APRIL 2015

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Foreword by Aaron Churchill and Michael J. Petrilli

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# FOREWORD

*By Aaron Churchill and Michael J. Petrilli*

Bad schools rarely die. This was the conclusion of Fordham's 2010 report *Are Bad Schools Immortal?*, which discovered that out of 2,000 low-performing schools across ten states, only 10 percent actually closed over a five-year period. On reflection, the finding was not too surprising: shuttering schools nearly always sets off a torrent of political backlash, as authorities in Chicago, Philadelphia, and other urban districts have learned in recent years. And for understandable reasons: schools are integral parts of communities; they're built into families' routines and expectations, and closing them inevitably causes pain and sadness, even when it's what's best for students.

However, we also recognize that closing schools is sometimes necessary. In the charter sector, in particular, closure is an essential part of the model: schools must perform or they are supposed to lose their contracts. That's the bargain. And in the district sector, experience has taught us that some schools have been so dysfunctional for so long that efforts to "turn them around" are virtually destined to fail.

That doesn't mean it's easy to put bad schools out of their misery. Part of the difficulty is political, but another important part is a genuine moral dilemma: Are we sure that kids will be better off after their schools close? What is the quality of the remaining schools in their neighborhoods? Most importantly, do students gain or lose ground academically when their schools close and they are obliged to enroll somewhere else?

We know from personal experience how important, even agonizing, these questions are. In our role as a charter-school authorizer in Ohio, we have blinked on a few occasions—choosing to keep marginal schools open because we worried that the children attending them might be even worse off if they had to move elsewhere. Were we right to do so?

The present study brings to bear empirical evidence on the critical issue of the impact that closures have on student achievement. At stake are two plausible theories about the effects of closing schools, particularly in urban areas. One theory suggests that closing a school could seriously derail pupil learning, leaving kids even worse off than before. Closures could have an adverse impact on learning as students lose familiar peers and routines, while having to adjust to a new environment. (After all, lots of evidence indicates that "student mobility" is rarely a good thing, at least in the short term.) On the other hand, the alternative theory suggests that school closure could result in educational improvement. Shutting down bad schools can result in children moving to better ones—which might lead to academic gains. Hence, the closure of low-performing schools, whether by policy injunction or by the invisible hand of market, could raise overall achievement.

Which is it? Does closure adversely impact student achievement, or is there evidence that shutting down schools can lift achievement? Should policymakers, district officials, and charter-school authorizers recognize school closures as a viable way to improve education, or should they seldom if ever shutter a school?

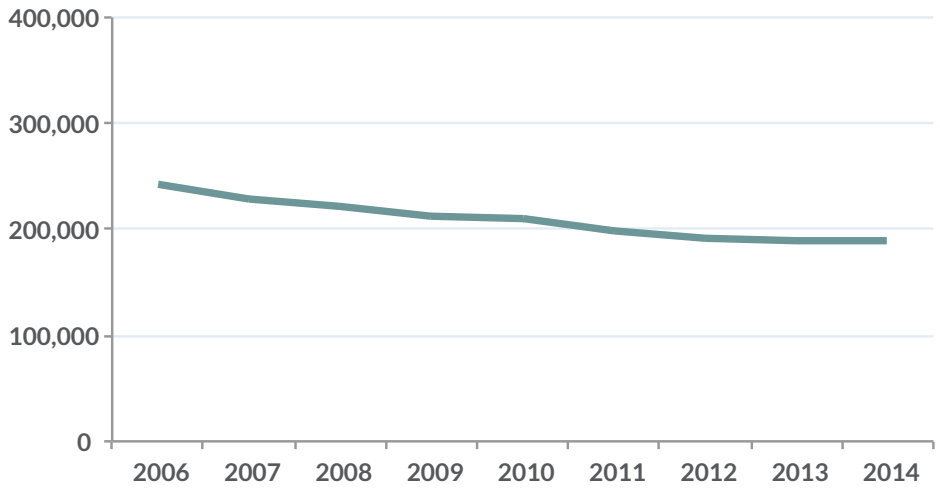
To date, policymakers and practitioners have had precious little research to anchor their thinking and inform their decision making. We could only locate three such studies, and their conclusions differed. In 2009, University of Chicago analysts studied the postclosure achievement of students who attended eighteen former district schools. They found no discernable impact of closure on achievement. But a more recent study of 246 school closures across Michigan showed positive impacts—but only if the closed school was low performing. Another study, carried out in 2012 on twenty-two closed schools in an unnamed midsized district, generally found negative effects from closure. Aside from these studies, we are unaware of other research related to the academic impacts of closure.

The high stakes associated with school closures, plus competing theories—both plausible—and the paucity of prior research, led us to explore this terrain ourselves. As it turns out, Fordham's home state of Ohio is fertile ground. Its large urban districts, referred to as the "Big Eight," have faced sharply declining enrollment due to both shrinking populations and an influx of charter schools. Figure A displays the combined enrollment trends

from 2006 to 2014 for those eight districts: Akron, Canton, Cincinnati, Cleveland, Columbus, Dayton, Toledo, and Youngstown. Confronting the loss of more than 50,000 pupils in just eight years, these districts have been forced to close scores of schools.

During the same period, dozens of charter schools have also closed for a variety of reasons, including financial difficulties and academic underperformance. In fact, Ohio's automatic-closure law, which is based on academic results, required twenty-three charters to close during the period of study.

**Figure A**: Enrollment trend in the Ohio Big Eight school districts




Our study examined the achievement trends of 22,722 students in grades 3-8 who attended one of the 198 urban schools in Ohio—both district and charter—that shut their doors between 2006 and 2012. These closures disproportionately affected low-income, low-achieving, and black students. To our knowledge, this is the first study to investigate separately the academic impact of closing charter schools.

Analyzing the impact of closures wasn't something we could do alone. Most critically, we needed longitudinal data that tracked individual student achievement over time on state exams. The Ohio Department of Education—understandably interested in these questions itself—generously cooperated by making available to us detailed (though not individually identifiable) information on public-school students. In order to unpack and analyze these data, we also needed experts, so we turned to Dr. Stéphane Lavertu of The Ohio State University and Dr. Deven Carlson of the University of Oklahoma, both of whom have published empirical research in the academic and policy-making arenas.

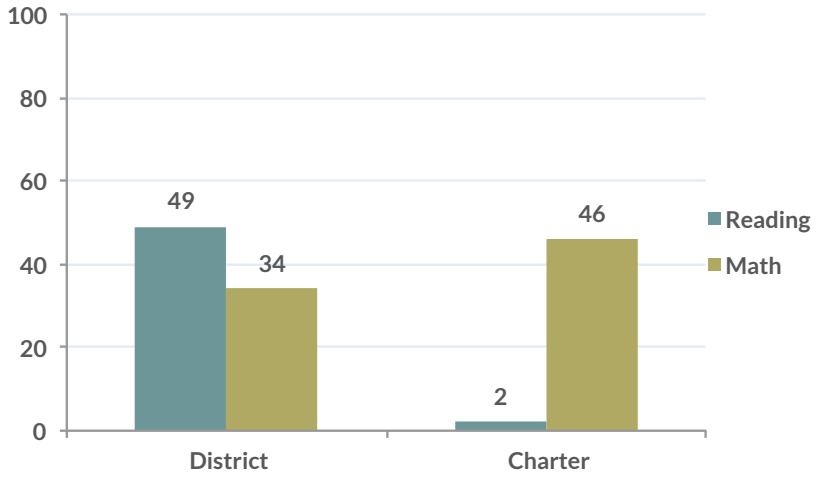
We asked them to investigate these questions: What are the characteristics of students displaced by school closure? In what types of schools do they enroll after their previous schools are closed? What is the impact of closure on student achievement? Does that impact depend on whether the closed schools are charter or district? Does that impact depend on whether students land in higher-quality schools than the one that closed?

In pursuit of answers, the analysts built rigorous statistical models that zeroed in on the academic impact of closure, while controlling for student demographics. Their methods compare the achievement trends of students displaced by closure, before and after the closure event, with the achievement trends of students who were untouched by closure. The researchers tracked the learning gains (or losses) of displaced students, relative to the comparison group, for one, two, and three years after the school closed. This report presents the

impact estimates as changes in standard deviation units. It also translates key results into equivalent days of learning gained or lost with respect to a 180-day school year.

The study's most important finding is that school closure has significant positive impacts on the achievement of displaced students. Figure B displays the cumulative learning-gain estimates of displaced students by the third year after their schools closed. For example, it shows that displaced students from district schools that closed in urban areas gained, on average, forty-nine extra days of learning in reading, relative to the comparison group—a meaningful increase in achievement. In math, district students gained thirty-four days of learning by their third year in the new school. In the charter sector, students displaced from a closed school also made substantial gains in math—forty-six additional days—but did not make statistically significant gains in reading.

**Figure B**: Impact of closure on displaced students, measured as cumulative student learning gains by the third year after closure




| Closed-school type | **Reading impact:** Cumulative days of learning gained or lost by third year after closure | **Math impact:** Cumulative days of learning gained or lost by third year after closure |
|---|---|---|
| **District** | +49 | +34 |
| **Charter** | +2 (not statistically significant) | +46 |

The analysts then focused on charter and district students who landed in higher-quality schools after closure. (We defined quality as a school's contributions to student growth—its "value added," in education parlance.) Across both sectors, the cumulative learning gains were even larger for the displaced students in this sample. Figure C displays the results: District students who landed in higher-quality schools gained an equivalent of sixty-nine extra days of learning in reading and sixty-three extra days of learning in math. When charter students moved to higher-quality schools, they gained an additional fifty-eight days of learning in reading and eighty-eight days of learning in math by the third year after their school closed.

