were enrolled in their next schools, scenarios about schooling could diverge. Some families might reasonably seek stability for their students, regardless of school quality. On the other hand, they might have enduring concerns about the impact of school closure on their children’s chances for success and resolve to pursue the highest-quality schools available. In the latter case, there might be stronger options which were unavailable due to capacity constraints. While it was not possible to tease out the relevant motivations for individual students, the aggregate picture of placement over time provided at least a partial view of family behavior.<sup>19</sup>

Table 11 depicts the quality of the  $t_2$  schools by the category of the  $t_1$  schools for displaced students and early leavers. The darker cells illustrate the same quality of the  $t_1$  and  $t_2$  schools as compared to the closed school. The values along the diagonal show that in  $t_2$ , the largest share of students remained in schools of the same quality as their first post-closure school. In each strand, early leavers showed a stronger preponderance than the students who remained until the school actually closed. It is not surprising that a large share of students who landed in superior settings in  $t_1$  remained in that relative quality of schooling in  $t_2$ .

There was evidence too that some families whose children failed to land in a higher-quality school in  $t_1$  found ways for their children to move to better options in the next year. Around two-fifths of families whose children first enrolled in an inferior school in  $t_1$  made an upward move in  $t_2$ . Similarly, about one-quarter of students whose  $t_1$  schools were equivalent in quality to their closed schools moved to better settings in  $t_2$ . The countertrend was less prevalent: Small shares of students made moves to less desirable settings compared to their first post-closure placement.

**Table 11: Relative Quality of the  $t_2$  School of  $t_0$  Closure Students and  $t_1$  Leavers by Quality of the  $t_1$  School**

Relative Quality of $t_1$ School	Category of Students	Relative Quality of $t_2$ School		
		Inferior	Equivalent	Superior
Inferior	Early Leavers	66%	22%	13%
	$t_0$ Closure Students	56%	29%	15%
Equivalent	Early Leavers	9%	67%	25%
	$t_0$ Closure Students	11%	66%	23%
Superior	Early Leavers	4%	18%	79%
	$t_0$ Closure Student	4%	25%	71%

Table 12 illustrates the quality of the  $t_3$  schools for each category of the  $t_2$  schools. The changes from  $t_2$  to  $t_3$  were similar to those from  $t_1$  to  $t_2$  described above. Again, the values in the darker cells along the

<sup>19</sup> There were several possible factors underlying the placement over time beyond parental motivation for change, such as planned school changes at exit grade, school itself getting better or worse, and family moving within the state.

diagonal indicate that the schools the majority of students attended in  $t_3$  were of the same quality as their  $t_2$  schools. Some of the students whose  $t_2$  schools were inferior or equivalent to their  $t_0$  schools landed in better settings in  $t_3$ . Specifically, about 40 percent of students going to inferior schools in  $t_2$  enrolled in higher-quality schools in  $t_3$ , and close to 30 percent of students with equivalent placement in  $t_2$  saw improvement in the school setting in  $t_3$ . The percentage of students who experienced downward mobility in school quality in  $t_3$  was small.

**Table 12: Relative Quality of the  $t_3$  School of  $t_0$  Closure Students and  $t_1$  Leavers by Quality of the  $t_2$  School**

Relative Quality of $t_2$ School	Category of Students	Relative Quality of $t_3$ School		
		Inferior	Equivalent	Superior
Inferior	Early Leavers	60%	28%	12%
	$t_0$ Closure Students	65%	23%	13%
Equivalent	Early Leavers	10%	64%	26%
	$t_0$ Closure Students	15%	56%	29%
Superior	Early Leavers	4%	18%	78%
	$t_0$ Closure Student	4%	20%	76%

### Summary of the Flow of Students from Closing Schools

Our analysis revealed that a significant number of students voluntarily left closing schools in the year before the official closure, suggesting that some parents were “in the know” about the schools their children attended. (This also reinforces the idea that closure decisions were made in  $t_1$  and implemented at the end of the following year.) The percentage of early leavers was higher for closing charter schools than for closing TPS, which corresponds to the conventional wisdom that in general parents of charter school students have greater experience in seeking the best schooling options available for their children. In both the charter and TPS sectors, early leavers from closing schools had poorer academic performance than staying students. They also performed worse than students who transferred from not-closed low-performing schools in the same sector in an equivalent time window.

A substantial proportion of closure students stayed in the same sector as their closed schools in the year after closure. An overwhelming majority of TPS students displaced by closure attended another TPS. Over 40 percent of charter displaced students went to a charter school, which is impressive given that the charter school alternatives are limited or have admission schedules that do not align with end-of-year closures.

The biggest concern about school closure is the fate of the students who have been involved. Nearly half of displaced students in this study ended up in higher-performing schools in the year after closure. Realistically, this option was constrained by the quality of the alternative supply. The proportion of superior placement was higher for charter closure students than for TPS closure

students, an indication of the stronger experience of parents of charter school students in navigating the school choice landscape. In both sectors, a higher percentage of early leavers from closing schools than of displaced students landed in better settings in the year after they transferred, implying early departure might be somewhat advantageous given limited seats in nearby better schools.

We saw that some families made further changes in the schools their displaced students attended in later post-closure periods. The pattern of enrollment in extended periods suggested that many families sought stability over improved quality in their choice of schools. Some students who had not landed well in the first one or two years after closure attended a better school in the subsequent year. That said, in the second and third years after closure, the majority of students enrolled in a school of the same quality as the school they attended in the previous year. Districts and charter authorizers still have a long way to go to offer superior alternatives for students displaced by school closure. And as will be shown in the next chapter, the quality of the alternatives matters greatly for the students affected by school closures.

## **6. Post-Closure Student Academic Performance**

Any discussion about school closure as an education improvement approach is incomplete without a deep understanding of what happens to the learning outcomes of the students who are involved. Whether closure students fare better academically should factor directly into an overall assessment of the practice and should heavily influence popular opinion on the matter. Given the mixed findings in earlier studies of smaller areas (as reviewed in the Introduction chapter), providing a broad-based examination of student academic outcomes following school closure was a prime motivation for this study.

The investigation of student outcomes involves tracking students' post-closure experiences. Not surprisingly, these pathways become more complex over time. The cleanest picture of the impact arises from the experience of the students who remain in their schools until the schools close. Using longitudinally linked data on students in all schools in the bottom 20 percent of performance in the 26 states included in this study, it was possible to measure the academic progress of students who were affected by school closures and compare their experiences to what would have occurred had the school not closed. The comparison condition was created by matching each closure student to a VCR consisting of identical students in other low-performing schools that continued to operate. (Our method for generating VCR peers is described in Chapter 2 in Volume I and Appendix B in this volume.) Two sets of comparisons were made throughout the analyses: charter closure students with their VCRs from the other low-performing charter schools and TPS closure students and their VCRs from the other low-performing traditional public schools.

The outcome of interest is the academic growth of students as reflected in yearly gains on state achievement test scores. Looking at academic growth ensures a clear estimate of the impact of the schools that students attend. In this case, it permitted us to gauge how closure students fared in the specific schools they attended in the three years following school closure. The results are presented in marginal terms; that is, we take the VCR comparison experience as the baseline and describe closure students' performance as positive (i.e., greater progress) or negative (i.e., less progress) against the baseline.

We first scrutinized the average yearly progress of closure students up to three years after their schools closed, overall and by subgroup, as compared to their VCR peers from the other low-performing schools that remained open. (Some students had shorter periods of follow-up due to exits from the public system, progression into untested high school grades or eclipse at the end of the study window.) The results illustrate that over the three years after closure, the average negative effects of closure persisted for students and, for some, became more intense over time. Then we probed whether the impact of closure differed by the quality of the receiving school by tracking closure students in the year after closure. We found that in general and by sub-population, closures benefited the academic growth of students who landed in higher-performing schools but impaired the performance of students with equivalent or inferior school placement.

### **Academic Progress in the Three Years Following School Closure**

Our analysis rested on two assumptions that are in tension. We assumed it might take some time for some students' performance to stabilize after their educational experience is disrupted by closure. On the other hand, the impact might dissipate over time after closure, as students accumulate additional time in school. In this section, we describe the academic progress of closure students over the three years after their schools closed. As mentioned above, some students had shorter periods to track due to structural changes. The overall yearly growth in the reading and math test scores for all closure students, as compared to those of their VCR peers from the same sector, are reported first. Then we disaggregate the relative growth of closure students by subgroup.

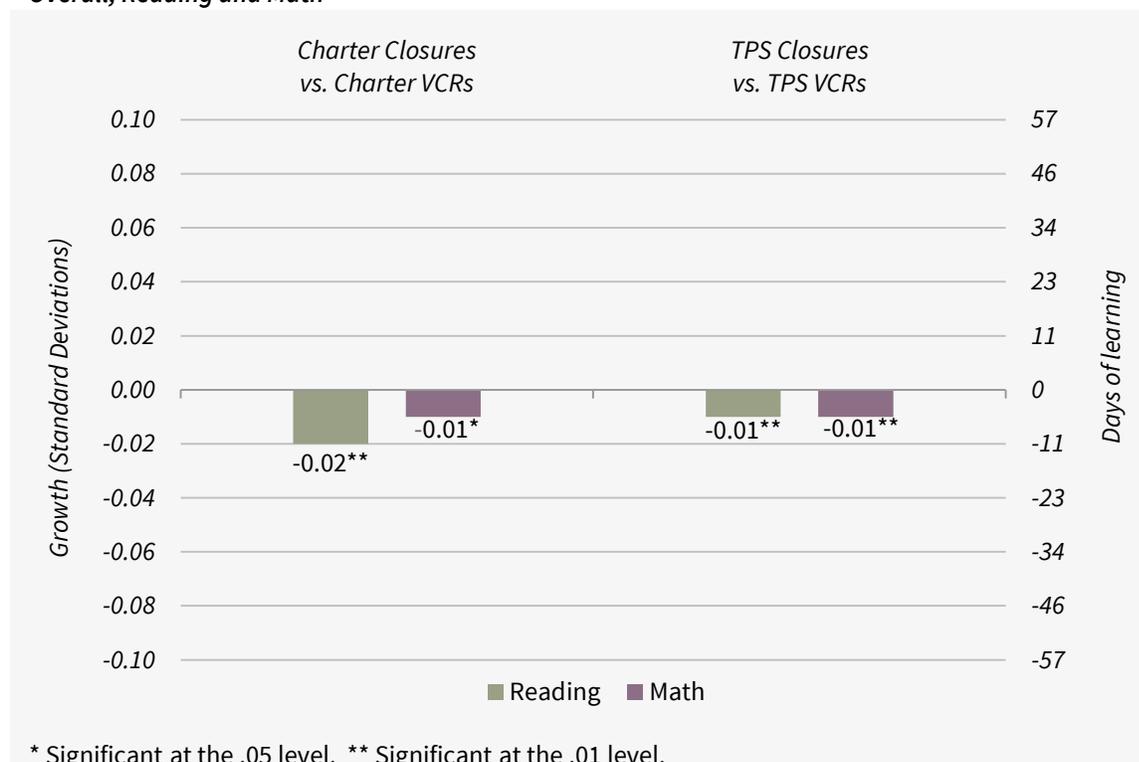
Overall, the effect sizes for closure students were negative in comparison with their VCRs from the same sector. A negative effect size for the closure students does not mean the students have not made an improvement in academic achievement, but means the students have not advanced as much as expected based on their characteristics. In fact, as Table 27 in Appendix A indicates, both closure students and their VCR peers registered slightly positive average growth in reading and math in the three years after closure.

