



Does Investing in School Capital Infrastructure Improve Student Achievement?



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ABSTRACT

Within the research community, there is a vigorous debate over whether additional educational expenditures will lead to improved performance of schools. Some of the debate is an outgrowth of the lack of causal knowledge of the impacts of expenditures on student outcomes. To help fill this void, we examine the causal impact of capital expenditures on school district proficiency rates in Michigan. For the analysis, we employ a regression discontinuity design where we use the outcomes of bond elections as the forcing variable. Our results provide some evidence that capital expenditures can have positive effects on student proficiency levels.

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1. Introduction

Capital expenditures represent a significant investment into education. The U.S. Department of Education reports that as much as \$70 billion are spent in a year on public school construction and repairs (U.S. Department of Education, 2012, Table 205). Despite this substantial investment, many argue that further investments into facilities are needed as many students are educated in inadequate and crumbling facilities, especially in urban districts (Dejong & Clover, 2003).² In some cases, urban districts and state legislators have answered this call by investing billions of

dollars to improve school facilities in places like Los Angeles, New Haven, and urban districts across New Jersey. In many other districts and states, policymakers have made more modest, but substantial investments into maintaining or augmenting existing facilities.

Despite the magnitude of these investments, little is known about the effectiveness of capital expenditures. The question of what impact these capital expenditures have on student outcomes is part of the larger debate of the impact of expenditures on student outcomes in general. Some argue that past investments into education have not led to significant returns. For instance, Hanushek and Lindseth note that between 1960 and 2005, inflation-adjusted spending per pupil in the U.S. increased from \$2606 to \$9910, but was not accompanied by substantial improvement in national test scores, graduation rates, or the U.S.'s relative rankings on student outcomes among developed countries (Hanushek & Lindseth, 2009, pp. 45–46). Hanushek (1986, 1996, 2003) found, in a series of literature reviews, no consistent relationship between increased

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² Advocates for greater investment includes 21st Century School Fund. See: <http://www.21csf.org/csf-home/best/best.asp>

inputs and student performance on test scores. These findings could lead one to question whether the U.S. should continue to invest more resources in education.

However, some researchers argue that much of the literature that Hanushek relied upon was not always rigorous (Ferguson & Ladd, 1996) and has not controlled for the possibility of reverse causality—i.e., policymakers often invest more in schools performing poorly in hopes of improving outcomes.³ Advocates for additional educational resources often point to evaluations of the Tennessee STAR experiment which used a causal research design to randomly assign students to larger or smaller classes and found an inverse relationship between class size and student outcomes (Kruger, 1999; Kruger & Whitmore, 2001). While the Tennessee STAR experiment does provide some causal evidence of one input, the broader literature has provided little causal estimation of the relationship between student outcomes and educational inputs, including capital expenditures.⁴

Research on the impact of capital expenditures only emerged in the last 10 to 15 years. An initial question is why we expect an impact from capital expenditures. Some have speculated that capital investments would lead to safe and clean school environments, free from overcrowding with good lighting—all of which could make it easier to concentrate and lead to greater student and teacher morale and effort (Filardo, Vincent, Sung, & Stein, 2006; Jones & Zimmer, 2001). In addition, research has suggested that teachers put a premium on school facilities when making an employment decision (Hornig, 2009), which suggests that schools with better facilities may be able to recruit better teachers. With these hypotheses in mind, researchers set out to examine the relationship between capital expenditures and student outcomes.

Much of the early research, while providing initial insights, did not fully account for the endogenous expenditures levels within districts—i.e., unobserved factors such as the communities' taste for education, which can drive both capital spending and student outcomes (Blincoe, 2009; Jones & Zimmer, 2001; Picus, Marion, Calvo, & Glenn, 2005; Schneider, 2002). However, researchers are beginning to employ more causal designs. Two recent papers employed difference-in-differences approaches to examine the impact of large-scale construction projects of new schools in New Haven (Neilson & Zimmerman, 2011) and Los Angeles (Welsh, Coghlan, Fuller, & Dauter, 2012) finding strong positive effects. Both papers provide strong insights into capital projects to replace old and decaying school buildings, but provide limited implications for smaller-scale projects, including maintenance and additions.

A recently published paper by Cellini, Ferreira, and Rothstein (2010) (henceforth, CFR) better encompasses the range of capital expenditures using a regression discon-

tinuity design (RDD) to examine outcomes of districts in which capital expenditures are narrowly approved relative to districts in which capital expenditures narrowly fail. Theoretically, districts that marginally pass a bond should be similar both in observed and unobserved ways to those that marginally fail a bond. CFR's paper primarily focuses on the impact of capital expenditures on housing values, but also examines test scores and finds modest positive effect on student outcomes, but with some delays as the effects generally do not appear until six years after bond passage.

In this paper, we build on the CFR econometric approach and employ a “dynamic” RDD to obtain an unbiased estimate of capital expenditures on student outcomes in Michigan by examining bond referenda that narrowly pass and fail.⁵ However, our paper takes a number of steps previously not taken to ensure the complexity of issuing bonds does not create any manipulation. Manipulation could occur for a variety of reasons, but the most important concern is whether the district learns from failed election and tries again with a modified proposal, or breaks up a bond proposal into multiple elections on the same day in hopes of gaining support for at least some of the capital expenditures. In the analysis, we take into account these possibilities by extending CFR dynamic sharp RDD to a dynamic fuzzy RDD. The fuzziness comes from the fact that districts which fail a bond can propose another one in the same year. Therefore, our paper adds to this literature by not only exclusively focusing on the impact of a wide array of capital expenditures on student achievement, but by also more explicitly discussing possible threats to the RDD approach. Focusing on the findings from our fuzzy RDD approach, we find that passing a bond increases reading proficiency by 2 to 6 percent five to seven years after passage.

2. Issuing bonds in Michigan

Prior to 1994, Michigan primarily relied upon local property taxes to fund public education (Courant, Gramlich, & Loeb, 1995). In 1994, school districts began to rely more heavily on state funding of operating expenditures in schools with new legislation. Despite this policy change, funding of capital remained a local responsibility through a bond referendum in which a district must receive 50 percent approval from the electorate to approve a bond (Zimmer & Jones, 2005; Zimmer, Buddin, Jones, & Liu, 2011). Because Michigan school districts rely upon a local referendum to approve capital expenditures, we are able to use an RDD as an identification strategy to estimate the impact of capital expenditures on student outcomes. We summarize the referendum elections between 1996 and 2009 included in our data in Table 1. In the table, we provide some general trends in the number of bonds voted on per year, the average number of voters, percent of bonds passed, average bond amount, and for a subset of years in which we have the data, average repayment length millage

³ On the flip side, it is possible that districts that are willing to spend more have families and students engaged in the educational production process, and these unobservable characteristics are not captured in these same studies, leading to an upward bias in the estimated relationship.

⁴ Other studies that provide credible results are Guryan (2001), Papke (2005), Papke (2008), and Hyman (2013).

⁵ In an contemporaneous working paper, Martorell, McFarlin, and Stange (2015) examines whether successful passage of a bond leads to improvements in facility conditions, student attendance, and student achievement in Texas; they find no effects on student achievement.

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