CREDIT CONSTRAINED? HOW THE COST OF CAPITAL AFFECTS DISTRICT RESOURCES AND STUDENT ACHIEVEMENT

J. Cameron Anglum

A DISSERTATION

in

Education

Presented to the Faculties of the University of Pennsylvania

in

Partial Fulfillment of the Requirements for the

Degree of Doctor of Philosophy

2019

Supervisor of Dissertation

_____

Matthew P. Steinberg, Assistant Professor of Education

Graduate Group Chairperson

_____

J. Matthew Hartley, Professor of Education

Dissertation Committee

Rebecca A. Maynard, University Trustee Professor of Education and Social Policy

Andrew M. Reschovsky, Professor Emeritus of Public Affairs and Applied Economics, University of Wisconsin - Madison

DEDICATION

This work is dedicated to my mentors and role models who have supported my educational journey. It is my most sincere desire that I may repay this debt through my future teaching and research. I hope, in some way, however small, to positively impact the lives of students through an improved shared understanding of the policies and programs that enhance equitable access to precious resources, a robust system of public education perhaps most of all.

ACKNOWLEDGMENTS

This work received financial support from the National Academy of Education / Spencer Foundation Dissertation Fellowship Program and the Association for Education Finance and Policy New Scholar Grant Program. I am grateful to each of these organizations for their generous support.

I would first like to express my sincerest thanks to my dissertation committee. Dr. Matthew Steinberg has provided me tremendous support on this project and in many other settings. His invaluable mentorship has informed my development as a researcher and a as a scholar and I owe him an enormous debt of gratitude as I continue in my career. I thank Dr. Rebecca Maynard for her generous support and guidance over my entire graduate course of study. Finally, I thank Dr. Andrew Reschovsky for kindly offering his guidance as a subject matter expert.

I would like to extend my gratitude to my family, especially to my parents Peter and Angela. The motivation for my entire body of research, teaching, and mentorship in education and public policy derives primarily from my own upbringing, one characterized by an unwavering commitment to substantive educational opportunities in all aspects of life. They instilled in me a concerted focus on the virtues of education, one I wish to avail to others through research and teaching.

Last, and most of all, I would like to thank my wife Lauren who has selflessly endured my entire course of graduate education. We met only weeks before I began my masters degree in what began a near seven year course of study, research, and reflection. As I complete my dissertation many years later, I reflect on her many instances of

encouragement and confirmation, particularly in the more difficult moments. I am excited for all the opportunities which lay ahead for the two of us.

ABSTRACT

CREDIT CONSTRAINED? HOW THE COST OF CAPITAL AFFECTS DISTRICT RESOURCES AND STUDENT ACHIEVEMENT

J. Cameron Anglum

Matthew P. Steinberg

From the mid-1990s to the mid-2010s, school districts across the United States spent over $1.25 trillion on capital outlays to invest in the physical infrastructures of their schools. To finance these expenditures, districts today carry over $400 billion in long-term debt and pay over $17 billion in interest payments annually, figures which have doubled over the past two decades. Despite the immense magnitude of these debt-driven investments, scant research has examined the subject of school district debt and differences which may exist in debt utilization among districts of varying characteristics and across varied state policy contexts. In this paper, I first explore trends in district debt practices over the past two decades on a national basis and decomposed by several different school district characteristics. I then leverage an exogenous shock to the costs of district borrowing, a 2010 municipal credit rating recalibration event, to estimate the effect of cheaper access to debt financing on district debt issuance. I find that in contexts where state governments do not financially support district school facilities expenditures, districts are particularly sensitive to their cost of debt, and issue more debt when it becomes cheaper to do so, particularly districts serving large shares of disadvantaged students. On the other hand, I

also present evidence which suggests that additional debt issuance may be crowded out by existing capital expenditures and spent instead on instructional expenditures. As national dialogue regarding infrastructure investments and constrained school district budgets gain increased attention, these findings may inform governmental policies regarding state investments in local school district capital expenditures, particularly in districts serving large shares of disadvantaged students.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

WHY STUDY SCHOOL DISTRICT DEBT?

In recent years, school finance research has extensively augmented the body of empirical evidence concerning the effects of school finance reforms on underserved student populations. As a result, there is a substantial body of evidence documenting the impact of state and federal finance reforms on the provision of school resources and on student outcomes. Much of this research reveals the important role of resources for the outcomes of students in economically disadvantaged districts. At the same time, much remains empirically unknown and untested in the subject of public school funding. One of those underexplored areas in education finance is the subject of school district capital constraints in their access to resources and, in particular, how the cost of debt may influence a district's decision to issue debt and subsequently spend it on school resources. Amid this paucity of research, the education and public policy literatures largely remain silent on the determinants of district debt issuance and connections between school district debt, district resource provision and allocation, and student outcomes. In this context, this dissertation seeks to shed light on critical aspects school district debt and the role it serves in the funding of public education.

In Chapter One I review the literature related to school district debt issuance and capital expenditure. I motivate the study of school district debt as a component of school district revenues used to fund district capital investments. Reporting in recent decades indicates there is a growing need for improved school infrastructure. More recent evidence analyzes the extent to which such investments may influence district and

student outcomes. I also review elements of how a school district issues debt and the importance of credit ratings in the issuance process.

In Chapter Two I explore trends in district debt utilization. Notable upward trends in per-pupil district debt holdings have emerged over the past two decades, trends which are shared across many different district categorizations. Differences in levels of debt utilization persist, however, across district types. These differences may inform policy conversations as states consider whether to support local district debt costs and capital expenditures.

In Chapter Three I examine a natural experiment, a 2010 Moody's Investor Services 'recalibration' of its municipal credit ratings, to estimate the effect of a reduction in the cost of debt on district debt issuance. While there exist several levers which may influence a district's decision to utilize debt, the cost of debt may present a primary driver of district decision making. Districts may be more likely to issue debt when it is cheaper. The examination of this natural experiment empirically tests whether district cost of debt constrains district debt issuance by examining a loosening of those constraints for a subset of districts. I also explore the effects of two prevalent state-level policies related to district capital expenditure, state funding programs in support of local capital expenditures and state credit enhancement programs, on district sensitivity to costs of debt. Finally, I extend the analysis of the Moody's recalibration natural experiment to examine the effect of debt funded expenditures on district resource allocations and on student achievement. This analysis empirically analyzes the budgetary and achievement effects of cost-driven debt constraints, testing the elasticities of district expenditures.

In Chapter Four I consider the empirical findings of the preceding chapters in light of the existing literature. Research over the past two decades has focused primarily on district capital need and on the effects of certain infrastructure investments. By comparison, little work has focused on the funding mechanisms through which districts may allocate resources to capital projects and, by extension, the effects of such mechanisms on district and student outcomes. I conclude with policy considerations derived from my empirical findings.

Chapter 1

SCHOOL DISTIRCT DEBT FINANCING AND CAPITAL EXPENDITURE: MOTIVATIONS AND EFFICACY

School District Revenues

Over the past half-century, per-pupil expenditures in public education nearly tripled in real terms (U.S. Department of Education, 2005). In recent decades, to generate this increase in average per-pupil expenditures school districts have relied upon a range of policy mechanisms including several new state and federal revenue initiatives. For example, many state-level finance reforms, achieved through court-ordered funding formulae revisions, legislative reforms, or a combination of the two restructured state roles in local district funding (see Shores, Candelaria, & Kabourek, 2019). Such revisions typically direct a greater share of state education funds to districts which serve larger shares of disadvantaged students. These reforms often have been found to generate improved student outcomes (i.e. Jackson, Johnson, & Persico, 2016; Lafortune, Rothstein, & Schanzenbach, 2016; Card & Payne, 2002; Hoxby, 2001; etc.). Although irregular in their respective timing and duration, new federal programs, including fiscal stimulus and competitive grant programs, have increased federal revenue provision in support of local educational expenditures particularly during times of economic downturn (i.e. Evans, Schwab, & Wagner, 2017; Chakrabarti, Livingston, & Roy, 2014).

The aforementioned state and federal finance reforms augmented local education spending during an era characterized by two central public policy considerations: 1) measures of equity and adequacy in the distribution of public resources; and 2) on the academic and longitudinal outcomes of disadvantaged students (i.e. Duncombe & Yinger,

1998). Governance over revenue provision from state and federal revenue sources, however, lies beyond the direct control of local voters and their respective government officials who hold power over local taxation policies. Therefore, in many scenarios school districts with taxing authorities and local municipal governments tasked with funding their local districts must rely on local revenue sources to guarantee increased or sustained funding levels.

District revenues are comprised of four inputs, revenues derived from the aforementioned federal and state sources, and those received from local and private sources. In other words, revenue in district *i* is comprised of receipts from federal, state, local, and private sources such that $\text{Revenue}_i = f(\text{RevFederal}_i, \text{RevState}_i, \text{RevLocal}_i, \text{RevPrivate}_i)$. State and local revenues constitute the vast majority, or approximately 90%, of local district revenues, on average (Snyder, de Brey, & Dillow, 2016). Local governing bodies, however, only directly control local revenues, those made up of local tax receipts and borrowed funds, the latter of which typically are acquired through municipal bond issuance, such that $\text{RevLocal}_i = f(\text{LocalTaxReceipts}_i, \text{FundsBorrowed}_i)$. Policies related to the first component, local tax receipts, have been studied extensively across varied state and local contexts. Many studies have explored district response to changes in the formulas or programs which distribute non-locally derived funding, state funding formulas, for example. Conversely, little research has examined how districts pursue debt-funded revenue strategies, how such strategies may vary by district characteristics, and how changes to district borrowing capacities may affect district borrowing decisions and subsequent resource allocations.

Research on tax policies related to the funding of public education has examined both locally driven tax legislation and local tax response to state and federal revenue policies. One line of research has examined the effects of restrictive tax laws on district resources and student achievement (i.e. Figlio, 1997; Downes & Shah, 2006). Property tax limitations, these studies conclude, may harm student achievement by constricting local education spending, particularly in low-income districts. The level at which a taxation ceiling is legislated relative to preexisting tax rates, however, may attenuate the effects of such policies in circumstances where local school budgets may not require significant reductions (Downes, Dye, & McGuire, 1998). Furthermore, the effects of locally determined tax limitations on district spending may be difficult to generalize due to their endogenous origins in the prevailing tax preferences of local voters (Dye, McGuire, & McMillen, 2005).