### **Average Academic Impact in the Three Years after Closure**

Figure 34 illustrates the impact of school closure on student academic progress in the three years following closure. In this figure, the impact of closure is measured by the mean yearly growth of closure students over all three years relative to the progress of students in continuing low-performing schools. (Year-by-year results will be presented below.) Charter closure students had weaker growth than their VCRs from low-performing charter schools that remained open, amounting to 11 fewer days

of learning in reading and six fewer days of learning in math per year. TPS closure students also made less academic progress than did their TPS VCRs, lagging behind by six days of learning each year in both subjects. The relative negative growth of charter and TPS closure students suggests that closure of low-performing schools somewhat hampered academic progress for the average student.

**Figure 34: Average Yearly Growth of Closure Students as Compared to VCR Peers Up to Three Years after Closure – Overall, Reading and Math**



While the overall impact analysis establishes a baseline for discussion, these results are not subtle enough to provide insight for policy implications. A clearer picture of more granular distribution around the averages along with relevant factors will add to a general understanding of the impact of closure. Hence, we made a further exploration of the closure effects by state, lapsed time since closure, number of closures students have experienced and sub-population.

### Impact by State

Our general analysis used statistical methods to control for differences between states. These differences may provide useful insight into state policy environments, so we compared the average yearly progress of closure students and their VCRs by state. As Table 13 shows, states varied in the degree to which school closure was helpful to the students affected by the closures, with more positive results found in the charter sector. Looking into both reading and math growth scores,

charter closure students did not differ significantly from their VCR peers in the majority of the states, achieved stronger growth in one subject in five states, and suffered weaker gains in one or both subjects in six states. In the TPS sector, only two states saw positive impacts for closure students relative to their VCRs; 14 states witnessed relative negative impacts; and the other states had no significant difference.

Focusing on the good results, there were more states with positive outcomes for charter school closure students (Arizona, Colorado, DC, Missouri and New Mexico) than for TPS students (Massachusetts and Pennsylvania). This finding is perhaps not surprising, since charter authorizers are explicitly tasked to be watchful. Looking at the effect sizes in Table 13 side by side with the closure rates in Table 3 in Chapter 3, there seemed to be “choreographing” by charter authorizers in some states with positive results. For example, Colorado, the District of Columbia and Missouri shut down a relatively high share of low-performing charter schools (Table 3) and at the same time saw stronger academic growth among charter closure students relative to their VCR peers. It is likely charter closures in these states were handled by authorizers who cared about quality, so there were better chances for students to land well. Practices in the states that have produced positive results may hold useful lessons for the remaining states.

**Table 13: Average Yearly Growth of Closure Students as Compared to VCR Peers Up to Three Years after Closure by State**

	Charter Closures vs. Charter VCRs		TPS Closures vs. TPS VCRs	
	Reading	Math	Reading	Math
Arizona	0.04	0.07*	-0.04	-0.06*
Arkansas	-0.12**	0.06	-0.03**	-0.01
California	-0.03**	-0.01	0.00	0.00
Colorado	0.05*	0.01	0.00	-0.01**
District of Columbia	0.27*	0.03	0.03	-0.02
Florida	0.00	0.01	-0.05**	-0.04**
Georgia	0.00	-0.03	-0.04**	-0.03**
Illinois	0.02	-0.02	-0.01	0.01
Louisiana	--	--	-0.01	-0.03**
Massachusetts	0.02	0.02	0.01	0.06**
Michigan	-0.03*	-0.01	0.00	0.01
Minnesota	0.01	-0.06	-0.01	-0.02
Missouri	0.15**	0.00	0.04	-0.03
Nevada	--	--	-0.14	-0.21
New Jersey	-0.06*	-0.05	-0.01	-0.02*
New Mexico	0.26**	0.01	0.04	-0.10*
New York City	--	--	-0.02	-0.03**
New York State	-0.07**	-0.06**	0.00	0.00
North Carolina	-0.10	-0.01	-0.06	-0.26**
Ohio	-0.04**	-0.05**	-0.02**	-0.02**
Oregon	0.10	0.05	-0.06**	-0.04**
Pennsylvania	0.00	0.01	0.01	0.01**
Rhode Island	--	--	-0.01	-0.04
Tennessee	-0.16	-0.08	0.01	-0.01
Texas	0.01	0.03	-0.01**	-0.01*
Utah	--	--	-0.05**	-0.10**
Wisconsin	-0.03	-0.01	0.00	0.00

Note: (1) There were no closed low-performing schools in Nevada, New York City, Rhode Island and Utah within our data window, so no results were reported for charter closure students for these four states. (2) No results are reported for charter closure students in Louisiana as there was only one charter closure in 2009 within our data window and no continuing low-performing charter school in 2009 to draw VCRs from.

\* Significant at the 0.05 level.

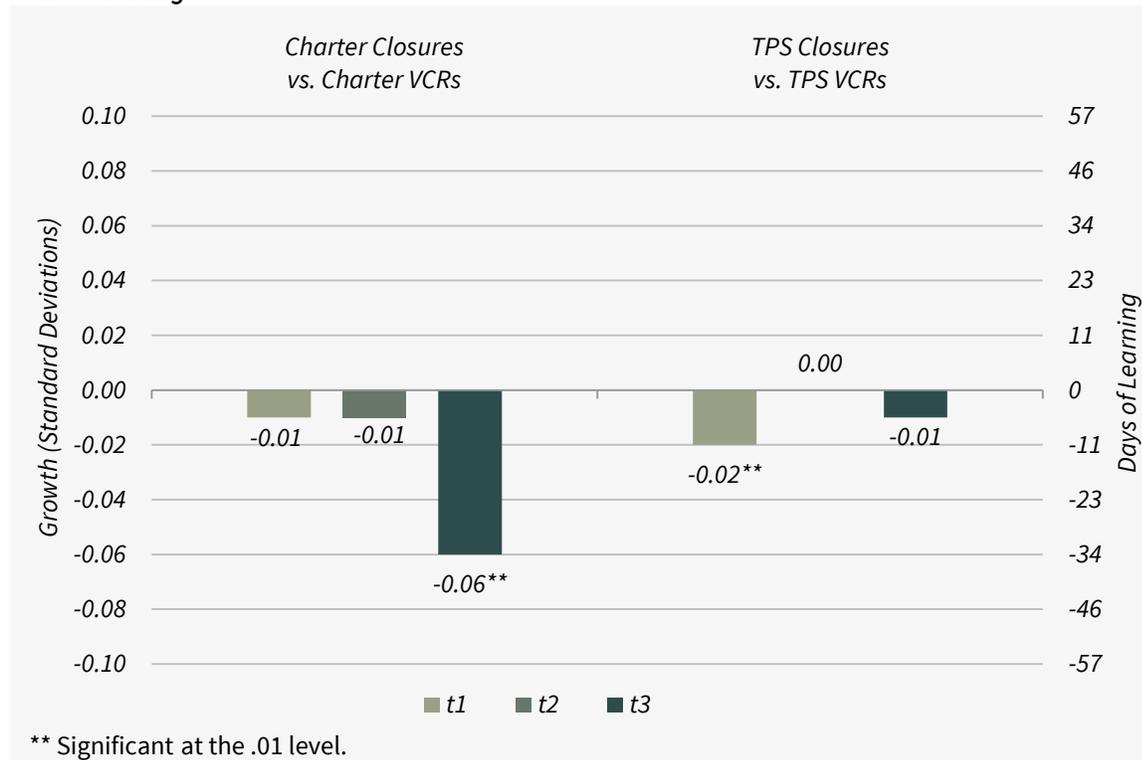
\*\* Significant at the 0.01 level.

### Impact by Lapsed Time since Closure

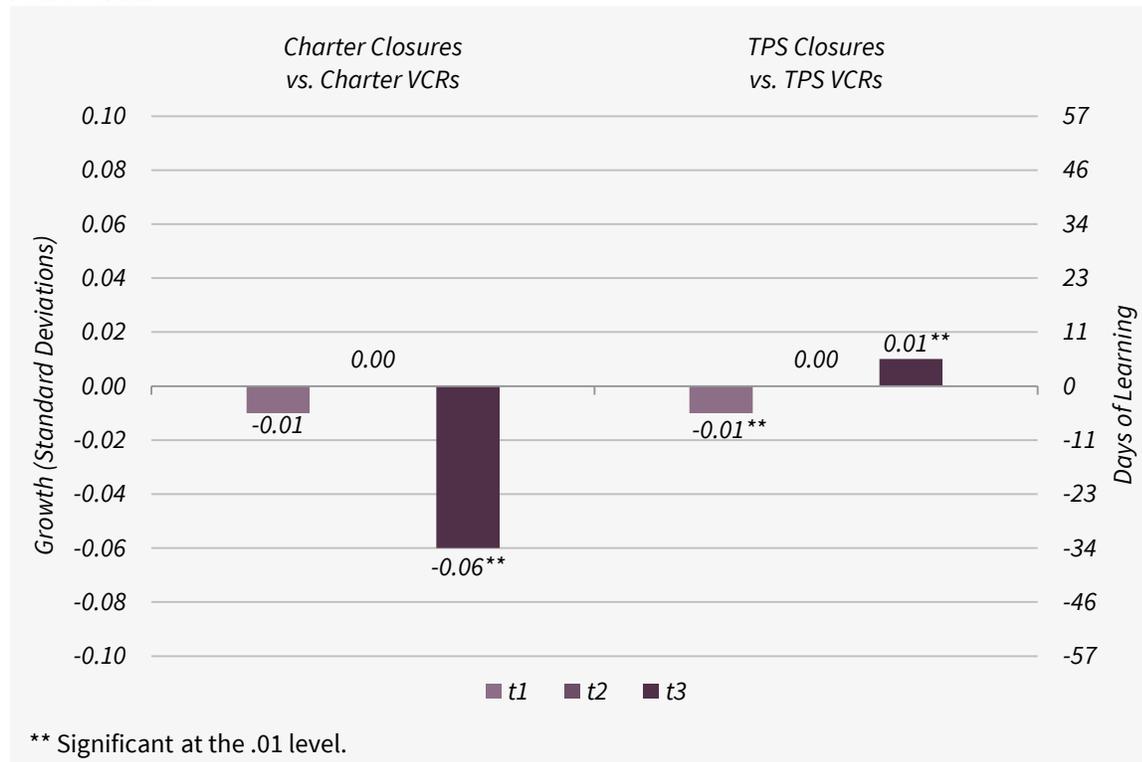
Figures 35 and 36 plot the year-by-year growth of closure students one, two and three years after closure relative to their VCRs in the same growth period. They reveal distinct patterns by sector.

Charter closure students did not differ significantly in growth from their VCRs in  $t_1$  and  $t_2$  but performed significantly worse in both reading and math in  $t_3$ . TPS closure students made significantly less progress in both subjects than their peers from not-closed low-performing TPS in  $t_1$ , caught up in  $t_2$ , and achieved a significantly greater gain in math in  $t_3$ . The mechanisms underlying the varying impacts by the lapsed time since closure between the two sectors are worth detailed investigation in future research.

**Figure 35: Year-by-Year Growth of Closure Students One, Two and Three Years after Closure as Compared to VCR Peers – Reading**



**Figure 36: Year-by-Year Growth of Closure Students One, Two and Three Years after Closure as Compared to VCR Peers – Math**



### Academic Impact by the Number of School Closures a Student Experiences

Around 4 percent of matched charter closure students and 3 percent of matched TPS closure students experienced two school closures within our study window. We examined whether two closure experiences worsened the impact of closure. Table 14 illustrates that both charter and TPS students with a single experience of closure made significantly less progress in both reading and math than did their counterparts in the same sector without any closure experiences. Nevertheless, the second experience of closure did not further aggravate the negative impact, with only one exception: TPS closure students with two closure experiences had significantly weaker growth as compared with TPS students who experienced only one closure.