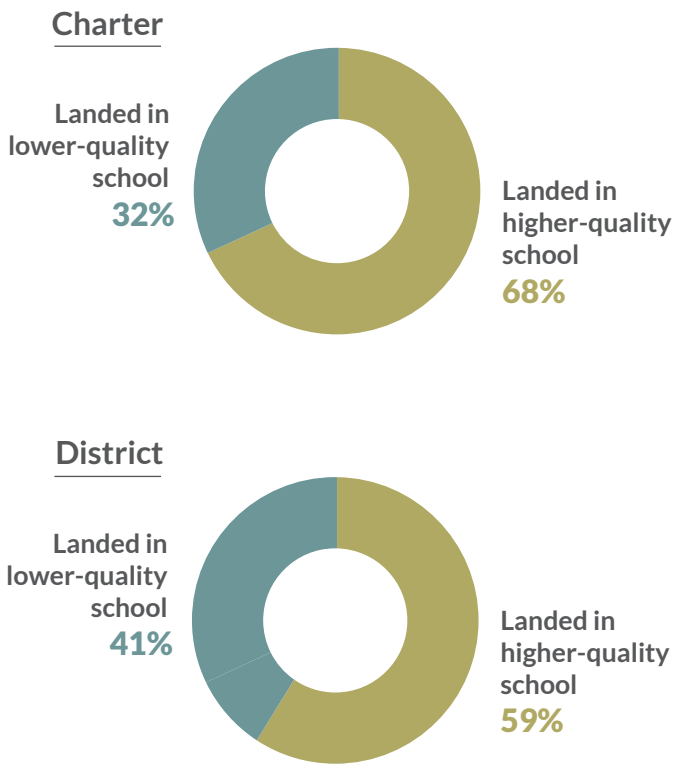
**Figure C**: Impact of closure on displaced students who landed in higher-quality schools, measured as cumulative learning gains by third year after closure


| Closed-school type | **Reading impact:** Cumulative days of learning gained or lost by third year after closure | **Math impact:** Cumulative days of learning gained or lost by third year after closure |
|---|---|---|
| **District** | +69 | +63 |
| **Charter** | +58 | +88 |

Although the figures above display the results for the third year after closure, the researchers also discovered positive (but smaller) impacts even in the first year after closure. This finding should challenge the common notion that all types of student mobility induce a short-term drop in achievement. In the case of school closures, displaced students, on average, did not suffer adverse academic effects immediately after switching schools.

The study also casts light on the types of schools in which students enroll after their previous schools close. It shows that the majority of displaced students—though not all—did, in fact, end up in higher-quality schools. As Figure D displays, 59 percent of displaced district students ended up in higher-quality schools immediately after closure, as did 68 percent of displaced charter pupils.

**Figure D**: Percentage of district and charter students displaced by closure who landed in higher- versus lower-quality schools




We also found interesting differences in the school-transfer patterns of displaced district versus charter students. Among children displaced by a closed district school, virtually all (93 percent) went to another district-run school, whereas about 50 percent of displaced charter students went to another charter school. This finding is consistent with a February 2015 report from the University of Chicago, which found that over 90 percent of students displaced after Chicago's mass closures remained in the district sector. It appears that districts retain most of their students after a school closure, while displaced charter students are more apt to switch sectors.

We must register one caveat that tempers the positive findings on closures: when students displaced by closures enter their new schools, it is possible that they negatively impact the learning of students who had previously attended the school. Think of this as a possible "side effect" of the closure "treatment." The study provides suggestive (but not conclusive) evidence that there might be minor side effects—the value-added scores of schools absorbing displaced students fall slightly. The net effect of closure remains an open empirical question.

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What are the implications for policy?

First, policymakers should embrace closures as one way to improve urban education. It's no secret that all sectors of the economy experience churn—the most productive and innovative ideas grow, while obsolete ways of doing things perish. In the transportation industry, for example, horses and mules have given way to cars and jet planes. The continuous process of destruction and rebirth generally drives progress forward even as it causes discomfort along the way. The education sector is no different: persistently unproductive schools, be they charter or district, should be removed to make room for schools that are already successful (or have high potential to succeed).

Second, policymakers should consider forswearing "turnaround" approaches when addressing the nation's worst schools. Instead, they should take a tougher line on closures. As Andy Smarick and others have argued, fixing a chronically low-performing school is often more wishful thinking than a promising strategy. Although successful school turnarounds are not impossible, Smarick is correct when he writes, "Today's fixation with fix-it efforts is misguided." This study adds hard evidence that shutting down low-quality schools could better serve students' interests than endless (and fruitless) efforts to improve them.

Finally, policymakers have to grapple with the mechanism of closing schools—whether they ought to shutter schools via top-down decisions or the marketplace. Interestingly, save for the automatic-closure law that was applied to a handful of charters, state policy did not directly shutter Ohio's urban schools. Rather, population loss and the proliferation of school choice forced districts to close unneeded schools, while most charters closed due to stagnant enrollment, financial difficulties, or a combination of both.

In other words, Ohio's experience with urban school closures was primarily market driven. Families voted with their feet, and weaker schools withered and eventually died. And it worked. Most students—though not all—landed in higher-quality schools and made gains after closure. Could Ohio have done even better for its students, had school authorities closed schools more aggressively? Perhaps. But the study does suggest that policymakers, district officials, and charter authorizers should not shy from closing bad schools (judiciously, of course, taking into consideration whether better options are available). Though fraught with controversy and political peril, shuttering bad schools might just be a saving grace for students who need the best education they can get.

# ACKNOWLEDGMENTS

Many people contributed their time and talents to this endeavor. We are deeply grateful for the excellent work of Stéphane Lavertu and Deven Carlson; their technical expertise and fidelity to the data shine through in this study. We are also appreciative of their responsiveness and great patience with feedback and suggestions during the drafting process. We offer many thanks to Martin West of Harvard University and Andrew McEachin of North Carolina State University for their valuable input as external reviewers. Special thanks to the staff at the Ohio Department of Education and the Ohio Education Research Center; this study would not have been possible without their help and support. From the Fordham team, we offer our gratitude to Chester E. Finn, Jr. and Michael J. Petrilli for their sage advice at several key stages of the project. Many thanks also to Fordham's Michelle Lerner and Jeff Murray for their work in production and dissemination. Pamela Tatz copyedited the document, and Andy Kittles created the design and layout of the final report. Generous support for this study was provided by the Walton Family Foundation, the William E. Simon Foundation, and our sister organization, the Thomas B. Fordham Foundation.

*Aaron Churchill, Ohio Research Director*

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# EXECUTIVE SUMMARY

Closing poor-performing schools is an increasingly prevalent strategy for improving public education. And the promise of school choice is based in part on the notion that the educational market will force poor-performing schools to close. However, policymakers know little about the academic impact of closure on the students it displaces. On one hand, there are concerns that forcing students to change schools may lead to substantial achievement losses, as research clearly indicates that student mobility has a negative impact on academic achievement. On the other hand, school closure may result in students switching to higher-quality schools, which could result in superior academic outcomes. Thus, it remains an open question whether school closure ultimately has a positive or negative effect on the academic outcomes of the students it displaces. Displaced students may or may not subsequently attend schools of sufficient quality to compensate for the negative impact of student mobility.

This study explores these issues by examining the closure of elementary and middle schools, primarily in Ohio's "Big Eight" urban areas—Akron, Canton, Cincinnati, Cleveland, Columbus, Dayton, Toledo, and Youngstown—between 2006 and 2012. Specifically, this study focuses on answering the following questions:

1. What are the characteristics of students whose schools closed?
2. Did students displaced by closure subsequently attend higher-quality schools, as indicated by student test scores?
3. How did school closure affect the academic achievement of displaced students?

Ohio's Big Eight urban areas are ideal for examining the impact of school closures. First, they have experienced substantial declines in population and a rapidly growing charter-school sector, both of which have contributed to declining enrollments and numerous school closures in the Big Eight school districts. The sample of students displaced by closure is therefore large enough to draw conclusions about the effects of closure. Second, students displaced by closure in these densely populated communities have multiple educational options, providing them with a better chance of subsequently attending a higher-quality school. Third, these urban areas contain large numbers of both district-run schools and independent charter schools, and a significant number of each type of school closed during the time period of our study. Consequently, examining closures in Ohio's Big Eight urban districts and among charter schools that operate primarily in or near these districts allows for separate yet comparable analyses of closure across sectors. Conducting separate analyses is important because the likelihood that low-performing schools are closed and that displaced students end up in higher-performing schools might differ significantly between the two sectors.

The results of the study indicate the following:

■ *Students displaced by closure were disproportionately black, economically disadvantaged, and low achieving.*

In both district-run schools and charter schools, over 73 percent of students in closing schools were black, but only 59 and 54 percent of students in nonclosing district-run and charter schools, respectively, were black. Similarly, 92 percent of students in closing district-run schools were identified as economically disadvantaged, compared to 85 percent of students in nonclosing schools. Students in charter schools in their last year of operation were also somewhat more likely to be identified as economically disadvantaged (74 percent) than students in nonclosing charter schools (72 percent). Finally, in district-run schools, the average student in a closing school scored at approximately the twentieth percentile on statewide Ohio math and reading tests, whereas the average student in a school that would remain open the following year scored at approximately the thirtieth percentile. The results are similar for students attending closing and nonclosing charter schools.

■ *On average, displaced students ended up in more effective schools populated by higher-achieving students.*

Among both district-run and charter schools, school closure resulted in a majority of students moving to academically superior schools. For example, 60 percent of students attending a district-run school in its last year of operation switched to a school composed of students with higher average reading scores than their closed school. Additionally, about 59 percent of students displaced from district-run schools subsequently attended higher-quality schools, as measured by the year-to-year achievement gains of their students. Similarly, 72 percent of students attending a charter school in its last year of operation subsequently attended a school with higher average reading achievement than their closed school, and 68 percent switched to higher-quality schools as measured by the achievement gains of their students. The results were similar when we replaced year-to-year achievement gains with a range of other achievement-based measures of school quality.

