



Investing in schools: capital spending, facility conditions, and student achievement[☆]



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ARTICLE INFO

Article history:

Received 6 August 2015

Received in revised form 25 March 2016

Accepted 6 May 2016

Available online 13 May 2016

JEL classification:

I22

I24

H75

Keywords:

School facilities

School bonds

Student achievement

ABSTRACT

Public investments in repairs, modernization, and construction of schools cost billions. However, little is known about the nature of school facility investments, whether it actually changes the physical condition of public schools, and the subsequent causal impacts on student achievement. We study the achievement effects of nearly 1400 capital campaigns initiated and financed by local school districts, comparing districts where school capital bonds were either narrowly approved or defeated by district voters. Overall, we find little evidence that these school capital campaigns improve student achievement. Event-study analysis focused on the students actually affected by large campus renovations also generates very precise zero estimates of achievement effects. Thus, U.S. school capital campaigns financed by local districts – the predominant method through which facility investments are made – may be a limited tool for realizing substantial gains in student achievement or closing achievement gaps.

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1. Introduction

The Coleman Report (1966) ignited an enduring debate on the importance of school spending by concluding that school resources play a limited role in improving student outcomes. Many empirical studies followed with some concluding that there is no systematic relationship between school resources and student outcomes (Hanushek, 1986) and others concluding the opposite (Greenwald et al., 1996; Card and Krueger, 1996; Jackson et al., 2015). While these studies typically examine the impacts of instructional resources (e.g., teacher compensation

and class size), the physical condition of school buildings is another important component of school resources.

State and local governments invest an enormous amount on public school facilities, with annual expenditures totaling about \$66 billion (or \$1336 per student; Snyder and Dillow (2011)) and \$407 billion in outstanding taxpayer-supported bond debt attributable to school facilities (U.S. Census Bureau, 2012). Despite the magnitude of such investments, many students, especially those from disadvantaged backgrounds, attend schools that are in a state of disrepair (Filardo et al., 2010), with \$300 billion in deferred maintenance needed to bring U.S. schools into “good” condition (ASCE, 2009). The prevalence of public schools in need of repair is worrisome because poor physical environments may impede student achievement if students learn more easily in safe, clean, controlled environments (Jones and Zimmer, 2001).

Indeed, recent evidence on the impacts of very large construction projects in contexts where school facilities were either in very poor condition or non-existent suggests that new school construction projects can improve student outcomes (Duflo, 2001; Aaronson and Mazumder, 2011; Neilson and Zimmerman, 2014). For instance, Neilson and Zimmerman (2014) find positive effects on reading achievement of a construction project financed through state and federal sources that cost \$70,000 per pupil and involved rebuilding almost every school campus in an urban district (New Haven, CT). However, this type of capital campaign is atypical in the U.S. where school capital projects (both renovations and new construction) are primarily financed locally through the issuance of voter-approved

[☆] The research is supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305A140363 to University of Michigan. The opinions expressed are those of the authors and do not represent views of the Institute, the U.S. Department of Education, or other organizations. Financial support for this research was also received from the Upjohn Institute and WT Grant Foundation (grant number 183564). We are grateful to seminar and conference participants at American University, Cornell University, Michigan State University, Federal Reserve Bank of New York, Northwestern University, Syracuse University, University of Illinois, University of Michigan, University of Wisconsin (IRP and WCER), the NBER Economics of Education program, and the AEPF, APPAM, and SOLE annual meetings for helpful feedback. Yu Xue and Bing Zhao provided outstanding research assistance. Hillary Smith, Maria Keller, Lin Shan, Frank Cousin, Meredith Reid, Dipika Mouli, Molly Cohen, Shireen Smalley, and Kathryn DeVor also made significant contributions related to data collection.

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bonds that are repaid with property taxes. For instance, the average per-pupil size of capital campaigns in Texas, the state we study in this paper, is about \$7800. The achievement effects of investments of this magnitude remain unclear. Cellini et al. (2010; henceforth CFR) find that school bond passage in California increases housing prices, but they only find modest and imprecisely estimated effects on student achievement.

In this paper we provide the most comprehensive assessment of achievement effects from school facility investments initiated and financed by local school districts. The first part of the analysis examines the impact of nearly 1400 capital campaigns initiated by 748 school districts in the state of Texas over a 14-year period. To address the concern that districts conducting such campaigns are different from those that do not, we use dynamic regression-discontinuity methods (Cellini et al., 2010) to compare school districts where bond referenda narrowly pass to those that narrowly fail. We examine the impact of capital campaigns on student outcomes using information on all tested students in the state over this time period, which includes all 3rd through 8th graders and 10th or 11th graders that take the state's high school exit exam.