**Table 14: Average Yearly Growth of Closure Students Up to Three Years after Closure: By the Number of Closures Experienced**

	Charter Closures vs. Charter VCRs		TPS Closures vs. TPS VCRs	
	Reading	Math	Reading	Math
1 vs. no closure	-0.02**	-0.01*	-0.01**	-0.01**
2 vs. 1 closure	-0.03	-0.02	-0.01	-0.04**

\* Significant at the 0.05 level.

\*\* Significant at the 0.01 level.

### Impact by Sub-Population

Understanding the impact of any education policy is important both in the aggregate and in the extent to which the policy affects students with different attributes. In the case of school closures, the question of differential impacts across student groups is especially germane since, as shown in Chapter 4, low-performing schools with higher levels of poverty or larger proportions of minority students were more likely to be closed. The higher propensity to close traditional public schools with larger shares of poverty or minority students coupled with the larger number of TPS that were closed make the question acutely pertinent.

Table 15 presents the average yearly progress in reading and math for various student groups in each sector of school closure in the three years after closure. The values reflect the closure students' performance compared to their VCR peers. Breaking out the various sub-populations revealed that school closure placed students at about the same academic growth as their peers in low-performing schools that did not close. There were, however, some noteworthy exceptions. For charter school closures, students in poverty, particularly black students in poverty, saw worse impacts in reading than their peers in low-performing schools that continued to operate. Multiracial closure students had weaker growth in math. Special education students and Hispanic students who were not in poverty posted greater academic gains in reading. In the TPS closures, there were no bright spots: Black students, black students in poverty, and white students faced worse impacts after school closures than the common experience of their peers in other continuing low-performing schools. Asian-Pacific and multiracial closure students fared worse in reading. The general progress of the other groups suggested similar results as peers in other low-performing schools that continued operating.

**Table 15: Average Yearly Growth of Closure Students as Compared to VCR Peers Up to Three Years after Closure by Sub-Population**

	Charter Closures vs. Charter VCRs		TPS Closures vs. TPS VCRs	
	Reading	Math	Reading	Math
Poverty	-0.04**	-0.01	0.00	0.00
ELL	-0.01	-0.01	-0.01	0.01
Special Education	0.07**	-0.01	0.00	0.01
Black Students	0.01	0.00	-0.01*	-0.01*
Hispanic Students	0.03	0.00	-0.01	-0.01
White Students	-0.03	-0.01	-0.01**	-0.02**
Asian-Pacific Students	0.01	-0.12	-0.02*	-0.02
Native American Students	0.08	-0.11	-0.01	-0.04
Multiracial Students	-0.02	-0.12*	-0.03*	-0.02
Black Students in Poverty	-0.02**	-0.01	-0.01**	-0.01**
Black Students Not in Poverty	-0.02	-0.03	-0.01	-0.02**
Hispanic Students in Poverty	-0.02	-0.01	0.00	-0.01
Hispanic Students Not in Poverty	0.08**	0.07	-0.02	0.00

\* Significant at the 0.05 level.

\*\* Significant at the 0.01 level.

### Academic Progress by Quality of Receiving School

The overall effect of the impact of closure on student academic progress masked the variations by the quality of the schools to which closure students transferred. As shown in Chapter 5, nearly half of closure students ended up in better schools, and many went to schools equivalent or inferior to their closed schools. Does the quality of the next school make a difference in the academic progress of closure students? We examined the growth of closure students in the year after closure as compared to their average peers by the level of quality of their receiving school relative to the closed school.<sup>20</sup> We further explored whether the differential impacts by the quality of the receiving school were prevalent across sub-populations. We are agnostic on whether the next school was assigned by districts or selected by parents. The key question is whether the choices were helpful to the students who survived a school closure, whoever did the enrollment allocations.

#### Overall Impact of Post-Closure School Quality on Student Academic Progress

Recapping from Figures 35 and 36, Table 16 shows that in the first growth period, charter closure students did not progress significantly differently from their VCRs from low-performing charters that

<sup>20</sup> Because substantial proportions of students made subsequent moves in years two and three following closure, a longer range of analysis such as three post-closure years would have involved 27 different move patterns and would not have added any clarity to the findings.

were not closed, while TPS closure students made significantly fewer gains in both subjects than did their TPS VCRs.

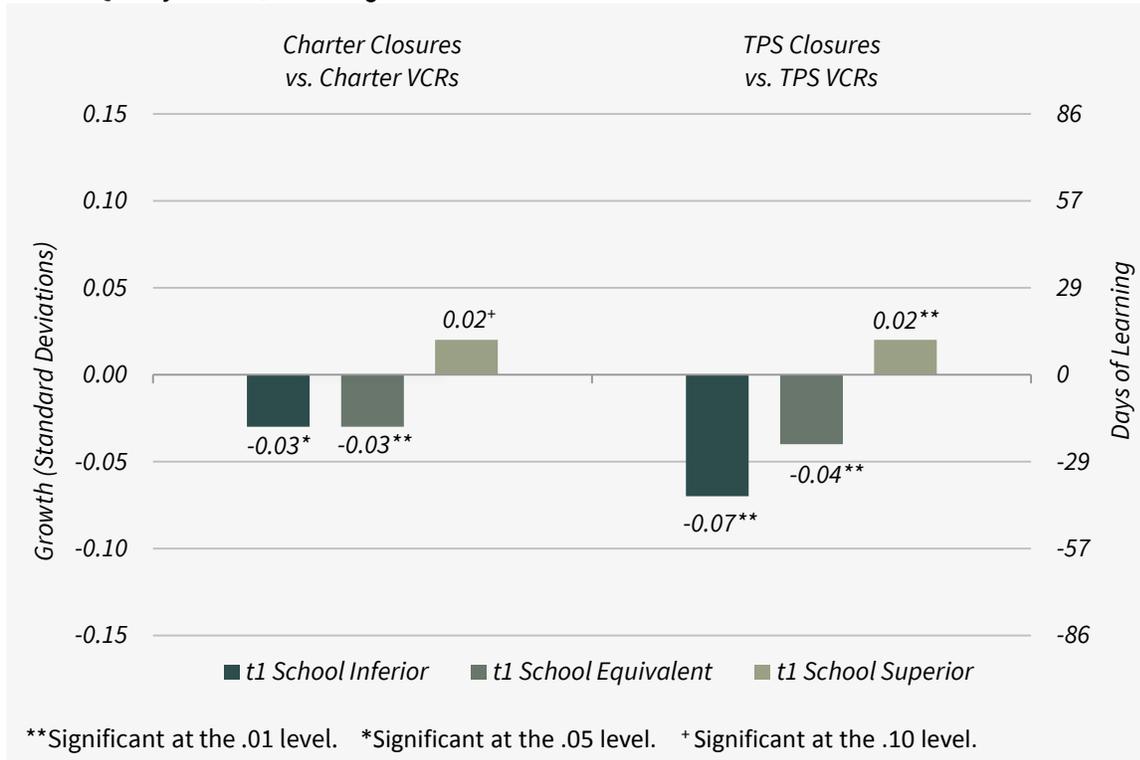
**Table 16: Relative Growth of Closure Students as Compared to VCR Peers in Growth Period 1-Overall**

	Charter Closures vs. Charter VCRs		TPS Closures vs. TPS VCRs	
	Reading	Math	Reading	Math
Growth	-0.01	-0.01	-0.02**	-0.01**

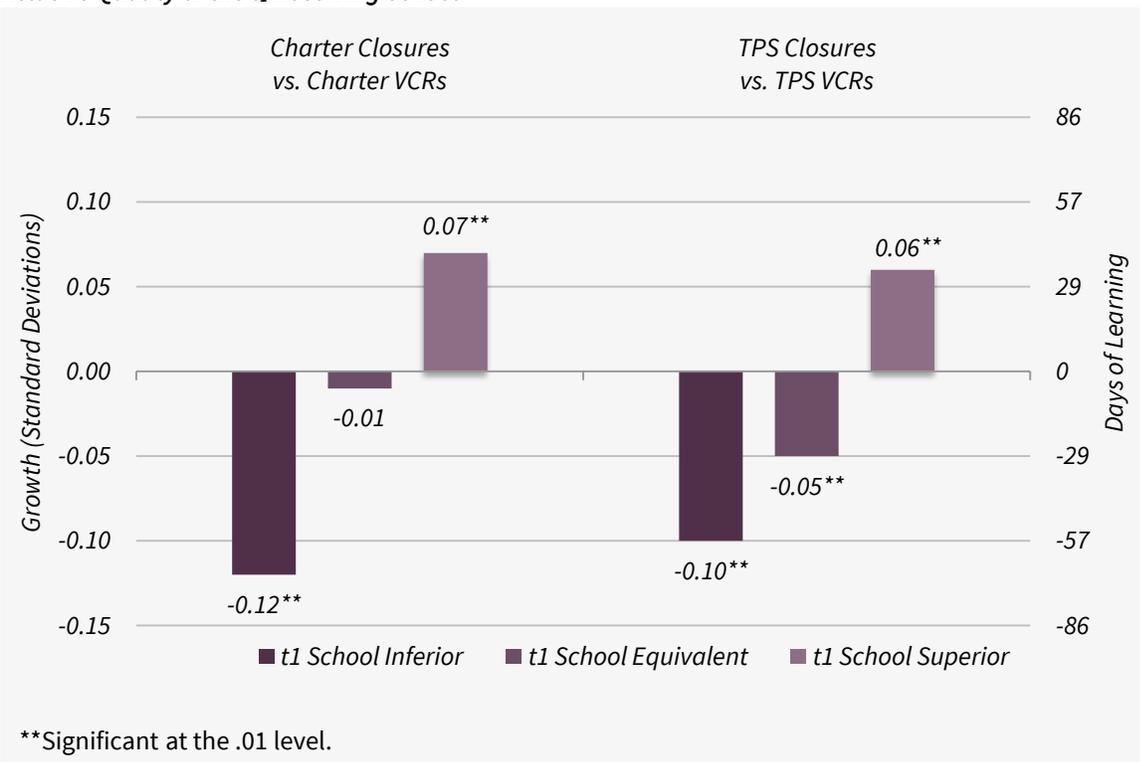
\*\* Significant at the 0.01 level.

Figures 37 and 38 show an evident role of the quality of the receiving school in the post-closure academic progress of closure students. The performance of closure students in their new schools was strongly associated with the quality of the school in both sectors, even more so in TPS where the differences were significant across the board. For both charter and TPS closure students, the value of superior school placement was stronger in math than in reading by a considerable amount. Compared to the average VCRs from continuing low-performing schools in the same sector, a reading benefit equivalent to 11 days of extra learning was found among TPS and charter closure students landing in superior receiving schools, while the math benefit increased to 40 days of extra learning for charter closure students in subsequent superior settings. Conversely, the moves to inferior and equivalent schools clearly demonstrated continued injury to the progress of students who had already experienced closures in the first place. The largest growth gap between superior and inferior school placements was found in math for charter closure students, standing at 108 days of learning.

**Figure 37: Breakdown of Relative Reading Growth of Closure Students as Compared to VCR Peers in  $t_1$  by the Relative Quality of the  $t_1$  Receiving School**



**Figure 38: Breakdown of Relative Math Growth of Closure Students as Compared to VCR Peers in  $t_1$  by the Relative Quality of the  $t_1$  Receiving School**



### Impact of Post-Closure School Quality by Sub-Population

We further explored the differential impact of attending a superior, equivalent or inferior school across different sub-populations of closure students.