Several studies have examined local tax response to exogenous increases in state aid, primarily policies aimed to improve the equitable distribution of state resources to districts which serve large shares of disadvantaged students (i.e. Card & Payne, 2002; Steinberg, Quinn, Kreisman, & Anglum, 2016). Such studies empirically estimate the degree to which a "flypaper effect" or a "crowding-out effect" materializes in local districts (Hines & Thaler, 1995). The theory which motivates the flypaper effect contends that money "sticks" where it is designated. For example, an increase in state monetary allocations to local school districts would result in increased local educational expenditures; revenues designated by the state for local educational expenditures "stick" to that purpose. The crowding-out effect, on the other hand, occurs when local expenditure levels are maintained after grant receipts rather than increased. Instead, such

grants may fund commensurate reductions in local taxes, thus reducing local contributions to the budget item, or spur the reallocation of local revenues to fund other purposes; revenues designated by the state for local expenditures crowd out local expenditures previously designated to fund the same purpose.

Despite long-running increases in educational expenditures, state funding sources have not uniformly increased their contributions to local education spending. For example, over the past decade school districts have witnessed increased pressure to maintain total funding levels in the wake of the Great Recession, primarily due to notable declines in state budget allocations to public K-12 education. In fact, average state funding declined $850 per pupil from 2008 to 2013 and 31 states had not restored pre-recession funding levels by 2015 (Leachman, Masterson, & Figueroa, 2017). These declines in state support sharpened the burden on local municipalities to bridge funding gaps through local revenue provision. Furthermore, in the aftermath of the Great Recession, funding gaps between well-resourced and poor school districts grew, effects witnessed most evidently for districts with the highest state aid allotments (Evans, Schwab, & Wagner, 2017). State revenues for public education also declined in other recessionary environments, including the aftermath of the 2001 recession. To compensate for lost state revenues, local districts responded by increasing local property tax revenue (Dye & Reschovsky, 2008). Districts in New York responded in a similar manner after the Great Recession, (Chakrabarti, Livingston & Roy, 2014). Each of these analyses focus on local tax response to state and federal policies, many enacted as responses to specific economic circumstances or to address fiscal challenges due to the enactment of particular funding policies.

School District Debt

School district debt financing serves another key role in local revenue provision. Districts typically seek access to debt markets, most commonly through municipal bond issuance, to support long-term expenditures including facilities construction; districts may also issue short-term debt typically to support financing of day-to-day operations (Ammar, Duncombe, Jump, & Wright, 2004). The following section reviews the existing literature regarding school district debt issuance including its public policy motivations and evidence of the effects of debt-funded expenditures on students and other constituencies. While much of this research may help inform policymakers and administrators engaged in district revenue raising, further research is needed to help explain disparities in debt issuance among different district types and the effects such disparities may have on district and student outcomes.

School Facilities Quality

Demand for public school facilities investment has longstanding roots in public policy discussions. Amid a growing national focus on entrenched socioeconomic and educational disadvantage among minority groups driven by the civil rights movement in the 1950s and 1960s, The Civil Rights Act of 1964 and the Coleman Report in 1966 sharpened public focus on public school resources. Quality of school facilities and resource provision across students of varying disadvantage and race became emblematic of chronic inequities in the provision of public education, differences hypothesized to contribute to differences in academic achievement. The national focus placed on public school quality continued in the 1980s through the publication of *A Nation at Risk* in 1983

and the 1989 Education Summit in Charlottesville, Virginia during Ronald Reagan's and George H. W. Bush's presidencies, respectively. Continuing federal deliberation over public education, both debates raised significant concerns over trends in American academic achievement and economic competitiveness while continuing to underscore longitudinal disparities in achievement among different groups of students.

Despite these national calls to action, resource disparities across student populations persisted, including severe deficiencies in public school facilities. In 1996, the United States General Accounting Office (U.S. GAO) published a report for Congress detailing the status of American public school facilities, a report which shed light on widespread and significant inadequacies. The report estimated that America's public schools required $112 billion (approximately $175 billion in 2017 dollars) in school infrastructure improvements. Necessary improvements cited in the report spanned a broad range of concerns associated with, "Deferred maintenance, health and safety, and accessibility" (Arsen & Davis, 2006). In the years since the GAO report, capital outlays on public school facilities increased and today range between $50 and $90 billion annually (2017 dollars), or approximately 7 to 11%of total public elementary and secondary school budgets nationwide (Snyder et al., 2016). Nonetheless, reports in many districts suggest greater investment is warranted, particularly in low-income districts. The School District of Philadelphia, for example, recently cited a $5 billion facilities need to correct for issues associated with health and safety, code compliance, operations and general maintenance, and capital improvement (Parsons, 2017). Many other urban and low-income districts may require similar types of investments. Such reports suggest that the GAO report two decades ago may have offered a decidedly conservative estimate of

school capital requirements. Isolated reports of district capital need may be common, yet little research has systematically reviewed differences in such need among different district types and differences in how districts raise revenues to fund such capital expenditures.

Districts may pursue substantive capital projects to address several contemporary demographic and infrastructure-related demands. Harris and Munley (2002) cite several prevalent rationales. First, as the school-aged population in the so-called 'baby boomer generation' expanded in the 1950s and 1960s, many school districts built new school facilities, buildings which may require substantial investment by the 2000s and 2010s, particularly in the suburban districts which expanded rapidly in prior decades. Second, many districts have witnessed overcrowding due to changing migration patterns. Urban school districts in Sunbelt states, for example, have experienced strong enrollment growth largely comprised in large part of significant influxes of students of color (Frankenberg, 2009). Third, district facilities may require investment to accommodate modern technology infrastructure including adequate internet capabilities. Finally, school districts must comply with new government accessibility mandates such as those required by the Individuals with Disabilities Education Act and the Americans with Disabilities Act, both of which witnessed substantive revisions in the 1990s and 2000s to create more equitable learning environments for the disabled.

In 1999, the U.S. Department of Education commissioned a report on public school facilities quality (Lewis et al., 2000). The report identified 14% of public schools as overcrowded, schools with between 6% and 25% more students than their capacities, and 8% as severely overcrowded, schools with over 25%more students than their

capacities. Overcrowded and severely overcrowded schools both were more likely to serve larger shares of minority students (Ready, Lee, & Welner, 2004). Long-term planning to alleviate such conditions, however, has proved challenging in many jurisdictions. The growth of school choice, the expansion of the public provision of early childhood education, and the movement in support of smaller schools, among other prevalent education policy initiatives, represent many competing demands on school facilities infrastructure, initiatives which may generate uncertainty in school facilities planning for local neighborhood schools (Stevenson, 2006).

School facilities construction has also been cited as a key element of contemporary debates concerning equitable and adequate school funding. For example, Arsen and Davis (2006) analyzed school facilities and unmet capital need in Michigan, a state with a wide distribution of school capital expenditure and, in turn, a wide distribution of school facilities quality across districts with varying levels of local property wealth. The authors estimated that school capital assets in Michigan varied from $4,300 to $87,000 per pupil, while schools in districts with unmet capital need required an average investment of $7,000 per pupil, or an additional 30% investment on the valuation of existing capital. Such shortfalls were found to be most prevalent in Michigan's 15 central city school districts and in low-income suburban districts, districts with roughly half the school capital stock of the state average. These disparities highlight differences in facilities quality across student populations, differences the authors argue motivate significant equity and adequacy debates. The Michigan example recalls longstanding resource deficiencies, elements prevalent in the 1996 U.S. GAO report and prior government accounting.

Efficacy of Investments in School Facilities

Despite frequent calls for investment in public school facilities in past decades, there existed scant rigorous evidence on the direct effects of such investments. To address this shortcoming, a number of recent studies have contributed to an emerging body of evidence regarding the effects of capital investment in school facilities on a host of important outcomes including student achievement, teacher attrition, and property values, outcomes relevant to a range of interested parties and research disciplines. An increased focus on America's deteriorating public infrastructure, including its stock of public school facilities, may continue this trend in years to come.

1. Student Achievement

In one of the first studies to directly examine the association between school facilities quality and student achievement, Berner (1993) studied school facilities conditions in Washington, D.C. Categorizing school facilities condition as poor, average, or excellent, Berner found an improvement in school quality of one level (i.e. poor to average) to be associated with a 5.5 percentage point increase in student achievement after controlling for several important covariates including student race, enrollment, school age, and local average income. Further, Berner cautioned that despite such associations, school facilities maintenance budgets often are primary targets of budget cuts. On the other hand, Berner warned that unobserved variables beyond the covariates in her model, variables including parental motivation and residential selection, may bias her findings.

Despite Berner's findings, correlational studies may remain unlikely to convincingly demonstrate the direct relationship between capital investment and student achievement. Several recent studies, however, have employed a variety of more rigorous econometric techniques to investigate the relationship between capital investments and student outcomes. Typically leveraging a range of natural experiments, these studies have employed rigorous research designs to directly support causal claims relating to school facilities investments and student achievement.

Cellini, Ferreira, and Rothstein (2010) examined two decades of school bond referenda in California to estimate the effects of investments in the physical infrastructure of public schools on student achievement, housing prices, and household sorting. The California contexts offers a rich research setting as 629 of its 1,035 districts conducted at least one bond referendum between 1987 and 2006. Pioneering a dynamic regression discontinuity design to investigate third grade student achievement, the authors found a 0.077 standard deviation increase in math achievement and a 0.067 standard deviation increase in reading achievement in response to bond passage. Importantly, the modest measured effects emerged six years after bond passage and dissipated in the decade thereafter.

Nielson and Zimmerman (2011) studied New Haven, Connecticut, a poor urban school district comprised of 22,000 students, 80% of whom qualify for free lunch and 90% of whom are racial minorities. New Haven pursued an aggressive plan of facilities improvement wherein 49 schools were improved substantially or newly built. The authors leveraged the staggered execution of construction from the mid-1990s to 2010 to evaluate several outcomes associated with school construction including elementary and middle

school student achievement, home prices, and student enrollment. Regarding academic achievement, the authors found an average 0.21 standard deviation improvement in reading achievement six years after students moved to a new or improved school building, or a 0.027 standard deviation increase per $10,000 invested. Estimated effects in math were of a similar magnitude but with variation too great to claim statistical significance.