■ *Closing charter schools and schools in Ohio's Big Eight urban districts had a positive impact on the academic achievement of displaced students.*

The analysis compares the achievement gains of displaced students—that is, the change in their achievement before and after closure—to the achievement gains over the same time period of students not displaced by closure. Examining these differences in achievement growth helps us "control" for differences between students displaced by closure and those not displaced by closure. When the final year of attendance at the closed school is used as the baseline for the growth calculation, the results indicate that the closure of a district-run school increased the reading and math achievement of displaced students by 0.073 and 0.065 standard deviations, respectively—corresponding to forty-nine and thirty-four extra days of learning—by the third year after closure.

The achievement effects differ somewhat for students displaced by charter-school closure. Using the same baseline for the growth calculation, the analysis indicates that the closure of charter schools increased math achievement by about 0.087 standard deviations—corresponding to forty-six extra days of learning—by the third year after closure. In reading achievement, however, our analysis indicates that the initial positive impact of closure becomes negligible by the third year after closure.

For both school types, the achievement gains associated with closure were, unsurprisingly, significantly greater if a displaced student subsequently attended a school of higher quality than her closed school. Overall, these findings suggest that school-closure policies can yield academic benefits for displaced students so long as there are higher-quality schools nearby that students can attend.

# INTRODUCTION

The Chicago Board of Education generated significant controversy when it voted to permanently close forty-nine low-performing and underenrolled schools by the beginning of the 2013–14 school year. Several other cities have recently pursued such a strategy, including Cleveland, Philadelphia, and Detroit. Proposals to close underenrolled schools are typically motivated by a desire to free up resources that can be reallocated in order to increase the overall educational quality of school districts, as well as by the belief that closing underperforming schools will remove students from bad academic contexts and enable them to realize better outcomes. Indeed, the school-choice movement is driven in part by the notion that the educational market will lead to the closure of poor-performing schools.

Significant improvements in student achievement seem likely if school closure plays out as theorized. There are, however, potential problems underlying this theory. A key assumption is that students whose schools close will switch to schools of higher quality. However, it is very possible that students displaced by closure will move to schools of similar, or even inferior, quality. Additionally, a central feature of school closure that could undermine its effectiveness is that it induces student mobility. A number of studies (see, e.g., Hanushek, Kain, and Rivkin 2004; Booker et al. 2007; Xu, Hannaway, and D'Souza 2009) demonstrate that student mobility has a negative effect on student achievement. Indeed, most of the few existing studies that rigorously examine the impact of school closure have found short-term negative effects (presumably from student mobility) and no discernable long-term effects on student achievement (see, e.g., Enberg et al. 2012; de la Torre and Gwynne 2009; Young et al. 2009).

One study, however, indicates that school closure can have a positive impact on the achievement of displaced students. In his study of school closures in the state of Michigan, Brummet (2014) found that closure had a positive impact on students whose closed schools were relatively low performing. In other words, closure can have a net positive impact if the difference in quality between closing and nonclosing schools is sufficiently great that it compensates for the educational disruption associated with student mobility. On the other hand, Brummet also finds that students attending schools that received teachers and students displaced by closure experienced a decline in their academic achievement, which moderated the overall achievement gains districts realized from closing poor-performing schools.

This report examines the closure of elementary and middle schools primarily located in Ohio's "Big Eight" urban areas—Akron, Canton, Cincinnati, Cleveland, Columbus, Dayton, Toledo, and Youngstown—between 2006 and 2012. In particular, it examines separately the impact of closing 120 schools run by the eight urban districts and the impact of closing seventy-eight charter schools, most of which are independent and operate in or near these districts.[1] Ohio is an ideal place to study school closure because its demographic changes have led to declining enrollments and, consequently, a large number of closures. Additionally, it has a large number of urban areas in comparison to other Midwestern states facing declining enrollments, enabling us to examine the impact of closures where they are most likely to be effective: densely populated areas with many school options in close proximity to one another. Finally, the large sample of closed schools in these urban areas enables us to examine separately the impact of closure among district-run and charter schools. This disaggregated analysis is important because of differences across these sectors, such as the reasons motivating school closure and the process by which displaced students are assigned to or select new schools.

The analysis employs student-level data that spans the 2005–06 through 2012–13 school years, which we obtained from the Ohio Department of Education. Our focus is on the impact of closure on the students it displaces. In particular, the analysis summarizes the characteristics of displaced students, compares the educational quality of their closed schools and the schools to which they moved immediately after closure, and estimates the impact of closure on the academic achievement of displaced students. We based the analysis of school quality and the impact of closure on our analysis of student test scores in math and reading. Specifically, to estimate the impact of closure on displaced students, we employed statistical models that compare the achievement gains of displaced students—that is, the change in their achievement before and after closure—to

the achievement gains over the same time period of students not displaced by closure. We calculated these achievement gains by comparing a student's achievement prior to school closure to her achievement one, two, and three years after closure. Focusing on achievement gains essentially helps us "control" for differences in achievement levels between students that closure did and did not displace.

The report is organized as follows. First, it provides some brief background on the Ohio schools on which our analysis focuses. Second, it presents a descriptive analysis of the students displaced by closure. Third, it examines the differences in quality between students' closing schools and the schools that they attended immediately following closure. Fourth, it presents estimates of the impact of school closure on the academic achievement of students from the closing schools. Finally, the report examines additional issues in sidebars, such as the impact of closure on the students whose schools absorbed displaced students.

## SCHOOL CLOSURES IN OHIO

As is the case in other Midwestern states (see, e.g., Brummet 2014), the enrollment declines that prompt district-school closures are due in part to general population changes in urban areas. For example, according to the U.S. Census, Cleveland's population was 478,005 in 2000 but plummeted to 396,815 by 2010; Dayton's population was 166,303 in 2000 but fell to 141,527 by 2010. What's more, every one of Ohio's Big Eight urban districts has experienced significant declines in enrollment virtually every year over the past few decades. In 2000 the Big Eight enrolled a total of 299,311 students, but in 2014 they enrolled only 188,448 students. School closure has also been particularly prevalent in Ohio's Big Eight districts due to the rapid proliferation of charter schools and, to a lesser extent, the introduction of multiple voucher programs. From 2000 to 2014, Ohio's charter-school sector—which operates primarily in the Big Eight urban areas—expanded from approximately fifty schools to 400 schools. So, in addition to population loss, school-choice programs have also contributed to district enrollment declines—and the need for school closings.

Enrollment declines and an eroding tax base have led Ohio's largest districts to close schools, but these districts consider a number of factors when deciding which schools to close. School quality, as measured by the academic achievement of a school's students, has become a particularly salient concern among district leaders. For example, in 2007 the state gave the mayor of Cleveland the authority to implement a plan to shut down "failing" schools (those whose students are low achieving) in order to invest in high-achieving schools. However, other factors—such as the condition of school buildings, the proximity of alternative educational options, and local political considerations—also play important roles. Thus, although school quality as measured by student performance has become a very important factor, it is often one of many.

Ohio's charter schools, which are usually independent of districts, also close because of fiscal stress due in part to low enrollment. However, state law makes academic performance an especially important factor in charter-school closure. In 2006, Ohio enacted a law requiring charter school students to attain minimum levels of academic achievement or growth. In 2008, the state began to require schools that failed to meet these minimum requirements for multiple years to shut down by the end of the following academic year. During the period of this study, the state required twenty-three schools to close for failing to meet those minimum performance standards (see Carlson and Lavertu 2015). Finally, in addition to low enrollment and low student performance, some Ohio charter schools have been forced to shut down because of mismanagement or because their sponsors have been dissatisfied with school performance along a number of dimensions.

The process by which a displaced student selects a new school is likely to be quite different depending on whether the closing school is a district-run or charter school. A student attending a Big Eight district school can choose to attend any other district school or charter school, and many students qualify for a state voucher to attend a private school. Most of these displaced students, however, end up attending the schools the district assigns them based on their address. On the other hand, a student displaced from a shuttered charter school is far more likely to exercise choice. For example, we found that students displaced due to the closure of a charter

school had roughly a 50–50 chance of switching to another charter school, whereas only a small fraction of students in district-run schools (6.7 percent) switched to a charter school.

# ANALYSES OF CLOSURES

### Analysis 1: Comparing Students in Closing and Nonclosing Schools

Using student-level data from the 2005–06 through 2011–12 school years,[2] the descriptive analysis presented in table 1 compares the characteristics of students displaced by closure—that is, students attending a school in its last year of operation—to the characteristics of students whose school is not in its last year of operation.[3] The first two columns of table 1 compare characteristics of students from closing and nonclosing schools operated by the Big Eight districts—Akron, Canton, Cincinnati, Cleveland, Columbus, Dayton, Toledo, and Youngstown. The third and fourth columns present results analogous to those in columns one and two, respectively, but are limited to students enrolled in charter schools.