Table 17 exhibits sporadic, inconsistent and sometimes counterintuitive impacts of the quality of the receiving school on closure students with high needs. For students in poverty, only those from charter closures registered significantly weaker growth in math relative to their VCRs if they landed in an inferior school. For English language learners, those from closed charter schools who gained seats in superior schools achieved stronger growth in reading, while those from closed TPS and with inferior placement made greater gains in math. Charter special education closure students had weaker growth in math if they ended up in an inferior school; counterintuitively, TPS special education closure students witnessed weaker growth in math if they went to a better school, made greater progress in math if their next school was equivalent to the closed one, and achieved greater gains in both subjects if they went to an inferior school. The counterintuitive patterns found among some TPS ELL and special education closure students might be accounted for by their high-need status or their small numbers. What mattered more for them might be to what extent the new school met their specific needs rather than the general quality of the school.

**Table 17: Breakdown of Impact of Closure on Students of Poverty, ELL and Special Ed Status in  $t_1$  by the Relative Quality of the  $t_1$  Receiving School**

	Charter Closures vs. Charter VCRs		TPS Closures vs. TPS VCRs	
	Reading	Math	Reading	Math
<b>Students in Poverty</b>				
Poverty* $t_1$ School Superior	-0.05	0.01	0.00	0.00
Poverty* $t_1$ School Equivalent	0.00	0.04	-0.01	0.02
Poverty* $t_1$ School Inferior	-0.08	-0.10*	0.00	0.01
<b>ELL Students</b>				
ELL* $t_1$ School Superior	0.07*	0.02	-0.02	-0.01
ELL* $t_1$ School Equivalent	-0.05	0.00	0.01	0.02
ELL* $t_1$ School Inferior	-0.08	-0.06	0.00	0.05**
<b>Special Education Students</b>				
Sped* $t_1$ School Superior	0.04	-0.02	0.00	-0.03**
Sped* $t_1$ School Equivalent	0.02	-0.04	0.00	0.03**
Sped* $t_1$ School Inferior	0.01	-0.16*	0.03*	0.04**

\* Significant at the 0.05 level.

\*\* Significant at the 0.01 level.

Table 18 separates the academic progress of closure students of each race/ethnicity in the year following closure relative to their average VCRs by the quality of the school they transferred to. For charter closures, relocation to a superior school led to stronger growth in reading for black students and greater gains in math for Hispanic students. The effect size was particularly large in math for upward-moving Hispanic students, equivalent to 74 days of additional learning.

**Table 18: Breakdown of Impact of Closure on Students of Different Races and Ethnicities in  $t_1$  by the Relative Quality of the  $t_1$  Receiving School**

	Charter Closures vs. Charter VCRs		TPS Closures vs. TPS VCRs	
	Reading	Math	Reading	Math
<b>Black Students</b>				
Black* $t_1$ School Superior	0.06*	0.05	0.03**	0.07**
Black* $t_1$ School Equivalent	-0.01	-0.03	-0.02*	-0.06**
Black* $t_1$ School Inferior	0.03	0.00	-0.07**	-0.12**
<b>Hispanic Students</b>				
Hispanic* $t_1$ School Superior	0.03	0.13**	0.03*	0.06**
Hispanic* $t_1$ School Equivalent	-0.03	-0.08	-0.02	-0.08**
Hispanic* $t_1$ School Inferior	0.04	-0.06	-0.08**	-0.12**
<b>White Students</b>				
White* $t_1$ School Superior	-0.05	0.01	0.03**	0.06**
White* $t_1$ School Equivalent	-0.02	-0.03	-0.03**	-0.05**
White* $t_1$ School Inferior	0.10	0.03	-0.09**	-0.11**
<b>Asian-Pacific Students</b>				
Asian-Pacific* $t_1$ School Superior	--	--	0.01	0.09**
Asian-Pacific* $t_1$ School Equivalent	0.05	--	-0.06**	-0.12**
Asian-Pacific* $t_1$ School Inferior	--	0.05	-0.04	-0.19**
<b>Native American Students</b>				
Native American* $t_1$ School Superior	0.22	-0.12	0.04	0.04
Native American* $t_1$ School Equivalent	--	-0.26	-0.05	-0.13**
Native American* $t_1$ School Inferior	--	--	-0.19**	-0.15**
<b>Multiracial Students</b>				
Multiracial* $t_1$ School Superior	0.04	-0.18	-0.01	0.04
Multiracial* $t_1$ School Equivalent	-0.22	-0.13	-0.10**	-0.06*
Multiracial* $t_1$ School Inferior	-0.16	-0.14	-0.12*	-0.05

Note: Cells with "--" indicate the number of observations was smaller than the minimum required in the suppression rule of our state partners.

\* Significant at the 0.05 level.

\*\* Significant at the 0.01 level.

The role of the quality of the receiving school in learning gains was more prevalent among TPS closure students of different racial/ethnic characteristics. As shown in Table 18, attendance in a superior

school in the post-closure year was associated with higher gains in both subjects for black, Hispanic and white students and stronger growth in math for Asian-Pacific students. Going to an equivalent or inferior school led to weaker progress in both subjects almost across the board. The magnitude of the impact in inferior settings exceeded that of equivalent placement and supported the proposition that the quality of subsequent educational settings is extremely important. It is also notable that in most cases, the effect size was larger for math than for reading.

Does the quality of the receiving school help alleviate or intensify the impact of closure on the most underserved groups, such as black and Hispanic students in poverty? Table 19 shows compelling effects for both groups and even more marked impacts in TPS closures. Specifically, with the average charter peers as the benchmark for comparison, black students in poverty from charter closures made greater progress in math when they landed in a better school and fewer gains in both subjects if they moved to an inferior school. For black students in poverty from TPS closures, superior school placement brought about greater gains in both reading and math, while ending up in an equivalent or inferior setting led to weaker progress in both subjects.

**Table 19: Breakdown of Impact of Closure on Black Students in Poverty and Hispanic Students in Poverty in  $t_1$  by the Relative Quality of the  $t_1$  Receiving School**

	Charter Closures vs. Charter VCRs		TPS Closures vs. TPS VCRs	
	Reading	Math	Reading	Math
<b>Black Students in Poverty</b>				
Black* Poverty* $t_1$ School Superior	0.02	0.06**	0.02**	0.06**
Black* Poverty* $t_1$ School Equivalent	-0.01	0.02	-0.04**	-0.05**
Black*Poverty* $t_1$ School Inferior	-0.04*	-0.09**	-0.07**	-0.11**
<b>Hispanic Students in Poverty</b>				
Hispanic* Poverty* $t_1$ School Superior	0.01	0.14**	0.02**	0.05**
Hispanic* Poverty* $t_1$ School Equivalent	-0.06*	-0.04	-0.03**	-0.07**
Hispanic* Poverty* $t_1$ School Inferior	-0.06	-0.19**	-0.08**	-0.08**

\* Significant at the 0.05 level.

\*\* Significant at the 0.01 level.

Similar patterns were found for Hispanic closure students in poverty. Relative to their average counterparts from not-closed charters, there were more gains in math for poor Hispanic students from charter closures who landed in better schools, weaker growth in reading for those attending equivalent schools, and fewer gains in math with inferior placement. The impact of the quality of the receiving school was pervasive for Hispanic students in poverty from TPS closures, with attendance in superior schools associated with greater gains in both reading and math and placement into equivalent or inferior schools related to weaker growth in both subjects.

## Summary of Post-Closure Student Academics

This chapter examines post-closure academic progress of students from charter and traditional public schools. At the aggregate level, both charter and TPS closure students had weaker average yearly growth than their VCR peers in the three years after their schools closed. When we disaggregated our investigations by geography, time or student subgroup, a strong but nuanced picture emerged. States differed in whether and how closure students progressed in reading and math tests relative to their VCRs in the same sector. Some states did post partially positive impacts for their closure students, and more of such positive examples came from the charter sector than from TPS. States where closure students fared well academically may hold useful lessons for decision-makers of school closure policies to learn from, which is worth exploring in a subsequent study.

Year-by-year analysis demonstrated that charter closure students did not lag behind their VCRs until the third year after closure, while TPS closure students performed worse than their counterparts in not-closed TPS in the first year, caught up in the second year, and made greater progress in math in the third year. Why the two sectors differed in the year-by-year academic impact of school closure is an area of future research. A small fraction of students had a second experience of school closure. In general, the second closure did not further aggravate the negative impact on academic growth.

The role of the quality of the receiving school in post-closure student academic progress stood out in our probing and was even more prevalent for TPS closure students. Overall, closure students transferring to a superior school were likely to achieve greater growth, which is encouraging as we adopted a lenient measure of the superiority of the receiving school (achievement being two or more ventiles higher than the closed school). On the contrary, closure students who ended up in inferior or equivalent settings were prone to making fewer academic gains than their peers in other low-performing schools that remained open. These patterns held for students of various racial and ethnic characteristics and somewhat for charter closure students in poverty. They were pronounced for conventionally most-underserved groups such as black and Hispanic students in poverty.

The discernible impact of the quality of the receiving school means that if students can be moved to even a slightly better school, then closure can have positive results. However, if students are sent to schools which are similarly low-performing or even worse than their closed schools, closure generally will result in negative learning outcomes. Considering that only close to half of closure students landed in superior settings (Chapter 5), there is still a large gap to fill in the policy and practice of relocating closure students so that school closures promote rather than hinder the learning of affected students.

## 7. Summary and Implications

Closing academically failing public K-12 schools has gained momentum as a policy instrument of accountability over the past decade and more. Advocates believe that closing failing schools helps improve the academic fates of students by removing damaging learning environments and enabling students to move to better schools. School closures also are expected to provide an incentive for the continuing schools to improve. Opponents are concerned that school closures will jeopardize student outcomes due to the disruption and stress induced by an involuntary change of schools. Despite heated debate over the issue, empirical evidence is scant and fragmented. Taking advantage of the unique longitudinal, multistate data that CREDO has amassed, this study represents the most comprehensive investigation of closure of low-performing schools to date.

### Major Findings

**Closures of low-performing schools were prevalent but not evenly distributed.** Closures were on the rise in the study period. Geographically, closures appeared to be concentrated in a few key states, especially so in the TPS sector. Considering locale and grade span, closure was mostly an urban phenomenon focused largely on elementary schools, where students have a longer time to recover and communities tend to have more than one school in the system to receive affected students. High school closures were rarer, probably because of strong community affinity and scarcer alternatives.

**Low-performing schools that were eventually closed exhibited clear signs of weakness in the years leading to closure compared to other low-performing schools.** Closing schools had lower academic performance and smaller student enrollment than low-performing schools that were permitted to remain open. In fact, there were steady declines in both academic achievement and growth in closing schools in the last three years before closure. Enrollment in those schools also dwindled in the last few years of operation.

**Variations in closures of low-performing schools by sector were particularly salient.** Although the number of charter closures was smaller than that of TPS closures, the percentage of low-performing schools getting closed was higher in the charter sector than in the TPS sector. This pattern was particularly pronounced in the first (from the bottom) state ventile of achievement. On average, the academic performance of closed charter schools was lower than that of closed TPS. However, the performance differences between the charter and TPS closures varied widely from state to state, which suggests that districts and charter authorizers operated in different legislative and regulatory environments. It was also clear that within states, decision-makers in the charter and TPS sectors exercised varying degrees of political will and drew on different approaches when they determined how to deal with low-performing schools.

**Closures of low-performing schools were not blind to socioeconomic status or race/ethnicity of the students who were enrolled.** In both the charter and TPS sectors, and particularly in the lowest ventile of achievement, low-performing schools with a larger share of black and Hispanic students were more likely to be closed than similarly performing schools with a smaller share of disadvantaged minority students. Moreover, the closure rates for higher-poverty low-performing TPS in the bottom

two ventiles surpassed the rates for lower-poverty TPS of similarly low performance. These observed inequivalent tendencies raise the issue of equity in decision-making about school closures.