Hong and Zimmer (2016) studied bond elections in Michigan from 1996 to 2009 to evaluate the impact of school capital infrastructure investments on student achievement. The authors employed the dynamic regression discontinuity design initially employed by Cellini et al. (2010). They found improved reading proficiency rates in fourth graders of 2 to 5% beginning five years after bond passage and three to six percent in seventh graders beginning seven years after bond passage; these results constitute approximately 0.1 to 0.3 standard deviations of reading achievement proficiency rates. The authors caution that while there is evidence that such investments generate notable improvements in student achievement, speculation regarding the results of long-term cost-benefit analysis measuring the societal impact of the investments remains unclear. Also notable in their results is the significant delay witnessed in improved achievement, echoing the timing of the findings of Cellini et al.

Martorell, Stange, and McFarlin (2016), on the other hand, found limited, if any evidence that school construction projects improve student achievement. Studying bond elections in Texas from 1994 to 2011 covering 2,277 different local bond referenda, the authors found no evidence of gains in student achievement even six years after bond passage. The authors did detect small improvements in student achievement among

disdadvantaged students, those students eligible to receive free lunch, though they caution that those estimates are sensitive to different model specifications. In addition, only modest improvements in student attendance were detected.

Conlin and Thompson (2017) studied a large-scale school construction program in Ohio from 1997 to 2011. The state invested over ten billion dollars in school improvement projects across 231 school districts, over one-third of Ohio's districts. The authors exploit variation in district eligibility to participate in Ohio's Classroom Facilities Assistance Program (CFAP) and in investment timing to estimate effects of school construction projects on student achievement and housing prices using an instrumental variables approach. The authors estimated a 0.15 percentage point decline in student math achievement proficiency rates per $1,000 per-pupil investment in the two years prior to facilities completion potentially reflecting the disruptive short-term effects of construction. Four years after facilities completion, once investments had been completed and capitalized in improved value of capital stock, however, the authors found a 0.1 percentage point increase in math proficiency rates. Trends in reading proficiency were of similar timing though of generally smaller magnitude.

Lafortune and Schonholzer (2018) examined a large-scale capital improvement program in the Los Angeles Unified School District where more than 150 schools were built and hundreds more were renovated from 2002 to 2017. Similar to prior results found by Conlin and Thompson, the authors found a decline in mathematics achievement in students' first year in a new school facility, 0.04 standard deviations in this instance. Any achievement losses, however, were overcome within four years, after which time student math achievement improved by 0.1 standard deviations, on average. Student reading

achievement improved as well after four years in a new school facility, by 0.05 standard deviations.

2. Teachers

In the literature pertaining to teacher labor markets, teacher turnover often is cited as the most important factor pertaining to school staffing, more important than the recruitment of new teachers or the retirement of experienced teachers (i.e. Ingersoll, 2001). The literature offers evidence pertaining to a wide range of factors associated with teacher attrition including teacher wages, accountability practices, societal standing and perceived status, and school working conditions, including facility quality. For example, teachers working in urban districts often cite poor working conditions including dilapidated and overcrowded facilities as primary rationales for leaving a teaching position. In fact, such working conditions often are more important predictors of teacher attrition than student demographic characteristics (Darling-Hammond, 2003). To investigate this crucial aspect of teacher labor markets, several studies have examined how school facilities quality may impact important teacher staffing issues including retention, turnover, and job satisfaction.

Buckley, Schneider, and Shang (2005) surveyed teachers in Washington, D.C. schools to gauge the factors which contribute to teacher decisions to leave a teaching position. In addition to teacher age, satisfaction with pay, and perceptions of community supports, facilities quality, including atmospheric elements such as temperature, lighting, acoustics, emerged as a significant predictor of teacher retention. Johnson, Kraft, and Papay (2012) surveyed teachers in Massachusetts on a range of elements that make up

school working conditions. They found facilities quality to be a key predictor of teacher job satisfaction and retention decisions, approximately half as large as estimated effect sizes related to school social characteristics including principal leadership and school culture. Simon and Johnson (2015) corroborate Johnson et al.'s findings regarding teacher working conditions. Analyzing six prior studies on teacher turnover, including Johnson et al., the authors support conclusions indicating the importance of school facilities to teacher retention, though again less important an indicator than social working conditions including school leadership. In sum, alongside oft-cited school attributes including principal leadership and school culture, school facilities quality remain an important element of teacher working conditions and a significant predictor of teacher turnover.

3. Property Values

Several of the aforementioned studies extended their analyses to examine important public policy outcome measures beyond student achievement. Parental preferences for schools often are studied through effects witnessed on local housing prices in the aftermath of new policies or specific financial investments (i.e. Bayer, Ferreira, & McMillan, 2007). In addition, neighborhood-level effects of school improvement programs often are examined due to the role of schools as anchor institutions crucial to local social interactions (i.e. Taylor, McGlynn, & Luter, 2013). While each of the following studies approaches the measurement of housing prices utilizing a slightly different methodology, they each address the capitalization of investments in neighborhood public schools through local housing prices.

In California, Cellini et al. (2010), found between a $1.39 and $1.79 increase in local housing prices for each dollar of school district bond issuance. Nielson and Zimmerman (2011) found a 1.27% increase in housing prices per $10,000 per capita school construction expenses, an amount which translated to 10% total effect per the average school investment in New Haven, Connecticut. Similar to their findings pertaining to student achievement, Conlin and Thompson (2017) found home prices to decline in the two years following capital school investment, then increase by $0.80 for every dollar of improvement in the value of school capital stock in the following years. The facilities investments studied by the authors in Ohio suggest that a $10,000 increase in capital investment is associated with a 1.2% increase in local housing prices. Lafortune and Schonholzer (2018) found housing prices in Los Angeles to increase by six percent in neighborhoods with a new school and determined a "willingness-to-pay" of 1.2 to 1.6 for every dollar of capital investment, an estimate consistent with prior findings by Cellini et al. and Nielson and Zimmerman. In varied geographies across the country, each of these recent studies help to inform policies that increase investments in school infrastructure by demonstrating their effects on local housing prices.

4. Additional Outcomes

Student Health. Health considerations related to indoor air quality and other harmful exposures in school facilities are particularly salient for children as they spend a large portion of their time in school buildings during formative years of physical maturation. Despite such considerations, there exist scant environmental regulations regarding air quality in schools. Mendell and Heath (2005) reviewed the literature

specifically pertaining to the relationship between school indoor air quality and student achievement. In their review, the authors found suggestive evidence that a range of poor indoor environmental qualities (IEQs) including nitrogen dioxide exposure, poor outdoor air ventilation, and exposure to a range of biological and chemical pollutants contributed to decreased student attendance and lower academic achievement. Many of these pollutants have been linked to a host of ailments including asthma, respiratory infections, and allergic reactions. Mendell and Heath warn, however, that strong causal links of such factors in schools are not prevalent in the literature.

A number of studies examine the effects of early childhood lead exposure on subsequent achievement results (i.e. Bellinger et al., 1992; Evens et al., 2015; Zhang, et al., 2013). Each of these studies finds a negative relationship between early childhood lead exposure and later achievement. The majority of such studies, however, focus on early childhood exposure rather than exposure in public school facilities. In school contexts, a Philadelphia study found 57.4% of its public school buildings exceeded acceptable lead levels in drinking water as directed by the Environmental Protection Agencies (EPA) (Bryant, 2004). A New Orleans study concluded that inner-city schools demonstrated significantly higher lead levels in soil than mid-city and outer-city schools (Higgs, Mielke, & Brisco, 1999). Such exposures both within and beyond school environments require special medical treatment and ongoing academic attention, costs that far outstrip exposure prevention efforts (Zahan et al., 2009).

School Climate. Uline and Tschannen-Moran (2008) and Durán-Narucki (2008) investigated variables posited to mediate the relationship between school facilities quality

and student achievement. Examining 80 middle schools in Virginia, Uline and Tschannen-Moran administered surveys to over a thousand teachers to gain insights into the role of school climate. The authors concluded that that inadequate facilities were associated with weakened focus on strong academics, reduced community engagement to support student learning, and diminished teacher enthusiasm to support student learning, qualities that contributed to poorer school climate, a mediating variable for student achievement. Bowers and Urick (2011) drew similar conclusions regarding teacher perceptions of facilities quality. Utilizing a nationally representative sample, the authors studied the relationship between facilities quality and eleventh and twelfth grade math achievement. While they concluded that high school math achievement does not vary significantly by facilities quality, the authors posited a mediated effects hypothesis whereby teacher perceptions of facilities quality mediates its relationship with student achievement.

Attendance and Enrollment. Durán-Narucki (2008) studied 95 elementary schools in New York City, each of which was administered a building condition survey by an independent architect or engineer. The author concluded that student attendance mediated the relationship between building quality and student achievement while concluding that students in poorer facilities attended school less often and displayed poorer performance on standardized mathematics and English language arts assessments. Several additional studies including those by Branham (2004) and Maxwell (2016) found school climate and student attendance to mediate relationships between poor school facilities quality and student outcomes including academic achievement and dropout rates.

In addition to their findings regarding student achievement and housing prices in New Haven, Connecticut, Nielson and Zimmerman analyzed the effect of school construction projects on student enrollment. They concluded that enrollment in a neighborhood school increased by 4.4% for a per-capita investment of $10,000 in school capital projects. Similar to many findings pertaining to student achievement, the authors identified enrollment estimates after six years of occupancy in a newly constructed or substantially improved school facility.

Summary

There is a wide body of literature which identifies a range of positive outcomes associated with school facilities improvement. First, the majority of relevant studies found improvements in student achievement, though many estimates only emerged five or more years after the investment was made. Second, local housing prices were found to increase after investments in public school facilities. Third, poor school facilities conditions often are cited as a key element in teacher mobility decisions, alongside other oft-cited elements of teacher working conditions. Finally, additional evidence, much of it lacking strong causal identification, links school facilities quality to student outcomes, including health and attendance, and school outcomes, including school climate and enrollment. The entire body of evidence lends strong support to the allocation of expenditures that improve public school facilities.