**Table 1. Characteristics of students in closing and nonclosing schools, 2005–06 to 2011–12**

| | Big Eight district-run schools | | Charter schools | |
|---|---|---|---|---|
| | Schools in final year | Schools not in final year | Schools in final year | Schools not in final year |
| **Race/ethnicity (%)** | | | | |
| Asian | 0.8* | 1.2 | 0.4* | 0.9 |
| Black | 73.1* | 58.7 | 73.1* | 53.7 |
| Hispanic | 4.1* | 6.4 | 2.8* | 4.8 |
| Multirace | 3.7* | 4.9 | 4.5 | 5.0 |
| White | 18.3* | 28.8 | 19.2* | 35.6 |
| **Sex (%)** | | | | |
| Female | 48.3 | 49.6 | 51.8 | 50.1 |
| **Economic disadvantage (%)** | | | | |
| Economically disadvantaged | 92.1* | 85.3 | 73.9* | 72.3 |
| **Disability status (%)** | | | | |
| Disabled | 19.4* | 17.0 | 15.1 | 15.3 |
| **Average achievement** | | | | |
| Reading | −0.844* | −0.541 | −0.751* | −0.461 |
| Math | −0.847* | −0.569 | −0.864* | −0.566 |
| ***Number of students*** | 17,485 | 656,474 | 5,237 | 239,188 |

**Note:** The table compares the characteristics of students who are enrolled in a school in its last year of operation (a closing school) to students who are enrolled in a school that is not in its final year of operation. Stars indicate that the difference between closing- and nonclosing-school students is statistically significant at $p<0.01$ for a two-tailed test.

The table indicates that from 2005–06 through 2011–12, approximately 17,000 students were enrolled in a district school in its final year of operation and approximately 5,200 attended a charter school in its final year of operation. Thus, in an average year, slightly over 2 percent of students attend a school in its final year of operation (which compares to about 1 percent throughout the rest of the state). The table also reveals that students who attended a school in its final year of operation during the study period were disproportionately black and economically disadvantaged.[4] Over 73 percent of students in closing schools were black, but only 59 and 54 percent of students in nonclosing Big Eight and charter schools, respectively, were black. Similarly, 92 percent of students in a closing district-run school were identified as economically disadvantaged, compared to 85 percent of students in a nonclosing school. Students attending a charter school in its last year of operation were also somewhat more likely to be identified as economically disadvantaged (74 percent) than students in a nonclosing charter school (72 percent).

Finally, table 1 reveals that students in a closing school are low achieving. As discussed in sidebar 1, we report the achievement test scores as *z*-scores, which indicate the distance from the average student test score in Ohio in terms of standard deviation units. The table indicates that the average student in these urban areas has significantly lower test scores than the average student in Ohio. Additionally, the results indicate that, within this sample of low-achieving students, students attending a school in its final year of operation score about 0.3 standard deviations lower than students attending a school that will remain open the following year. To provide a substantive interpretation of the magnitude of these achievement differences, in district-run schools, the average student in a closing school scores at about the twentieth percentile on statewide Ohio math and reading tests, whereas the average student in a school that will remain open the following year scores at about the thirtieth percentile. The results are similar for students attending a charter school.

**Sidebar 1: Student Achievement Comparisons Using *Z*-scores**

Average student achievement (table 1) and differences or changes in student achievement (tables 2–7) are calculated based on standardized units called "*z*-scores." Specifically, in this analysis, we standardize test scores so that students with the mean test score—as compared to the test scores of all other students taking the same test in the same year and grade—have a *z*-score of 0, while students who perform better than average have a positive value and those performing below average have a negative value. Thus, if students in a particular type of school perform worse than the average student in the same grade in that school year, then the average of their *z*-scores will take on negative values. For example, table 1 indicates that, on average, a student in a nonclosing Big Eight district school scores worse than a typical Ohio student on math and reading exams and that the deficit is worse among students in closing Big Eight schools.

Understanding the magnitude of differences between average *z*-scores—or, as in tables 2–7, differences or changes in *z*-scores—requires some understanding of the scale. *Z*-scores indicate distance from the mean test score (the average test score across the state in the same subject, grade, and year) in standard deviation units, based on a normal (or "bell-shaped") distribution. For instance, table 1 indicates that, on average, students in Big Eight districts whose school is in its last year of operation score approximately 0.85 standard deviations below the state average for students taking the same test in the same grade and year. If one looks up the area under the normal curve to the right of −0.85, one finds that 80.23 percent of students in Ohio perform better on the exam than the average student attending a closing school run by one of the Big Eight districts.

The substantive significance of *z*-score values is not intuitive, as it requires translation from the normal curve. That is why we sometimes convert this metric to "days of learning," in order to characterize the estimated benefits of closure and percentile ranks when discussing absolute levels of student achievement.

### Analysis 2: Comparing the Quality of Closed Schools and Schools Subsequently Attended

Table 2 compares the quality of displaced students' closed schools and the schools that these students attended immediately after closure. Importantly, the measure of school quality for both the closed schools and the new schools are drawn from the final year of operation of the students' closed schools. The measure of quality that is the focus of the first four columns is the average reading achievement of the schools' students. This is a weak measure of school quality because it does not isolate schools' contributions to student achievement, but it is a widely reported measure of quality and one that parents who want their children to have high-performing peers may find desirable. The comparison of school quality in the last four columns, on the other hand, is based on an estimate of the average yearly achievement gains of schools' students, which is widely considered to be a superior measure of school quality.[5] Once again, the table presents achievement levels and gains in standard deviation units.

**Table 2. Comparing quality of displaced students' closing and new schools**

| Closure type | Average reading achievement | | | | School-quality estimate based on growth | | | |
|---|---|---|---|---|---|---|---|---|
| | Closed school | New school | Change | Percent in better school | Closed school | New school | Change | Percent in better school |
| **Big Eight district** | −1.47 | −1.21 | +0.26* | 59.6 | −0.96 | −0.70 | +0.26* | 59.0 |
| **Charter** | −1.18 | −0.77 | +0.41* | 71.5 | −1.17 | −0.38 | +0.79* | 67.8 |

**Note:** The table presents quality estimates of displaced students' closing schools and the schools to which these students switched immediately after closure. The quality estimates for the closing and new schools are both taken from the final year of operation of the corresponding closing schools. Stars indicate that the improvement in school quality is statistically significant at *$p<0.01$ for a two-tailed test.

Table 2 indicates that the mean achievement level in the average closing district school is 1.47 standard deviations lower than the mean achievement level in the average school statewide. The average closing charter school has a mean achievement level that is 1.18 standard deviations lower than the statewide average. In other words, these closing schools are composed of very low-achieving students. The schools to which displaced students switched were also very low achieving—1.21 and 0.77 standard deviations lower than the statewide average for district and charter schools, respectively. However, it is clear that, on average, displaced students ended up in schools with student bodies that are higher achieving than the schools they left. The third column reveals that the mean differences in quality are substantively and statistically significant. And the fourth column reveals that, according to this metric of quality, 71.5 percent of displaced charter-school students and 59.6 percent of displaced district-school students ended up in better schools.

Interestingly, as the last four columns reveal, the results are similar if one measures quality based on student achievement gains. The percentage of students who ended up in higher-quality schools is nearly identical, though the magnitude of the improvement appears to be higher for charter schools. It is worth noting that the results are similar no matter what achievement-based measure of quality we consider. Thus, it is clear that if one measures quality based on academic achievement (absolute levels or gains), the average student displaced by closure ends up in a far better school.

**Sidebar 2: Measuring School Quality**

Recognizing that no perfect measure of quality exists, we compared displaced students' closed schools to the schools in which they enrolled in the following year using multiple measures. First, we compared school quality based on the average achievement of a school's students. Average achievement levels are often considered weak indicators of school quality because they reflect the population of students that a school serves at least as much as they represent the quality of the school. However, the measure is commonly used in education-policy debates and, as long as its flaws are recognized, it can serve as a useful basis of comparison for the value-added measures.

Second, we measured school quality based on the year-to-year achievement growth of their students, a measurement that is more likely to capture school quality. As we discuss in the appendix, we compared quality using multiple measures of growth. These measures yielded similar results, so we report the results using the measure available for all years of our study and that maximized the number of schools we could include. This measure accounts for students' prior achievement and demographic characteristics.

It is important to note that we standardized the quality measures so that they are on the same scale and are therefore directly comparable in terms of magnitude. Specifically, they are all *z*-scores that indicate the number of standard deviations from the average school (as opposed to the average student, as in table 1) in terms of estimated quality across the state. Please consult sidebar 1 for an in-depth discussion of *z*-scores.

### Analysis 3: Calculating the Impact of School Closure on Academic Achievement

The results in the previous sections reveal that closed schools disproportionately served low-achieving, economically disadvantaged, and minority students. Additionally, they reveal that among both Ohio's Big Eight urban districts and charter schools, which primarily operate in in these large urban areas, school closure resulted in students moving to schools that were, on average, academically superior. Thus, the descriptive analysis suggests that school closures have the potential to improve student achievement in these urban environments. We now turn to our analysis of the impact of school closure on displaced students' achievement outcomes.

The analysis entails comparing the achievement gains of displaced students—that is, the change in their achievement before and after closure—to the achievement gains over the same time period of students not displaced by closure.[6] We calculated these achievement gains by comparing a student's achievement prior to school closure to her achievement one, two, and three years after closure. Essentially, focusing on achievement gains helps us "control" for differences in achievement levels between students that closure did and did not displace. Additionally, we further accounted for differences between displaced and nondisplaced students by controlling for student demographic characteristics. We describe the statistical model in detail in the appendix.[7]

One must choose an achievement baseline in order to calculate any achievement changes that stem from closure. It is not clear, however, what that baseline should be. One could argue that achievement in the final year of a school's operation—the year of closure—should be the baseline. However, if the impending closure of the school is announced prior to or during that year, student achievement might dip during that final year as a result of the announcement. For example, students and teachers might not exert as much effort if they know that the school soon will close. If this effect results in a temporary dip in student achievement, then

using the final year of operation as a baseline could yield inflated estimates of closure-induced gains because displaced students may naturally rebound to their prior achievement growth rates. If that is the case, then it may be better to set a student's achievement baseline using test scores from one or two years prior to her school's final year of operation. On the other hand, if the decline in quality is part of a long-term trend and is not a temporary dip, then using prior years as a baseline might lead one to underestimate achievement gains associated with closure. To address this possibility, we calculated the achievement effects of closure using two different baselines: (1) the schools' final year of operation and (2) two years prior to their final year of operation. Following Brummet (2014), we treat the estimates calculated from the final year of operation as an upper bound on the effects of closure and treat estimates calculated from the baseline of two years prior as a lower bound.