**There was an obvious early departure of students before the official closure.** In both sectors, a higher percentage of students transferred from closing schools one year before the official closure than students attending continuing low-performing schools in the same period. The rate of early transfers was higher for closing charters than for closing TPS. Early leavers from both charter and TPS closures had worse academic performance than students who remained until the official closure as well as students who transferred from not-closed low-performing schools in the same sector in the same year.

**A little less than half of displaced closure students landed in better schools.** This held for both sectors. A higher share of displaced charter students ended up in better school settings than TPS closure students, compatible with the stronger capabilities of parents of charter school students in maneuvering through school choices. The chance for superior placement among students who left in the year before school closure was somewhat higher, implying some advantage for early departure given limited seats available in better local schools. Some students who did not land well in the first one or two years after closure attended a better school in the next year. However, the dominant pattern was for the schools that students attended in the second and third years following closure to mirror the quality of their schools in the previous year. The pattern possibly reflected families' preference for stability over improved quality in their choice of schools or the realistic constraint of the options of quality alternatives. These findings resonate with a widely held concern that there is a shortage of better options for students displaced by school closures. This concern is well founded as better schools are critically important for students' future academic progress.

**The quality of the receiving school made a significant difference in post-closure student outcomes.** Closure students who attended better schools tended to make greater academic gains than did their peers from not-closed low-performing schools in the same sector, while those ending up in worse or equivalent schools had weaker academic growth than their peers in comparable low-performing settings. This pattern was stronger for TPS closure students. The finding also held for a number of racial/ethnic groups and was particularly salient for black and Hispanic closure students. The effect was most pronounced for black and Hispanic students in poverty. However, the academic benefit of closure is systematically constrained as the supply of superior alternatives for closure students is limited and there are systemic access challenges such as parent information and district placement practices.

### Implications

Views on how to deal with academically failing schools diverge among policymakers, educators and parents. As the most radical measure, closure has received politically charged debate. The findings revealed in this study establish a foundation for evidence-based discussion about the implications of closing low-performing schools.

**Closing chronically low-performing schools seems to be an inevitable option.** The widespread failure of the school improvement strategies under the SIG programs (Dragoset, et al., 2017) makes the option of keeping chronically low-performing traditional public schools open in the hope of making progress over time unattractive and impractical. Previous research by CREDO has also demonstrated that a charter school that performs poorly at the beginning is very unlikely to improve later on (Peltason & Raymond, 2013; Woodworth & Raymond, 2013). Hence, closing persistently low-performing schools seems to be pushed to the front as an inevitable alternative. However, our findings point out several intricacies of – and call for caution in – implementing this bold policy measure.

**Decision-makers need to assure equity in dealing with low-performing schools.** Only a small fraction of low-performing schools have been closed, and our evidence suggests that closures of low-performing schools were biased by non-academic factors. In particular, closures were tilted toward the most disadvantaged schools such as the ones with higher concentrations of students in poverty and higher shares of black and Hispanic students, raising the issue of equity in the practice of closures. Districts and charter authorizers face exposure in this regard. They will benefit from reviewing their closure policies and processes and identifying and refraining from explicit and unconscious biases in decision-making about closing low-performing schools.

**Distinct patterns of closures in the charter and TPS sectors call for attention to accountability in both systems.** School districts have been more tolerant of low-performing TPS, as evidenced by lower rates of closures of low-performing schools in sum and by category in the TPS sector than in the charter sector. Although districts are likely to be confronted with greater pressure from various stakeholders when dealing with academically failing schools, the well-being of students should be their top concern. Responsible districts should never let chronically low-performing schools continuously erode student learning outcomes. In the charter sector, there should not be schools with very poor performance, particularly in the lowest state ventile, since the contract with authorizers obliges individual schools to meet certain academic goals. The existence of poor-performing charter schools raises the question of how accountability is implemented. Apparently, agreement with the terms on paper is not always sufficient. What matters more is the will on the part of charter authorizers to execute the terms and take actions when things go wrong in schools.

**Individual states will benefit from reviewing their closure criteria and processes and by learning from the experiences of successful states.** The state is the locus for the formulation and supervision of many education policies and practices. Our data demonstrated that states varied extensively in the prevalence of closing low-performing schools, the academic criteria that were applied in the decisions about closures, and the focus on ensuring student academic progress in post-closure periods. Individual states are yet to review the level of rigor in their creation and implementation of policies and practices for coping with low-performing schools. They can also learn useful lessons from their counterparts that have successfully closed low-performing schools, relocated closure students to better schools and promoted improved academic performance of post-closure students.

**The quality of the receiving schools plays a significant role in the academic progress of closure students. However, superior alternatives are limited. Innovative measures are needed to yield positive outcomes for students.** Closing low-performing schools alone does not automatically lead to better outcomes for students, but needs to be accompanied by effective follow-up measures to ensure better treatment of students. Our findings of the role that the quality of the receiving school played in the academic progress of closure students suggest it is crucial to assign affected students to higher-performing schools. However, we cannot pin all our hopes on higher-performing schools if there are many students to place. Not even half of the displaced students in our analysis were able to land in better schools. The chance for superior placement will grow slimmer if there are further increases in the practice of closure. Additional options need to be designed – starting new schools, for example. It is true that new schools are likely to be mixed in quality. But if poorly performing schools are closed and better schools are kept, there will be an accumulation of high-quality schools over time.

## Appendix A. Supplementary Findings

### Number of Low-Performing Schools That Closed by Sector, State and Year

Tables 20 and 21 list the number of closures by state and year in the charter and TPS sectors, respectively, in our study period.

**Table 20: Number of Closed Low-Performing Charter Schools by State and Year**

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Arizona	5	3	6	4	6	4	5
Arkansas	0	0	0	2	0	2	1
California	5	2	13	4	10	10	
Colorado	1	2	0	4	1	1	2
District of Columbia	0	1	0	0	2	0	0
Florida	3	5	9	1	5	6	5
Georgia	1	0	1	1	2	1	1
Illinois				1	0	0	0
Louisiana	0	0	0	1	0	0	0
Massachusetts	0	1	1	0	0	0	1
Michigan	2	5	1	9	5	8	
Minnesota	1	2	3	2	5	1	4
Missouri	0	0	0	3	1	4	0
Nevada	0	0	0	0	0	0	0
New Jersey		0	0	1	0	3	2
New Mexico	0	0	1	0	0	0	2
New York City	0	0	0	0	0	0	0
New York State	0	2	0	1	0	1	1
North Carolina						1	2
Ohio	0	9	7	11	0	5	12
Oregon	0	1	2	2	0	0	0
Pennsylvania		1	2	0	0	0	0
Rhode Island	0	0	0	0	0	0	
Tennessee	1	0	0	0	0	0	1
Texas		1	2	2	0	3	0
Utah	0	0	0	0	0	0	0
Wisconsin	5	1	7	7	5	7	

Note: Empty cells indicate state-years outside the data window of the study.

**Table 21: Number of Closed Low-Performing TPS Schools by State and Year**

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Arizona	0	1	2	2	0	2	7
Arkansas	3	3	4	9	1	9	5
California	18	11	17	15	11	18	
Colorado	3	14	4	10	3	6	7
District of Columbia	0	3	0	0	2	0	4
Florida	3	5	3	5	3	0	5
Georgia	3	8	16	2	10	15	5
Illinois				4	8	8	46
Louisiana	3	5	16	13	15	3	3
Massachusetts	7	11	16	0	15	2	4
Michigan	32	18	45	16	27	45	
Minnesota	12	10	4	10	12	2	12
Missouri	1	2	2	1	0	0	1
Nevada	0	0	0	0	1	0	0
New Jersey		6	6	5	6	6	4
New Mexico	0	1	1	1	0	0	0
New York City	10	5	2	3	8	0	3
New York State	3	4	6	3	8	0	13
North Carolina						4	1
Ohio	18	10	18	35	15	8	8
Oregon	4	2	2	2	3	3	2
Pennsylvania		5	11	13	17	34	11
Rhode Island	0	0	2	1	1	5	
Tennessee	7	0	7	2	1	3	4
Texas		10	7	10	16	13	18
Utah	4	10	0	0	1	0	0
Wisconsin	10	4	6	6	12	5	

Note: Empty cells indicate state-years outside the data window of the study.

### Number and Rate of Closures by State Ventile of Achievement

Tables 22 to 24 report the number of and the rate of closures of low-performing schools in each state ventile of math achievement, overall and then by the poverty level and the concentration of minority (black and Hispanic) students, in charter and TPS sectors respectively.

**Table 22: Number and Rate of Closures of Low-Performing Schools by Sector and State Ventile of School Achievement in Math**

State Ventile	Charter			TPS		
	Number of All Low-Performing Schools	Number of Closures	Rate of Closures	Number of All Low-Performing Schools	Number of Closures	Rate of Closures
1	2,632	202	7.7%**	12,183	560	4.6%
2	1,796	74	4.1%	11,805	375	3.2%
3	948	33	3.5%**	9,069	163	1.8%
4	381	9	2.4%	5,062	106	2.1%
<b>Sector Subtotal</b>	<b>5,757</b>	<b>318</b>	<b>5.5%**</b>	<b>38,119</b>	<b>1,204</b>	<b>3.2%</b>

\*\* Difference in the rates of closures of charter and TPS low-performing schools significant at the 0.01 level.

**Table 23: Number and Rate of Closures of Higher-Poverty and Lower-Poverty Low-Performing Schools by Sector and State Ventile of School Achievement in Math**

<b>Charter Sector</b>						
State Ventile	Charter ≥80% Poverty			Charter <80% Poverty		
	Number of All Low-Performing Schools	Number of Closures	Rate of Closures	Number of All Low-Performing Schools	Number of Closures	Rate of Closures
1	1,328	114	8.6%	1,304	88	6.7%
2	969	48	5.0%	827	26	3.1%
3	553	18	3.3%	395	15	3.8%
4	249	6	2.4%	132	3	2.3%
<b>Charter Subtotal</b>	<b>3,099</b>	<b>186</b>	<b>6.0%</b>	<b>2,658</b>	<b>132</b>	<b>5.0%</b>

<b>TPS Sector</b>						
State Ventile	TPS ≥80% Poverty			TPS <80% Poverty		
	Number of All Low-Performing Schools	Number of Closures	Rate of Closures	Number of All Low-Performing Schools	Number of Closures	Rate of Closures
1	8,813	432	4.9%**	3,370	128	3.8%
2	8,758	302	3.4%**	3,047	73	2.4%
3	5,971	111	1.9%	3,098	52	1.7%
4	3,145	67	2.1%	1,917	39	2.0%
<b>TPS Subtotal</b>	<b>26,687</b>	<b>912</b>	<b>3.4%**</b>	<b>11,432</b>	<b>292</b>	<b>2.6%</b>

\*\* Difference in the rates of closures of higher-poverty and lower-poverty low-performing schools significant at the 0.01 level.