Debt Processes and Constraints

School infrastructure investments including new school construction and substantial renovation projects typically are financed through the issuance of a bond, a debt instrument that facilitates large short-term expenditures repaid over the long term (Bowers & Lee, 2013). As a result, evidence regarding the prevalence and efficacy of district bond issuance is an important element of the conversation regarding school facilities improvement. Investments in school facilities now total tens of billions of dollars each year while recent empirical evidence supports the efficacy of such investments to improve a range of important public policy outcomes including student achievement. It is worthwhile, therefore, to scrutinize the procedures, policies, and key determinants of debt issuance, the method by which such investments typically are facilitated. School districts weigh a range of factors when they pursue debt issuance and bond referenda, some of which may influence their decisions regarding the timing, amount, or even the fundamental decision to issue debt.

Once a district has determined a need for a substantial capital improvement requiring funds in excess of its annual tax-funded allocations, it will typically engage in a bond issuance procedure (Harris & Munley, 2002). Financing for public capital projects custimarily is obtained through the issuance of municipal bonds, debt instruments issued by non-federal governmental entities including organizations with broad governing mandates such as states and cities, or organizations with more specific purposes including school districts and water authorities. Municipal bonds capital to the issuing entity through investor purchases who are repaid over a set period of time, often a period of ten years or longer (Bowers, Metzger, & Militello, 2010). To attract these investments,

municipal entities pays investors interest on the investment, interest which may provide special tax preferences including exemption from federal, state, and local income taxes for resident purchasers (U.S. Securities and Exchange Commission, 2018).

School districts engage in a series of steps to issue a municipal bond. Harris and Munley (2002) detail the bond issuance decision-making process which includes obtaining a credit rating, purchasing bond insurance, and, ultimately, bond issuance. First, a district determines its total capital need and the period over which it projects an ability to repay investors, usually through some form of increased local taxation. Second, the district obtains a credit rating from an external credit rating agency, Moody's Investor Services, Standard and Poor's Financial Services, or Fitch Ratings. Next, a district decides whether to pursue private bond insurance to enhance the bond's credit rating. Finally, the district pursues authorization to issue the bond depending on local finance laws and regulations. In a majority of states, this process occurs through a public voting referendum. In other states, the district may issue a bond without direct voter approval, typically depending on the amount of the bond (Ely, 2014). Each of the aforementioned steps are influenced heavily by a district's potential cost of borrowing, determined through its credit rating; therefore, it is worthwhile to review district credit ratings and the policies aimed to support district debt issuance.

Credit Ratings

A district's cost of interest on its debt holdings is determined primarily through its credit rating; as a result, credit ratings are important considerations in district debt issuance (Ely, 2012a). Credit ratings provide signals to potential investors of the risk of

the bond issuer defaulting on a repayment. Higher risk of default typically induces a bond issuer to increase the yield on the bond by increasing the amount of interest that accompanies principal repayment. Higher interest payments entice investors considering a range of potential securities by compensating bond holders for assuming greater risk. Moody's and Standard and Poor's are the primary independent credit rating agencies hired by districts and other municipal entities to generate credit ratings (Harris & Munley, 2002). These rating agencies consider several municipal characteristics to determine a bond's rating including the local economic activity, existing debt obligations, and municipal management capabilities (Hildreth & Miller, 2002).

Once a district receives a credit rating on a potential bond offering, it then decides whether to pursue bond insurance. Bond issuers may pursue insurance to reduce the cost of capital by "leasing" the higher credit worthiness of an insurance issuer. Its prevalence has varied over the years; it peaked in 2005 when 57% of all municipal bonds included some form of private insurance, a percentage that has declined sharply in the years following the Great Recession (Ely, 2012a). Denison (2001) details the role of bond insurance in the costs municipalities bear to issue bonds. The procurement of bond insurance reduces a bond issuer's cost of capital by diminishing the adoption of risk of a bond purchaser. Although a municipal entity may attempt to improve its credit rating, many of a rating's underlying characteristics are difficult to manipulate if not determined entirely exogenously to any municipal policy. Local characteristics including per-capita income and the strength of the property and income tax base may be affected somewhat through economic policies, though many such elements may rely more on regional or

national factors including federal government policy and overarching regional or statewide economic trends (Denison, 2001).

Bond referenda empower local voters to determine the fate of most bond offerings. Bowers, Metzger, and Militello (2010) examined factors associated with local district bond passage in Michigan from 2000 to 2005. The authors found four central factors influenced the likelihood of voter approval. Smaller bond amounts, larger district student enrollments, urban and suburban locales (rather than towns and rural areas), and first bond requests (as opposed to subsequent requests offered for vote) all were associated with greater likelihood of district bond passage. Collectively, these findings, in tandem with the literature which evaluates the investments bonds may facilitate in public schools, offer valuable guidance for policymakers and district administrators as they seek to allocate scarce resources in schools. On the other hand, further empirical evidence is needed concerning factors which may constrain school district debt issuance and the extent to which such constraints may affect district resource provision and student achievement across varied district contexts.

Several factors may constrain district decisions to issue debt. Districts with precarious revenue streams, substantial existing liabilities, or uncertain labor contracts, for example, may be constrained in their abilities to issue debt in a cost-effective manner due to poorer credit ratings and correspondingly higher potential interest costs. To support school district investments in public school facilities, many states utilize programs to either directly support construction projects with state funds or to support district debt issuance (Verstegen & Jordan, 2009). In fact, in the 2006-2007 school year, only 11 states did not use any type of state program to support school district construction

projects in any way. Roughly half the remaining states applied some type of program to ease potential district credit constraints including debt service grants and guarantees of district bonds. District access to these state-level programs may influence their respective credit-related constraints.

A majority of states employ some type of program to directly facilitate district investments in local school facilities construction. These programs include direct support in state formula allocations, support for districts of rapidly increasing enrollment, need-based and/or equalization programs determined through local wealth capacities, low-cost borrowing programs, matching grants, and debt service offset programs (Ely, 2014). These programs vary significantly by state but are generally growing in size and scope across the nation.

In addition, some states use credit enhancement programs to augment district credit ratings, a low-cost alternative to private bond insurance (Ely, 2012b). Similar to private bond insurance, credit enhancement programs bestow upon districts or other municipal entities additional backing from a stronger party, a district's state government in this instance. The financial advisory firm Fidelity Investments, among other financial advisory companies, advises its clients considering municipal bond investments on such state programs. In its most recent publication (DeMarco & Perlovsky, 2018), Fidelity reported that 27 states employ some type of district credit enhancement program including standing funds to guarantee district debt and intercept programs to divert state funding to district debt service in times of financial need. Credit enhancement programs likewise have grown in prevalence, particularly in the wake of the Great Recession and for municipal entities with marginal credit ratings (Ely, 2012b).

On the other hand, the provision of state aid to support district capital improvement projects may be particularly susceptible to economic downturns (Denison, Yan, & Zhao, 2007). The design of such state programs conscious of differences in district characteristics including property wealth and student poverty may serve to reduce funding inequalities across districts (Duncombe & Wang, 2009). Little research, however, has examined such policies in close detail. If districts are constrained in their abilities to access debt capital markets, they may not be able to support certain expenditures in a manner they may otherwise pursue. The empirical literature is lacking in evidence regarding how changes to borrowing capacities may affect school resource provision and student outcomes. Furthermore, access to debt markets may be constrained for certain district types. Districts with low property wealth and taxable income, for example, may fail to provide certain educational resources due to constraints on their debt issuance. For example, there is some indication that higher-spending districts are better able to meet local education spending preferences through debt markets than their lesser-spending peers after state funding reforms (Zimmer & Jones, 2005). Moreover, low-wealth urban districts may be especially price sensitive in their pursuit of debt-funded capital improvements projects (Wang, Duncombe, & Yinger, 2010). To date, the relationship between school district debt cost, access, and issuance remains largely unaddressed.

Chapter 2

TRENDS IN DISTRICT DEBT UTILIZATION

Introduction

A substantial element of school district expenditures, school capital investments including new school construction, renovation projects, and facilities maintenance typically are financed at least in part through the issuance of a bond, a debt instrument that facilitates large short-term expenditures (Bowers & Lee, 2013). As a result, evidence regarding the prevalence and trends of district bond utilization is an important element of the conversation regarding school facilities investments. In effect, municipal bonds act as long-term loans to the issuing entity. Investors provide capital to issuers through bond purchase and are repaid in regular intervals over a medium to long period of time, often longer than a decade (Bowers, Metzger, & Militello, 2010). To attract such investments, the municipal entity pays the investor interest on the investment, investments which carry particular tax advantages for investors (U.S. Securities and Exchange Commission, 2018). While the process of bond issuance may be similar across districts, little research to date has explored similarities and differences in bond utilization across time and district characteristics.

A number of descriptive trends in district debt utilization inform this study. The following chapter reviews elements of district debt including its long-term expansion both on average and decomposed by several heterogeneous district classifications including geographic characteristics, student demographic characteristics, and district credit ratings. While different district types utilize debt in greater amounts than do others,

each of the following groups utilize debt substantially more than they did two decades ago. As a result, they likewise spend greater amounts on debt service costs.

In this vein, the following research questions motivate this chapter:

1. How has district debt utilization changed over the past two decades?
2. How has district debt utilization varied by district characteristics including student demographics, district geography, and district credit worthiness over the past two decades?
3. How have district costs of debt changed over the past two decades?

Data and Sample

I construct a public school district-level panel dataset for the 1994-1995 through 2014-15 school years. These years represent the first and last years of publicly available annual national district-level finance data. The panel includes characteristics pertaining to districts and the demographics of their students obtained from the Common Core of Data (CCD) through the U.S. Department of Education's National Center for Education Statistics (NCES). A number of variables are drawn from the NCES Local Education Agency Finance Survey, or the F-33. These variables include detailed revenue (i.e. local, state, federal), expenditure (i.e. instructional, capital, salaries), and debt (long- and short-term holdings and issuance) variables. Additional district characteristics include student enrollment, school counts, and district urbanicity (i.e. urban, suburban, town, or rural). District demographic characteristics include the percentage of students who receive free- or reduced-priced lunch, the percentage of minority students, the percentage of students

who receive individualized education plans (IEP), and the percentage of students identified as English language learners (ELL).

To reduce the considerable noise characteristic of district financial data contained in the F-33 survey, I restrict the dataset by excluding district-year observations based on a small set of criteria. Following Evans, Schwab, and Wagner (2017), I exclude district-year observations with per-pupil expenditure data greater than 150% of the 95th percentile or less than 50% of the 5th percentile. Next, following Lafortune et al. (2018) and Brunner and Hyman (2018), I exclude district-year observations with enrollment greater than double the district's average over the sample period or more than 15% different than the district's enrollment in the year prior. The aforementioned authors and others conclude that such district-year observations observed in NCES likely were reported incorrectly.