The analysis described above estimates the effect of closure on the achievement of all displaced students, regardless of the type or quality of the schools they subsequently attended. To get a sense of the impact of closure on students who subsequently attended a better school, we performed a second analysis, in which we restricted our sample to displaced students who ended up attending a higher-quality school than the one that closed. Specifically, we performed an analysis based on a sample in which displaced students moved to superior schools, according to our quality measure of the average learning gains made by students in the school.

Overall, the results indicate that closure generally had positive effects on the reading and math achievement of displaced students. These results hold for students who were displaced by the closure of a charter school and those who were displaced by the closure of a school run by one of the Big Eight school districts. The results also indicate that the learning gains induced by closure generally begin immediately after closure and that they increase over time. In other words, the results are often consistent with the notion that the benefits of closure increase as students acclimate to their new schools. Unsurprisingly, the estimated effects were even more positive for students who transferred to a school of higher quality than their closed school.[8] We review these results in more detail below.

**Sidebar 3: Does the Impact of Closure Depend on Whether Displaced Students Subsequently Attend a Charter School?**

Students enrolled in a school that is closing may choose to change sectors. For example, students attending a closing district school may subsequently choose to attend charter schools, and vice versa. Such changes are particularly likely in the large urban areas where Ohio's charter schools are located. We conducted a supplementary analysis to examine such movement and to determine whether one type of movement is particularly beneficial to students. The analysis indicates that there is approximately a 50 percent chance that students attending a closing charter school will switch to a district-run school as opposed to another charter school. On the other hand, only about 7 percent of students attending closing Big Eight district-run schools switch to a charter school or any other school not operated by their district.

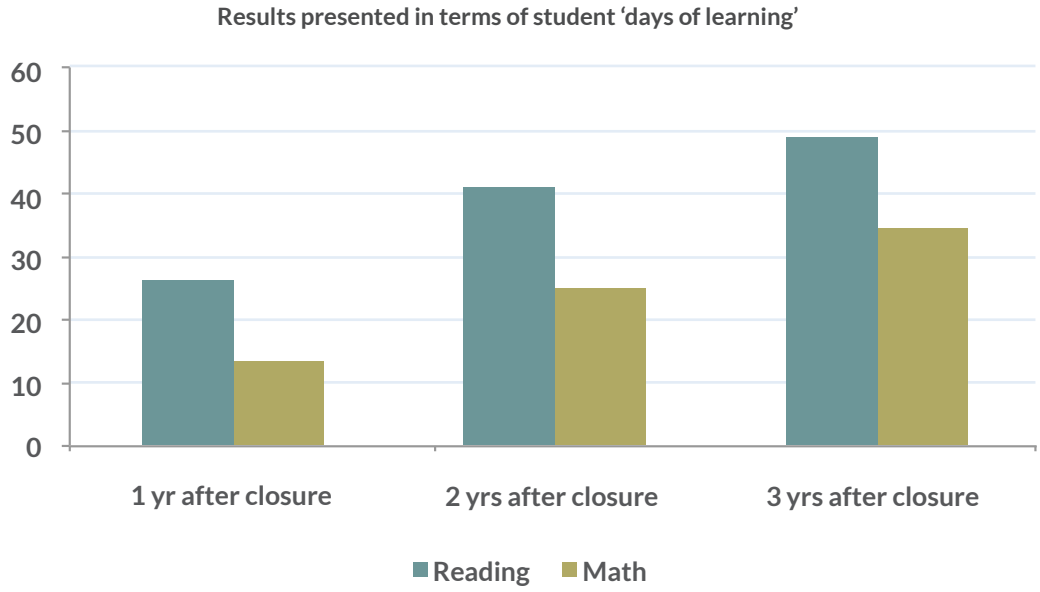
Do the estimates of closure's impact vary depending on the type of school to which students switch? Our supplementary analysis indicates that it does not make a dramatic difference. Although the estimates of the effect of closure are often larger for students who subsequently transferred to a charter school, as opposed to another district-run school, the differences between the two sets of estimates are generally not statistically significant. That said, the results suggest that the presence of charter schools may have improved the educational options for students in closing schools in large urban areas. As the quality of charter schools in Ohio improves due to the mandatory closure of poor-performing charter schools, this should increasingly be the case.

*A Quick Look in Terms of 'Days of Learning'*

Figures 1 and 2 present the estimated effects of closure, for which we calculate each student's achievement gains using the final year of the closing school's operation as the baseline. To provide some intuition for the magnitude of these effects, we present the estimated effects in terms of a relatively intuitive "days of learning" metric, as opposed to standard deviation units. Based on estimates of how much the average student learns at each grade level by Hill et al. (2008), we translated our effect sizes in reading and math into days of learning by assuming that a year's worth of learning takes place over the course of 180 days.[9] Because the results below indicate that closure has a positive impact on the achievement of displaced students, one might think of the metric as indicating the number of additional days of learning a displaced student would have needed in order to achieve at the same level if she were still attending her closed school.[10]

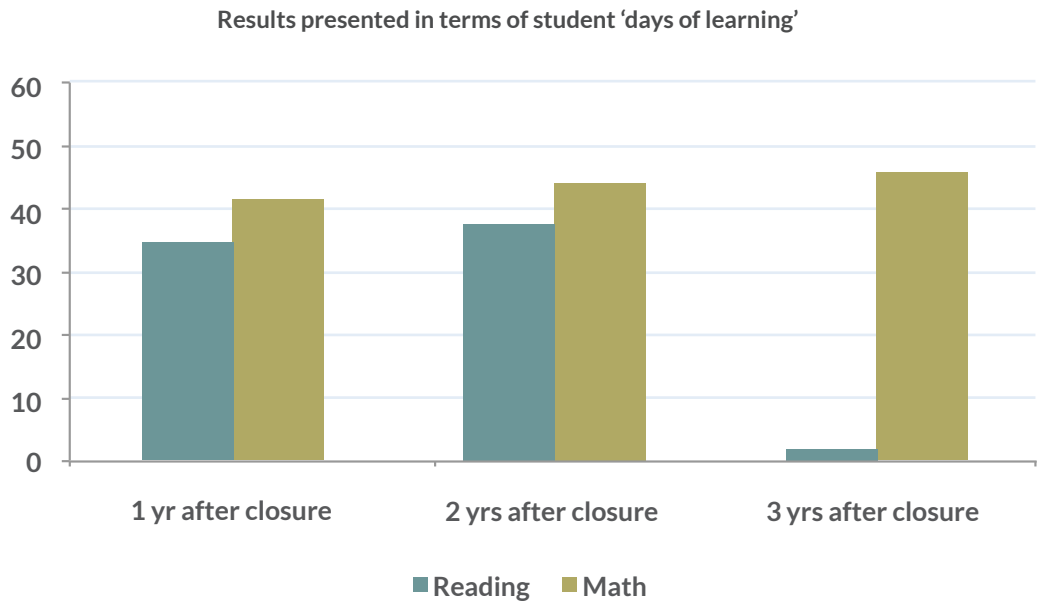
Figure 1, which illustrates the impact of closing district-run schools, indicates that the learning gains of displaced students outpaced those of nondisplaced students immediately following closure. In other words, the results suggest both that these students achieved at a higher level than they would have had they not been displaced by closure and that the benefits of closure increased as time went on. By the third year after closure, the achievement of displaced students was approximately 0.073 standard deviations higher in reading and 0.065 standard deviations higher in math—corresponding to about forty-nine and thirty-four more days of learning in reading and math, respectively.

**Figure 1. Impact of closing Big Eight district schools on the achievement of displaced students**




**Note:** The figure compares the additional achievement growth of Big Eight students displaced by closure, relative to Big Eight students not displaced by closure. The figure uses as a baseline student achievement during the last year of a closing school's operation. It presents effect sizes according to a "days of learning" metric. All results in the figure are statistically significant at the $p<0.01$ level for a two-tailed test.

**Figure 2. Impact of closing charter schools on the achievement of displaced students**




**Note:** The figure compares the additional achievement growth of charter students displaced by closure, relative to charter students not displaced by closure. The figure uses as a baseline student achievement during the last year of a closing school's operation. It presents effect sizes according to a "days of learning" metric. All results except the third-year reading estimate are statistically significant at the $p<0.01$ level for a two-tailed test.

Figure 2 presents the same set of estimates for the impact of closing charter schools. The results for math achievement are similar. By the third year after closure, the achievement of displaced students was approximately 0.087 standard deviations higher in math—corresponding to approximately forty-six more days of learning. However, by the third year, there is no significant effect in reading.