**Table 24: Number and Rate of Closures of Higher-Minority and Lower-Minority Low-Performing Schools by Sector and State Ventile of School Achievement in Math**

<b>Charter Sector</b>						
State Ventile	≥80% Minority			<80% Minority		
	Number of All Low-Performing Schools	Number of Closures	Rate of Closures	Number of All Low-Performing Schools	Number of Closures	Rate of Closures
1	1,495	139	9.3%**	1,137	63	5.5%
2	1,006	45	4.5%	790	29	3.7%
3	538	25	4.7%*	410	8	2.0%
4	235	4	1.7%	146	5	3.4%
<b>Charter Subtotal</b>	<b>3,274</b>	<b>213</b>	<b>6.5%**</b>	<b>2,483</b>	<b>105</b>	<b>4.2%</b>

<b>TPS Sector</b>						
State Ventile	≥80% Minority			<80% Minority		
	Number of All Low-Performing Schools	Number of Closures	Rate of Closures	Number of All Low-Performing Schools	Number of Closures	Rate of Closures
1	8,497	430	5.1%**	3,686	130	3.5%
2	7,907	245	3.1%	3,898	130	3.3%
3	4,912	89	1.8%	4,157	74	1.8%
4	2,523	45	1.8%	2,539	61	2.4%
<b>TPS Subtotal</b>	<b>23,839</b>	<b>809</b>	<b>3.4%**</b>	<b>14,280</b>	<b>395</b>	<b>2.8%</b>

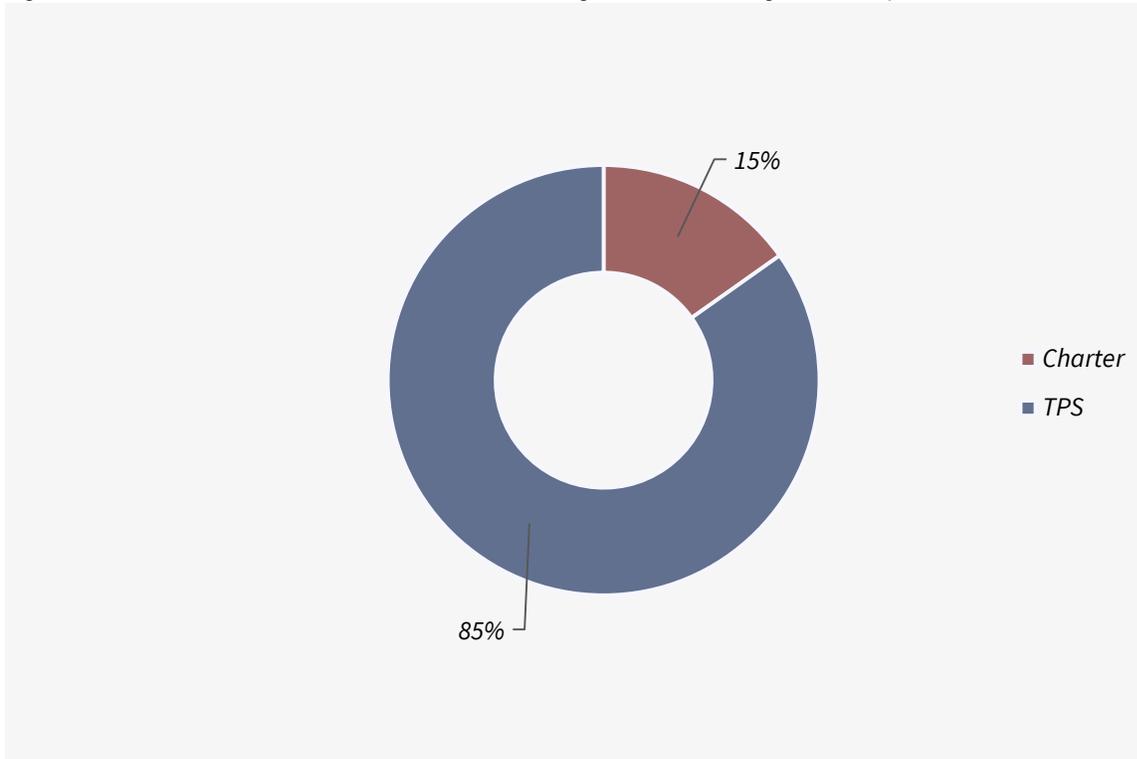
\* Difference in the rates of closures of higher-minority and lower-minority low-performing schools significant at the 0.05 level.

\*\* Difference in the rates of closures of higher-minority and lower-minority low-performing schools significant at the 0.01 level.

### Distributions of Closure Students

In this section, we counted the number and described the distribution of closure students, using the enrollment data provided in the Common Core of Data from the National Center for Education Statistics (NCES). In the 26 states over the period of our study, 450,264 students were enrolled in low-performing schools that closed. As Figure 39 displays, around 15 percent of closure students came from the charter sector and about 85 percent of them attended closing TPS. Not surprisingly, the number and percentage of closure students differed across states, as shown in Table 25.

*Figure 39: Distribution of Students Enrolled in Closing Low-Performing Schools by Sector*



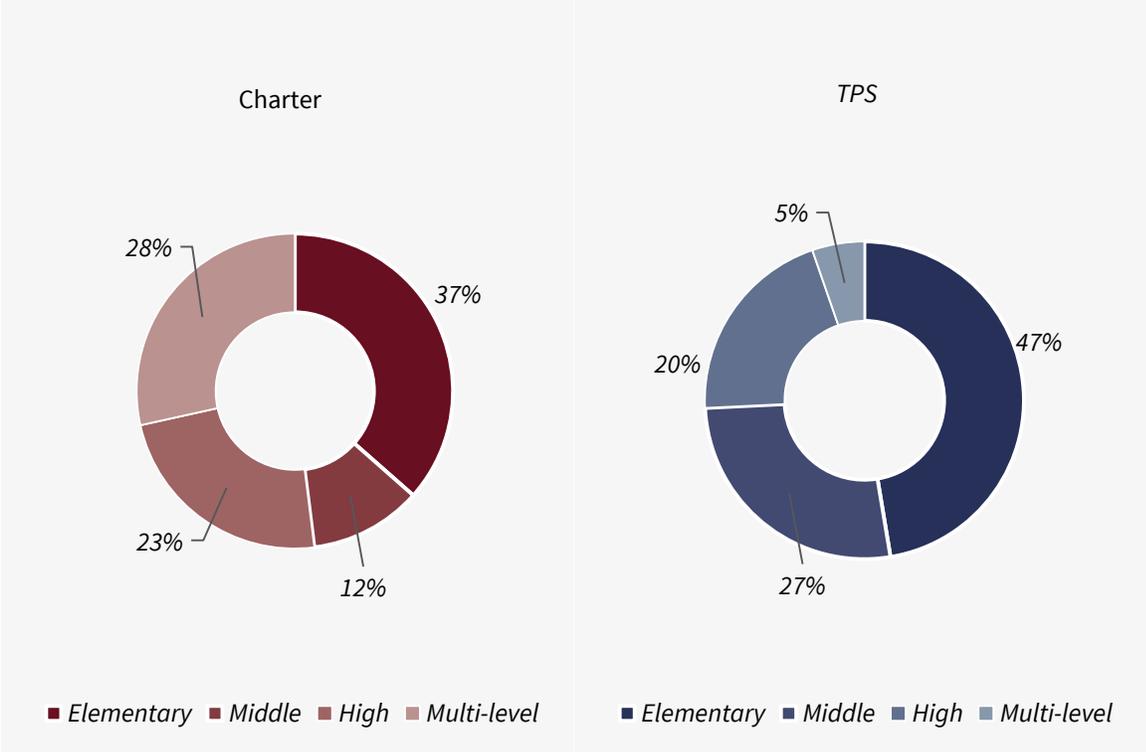
**Table 25: Distribution of Students Enrolled in Closing Low-Performing Schools by Sector and State**

State	Number of Years under study	Number of Charter Closure Students	Percentage of Charter Closure Students	Number of TPS Closure Students	Percentage of TPS Closure Students
Arizona	7	3,552	5.2%	3,064	0.8%
Arkansas	7	819	1.2%	9,313	2.4%
California	6	9,744	14.3%	27,199	7.1%
Colorado	6	5,636	8.2%	14,156	3.7%
District of Columbia	7	294	0.4%	1,349	0.4%
Florida	7	4,337	6.3%	5,410	1.4%
Georgia	7	2,353	3.4%	25,901	6.8%
Illinois	4	316	0.5%	18,556	4.9%
Louisiana	7	308	0.5%	18,312	4.8%
Massachusetts	7	810	1.2%	19,987	5.2%
Michigan	6	8,979	13.1%	57,929	15.2%
Minnesota	7	1,926	2.8%	9,320	2.4%
Missouri	7	3,820	5.6%	1,467	0.4%
Nevada	7	0	0.0%	14	0.0%
New Jersey	7	1,945	2.8%	12,707	3.3%
New Mexico	7	233	0.3%	426	0.1%
New York City	7	0	0.0%	6,898	1.8%
New York State	7	2,251	3.3%	10,300	2.7%
North Carolina	2	513	0.8%	1,025	0.3%
Ohio	7	9,709	14.2%	33,656	8.8%
Oregon	7	339	0.5%	4,305	1.1%
Pennsylvania	6	1,027	1.5%	35,184	9.2%
Rhode Island	7	0	0.0%	3,100	0.8%
Tennessee	7	255	0.4%	7,153	1.9%
Texas	6	917	1.3%	35,273	9.2%
Utah	7	0	0.0%	8,844	2.3%
Wisconsin	6	8,242	12.1%	11,091	2.9%

Note: There were no closed low-performing schools in Nevada, New York City, Rhode Island and Utah within our data window. So the number of charter closure students for these four states was zero.

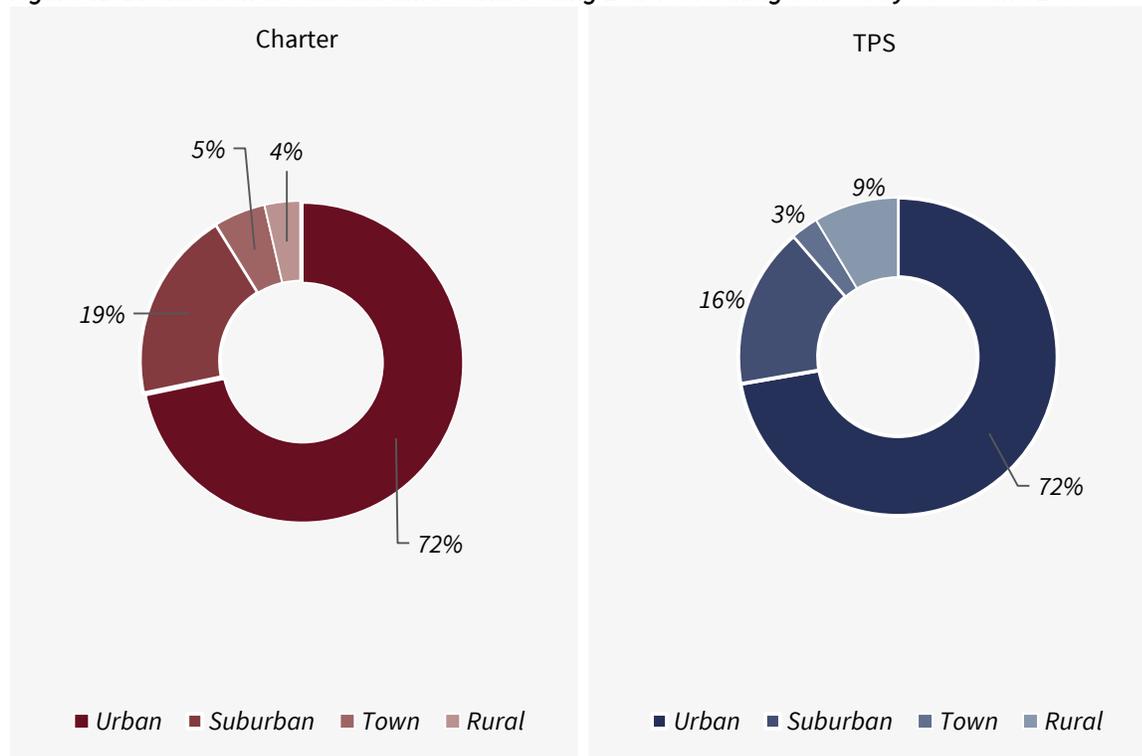
Closing elementary schools enrolled the largest number of closure students among all grade spans in both the charter and TPS sectors (Figure 40). Nearly 40 percent of charter closure students were enrolled in elementary schools, followed by close to 30 percent in multi-level schools and fewer in high and middle schools. In the TPS sector, about half of closure students came from elementary schools, followed by nearly 30 percent from middle schools and even fewer from high and multi-level schools.