District Trends: 1995-2015

Since the 1994-1995 school year, districts across the nation spent over $1.25 trillion on capital expenditures.[1] To finance these expenditures, district long-term indebtedness increased substantially from approximately $3,000 per pupil to $8,000 per pupil, on average, as seen in Figure 1. The sheer magnitude of district debt holdings is noteworthy unto itself. Approximately $8,000 per pupil in annual long-term debt holdings equates to approximately $400 billion in total across the nation. It is likewise important to note that these figures nearly have tripled, on average, over the past twenty years, growth that has closely tracked the magnitude of increases in average per-pupil

[1] Author's calculations from data obtained through National Center for Education Statistics' Common Core of Data.

revenues. The upward trends in district expenditures and debt holdings appear to have been interrupted in the aftermath of the Great Recession in the years following the 2008-2009 school year and have resumed subsequently.

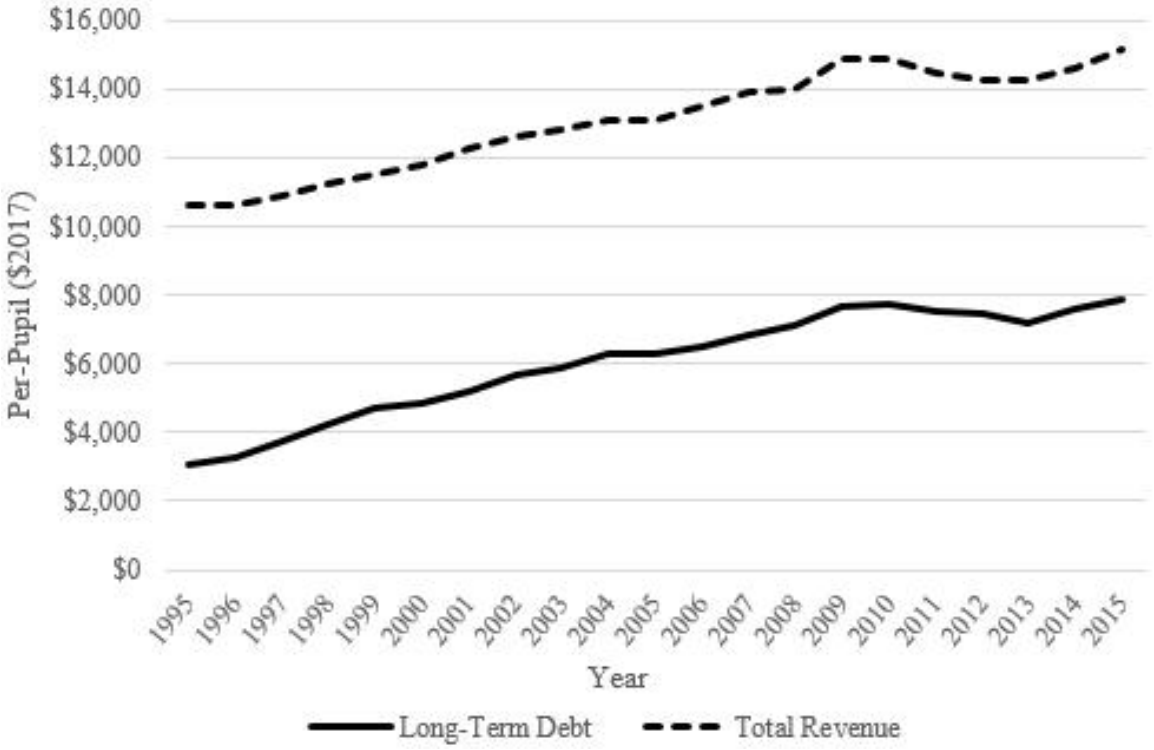


Figure 1. District Long-term Debt Holdings and Revenue

Notes: Author's calculations from data retrieved from the NCES Local Education Agency Finance Survey. The year 2015 refers to the 2014-2015 school year. Long-term debt is measured at the end of each school year. Debt and total revenue figures are reported on a per-pupil basis in inflation adjusted $2017. N=11,470 school districts.

The trend of increased per-pupil district indebtedness is shared across different district types as measured by a number of district characteristics. Figure 2 examines trends among districts by the number of disadvantaged students they serve, measured by quartiles of shares of students who receive free- or reduced-priced lunch. Districts serving the smallest shares of disadvantaged students, for example, hold substantially

more debt than their more disadvantaged peer districts, growth that appears to have been most affected by the Great Recession over the past decade. In addition, each quartile group has increased its respective debt holdings substantially since 1995; debt holdings in the most disadvantaged quartile increased threefold while debt holdings in the remaining quartiles at least doubled over the same time period. Substantial gaps in indebtedness between districts serving different shares of disadvantaged students, $3,000 to $4,000 between the most and least disadvantaged districts, have persisted over the past two decades.

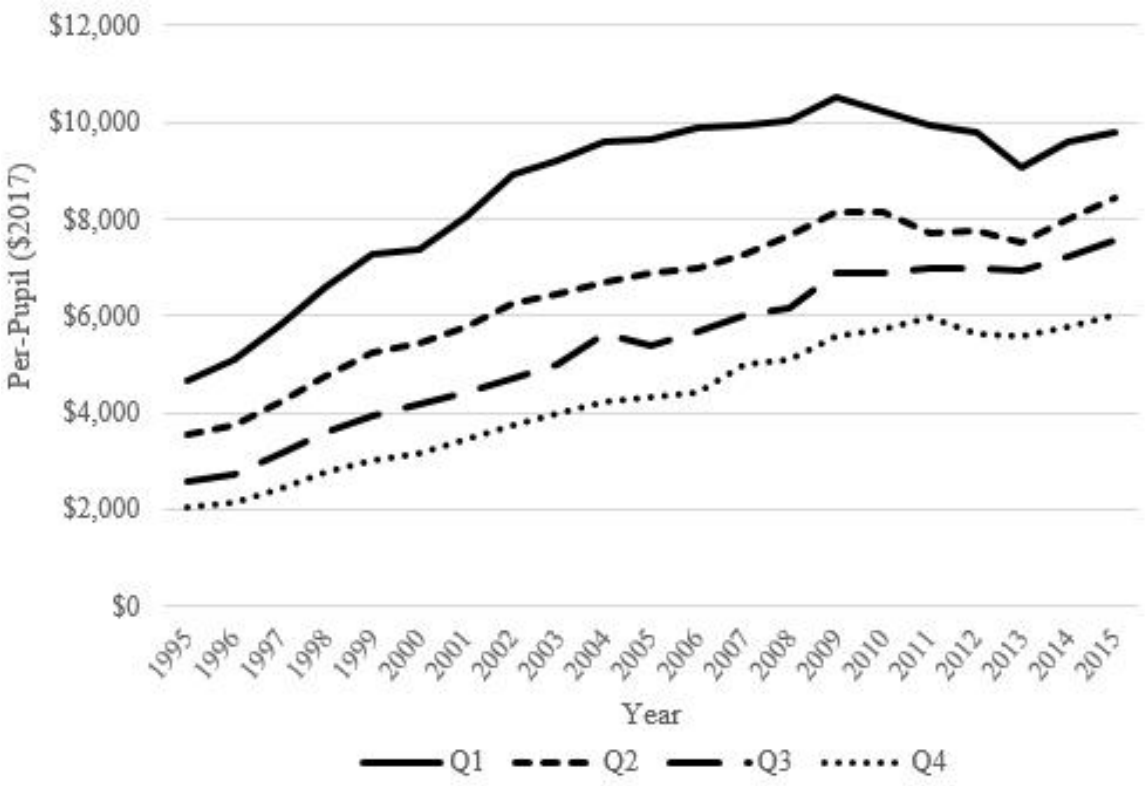


Figure 2. District Debt Holdings, by FRPL Quartiles

Notes: Author's calculations from data retrieved from the NCES Local Education Agency Finance Survey. The year 2015 refers to the 2014-2015 school year. Long-term debt holdings are measured at the end of each school year and are reported on a per-pupil basis in inflation adjusted $2017. FRPL quartiles are measured in the 2009-2010 year and refer to the proportion of students in a district who receive free- or reduced-priced lunch. Q1 contains the quartile of districts serving the fewest such students. N=11,470 school districts.

Student and district characteristics vary widely across each quartile, as reported in Table 1. Districts in the fourth quartile serve more than four and half times as many disadvantaged students and four times as many minority students as districts in the first quartile. They are approximately 50% larger measured both by student enrollment and number of district school buildings and are much more likely to be either urban or rural. On an annual basis, they spend approximately $2,500 less per pupil, or 15%, than the most advantaged districts. Importantly, their budgets are not derived predominantly from local sources. Whereas 62.5% of budgets in the first quartile of districts derive from local sources, less than 31% of budgets in the fourth quartile of districts are raised locally. These gaps may influence district disparities in certain types of expenditures, including debt-funded facilities construction and maintenance which are typically raised and paid off through local revenues.