Texas is an interesting state in which to conduct this analysis for several reasons. First, it is a large and diverse state with a combination of small rural districts and very large urban ones, many of which conducted capital investment campaigns during our study period. Second, the institutional context for funding facility investments in Texas differs from that in California, and our analysis thus provides a useful counterpoint to CFR's study in California. California has a number of institutional constraints (such as Proposition 13) that make it difficult for districts to raise funds to finance school facility improvements.¹ Capital spending could therefore be lower than the value preferred by local residents, which may help explain the CFR finding that school bond passage increased housing prices. In contrast, similar constraints do not exist in Texas. However, even in this context, there still may be positive effects of capital investments on student achievement. This is because in districts where residents choose to have low levels of spending for new school facilities (e.g., in poor districts that do not have the tax base to sustain a high level of capital spending), facilities may be in poor condition. Indeed, a third reason why TX is an interesting setting for this analysis is that a significant number of schools in the state are in need of repair. In these cases, facility investments could generate improvements in student outcomes if school building conditions exert a causal effect on student outcomes.

We find clear evidence that locally-funded campaigns lead to large increases in capital investment that are concentrated in the first two post-election years. Crucially, we find no effects on operating spending or on average class size, suggesting that funds raised through bonds "stick" to the capital account and are not reallocated to operating costs. We also find little evidence that capital campaigns attract students into school districts or help districts retain teachers. We also find that locally financed capital campaigns lead to measurable, yet modest changes in facility conditions. To our knowledge, this analysis is the first to look at the causal effect of typical bond-funded capital campaigns on the actual schooling environments of students. Three years after bond passage, average district-wide campus age decreases by merely 1.4 years; time since last major renovation or building construction decreases by 6.5 years; and the share of students enrolled in schools opened in the past four years increases by 3.6% age points on a base of 6%. Capital campaigns increase the likelihood that older schools are in at least fair or good condition; they also alleviate overcrowding in older schools (although overall district effects are insignificant).

Despite the investment, we find little evidence that school capital campaigns improve student outcomes. Our main RD point estimates for grades 3 to 8 are a small 0.016 and 0.030 standard deviation increase for reading and math, respectively, in year six (p -values = 0.438, 0.269) and we can rule out effects as large as 0.06 and 0.08. Estimates are

smaller or negative prior to year six. Difference-in-differences models (comparing districts before and after bond passage or failure) can rule out achievement effects greater than 0.03 and 0.05 for reading and math, respectively. The comparability of RD and difference-in-difference estimates suggests that effects of bond passage for marginal and inframarginal elections are similar, so the effects do not obviously vary with the support for bond passage.

Given that typical capital campaigns deliver only modest facility improvements for the average student, it may be unsurprising that overall achievement effects are also small. Most students simply do not attend schools that received large capital investments. To address this issue, the second part of the study directly measures the effect of capital investment on students actually exposed to it by analyzing more than 1300 major campus renovations. Controls for lagged individual test scores permit us to address changes in student composition resulting from capital investment, analogous to "value-added" models of teacher effectiveness. With or without this adjustment, we find no evidence of achievement effects of major campus renovations, even for renovations that appear to have generated large improvements in school facility conditions. Our estimates are sufficiently precise such that we can rule out positive effects larger than about 0.02 for math and 0.01 for reading for the first four years following a campus renovation.

Taken together, our analysis of capital campaigns and major renovations suggests that the typical school facility investments initiated and financed by local school districts do not generate appreciable improvements in student achievement. However, even with small effect sizes, school facility spending could still be a worthwhile use of resources since facilities are durable and can benefit many cohorts of students. To address this issue, we conducted a cost-effectiveness analysis comparing the cumulative test score impacts of facility investments implied by the largest effect size consistent with our event study estimates to the test score impact of a comparable increase in instructional spending to reduce class size. The results suggest that under reasonable assumptions regarding the durability of school facilities, school facility investments are unlikely to generate cumulative test score gains as large as those that could be obtained by reducing class size.

We describe the context of facilities funding in Texas and its implications for student outcomes in the next section. Sections 3 and 4 describe our data sources and methods, respectively. Section 5 presents our main RD results for district spending, school conditions, and student achievement. Event-study estimates of the effect of campus renovations and openings are presented in Section 6. We interpret the magnitudes and cost effectiveness of capital interventions in Section 7 and conclude in Section 8.

2. School facility spending in Texas and its potential effects on student outcomes

In 2008, total funding for Texas public schools was \$10,600 per student, of which \$1280 (12%) was spent on school facilities. The vast majority of these funds are raised internally by local school districts. Texas' well-known school finance equalization program, the Foundation School Program (FSP), was developed to address historical disparities in per-pupil funding across districts. This policy determines the amount of state and local funding for school districts and also determines the allocation of state funds to local districts. FSP aims to ensure that all districts receive "substantially equal access to similar revenue per student at similar tax effort" taking into account all state and local tax revenues of districts, student and district cost differences, and differences in property wealth (Texas Education Code, §42.001(b)). However, FSP mainly covers operational expenditures; responsibility for facility spending falls primarily on school districts. State and federal funding each account for about 10% of facility spending, with the remainder coming from districts (Table 181; Filardo et al., 2010). Thus, modernization, renovations, and repairs of Texas public educational facilities are financed primarily through local property taxes with minimal state support, a setting typical of most states.

¹ Proposition 13, passed in 1978, capped the property tax rate at 1% and has been blamed for the decline in school spending in California (Sonstelie, Brunner, and Ardon, 2000).

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