*Using a Different Baseline to Calculate the Effects of Closure*

We now allow for the possibility that the appropriate baseline for student growth calculations is one or two years before the final year of a closed school's operation. The full results of our models indicate that allowing for such a possibility is particularly important for district-run schools, as we observe a dip in math and, to a lesser extent, reading in the three years leading up to closure.[11] In other words, if the appropriate baseline is two years prior to the final year of a school's operation—perhaps because the dip in achievement is temporary and due to the announcement of a closure decision—then the estimates we presented above may be inflated. We do not know for sure what the appropriate baseline is, but we follow Brummett (2014) and treat the estimates calculated from the final year of operation as an upper bound on the effects of closure and estimates calculated from the baseline of two years prior to closure as a lower bound on those effects.

| Table 3. Range of impacts of Big Eight closures on the achievement of displaced students | | | | |
|---|---|---|---|---|
| | **Reading** | | **Math** | |
| | Growth baseline = Year of closure | Growth baseline = Two years prior | Growth baseline = Year of closure | Growth baseline = Two years prior |
| **First year after closure** | 0.039* | 0.027* | 0.025* | 0.001 |
| **Second year after closure** | 0.061* | 0.049* | 0.056* | 0.032* |
| **Third year after closure** | 0.073* | 0.060* | 0.065* | 0.041* |

**Note:** The table presents a range for the estimated impact of closure on the achievement growth of displaced students, depending on whether we use student achievement in the final year of a closing school's operation as the baseline or a student's achievement two years prior to closure as the baseline. The table presents the results in standard deviation units. Stars indicate that the estimated impact is statistically significant at *p<0.01 for a two-tailed test.

| Table 4. Range of impacts of charter closures on the achievement of displaced students | | | | |
|---|---|---|---|---|
| | **Reading** | | **Math** | |
| | Growth baseline = Year of closure | Growth baseline = Two years prior | Growth baseline = Year of closure | Growth baseline = Two years prior |
| **First year after closure** | 0.052* | 0.057* | 0.079* | 0.086* |
| **Second year after closure** | 0.056* | 0.062* | 0.084* | 0.091* |
| **Third year after closure** | 0.003 | 0.009 | 0.087* | 0.094* |

**Note:** The table presents a range for the estimated impact of closure on the achievement growth of displaced students, depending on whether we use student achievement in the final year of a closing school's operation as the baseline or a student's achievement two years prior to closure as the baseline. The table presents the results in standard deviation units. Stars indicate that the estimated impact is statistically significant at *p<0.01 for a two-tailed test.

Table 3, which presents the results in standard deviation units, indicates that the choice of the most conservative baseline leads us to lower our third-year estimates for district-run schools from 0.073 to 0.060 in reading (i.e., from forty-nine to forty days of learning) and from 0.065 to 0.041 in math (i.e., from thirty-four to twenty-one days of learning). Table 4 reveals, however, that the more conservative estimates are actually slightly higher for charter schools. In other words, there was a slight upward trend in the achievement of students in the years leading up to charter-school closure. Thus, if the appropriate baseline is two years prior to the final year of operation, then displaced students experienced 0.094 standard deviations of gains in math by the third year after closure, which corresponds to forty-nine extra days of learning. Overall, however, the results are quite similar no matter which baseline one uses.

*Impact on Students Who Ended Up in Better Schools*

It may be more appropriate to gauge the potential of school closure as a strategy for improving the achievement of displaced students by focusing the analysis on displaced students who ultimately ended up in schools of higher quality. After all, closure policy could theoretically be designed to ensure that students end up in better schools. Tables 5 and 6 present the results of models estimated using only the sample of displaced students who, subsequent to the closure of their school, attended a superior school. Specifically, we used the growth-based measure of school quality to identify this subsample of displaced students.

| Table 5. Range of impacts when displaced Big Eight students end up in higher-quality schools | | | | |
|---|---|---|---|---|
| | **Reading** | | **Math** | |
| | Growth baseline = Year of closure | Growth baseline = Two years prior | Growth baseline = Year of closure | Growth baseline = Two years prior |
| **First year after closure** | 0.059* | 0.041* | 0.054* | 0.000 |
| **Second year after closure** | 0.084* | 0.066* | 0.105* | 0.050* |
| **Third year after closure** | 0.104* | 0.087* | 0.120* | 0.066* |

**Note:** The table presents a range for the estimated impact of closure on the achievement growth of displaced students, depending on whether we use student achievement in the final year of a closing school's operation as the baseline or a student's achievement two years prior to closure as the baseline. "Higher-quality schools" are those with higher student achievement growth, holding student demographic characteristics constant. Stars indicate that the estimated impact is statistically significant at *p<0.01 for a two-tailed test.

| Table 6. Range of impacts when displaced charter students end up in higher-quality schools | | | | |
|---|---|---|---|---|
| | **Reading** | | **Math** | |
| | Growth baseline = Year of closure | Growth baseline = Two years prior | Growth baseline = Year of closure | Growth baseline = Two years prior |
| **First year after closure** | 0.088* | 0.082* | 0.144* | 0.130* |
| **Second year after closure** | 0.121* | 0.115* | 0.174* | 0.160* |
| **Third year after closure** | 0.087* | 0.081* | 0.168* | 0.155* |

**Note:** The table presents a range for the estimated impact of closure on the achievement growth of displaced students, depending on whether we use student achievement in the final year of a closing school's operation as the baseline or a student's achievement two years prior to closure as the baseline. "Higher-quality schools" are those with higher student achievement growth, holding student demographic characteristics constant. Stars indicate that the estimated impact is statistically significant at *p<0.01 for a two-tailed test.

Tables 5 and 6 reveal that the estimated impact of closure on the achievement of displaced students increases significantly for students who subsequently attended a higher-quality school. This is the case regardless of whether the closed school is district run (see table 5) or a charter school (see table 6). The conservative estimates indicate that by the third year after closure, students achieved as if they had received an additional thirty-five days of learning in math (0.066 standard deviations) and fifty-eight days of learning in reading (0.087 standard deviations). The results are even larger for the closure of charter schools. There are now substantial effects in reading three years after closure (between 0.081 and 0.087 standard deviations), and the conservative estimate in math is that the achievement of displaced students was 0.155 standard deviations greater (an extra eighty-one days of learning) than the achievement of nondisplaced students.

| Table 7. Trends in the quality of displaced students' new schools | | | | | | |
|---|---|---|---|---|---|---|
| | **Average reading achievement** | | | **School-quality estimate based on growth** | | |
| | Year of closure | Year after closure | Change | Year of closure | Year after closure | Change |
| **Big Eight district** | −1.21 | −1.23 | −0.02 | −0.71 | −0.81 | −0.10* |
| **Charter** | −0.77 | −0.76 | 0.01 | −0.38 | −0.56 | −0.18* |

**Note:** The table compares the quality estimates of displaced students' new schools based on achievement in the year of closure (before displaced students attended them) and the year after closure (when displaced students began attending them). Stars indicate that the improvement in school quality is statistically significant at *p<0.01 for a two-tailed test.

**Sidebar 4: Do Displaced Students Have a Negative Impact on the Schools To Which They Switch?**

In order for school closure to enhance a district's overall student achievement, one must consider the impact of closure on not only displaced students but also the achievement of students in schools absorbing students and staff from closed schools. Brummet (2014), for example, found that the academic achievement of students in absorbing schools declined—a modest impact that affected many students and that could potentially negate the gains realized by displaced students. On the other hand, Engberg et al. (2012) found no such effect. To examine this possibility, we compare our estimates of school quality in the year before and the year after closure—that is, before and after schools have absorbed students and staff from closing schools.

Table 7 presents those results using two quality measures: one based on average achievement levels and one based on student achievement gains. It is important to note that displaced students are the unit of analysis. For each displaced student, we compared the quality of her new school before and after she began attending it. In other words, the quality comparisons are weighted based on the number of students a school received. The results of this calculation are clear. Displaced students seem to have no effect on the overall achievement levels of receiving schools. However, there is a significant negative effect when one focuses on the superior, growth-based measure of school quality. In particular, the quality of the schools that take in displaced students declines by 0.10 and 0.18 standard deviations—for district and charter schools, respectively—before and after absorbing students and staff from closing schools.

The fact that absorbing more displaced students disturbs existing schools is understandable. The key question is whether this negative impact is temporary and, if it is not, whether any persistent negative effects outweigh the benefits to displaced students and to future students who would have attended the closed school. If the negative effects persist and if these persistent effects are indeed more pronounced for those schools that absorb more displaced students, then closure policy should probably consider carefully how to disperse students and staff who work at the closing school (and whether to retain said staff). Our study found significant dispersion of students and teachers. Obviously, such dispersion may not be possible outside of these densely populated urban areas.

# CONCLUSION

To recap, the results show that school closure in Ohio's Big Eight urban districts—and among the charter schools that operate primarily in or near these districts—displaced relatively poor, minority, and low-achieving students. It also reveals that, more often than not, these displaced students ended up in better schools, as measured by the academic achievement of the students in those schools. Finally, it reveals that, on average, students displaced by the closure of district and charter schools realized significant academic gains. In most cases, these gains began immediately after closure and increased in the second and third years. Overall, across Ohio's large urban areas, it appears that displaced students benefited from school closure.

The analysis also reveals, however, that the achievement gains from closure could be increased if the schools available for displaced students were all of higher quality than their closed schools. Displaced students who subsequently attended higher-performing schools experienced larger gains than those who did not. Thus, the analysis reveals that if policymakers are concerned about increasing the academic achievement of children who attend low-performing schools, then closing those schools is a promising strategy. This conclusion is in stark contrast to claims that closing low-performing urban schools negatively affects those schools' current students. Everyone agrees that shutting down low-performing schools is beneficial to those students who have not yet entered them. However, we show that this is also the case for the students currently attending them.

These results also speak to the value of shutting down poor-performing charter schools. A number of states have introduced laws that require the closure of charter schools whose students fail to achieve at minimum levels. This analysis suggests that this is a promising approach—particularly if policymakers use a growth or value-added metric to make those determinations, as is the case in Ohio. Indeed, as Carlson and Lavertu (2015) show using a rigorous research strategy, Ohio's law had a positive causal impact on student achievement.