Table 1. District Characteristics, by FRPL Quartiles

	All Districts	Q1	Q2	Q3	Q4
Panel A: District Demographics					
Enrollment	3,768.23 (12,522.50)	3,239.84 (5,347.68)	2,919.43 (8,754.82)	3,598.65 (11,852.85)	4,468.87 (18,805.04)
School Count	7.23 (18.07)	5.57 (7.24)	5.95 (11.17)	7.25 (16.93)	8.84 (27.65)
FRPL	0.445 (0.222)	0.159 (0.088)	0.370 (0.044)	0.519 (0.043)	73.33 (0.103)
ELL	0.047 (0.100)	0.024 (0.050)	0.027 (0.058)	0.039 (0.074)	0.106 (0.165)
IEP	0.138 (0.049)	0.130 (0.044)	0.141 (0.043)	0.143 (0.049)	0.141 (0.060)
Minority	0.196 (0.250)	0.097 (0.133)	0.107 (0.144)	0.168 (0.197)	0.415 (0.334)
Urban	0.058	0.034	0.043	0.054	0.096
Suburban	0.212	0.446	0.160	0.231	0.134
Town	0.187	0.110	0.204	0.125	0.211
Rural	0.543	0.410	0.593	0.590	0.559
Panel B: District Debt, Revenue, and Expenditure Characteristics					
Local Revenue	6,739.36 (5,008.42)	10,486.28 (6,105.57)	6,800.46 (4,215.75)	5,580.901 (3,805.21)	4,325.75 (3,215.49)
State Revenue	6,422.91 (5,696.79)	5,316.25 (2,735.38)	6,703.65 (3,233.39)	6,709.16 (3,181.35)	7,090.44 (3,280.91)
Federal Revenue	1,687.85 (1,303.67)	977.99 (706.64)	1,402.06 (728.96)	1,759.35 (817.32)	2,650.66 (1,992.12)
Total Revenue	14,850.12 (5,122.00)	16,780.52 (5,707.97)	14,906.17 (4,815.03)	14,049.41 (4,602.10)	14,066.85 (5,008.41)
Total Expenditures	15,008.30 (5,696.79)	16,875.75 (6,260.57)	14,951.01 (5,445.88)	14,259.48 (5,455.43)	14,323.36 (5,405.94)
Long-Term Debt Holdings	7,749.46 (10,373.23)	10,296.87 (9,853.78)	8,176.49 (8,647.65)	7,015.41 (8,440.16)	5,860.65 (14,196.75)
Long-Term Debt Issued	927.82 (3,008.77)	1,132.75 (3,241.56)	1,069.61 (3,347.92)	878.53 (3,191.87)	636.59 (2,286.00)
Short-Term Debt Holdings	291.19 (1,681.72)	241.13 (926.89)	377.873 (1,721.68)	434.15 (2,730.76)	171.53 (782.11)
Debt Service Payments	333.95 (392.32)	454.63 (444.76)	347.590 (388.42)	302.84 (374.58)	244.77 (351.62)
Districts	11,470	2,867	2,868	2,868	2,867

Notes: District characteristics are for the 2009-10 school year. Mean (standard deviation) of district characteristics reported; for geographic characteristic (urban, suburban, rural, and town), proportion of sample is indicated. Minority is the proportion of a district's students who are Black or Hispanic. Long- and short-term debt holdings are measured at the end of the 2009-2010 school year. All finance variables reported on a per-pupil basis and are inflation adjusted ($2017).

Next, as depicted in Figure 3, districts categorized by their geographic characteristics similarly have maintained different levels of indebtedness over the past two decades.[2] Suburban and urban districts hold more per-pupil debt than their more rural counterparts, trends that have persisted as overall indebtedness has grown for districts in all geographic areas. Urban and suburban districts, as illustrated in Table 2, hold $1,500 to $3,000 more long-term debt and spend $100 to $150 more in debt service costs than town and rural districts. If debt-funded facilities investments may be important to improve student and district outcomes, gaps in these investments across district types may present important public investment considerations.

[2] Districts are assigned an urbanicity status (urban, suburban, town, or rural) per its 2009-2010 classification provided by the Common Core of Data.

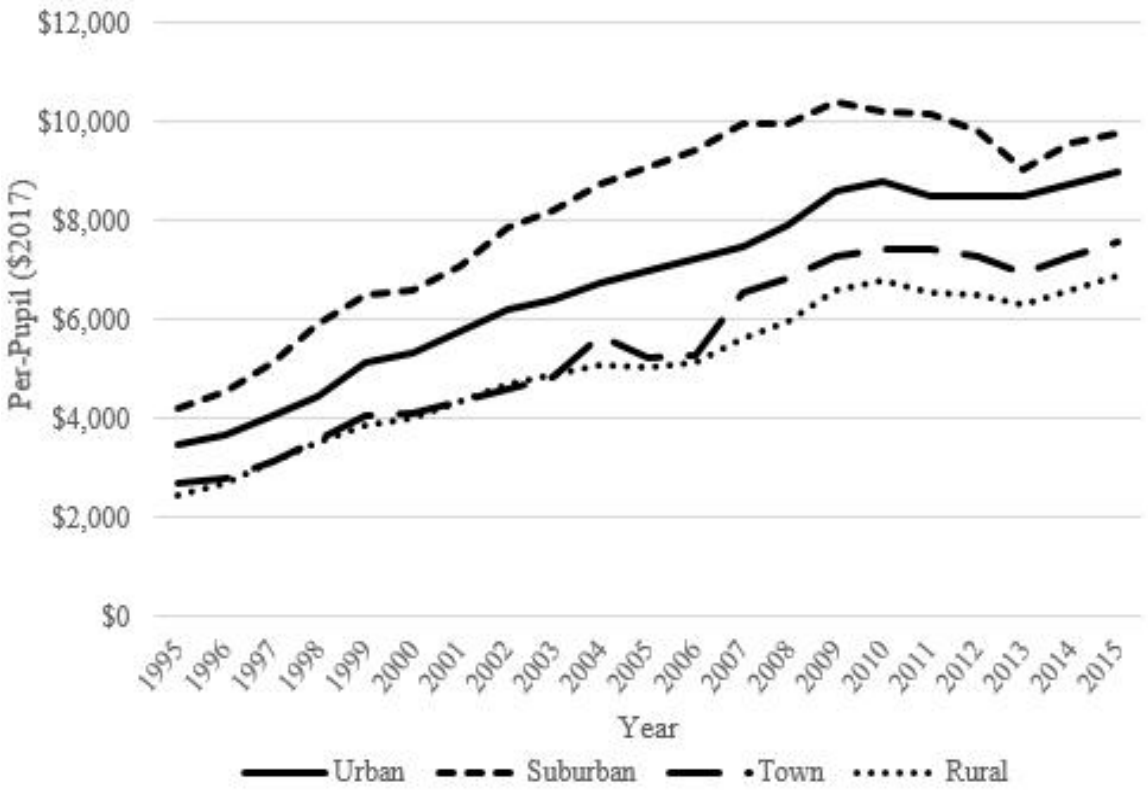


Figure 3. District Debt Holdings, by Urbanicity

Notes: Author's calculations from data retrieved from the NCES Local Education Agency Finance Survey. The year 2015 refers to the 2014-2015 school year. Long-term debt holdings are measured at the end of each school year and is reported on a per-pupil basis in inflation adjusted $2017. District urbanicity is determined in the 2009-2010 school year and is reported by CCD. N=11,470 school districts.

Table 2. District Characteristics, by Urbanicity

	All Districts	Urban	Suburban	Town	Rural
Panel A: District Demographics					
Enrollment	3,768.23 (12,522.50)	18,736.47 (35,913.77)	6,291.03 (15,451.04)	2,410.78 (2,113.58)	1,219.85 (2,475.06)
School Count	7.23 (18.07)	31.39 (52.76)	9.74 (20.52)	5.74 (4.11)	3.52 (3.80)
FRPL	0.445 (0.222)	0.526 (0.221)	31.48 (23.87)	0.486 (0.191)	0.464 (0.207)
ELL	0.047 (0.100)	0.137 (0.149)	0.060 (0.104)	0.052 (0.104)	0.033 (0.089)
IEP	0.138 (0.049)	0.129 (0.044)	0.142 (0.040)	0.140 (0.045)	0.138 (0.054)
Minority	0.196 (0.250)	0.456 (0.282)	0.252 (0.267)	0.217 (0.261)	0.134 (0.208)
Panel B: District Debt, Revenue, and Expenditure Characteristics					
Local Revenue	6,739.36 (5,008.42)	6,145.43 (3,914.57)	9,908.65 (6,217.98)	5,243.88 (3,551.33)	6,265.89 (4,562.41)
State Revenue	6,422.91 (5,696.79)	6,102.54 (3,161.60)	5,637.23 (2,884.62)	6,397.93 (2,549.82)	6,812.56 (3,428.93)
Federal Revenue	1,687.85 (1,303.67)	1,856.67 (1,087.28)	12,36.92 (964.65)	1,703.23 (963.21)	1,834.02 (1,531.87)
Total Revenue	14,850.12 (5,122.00)	14,104.63 (4,576.00)	16,782.80 (5,718.16)	13,345.04 (3,822.58)	14,912.46 (5,198.65)
Total Expenditures	15,008.30 (5,696.79)	14,391.69 (4,738.71)	16,868.46 (5,983.66)	13,539.32 (4,453.34)	15,057.55 (5,980.24)
Long-Term Debt Holdings	7,749.46 (10,373.23)	8,989.65 (7,402.42)	10,352.92 (9,039.33)	7,557.70 (7,550.79)	6,879.14 (12,157.38)
Long-Term Debt Issued	927.82 (3,008.77)	918.16 (2,129.27)	1,151.27 (3,143.96)	985.55 (2,991.80)	830.79 (3,128.05)
Short-Term Debt Holdings	291.19 (1,681.72)	229.17 (860.93)	260.94 (1,154.34)	304.88 (1,387.67)	333.28 (2,051.03)
Debt Service Payments	333.95 (392.32)	414.36 (358.42)	445.90 (411.16)	319.26 (333.74)	295.76 (411.32)
Districts	11,470	644	2,518	2,154	6,154

Notes: District characteristics are for the 2009-10 school year. Mean (standard deviation) of district characteristics reported. Minority is the proportion of a district's students who are Black or Hispanic. Long-

and short-term debt holdings are measured at the end of the 2009-2010 school year. All finance variables reported on a per-pupil basis and are inflation adjusted ($2017).

Finally, districts of varying credit scores, as measured by Moody's in 2010, have likewise maintained different levels of debt utilization over the past two decades.[3] Recall that district credit ratings are influenced by a range of factors including local economic activity, existing debt obligations, and municipal management capabilities (Hildreth and Miller, 2002). Those districts with the highest credit ratings hold more long term debt, up to $3,000 more than their lesser rated peer districts, as demonstrated in Figure 4. Each rated district type increased its outstanding long-term debt from the mid-1990s through the late 2000s. In light of this growth, the highest rated districts now hold between $0.70 and $1.00 of outstanding debt per every dollar of total revenues, as seen in Figure A2. Lower rated districts hold less debt per dollar of total revenues; districts with bonds rated A2 or below by Moody's now hold less than $0.60 in long-term debt per dollar of total revenues. Finally, districts lacking any outstanding Moody's bond ratings, hold the least outstanding debt, less than $6,000 per pupil, though a figure that has increased from less than $2,000 two decades ago.[4]

[3] Districts are categorized by their highest outstanding bond rating from Moody's at the end of the 2009-2010 school year. There are ten Moody's investment grade credit ratings from most to least creditworthy: Aaa, Aa1, Aa2, Aa3, A1, A2, A3, Baa1, Baa2, and Baa3.