**Figure 40: Distribution of Students Enrolled in Closing Low-Performing Schools by Sector and Grade Span**



Similar to the distribution of closed schools by locale described in Chapter 3 (see Figure 4), Figure 41 shows that an overwhelming majority (72 percent) of closure students were enrolled in urban schools, followed by around 20 percent in suburban schools and a tiny percentage in town and rural schools, in both sectors.

**Figure 41: Distribution of Students Enrolled in Closing Low-Performing Schools by Sector and Locale**



**Poverty, Special Ed, and ELL Statuses of Students Enrolled in Closing Schools**

Figure 42 shows non-substantial differences in the poverty, special education and ELL statuses of early ( $t_{-1}$ ) leavers as compared to staying students in closing schools. In both charter and TPS sectors, an overwhelming majority of early leavers from closing schools were eligible for free and reduced-price lunch, the measure of poverty. The percentage of early leavers living in poverty (79 percent) was a little lower than the percentage of stayers in poverty (82 percent) in closing charter schools. Conversely, the percentage of early leavers in poverty (86 percent) was slightly higher than that of stayers in poverty (85 percent) in closing TPS schools. In closing schools in both sectors, the percentage of early leavers of special education status was a little higher than that of stayers in closing schools, while there was a lower percentage of ELL students among early leavers than among stayers.

**Figure 42: Poverty, ELL and Special Ed of Early Leavers and Stayers from Closing Low-Performing Schools by Sector**

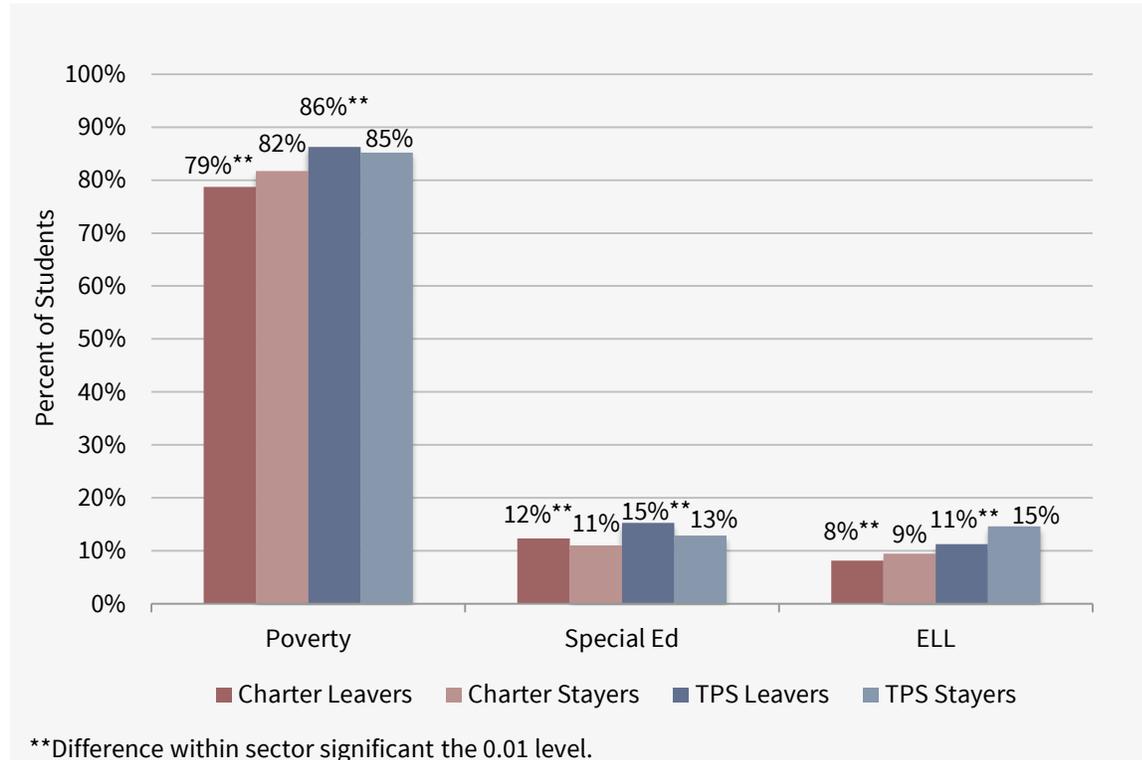
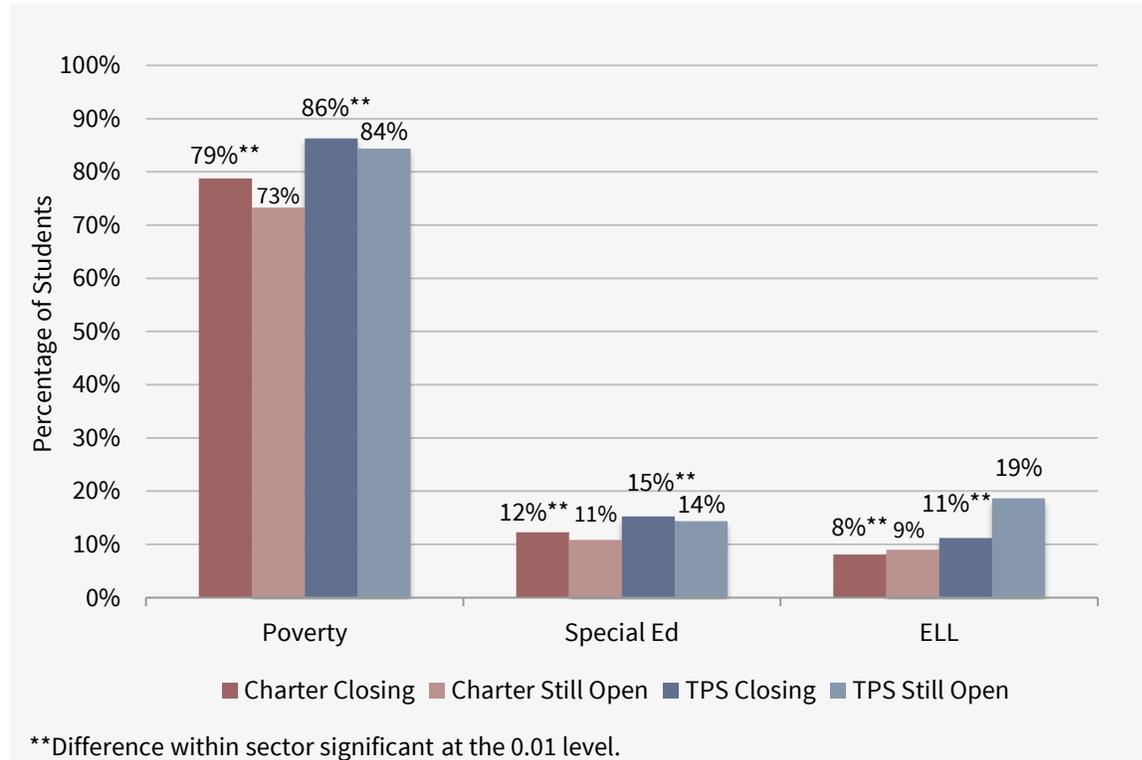


Figure 43 compares the poverty, special education and ELL status of early leavers from closing schools and students who transferred from not-closing, low-performing schools in  $t_{-1}$ . The patterns of the differences in all three statuses between  $t_{-1}$  leavers from closing and continuing low-performing schools were similar in the charter and TPS sectors. Specifically, a higher percentage of early leavers from closing schools were eligible for free and reduced-price lunch than  $t_{-1}$  leavers from the other low-performing schools that stayed open. The percentage of special education students was higher among early leavers from closing schools than among  $t_{-1}$  leavers from continuing low-performing schools, while the percentage of ELL students among early leavers from closing schools was lower than  $t_{-1}$  leavers from not-closing, low-performing schools.

**Figure 43: Poverty, ELL and Special Ed of Early Leavers from Closing and Not-Closing Low-Performing Schools by Sector**



## Distribution of Early Leavers and Stayers from Closing Schools by State Ventile of Achievement

Table 26: Distribution of Early Leavers and  $t_0$  Closure Students by Sector and State Ventile of Math Achievement of Their Respective  $t_0$  Schools

Sector of Closure in $t_0$	Category of Students	Ventile 1	Ventile 2	Ventile 3	Ventile 4
Closed Charter	Early Leavers	57%	24%	12%	7%
	$t_0$ Closure Students	48%	25%	22%	5%
Closed TPS	Early Leavers	44%	34%	13%	9%
	$t_0$ Closure Students	41%	32%	19%	8%

## Average Yearly Nominal Growth of Closure Students and Their VCRs

Table 27: Average Yearly Nominal Growth in Reading and Math of Closure Students and VCR Peers from Not-Closed Low-Performing Schools up to Three Years after Closure

	Charter Closures vs. Charter VCRs		TPS Closures vs. TPS VCRs	
	Closure Students	VCRs	Closure Students	VCRs
Reading	0.02	0.03	0.01	0.01
Math	0.01	0.01	0.01	0.02

## Appendix B. Technical Appendix

### Consolidating Student Data from Multiple States

To create a national student dataset for this study, CREDO worked with the state departments of education in the 26 states as listed in Table 1 in Volume I of the full report. Because each state used its standards and tests to evaluate student academic achievement, it was necessary for CREDO to standardize the values to make them comparable. CREDO did this by creating a bell curve for each test – by subject, grade, state and year – where the average student score on the test became the central value and all other scores were distributed around it. The transformation placed each student’s performance in relation to all other equivalent tested students, making it ready for comparison with other students. By comparing each student’s performance relative to the other students from one year to that same student’s relative performance in the next year, CREDO could estimate if the student was growing academically at a rate which was faster, similar or slower than the rate of the peers.

CREDO was able to combine growth results from multiple grades, states and years. Even though the average academic achievement in state A might differ from the average academic achievement in state B, a change in the academic achievement (growth) of .05 standard deviation in state A and a .05 standard deviation change in achievement in state B both represented the same level of improvement relative to their peers in the students’ home states. This is one of the reasons measures of academic growth are superior to simple measures of academic achievement, the level of which can vary greatly from state to state.

### Multiple Datasets

#### Longitudinal Data

We used the longitudinal data that CREDO had consolidated for addressing the national landscape of closures, (in)equivalence of closure of similarly performing schools, and pre- and post-closure student movement. Wherever applicable, we generated aggregate-level measures such as the average test scores from student data when we ran school-level analyses.

#### Matched Data

When examining the impact of closure on student academic progress, we used the virtual control record (VCR) method developed by CREDO (Davis & Raymond, 2012). The first step in conducting a VCR analysis is to create a matched data set. The matched data set consists of treated students (in this case students from closed schools) and demographically identical students in the control group. In this study, treated students were students from a closed school who had from one to three growth periods after the closure of their original school, did not attend an alternative school in subsequent

comparison years, and had test data in the final year of operation for the closure school and the year before.<sup>21</sup>

We created control groups for students from closed charter schools and TPS separately for this analysis. The control group consisted of students at similarly low-performing schools in the same sector that continued to operate.