There is, however, one large caveat to these conclusions. The results are consistent with the notion that closure has a positive impact only if closed schools are of sufficiently low quality compared to other nearby schooling options. It appears that this was the case in Ohio's large urban areas. Based on student learning gains, the improvement in quality that displaced students experienced was 0.26 and 0.79 standard deviations in district-run and charter schools, respectively. If the difference in quality between a student's closing school and the one she subsequently attends is not as large as it was in our study, school closure may not have such a positive effect on a displaced student—a tradeoff that policymakers will need to consider as they seek to increase the quality of educational options. Indeed, on average, this appears to be the case across the rest of the state.[12]

# APPENDICIES

### Appendix I: Data

Our analysis is based on a dataset that consists primarily of information drawn from annual individual-level records of all students attending public schools in the state of Ohio between the 2005–06 and 2012–13 school years. These records were provided by the Ohio Department of Education (ODE) via the Ohio Education Research Center (OERC) and contain information on student demographic characteristics, academic achievement, and the schools and districts that students attended. In terms of demographic information, the records contain standard information for databases of this type, such as student sex, race/ethnicity, economic-disadvantage status, disability status, and so forth. In terms of academic information, the records contain students' scale scores on the Ohio Achievement Assessment (OAA).

We focus the analysis on the reading and math portions of the OAA because only these tests are administered annually across our entire panel. Additionally, to facilitate valid comparisons across grades and years, we converted students' scale scores to *z*-scores standardized by subject, grade, and year. Consequently, we present all achievement test results in the metric of standard deviation units. Recognizing that standard deviation units are perhaps not the most natural metric for the purposes of substantive interpretation, we also provide interpretations of test score-based results in terms of percentiles and days of learning.

Using the school and district identifiers in the ODE data, we supplemented the student-level information with publicly available information on schools and districts provided on websites maintained by ODE and the National Center for Education Statistics (NCES), as well staff-level information provided by ODE. Most importantly for this analysis, we use information on annual school enrollment to determine when schools open and close, and we use staff information to confirm that these schools did indeed close. (We describe the procedure in greater detail in Appendix II.) Additionally, the data enable us to identify whether a school is from one of Ohio's Big Eight urban districts and whether schools are traditional public or charter schools.

A major purpose of this analysis is to assess the extent to which school closure leads to students attending academically superior schools the following year. Performing such an assessment requires one or more measures of school quality. There are several potential measures of school quality, but we believe that those based on students' year-to-year learning gains are the best available. Similarly, our analysis of closure's impact focuses on learning gains. Estimating such learning gains requires multiple and consecutive years of student achievement data. Because such data are only available for students in grades 3–8—this is the range of consecutive grades in which the reading and math portions of the OAA are administered—we restrict our analysis to students in these grades and, thus, to the schools serving them.[13]

### Appendix II. Identifying School Closures

After contemplating several alternative approaches, considering guidance provided by the Ohio Department of Education (ODE) regarding the assignment of building Internal Retrieval Numbers (IRNs), and comparing lists of closed schools generated using multiple data sources, we determined that the best way to identify closed schools entails using ODE enrollment data. ODE documentation makes clear that the assignment of a building IRN is primarily tied to the student composition of a school, as opposed to a physical building or a school's governance structure (e.g., charter or traditional public school).[14] We determined that a school should be classified as closed in a given year if student enrollment for a given building IRN was recorded as zero in that year but was some positive number in the previous year.[15]

Using this approach, we identified 549 schools serving students in grades 3 8 that closed at some point after the 2005–06 school year and prior to the 2012–13 school year. Of these 549 closed schools in our data, 351 were operated by a non–Big Eight school district, 120 were operated by one of the Big Eight districts, and seventy-eight were charter schools.

## Appendix III. Measuring School Quality

School-quality measures based on student academic growth are intended to isolate the contribution of schools to student learning irrespective of schools' socioeconomic and demographic compositions. One can estimate these measures in multiple ways. We employed three separate school growth measures in the analysis, including ODE's value added measure for the years in which it provides a measure of yearly student gains. All three measures use an average of student reading and math gains as the basis for estimating school quality, but the statistical models used to generate the three sets of estimates differ somewhat. Because all three measures yield similar results, we focus the presentation of results on the measure of yearly student gains that accounts for student demographics and that we calculated for all years of our panel. Nevertheless, we describe all three measures here.

ODE's value-added measure of school quality was calculated by SAS Institute Inc. for use in the state's accountability system.[16] ODE's online documentation indicates that for the 2006–07 through 2011–12 school years, these are annual estimates of school contributions to student learning gains for a single school year. Estimates for the 2012–13 school year, however, are based on a three-year composite of one-year gains in student-level test scores. Across all years, the ODE value-added estimates are generated by statistical models that account for past student performance.[17]

To get estimates for all years, we estimate school contributions to student growth using the felsdvregdm Stata routine developed by Mihaly et al. (2010), which enables us to retrieve building-year fixed effects that are calculated relative to the mean across all school buildings in a given school year.[18] First, we standardized student scale scores by subject, grade, and year. Second, we used the routine to estimate a building-year fixed-effects model in which the dependent variable was the average of students' standardized scores in mathematics and reading. Covariates included a student's prior test score in mathematics and prior test score in reading, the square of each of these variables (to capture nonlinear learning trajectories), and variables indicating whether or not a student is female, white, black, Asian, Hispanic, disabled, or economically disadvantaged and whether or not a student changed schools while not in a terminal grade. The felsdvregdm routine generates the coefficients of building fixed effects relative to the mean school building in a given year. These are the estimates on which we focus in our presentation of results.

Research has shown that estimates of school contributions to student achievement gains based on a single year of school performance can be somewhat unreliable, as the estimates can fluctuate significantly from year to year. In an effort to generate a more reliable measure, we based our third set of school-quality estimates on three years of annual student gains (four years of student data) to estimate annual school contributions to student learning. One can think of these estimates as a three-year rolling average of annual school achievement growth, using the student-level data. As with estimates based on a single year of student gains, we generate these three-year estimates from models that control for past student achievement, student demographic and socioeconomic characteristics, and nonstructural student mobility. The limitation of this measure, however, is that it is available only for schools that have been in operation for at least three years.

All three sets of quality measures yield similar results. We present the results using the second measure because it is available for all schools and years of our panel.

## Appendix IV. Samples Used to Estimate the Impact of Closure

The difference-in-differences analysis compares the change in students' pre- and postclosure achievement to the change in achievement over the same time period for students who did not attend a closing school. To construct these samples, we first created separate datasets for each year of our data, effectively creating cohort-based datasets. Within each of these annual datasets, we identified two types of students: (1) those attending a school in its final year of operation and (2) those attending a school not slated for closure in that year and who would not attend a closing school at any point during the study period.[19] Then for each student attending a school in its last year of operation—the "displaced group"—we extracted three years of preclosure

observations and three years of postclosure observations. For students in the "nondisplaced group," we extracted observations corresponding to the same years as those of the displaced group.

For example, for students who attended a school in its final year of operation during the 2008–09 school year—this would be considered the 2009 closure cohort—we extracted all available observations from 2006–07 through 2011–12. We also extracted all available observations from the same time period for students in the nonclosure group. We applied this procedure to the 2008, 2009, 2010, 2011, and 2012 cohorts and compiled the observations from each cohort into a single dataset.[20] The resulting sample for non–Big Eight districts consists of about 10.3 million observations from just under 2.5 million unique students, more than one million observations from over 300,000 individual students for the Big Eight sample, and over 430,000 observations from about 116,000 students for the charter-school sample.

**Appendix V. Comparing Academic Gains (Difference-in-Differences Models)**

The difference-in-differences analyses eliminate the threat of bias from time-invariant factors. Perhaps the most significant validity threat in difference-in-differences analyses comes from the two groups that exhibit differential pretreatment trends in the outcome variable of interest. In our context, concerns could arise if the preclosure achievement trends for students attending closing schools differed from the achievement trends of students in the comparison group—those attending nonclosing schools. We implement the difference-in-differences approach in a regression framework by estimating the following model:

$$Y_{ihts} = \mu_s + \lambda_t + (\lambda_t \times C_i)\delta + \phi_{ih} + \epsilon_{it}$$

where achievement (Y) for student i in closure cohort h at time relative to closure t in school year s is a function of a school-year fixed effect μ, a set of five indicator variables indicating the time relative to closure λ, an interaction between the time relative to closure indicators and a treatment (i.e., attended a school in its final year of operation) indicator ($\lambda_t \times C_i$), a student-cohort fixed effect ϕ, and a residual term ϵ.

We again measure achievement—separately for reading and math—as students' scale scores on the OAA, standardized using the mean and standard deviation from the proper grade and year. As our data span the 2006–07 to 2012–13 school years, μ contains a fixed effect for each of these years. Similarly, λ contains an indicator for each of the two preclosure years and each of the three postclosure years. Interacting λ with the treatment indicator C allows for the estimated effect of closure on student achievement to be dynamic in nature—that is, it allows us to separately estimate δ for one, two, and three years after closure and from multiple baselines. Finally, inclusion of a student-cohort fixed effect—as opposed to simply a student fixed effect—is necessitated by the fact that our cohort-based approach to assembling the dataset results in some students appearing in the data multiple times. The student-cohort fixed effect accounts for these multiple appearances, although we cluster standard errors in the model at the student, rather than student-cohort, level.