[4] Districts lacking a Moody's bond rating at the conclusion of the 2009-2010 school year either lacked any outstanding bond obligations, had outstanding bond obligations rated by another rating agency, or had unrated outstanding bond obligations. Harris and Munley (2002) cite three reasons a district would issue a bond without a credit rating. First, the anticipation of a very poor credit rating may offset any perceived signal to potential bond purchasers. Second, if bonds are to be marketed in a hyper-local manner, local investors may already hold sufficient knowledge of a municipal entity's credit worthiness. Third, if a bond is small enough, the monetary value associated with a good credit rating may not outweigh the small cost of obtaining one from a credit rating agency.

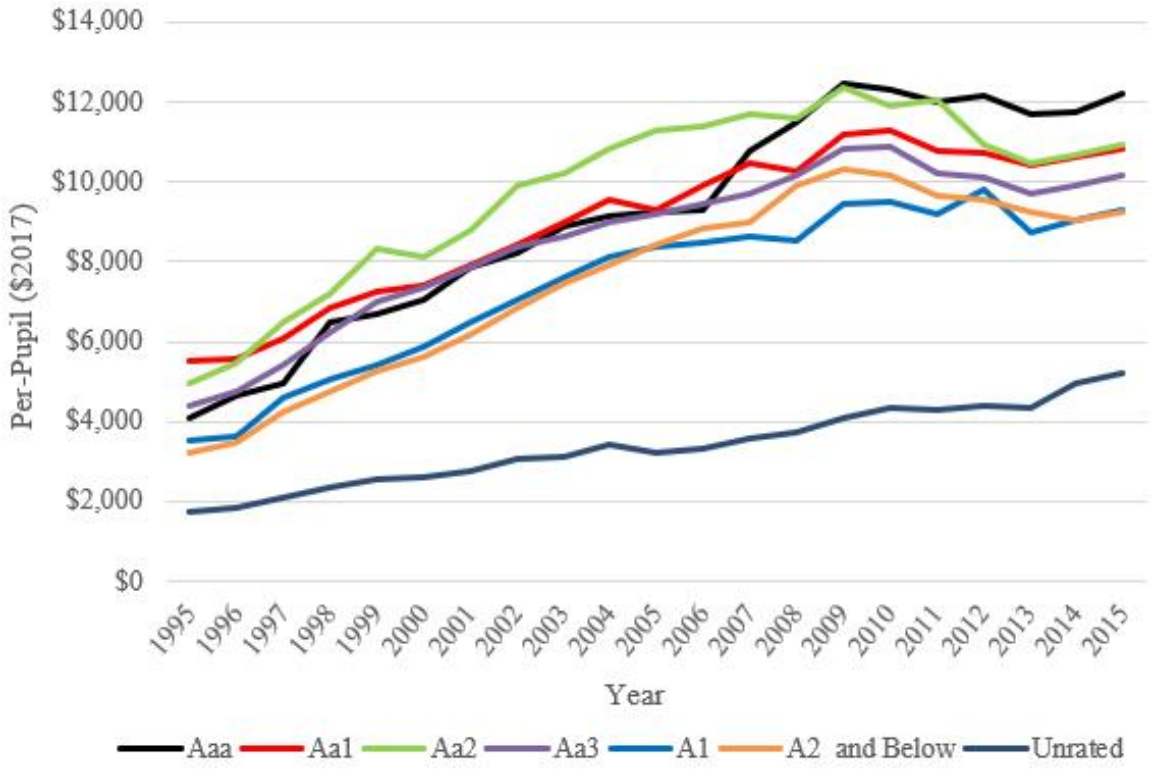


Figure 4. District Long-term Debt Holdings, by Moody's Credit Rating

Notes: Author's calculations from data retrieved from the NCES Local Education Agency Finance Survey. The year 2015 refers to the 2014-2015 school year. Capital expenditures are measured on a per-pupil basis in inflation adjusted $2017. A district's credit rating reflects its highest available bond rating in April 2010. N=11,470 school districts.

Table 3. District Characteristics, by Moody's Credit Ratings

Panel A: District Demographics

	Aaa	Aa1	Aa2	Aa3	A1	≤ A2	No Rating
Enrollment	8,179.99 (22,329.63)	9,852.16 (20,164.65)	6,139.73 (20,903.74)	4,192.66 (12,519.04)	3,634.72 (6,420.45)	3,674.56 (5,794.05)	1,554.82 (3,916.87)
School Count	13.14 (32.05)	16.30 (27.14)	10.51 (29.37)	7.67 (18.13)	7.19 (12.25)	6.88 (8.60)	4.11 (6.47)
FRPL	0.458 (0.222)	0.426 (0.256)	0.341 (0.216)	0.405 (0.204)	0.420 (0.183)	0.451 (0.211)	0.481 (0.222)
ELL	0.085 (0.959)	0.065 (0.081)	0.041 (0.076)	0.057 (0.120)	0.049 (0.102)	0.062 (0.125)	0.040 (0.098)
IEP	0.106 (0.301)	0.128 (0.313)	0.140 (0.485)	0.141 (0.042)	0.138 (0.035)	0.140 (0.045)	0.142 (0.055)
Minority	0.392 (0.302)	0.284 (0.256)	0.170 (0.204)	0.193 (0.257)	0.184 (0.232)	0.223 (0.269)	0.172 (0.242)
Urban	0.121	0.159	0.090	0.070	0.093	0.056	0.024
Suburban	0.210	0.347	0.441	0.269	0.173	0.247	0.122
Town	0.225	0.188	0.158	0.237	0.340	0.257	0.154
Rural	0.444	0.306	0.311	0.424	0.394	0.440	0.700

Panel B: District Debt, Revenue, and Expenditure Characteristics

	Aaa	Aa1	Aa2	Aa3	A1	≤ A2	No Rating
Local Revenue	6,480.91 (5,529.716)	6,907.50 (6,232.66)	8,272.39 (6,238.20)	7,093.457 (4,308.584)	6,531.59 (3,430.52)	6,367.19 (4,371.18)	6,479.85 (4,939.815)
State Revenue	5,388.20 (2,191.45)	6,073.52 (2,578.58)	6,031.09 (2,683.40)	6,502.486 (3,269.035)	7,925.43 (4,173.72)	7,011.03 (3,461.36)	6,496.10 (3,246.93)
Federal Revenue	1,788.14 (1,021.85)	1,548.19 (983.57)	1,272.09 (798.05)	1,396.259 (792.8391)	1,440.94 (817.14)	1,637.46 (1,454.60)	1,942.11 (1,608.81)
Total Revenue	13,657.25 (4,548.65)	14,528.76 (4,816.55)	15,575.57 (5,325.00)	14,992.2 (4,675.357)	15,897.96 (5,452.21)	15,015.68 (4,990.55)	14,918.05 (5,416.94)
Total Expenditures	14,297.06 (5,443.45)	14908.31 (6,165.43)	15,757.83 (5,568.62)	15,067.73 (5,225.05)	16,455.77 (7,025.28)	14,762.26 (5,401.56)	15,051.11 (5,977.57)
Long-Term Debt Holdings	12,312.02 (9,146.79)	11,272.83 (9,454.07)	11,889.83 (9,382.63)	10,867.37 (8,546.496)	9,525.77 (8,106.80)	10,181.37 (9,228.25)	4,362.78 (11,150.89)
Long-Term Debt Issued	1,225.86 (3,106.36)	1,369.17 (3,720.71)	1,027.15 (2,751.90)	1,309.543 (3,302.577)	1,083.94 (2,922.60)	950.02 (3,030.93)	665.95 (2,948.99)
Debt Service Payments	551.87 (420.94)	469.79 (386.98)	509.338 (402.50)	459.4868 (378.0116)	463.99 (429.32)	449.63 (450.02)	187.66 (338.47)
Districts	511	447	1,540	2,515	312	639	5,506

Notes: District characteristics are for the 2009-10 school year. Mean (standard deviation) of district characteristics reported; for geographic characteristic (urban, suburban, rural, and town), proportion of sample indicated. Minority is the proportion of a district's students who are Black or Hispanic. All finance variables reported on a per-pupil basis and are inflation adjusted ($2017).

In addition to the the magnitudes and upward trends of debt utilization, debt service payments, payments to satisfy costs of interest, have increased dramatically as well. As shown in Figure 5, whereas in 1995 districts paid less than $175 per pupil in interest payments, they now pay over $300 per pupil, on average, in real terms. Across the nation, these costs of interest now exceeds $17 billion each year. Similar to debt utilization, average debt service expenditures declined after the Great Recession but may increase as outstanding debt increased in the 2013-2014 and 2014-2015 school years. Debt service payments also constitute 2% to 3% of district budgets, a figure which varies by different district types and may be substantially higher in certain districts.