### **Selection of Comparison Observations**

A fair analysis of the impact of closure requires a comparison group which matches the demographic and academic profile of closure students to the fullest extent possible. As in previous CREDO studies, this study employed the virtual control record (VCR) method of analysis developed by CREDO. The VCR approach created a “virtual twin” for each closure student who was represented in the data. If matched, this virtual twin would differ from the closure student only in that one student attended a closing school. The VCR matching protocol has been assessed against other possible study designs and judged to be reliable and valuable by peer reviewers (Fortson, Verbitsky-Savitz, Kopa, & Gleason, 2012).

Using the VCR approach, a virtual twin was constructed for each closure student by drawing on the available records of students with identical traits and identical or very similar baseline test scores but who were enrolled in a continuing low-performing school in the same sector.<sup>22</sup> Factors included in the matching criteria were:

- Grade level
- Gender
- Race/ethnicity
- Free or reduced-price lunch eligibility
- English Language learner status
- Special education status
- Test score on state achievement tests in the final year of operation for the closed school

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<sup>21</sup> We do not include closure students who attended alternative schools in subsequent comparison years so that the estimation of the impact of closure on student academic progress is not biased by different educational experiences in alternative schools. We drop students without a test score in the final year of operation for the closed school as this score is one of the key matching variables, as will be demonstrated soon. In addition, we set the condition of having test scores for the year before the last year of operation for the closed school because this score is one of the control variables in our regression analyses of the impact of closure on student growth.

<sup>22</sup> Achievement scores are considered similar if they are within 0.1 standard deviation of the closure student’s achievement in the final year of operation for the closed school.

Figure 44 shows the matching process used by CREDO to create the virtual twins linked to each closure student. In the first step, CREDO identified all low-performing schools that were permitted to remain open by state and year. These schools in the same state and identified as low-performing for the final year of operation for a closed school were referred to as “comparison schools” for that particular closed school. Once a school was identified as a comparison school for a particular closed school, all the students in that low-performing school became potential matches for students in that particular closed school. All of the student records from all of a closure’s comparison schools were pooled and became the source of records for creating the virtual twin match.<sup>23</sup>

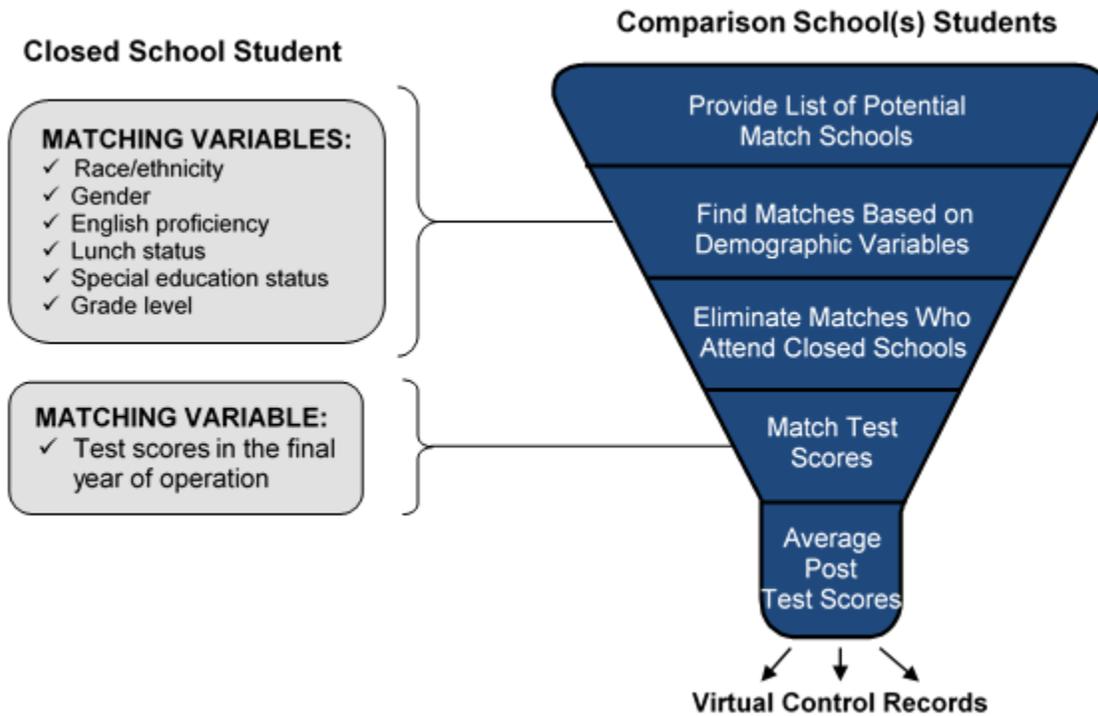
The VCR matching method then eliminated any of the students from the match pool whose demographic characteristics did not match exactly to the individual closure student. As part of the match process, we also dropped from the match pool any students who were enrolled in a closed or alternative school in subsequent comparison years and who did not have test scores one year before the final year of operation for the closed school.

Using the records of students at comparison schools in the final year of operation for the closed school, CREDO randomly selected up to seven comparison students with identical values on the matching variables in Figure 44, including identical or very similar test scores in the final year of operation for the closed school. Students with similar test scores were used only when there were not enough comparison students with exact test score matches. The values for the selected comparison students were then averaged to create values for the virtual twins. As all other observable characteristics were identical, the only observable characteristic that differed between the closure student and the VCR was attendance in a closing school. The test score in the final year of operation for the closed school represented the impact on academic achievement of both the observable and the unobservable student characteristics up to the time of the match. Since we matched on observable characteristics and the test score in the final year of operation for the closed school, we concluded that any differences in the post-closure scores were primarily attributable to school closure.

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<sup>23</sup> Each closure school has its own independent comparison school list, and thus a unique pool of potential VCR matches.

Figure 44: CREDO VCR Methodology



#### VCR Matched Samples

As stated above, VCRs for closure students were drawn from comparison schools, that is, low-performing schools in the same sector that continued to operate. Table 28 shows the match rates and the characteristics of the target students who met the criteria for inclusion in the impact analysis and matched students for whom a VCR has been created. The match rate for TPS closure students with TPS VCRs stood at 90 percent, making this matched sample highly reflective of the tested TPS students who met the conditions for our impact analysis. The match rate for charter closure students with charter VCRs was 61 percent. A plausible explanation for this lower match rate is that the number of charter comparison schools was small and charter schools tended to have small student enrollment. Both limitations added to the difficulty of finding a charter VCR for each charter target student. Nonetheless, as shown below, the characteristics of matched charter closure students were not that different from those of all charter target students.

**Table 28: Demographics of Target and Matched Students**

	Charter Closures		TPS Closures	
	Target Students	Matched Students	Target Students	Matched Students
Number of Tested Students	16,838	10,194	128,522	115,434
Match Rate		61%		90%
Students in Poverty	82%	89%	88%	89%
Special Ed Students	9%	5%	13%	11%
ELL Students	11%	10%	13%	12%
White Students	9%	5%	12%	12%
Black Students	58%	66%	53%	54%
Hispanic Students	29%	27%	30%	30%
Asian-Pacific Students	1%	0.2%	3%	2%
Native American Students	1%	1%	1%	1%
Multi-Racial Students	1%	1%	1%	1%

Table 28 shows the characteristics of the target students and matched students in each sector in the impact analysis. There was a high degree of similarity in all the attributes between TPS matched students and all TPS target students. Charter matched students were similar to all charter target students on five of nine characteristics and looked moderately different on the other four dimensions. Compared to all charter target students, a higher percentage of matched charter closure students was eligible for free or reduced-price lunch, and a lower percentage held special education status; they also had a higher percentage of black students and a lower percentage of white students.

### Models for Analysis of the Academic Impact of School Closure

After constructing a VCR for each closure student, we then set out to develop a model capable of providing a fair measure of closure impact. The National Charter School Research project by CREDO provided a very useful guide to begin the process (Betts & Hill, 2006). First, it was useful to consider student growth rather than achievement. A growth measure provided a strong method to control for each student’s educational history as well as the many observable differences between students that affected their academic achievement. The baseline model included controls for each student’s grade, race, gender, free or reduced-price lunch status, special education status, English language learner status, and whether they were held back in the previous year. The literature on measuring educational interventions found that the best estimation techniques must also include controls for baseline test scores (Betts & Tang, 2011). Each student’s prior-year test score was controlled for in our baseline model. Additional controls were also included for state, year and test score in the year before the final year of operation for the closed school. The study’s baseline model is presented below.

$$\Delta A_{i,t} = \theta A_{i,t-1} + \beta X_{i,t} + \rho Y + \sigma S + \gamma C_{i,t} + \varepsilon_{i,t} \quad (1)$$

where the dependent variable is

$$\Delta A_{i,t} = A_{i,t} - A_{i,t-1} \quad (2)$$

and  $A_{i,t}$  is the state-by-test z-score for student  $i$  in period  $t$ ;  $A_{i,t-1}$  is the state-by-test z-score for student  $i$  in the year before  $t$ ;  $X_{i,t}$  is a set of control variables for student characteristics and test scores in the year before the final year of operation for the closed school;  $Y$  is a year fixed effect;  $S$  is a state fixed effect;  $C$  is an indicator variable for whether student  $i$  attended a closed school in  $t_0$ ; and  $\varepsilon$  is the error term.

In addition to the baseline model above, we explored additional interactions beyond a simple binary to indicate closure. These included both “double” and “triple” interactions between the closure variable and student characteristics. For example, to identify the impact of closure on different racial groups, we estimated models that broke the closure variable into “closure\_black,” “closure\_Hispanic,” etc. To further break down the impact of closure by race and poverty, the variables above were split again. For example, black closure students were further split into students who were eligible for free and reduced-price lunches (“closure\_black\_poverty”) and those who did not (“closure\_black\_nonpoverty”).

We also investigated the differential impact of going to a superior, equivalent or inferior school on the growth of closure students for the first growth period. To that end, we estimated models that disaggregated the closure variable into “closure\_superior,” “closure\_equivalent” and “closure\_inferior.” To examine the impact of the quality of the receiving school on students of different characteristics, we split the interaction of closure and the quality of the receiving school into “closure\_superior\_black,” “closure\_equivalent\_Hispanic,” etc. In the further exploration of the impact of the quality of the receiving school by race and poverty, the variables above were broken down again. For example, black closure students who attended a superior school were broken into “closure\_superior\_black\_poverty” and “closure\_superior\_black\_nonpoverty.”

## Presentation of Results

In this report, we presented the impacts of school closure on student academic progress in terms of standard deviations. The base measures for these outcomes were referred to as z-scores in statistics. A z-score of 0 indicates the student’s achievement is average for his or her grade. Positive z-scores represent higher performance while negative z-scores represent lower performance. Likewise, a positive effect size value means a student or group of students has improved relative to the students in the state taking the same exam. This remains true regardless of the absolute level of achievement for those students. As with the z-scores, a negative effect size means the students have on average lost ground compared to their peers.

While it is fair to compare two effect sizes relationally (i.e., 0.08 is twice 0.04), this must be done with care as to the size of the lower value. It would be misleading to state one group grew twice as much as another if the values were extremely small such as 0.0001 and 0.0002.

Finally, it is important to consider if an effect size is significant or not. In statistical models, values which are not statistically significant should be considered as no different from zero. Two effects sizes, one equal to .001 and the other equal to .01, would both be treated as nil if neither were statistically significant.

To assist the reader in interpreting the meaning of effect sizes, we included an estimate of the average number of days of learning required to achieve a particular effect size. This estimate was calculated by Dr. Eric Hanushek and Dr. Margaret Raymond based on the latest National Assessment of Educational Progress (NAEP) test scores. Using a standard 180-day school year, each one standard deviation (s.d.) change in effect size was equivalent to 570 days of learning.

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