The results of this model are provided in table A1. Additionally, the results limited to students who attended higher-quality schools, according to those schools' student learning gains, are presented in table A2. Finally, we present results limited to Ohio's remaining 603 traditional public-school districts—those other than the Big Eight—in table A3. In the text, we report only posttreatment estimates and also present the results of models that use "two years prior to closure" as the baseline for the posttreatment effects.

| Table A1. Impact of closure on the achievement of displaced students | | | | |
|---|---|---|---|---|
| Year | Big Eight district-run schools | | Charter schools | |
| | Reading | Math | Reading | Math |
| **Two years prior to closure** | 0.012** (0.006) | 0.023*** (0.005) | 0.006 (0.014) | -0.007 (0.012) |
| **One year prior to closure** | 0.004 (0.004) | 0.014*** (0.004) | 0.007 (0.010) | 0.018** (0.009) |
| **Year of closure** | Omitted | Omitted | Omitted | Omitted |
| **One year after closure** | 0.039*** (0.004) | 0.025*** (0.004) | 0.052*** (0.010) | 0.079*** (0.009) |
| **Two years after closure** | 0.061*** (0.008) | 0.056*** (0.007) | 0.056*** (0.015) | 0.084*** (0.013) |
| **Three years after closure** | 0.073*** (0.012) | 0.065*** (0.012) | 0.003 (0.023) | 0.087*** (0.020) |
| ***N*** | 1,221,681 | 1,222,839 | 431,435 | 432,883 |
| ***Number of students*** | 313,581 | 313,637 | 115,898 | 115,943 |

**Note:** This table presents results from an OLS difference-in-differences regression model predicting student achievement. The model also contained student-cohort fixed effects, school-year fixed effects, and fixed effects for year relative to closure. Robust standard errors are clustered by student in parentheses below coefficient estimates. Stars indicate significance levels based on two-tailed t-tests: *p<0.10, **p<0.05, and ***p<0.01.

| Table A2. Impact on displaced students who moved to a school of higher quality | | | | |
|---|---|---|---|---|
| **Year** | **Big Eight district-run schools** | | **Charter schools** | |
| | **Reading** | **Math** | **Reading** | **Math** |
| **Two years prior to closure** | 0.018*<br>(0.010) | 0.054***<br>(0.009) | 0.006<br>(0.026) | 0.014<br>(0.023) |
| **One year prior to closure** | 0.000<br>(0.007) | 0.008<br>(0.006) | -0.013<br>(0.018) | 0.012<br>(0.016) |
| **Year of closure** | Omitted | Omitted | Omitted | Omitted |
| **One year after closure** | 0.059***<br>(0.007) | 0.054***<br>(0.006) | 0.088***<br>(0.015) | 0.144***<br>(0.015) |
| **Two years after closure** | 0.084***<br>(0.012) | 0.105***<br>(0.011) | 0.121***<br>(0.026) | 0.174***<br>(0.022) |
| **Three years after closure** | 0.104***<br>(0.019) | 0.120***<br>(0.017) | 0.087**<br>(0.044) | 0.168***<br>(0.034) |
| ***N*** | 1,165,433 | 1,166,557 | 415,684 | 417,134 |
| ***Number of students*** | 298,232 | 298,288 | 111,493 | 111,545 |

**Note:** The table presents results from an OLS difference-in-differences regression model predicting student achievement. The model also contained student fixed effects, school-year fixed effects, and fixed effects for year relative to closure. "Higher-quality schools" are those with higher student achievement growth, holding student demographic characteristics constant. Robust standard errors are clustered by student in parentheses below coefficient estimates. Stars indicate significance levels based on two-tailed t-tests: *p<0.10, **p<0.05, and ***p<0.01.

| Table A3. Range of impacts of non–Big Eight closures on the achievement of displaced students | | | | |
|---|---|---|---|---|
| | **Reading** | | **Math** | |
| | Growth baseline = Year of closure | Growth baseline = Two years prior | **Growth baseline = Year of closure** | **Growth baseline = Two years prior** |
| **First year after closure** | 0.006* | −0.018* | 0.000 | −0.035* |
| **Second year after closure** | 0.005* | −0.019* | −0.010* | −0.045* |
| **Third year after closure** | 0.010* | −0.014* | −0.006 | −0.041* |

**Note:** The table presents a range for the estimated impact of closure on the achievement growth of displaced students, depending on whether we use student achievement in the final year of a closing school's operation as the baseline or the student's achievement two years prior to closure as the baseline. The table presents the results in standard deviation units. Stars indicate that the estimated impact is statistically significant at *p<0.01 for a two-tailed test.

# ENDNOTES

[1] We include all charter schools, even if they did not reside within a Big Eight district, in order to have large enough sample sizes for all of the analyses. As the descriptive statistics indicate, the students served in these charter schools are very similar to those served in the Big Eight district schools and, therefore, provide a good comparison group.

[2] Appendix I provides a more detailed description of these data.

[3] Appendix II explains how we identified which elementary and middle schools were in their last year of operation from 2005–06 through 2011–12.

[4] The results in table 1 are based on all students attending closing or nonclosing schools. The results are similar if we restrict the sample to students in nonterminal school grades and who, therefore, would have to change schools the following year regardless of whether their school closes or not.

[5] See Appendix III for more details of this measure.

[6] These are student difference-in-differences models. The results are somewhat more positive for charter schools if we estimate student fixed-effects models that focus solely on the learning gains of displaced students.

[7] See Appendix V.

[8] The results are similar regardless of whether students transferred to district schools or charter schools.

[9] Specifically, we calculate the average growth across grades 5–8, as the estimated impacts one to three years after closure that we present below are based on these grades. We then divide our estimated effects in standard deviation units by these averages for math and reading, separately. Finally, we multiply by 180 days, as this is often assumed to be the typical length of a school year.

[10] We warn the reader not to read too much into this metric. It is more intuitive, providing a sense for the magnitude of the effects, and it takes into account that one standard deviation of growth in math is not synonymous with a standard deviation of growth in reading. However, the estimates of yearly growth are based on different tests and different student samples than those we examine in this study. Please see Hill et al. (2008) for more details.

[11] See table A1 in Appendix V.

[12] An analysis of Ohio's remaining 603 school districts reveals that closure had either a negligible positive or negative impact, depending on the statistical model (see table A3 in the appendix). We do not present the results of districts across the rest of the state, however, as the characteristics of those districts vary considerably and the logic of school closure is less applicable outside of densely populated urban areas.

[13] We also restrict the sample to students who spent the majority of a given school year attending a single school. Thus, we did not include the test scores of students who did not attend a single school for the majority of the year—or whose scores were bumped up to the district or state level for accountability purposes—in the value-added estimates of school quality. Associating these students' scores with the building in which they tested would be problematic because it is unclear how much of that student's learning should be attributed to that school.

[14] For an in-depth description of the policies surrounding building IRNs, please see https://education.ohio.gov/getattachment/Topics/Data/Report-Card/Ohio-Report-Cards/Local-Report-Card-and-Accountability-Information/IRN-Guidance2012.pdf.aspx

[15] To further validate this method, we employed student and staff data to examine the extent to which teachers and students dispersed to multiple schools after closure. We found significant dispersion of students and teachers after closure. For example, the students of 75 percent of closed schools moved to schools in which their former peers constituted 20 percent or less of the student body.

[16] Documentation of the SAS EVAAS method used to estimate value-added scores for Ohio schools is available on the Ohio Department of Education website.

[17] The most recent technical documentation indicates that the estimates account for up to five years of student test-score histories, though documentation for earlier years is ambiguous about how many years of test data are included.

[18] Please consult Mihaly et al. (2010, 85–87) for a formal description of the regression model.

[19] We elected not to use a matching procedure to generate the comparison group for our difference-in-differences analysis for two reasons. First, our choice to break down our results by Big Eight district-run schools and charter schools serves much of the same purpose as would a matching procedure in terms of eliminating heterogeneity. Furthermore, breaking down the results in this manner, which we believe to be quite important from a substantive standpoint, results in a smaller number of potential comparison cases to which students attending closing schools can be matched, particularly in charter schools and Big Eight districts. Matching procedures have been shown to work best when there is a large pool of potential comparison cases, relative to "treatment" cases. Second, as we describe in further detail below, our robustness checks suggest that within each of the three groups of schools we analyze, using all students attending nonclosing schools as comparison cases is not likely to bias our estimated effects of closure, and we believe doing so increases the external validity of our results.

[20] Our cohort-based approach to this analysis results in some students appearing in the dataset multiple times; these students are assigned to the "nonclosure" group in multiple cohorts. The fact that they appear in the data multiple times is not problematic—similar situations occur in other studies (see, e.g., Cellini et al. 2010). In the methods section, we detail our approach to handling this issue.

# REFERENCES


Booker, K., Gilpatric, S. M., Gronberg, T., & Jansen, D. (2007). The impact of charter school attendance on student performance. *Journal of Public Economics 91*(5-6): 849–76.

Brummet, Q. (2014). The effect of school closings on student achievement. *Journal of Public Economics*, *119*, 108–24.

Carlson, D., & Lavertu, S. (2015). The impact of Ohio's mandatory school closure law on student achievement. Working Paper.

Cellini, S. R., Ferreira, F., & Rothstein, J. (2010). The value of school facility investments: Evidence from a dynamic regression discontinuity design. *The Quarterly Journal of Economics*, *125*(1), 215–61.

de la Torre, M., & Gwynne, J. (2009). *When schools close: Effects on displaced students in Chicago Public Schools*. Chicago: Consortium on Chicago School Research.

Engberg, J., Gill, B., Zamarro, G., & Zimmer, R. (2012). Closing schools in a shrinking district: Do student outcomes depend on which schools are closed? *Journal of Urban Economics*, *71*(2), 189–203.

Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2004). Disruption versus Tiebout improvement: The costs and benefits of switching schools. *Journal of Public Economics*, *88*(9-10), 1721–46

Hill, C.J., Bloom, H.S., Rebeck Black, A., & Lipsey, M.W. (2008). Empirical benchmarks for interpreting effect sizes in research. *Child Development Perspectives*, *2*(3), 172–77.

Xu, Z., Hannaway, J., & D'Souza, S. (2009). *Student transience in North Carolina: The effect of school mobility on student outcomes using longitudinal data.* Washington, DC: Urban Institute.

Young, V.M., Humphrey, D.C., Wang, H., Bosetti, K.R., Cassidy, L., Wechsler, M.E., Rivera, M., Murray, S., & Schanzenbach, D.W. (2009). *Renaissance schools fund-supported schools: Early outcomes, challenges, and opportunities.* Menlo Park, CA: SRI International.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