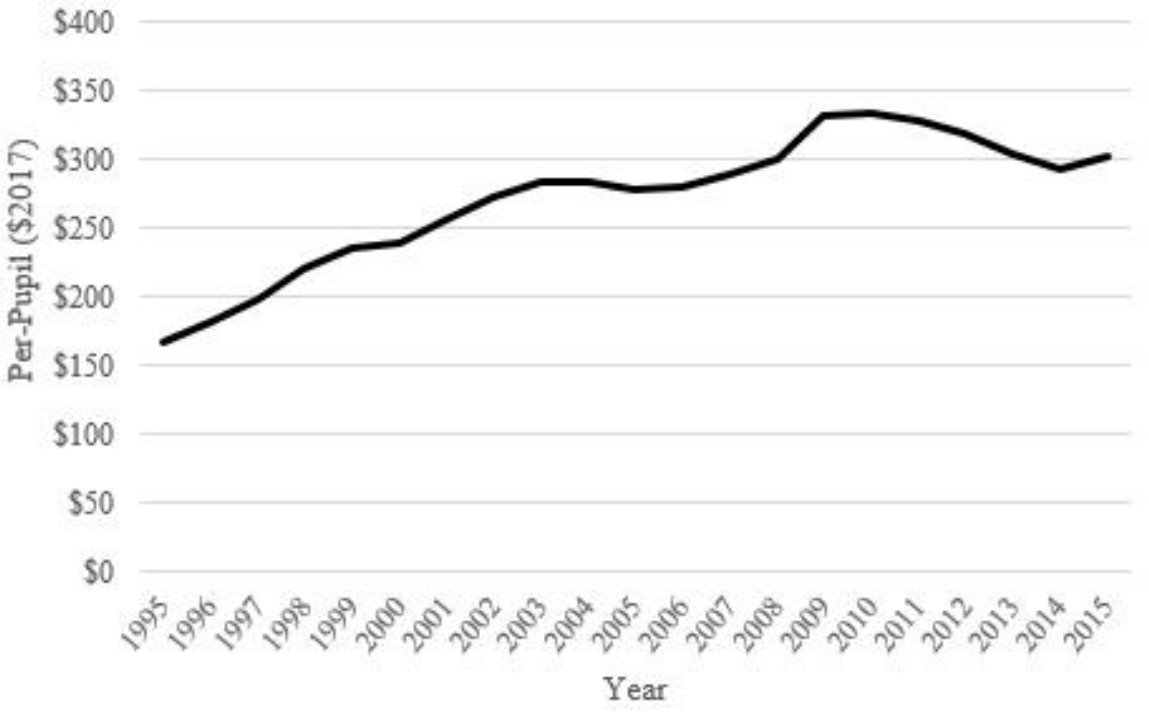


Figure 5. District Debt Service Expenditures

Notes: Author's calculations from data retrieved from the NCES Local Education Agency Finance Survey. The year 2015 refers to the 2014-2015 school year. District debt service expenditures are expenditures paid on costs of interest of long- and short-term indebtedness and exclude principal repayments. It is reported on a per-pupil basis in inflation adjusted $2017. N=11,470 school districts.

For the average school, debt service cost averaged approximately $174,000 in the 2009-2010 school year, a substantial expenditure which may crowd out other important district spending. There is also evidence that districts now expend a greater amount on debt service payments per dollar of capital expenditure. As shown in Figure 6, whereas districts spent $0.20 in debt service per dollar of capital expenditure in 1995, they now spend $0.25, a figure which reached a peak of $0.30 in the 2012-2013 school year. These expenditures would be sufficient to pay the average salaries of three teachers and substantially more than the average salary of a principal, (Snyder, de Brey, & Dillow, 2015). Districts could spend this amount on other combinations of teacher aides, assistant principals, etc. would likewise be possible if costs associated with debt spending could be averted. The efficacy of such hypothetical tradeoffs, however, remain unclear.

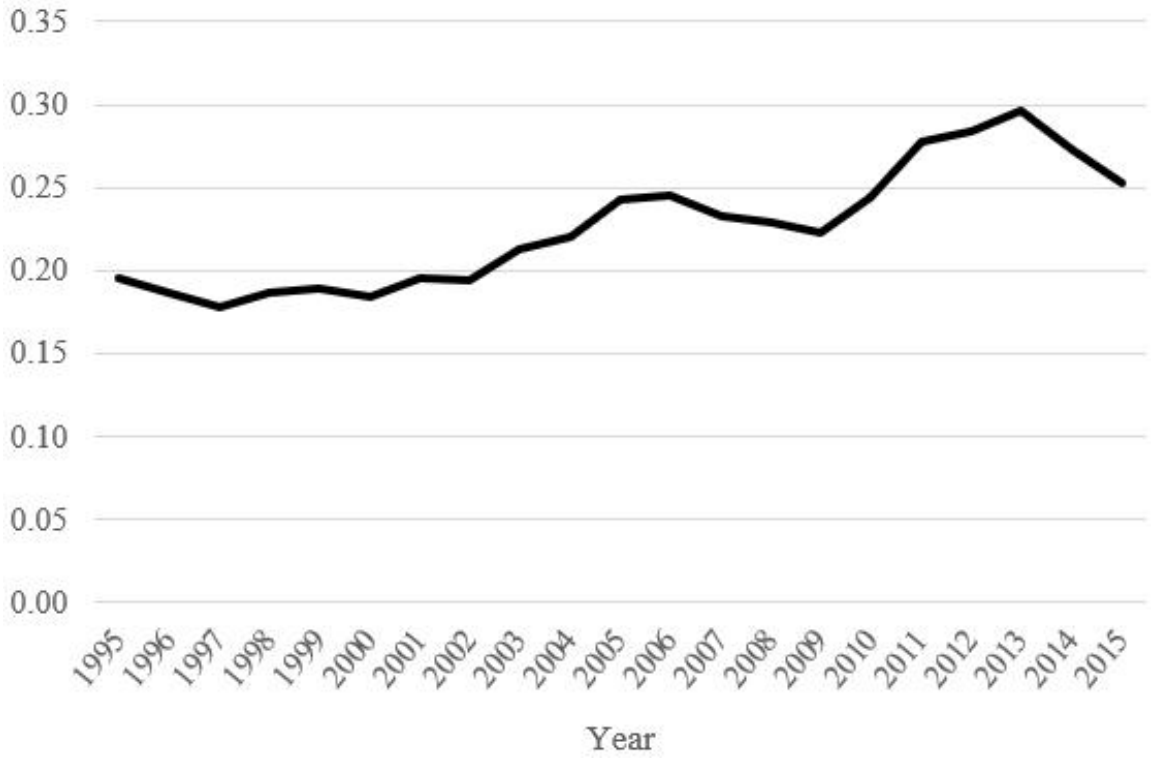


Figure 6. Ratio of District Debt Service Payments to Capital Expenditures

Notes: Author's calculations from data retrieved from the NCES Local Education Agency Finance Survey. The year 2015 refers to the 2014-2015 school year. District debt service expenditures are expenditures paid on costs of interest of long- and short-term indebtedness and exclude principal repayments. The y-axis measures the ratio of per-pupil district debt service payments to capital expenditures. N=11,470 school districts.

Discussion

Over the past two decades, school districts have utilized an increasing amount of debt. Now averaging $8,000 per pupil on an annual basis, or $400 billion nationally, long-term debt constitutes an increasingly large component of local school district revenue-raising. This upward trend is shared by districts characterized by a host of different student and district characteristics. Districts of varying quantities of disadvantaged students, of different geographic characteristics, and of a range or credit worthiness all carry substantially more debt than they did two decades ago. In some

cases, this amount has tripled in real terms. To finance this increasing amount of debt, districts have expended an increasing amount on costs of interest, over $300 per pupil on average.

On the one hand, debt service costs facilitate capital expenditures, potentially crucial investments in school infrastructure. On the other hand, in the absence of such costs, districts potentially could make investments in other areas including additional human capital in the form of additional teachers, aides, or school and district leadership. Trends in district debt utilization and associated costs, however, do not shed light on the mechanisms which may influence a school district to alter its debt utilization practices. Of relevance to local and state bodies of government, questions remain as to whether there particular policies which may influence school district debt policies. The following chapter examines a natural experiment related to school district credit scores, a key driver of district debt service. The experiment avails an opportunity to empirically investigate potential levers of district debt issuance stemming from sensitivity to its cost. It also informs analysis of different state policies related to local debt and investigates differences which may exist across district types, potentially important findings for state policies governing capital expenditures in schools.

Chapter 3

DISTRICT CREDIT CONTRAINTS, DEBT ISSUANCE, AND RESOURCE PROVISION

Introduction

Absent the costs of debt, school districts could issue debt in a manner strictly governed by local capacities and preferences for principal repayment. In this setting, districts would not be required to consider the budgetary implications of a line item dedicated to debt service costs, interest payments directed to bondholders or other lenders. In reality, districts attract investors to purchase bonds by offering interest on principal, the magnitude of which are determined primarily through district credit ratings. Credit ratings, measures of district repayment risk, are informed by a range of underlying district characteristics discussed previously, factors which may be difficult to manipulate solely through district policies (Hildreth & Miller, 2002). To better understand the effects of credit ratings and associated costs of debt on district debt issuance, the following chapter examines a natural experiment to municipal credit ratings and its effects on district debt issuance and resource provision.

Moody's Recalibration

Prior to 2010, Moody's Investor Service maintained two different bond rating methodologies. This 'dual-class' rating system applied one methodology to U.S. municipal bond ratings and a second methodology to sovereign bonds, corporate bonds, and other structured financial products (Moody's, 2010). In April and May 2010, Moody's eliminated its previous municipal bond rating system and applied its 'Global

Rating Scale' to its U.S. municipal bond ratings, including its outstanding ratings on U.S. school district bonds. As a result of this 'recalibration' event, a subset of school district bond received upgrades of one to three notches on a scale of ten investment-grade ratings, a purely mechanical shift rather than a reflection of a change in any underlying district characteristic such as local financial capacities or student demographic characteristics. Importantly, many districts did not receive a credit rating upgrade on an outstanding bond. In addition, additional districts did not have outstanding bonds rated by Moody's or already had the highest Moody's credit rating and could not have witnessed an upgrade.

During and after the Great Recession, credit rating agencies suffered a spate of criticism in part due to their collective failures to accurately forecast issuer default (i.e. Pagano and Volpin, 2010).[5] Although primarily focused on ratings of structured debt obligations largely of subprime mortgages, this criticism called into question the ability of credit ratings to offer substantive information to debt issuers and investors. To investigate this issue, the House of Representatives Committee on Oversight and Government Reform held a hearing on October 22, 2008 titled, "Credit Rating Agencies and the Financial Crisis." Cornaggia, Cornaggia, and Israelsen (2017) cite the Congressional testimony of Christopher Shays. Criticizing credit rating agency performance, Shays commented, "They have no brand, they have no credibility

[5] Credit rating agencies also were criticized along additional rationales. Yinger (2009), for example, compares aspects of credit rating to redlining, suggesting a stricter regulatory framework around the credit rating process. For purposes of this study, relevant criticisms focus on the role of credit ratings to inform an issuing entity's cost of debt.

whatsoever. I can't imagine any investor trusting them."[6] Agency failure to accurately forecast subprime mortgage default, however, would not necessarily have influenced how credit ratings could continue to inform subsequent financial activity. Several studies examine this question (and others) empirically. Indeed, Cornaggia, Cornaggia, and Israelesen leverage the Moody's recalibration and find that credit spreads of upgraded bonds declined relative to non-upgraded bonds. Their findings indicate that upgraded bonds were seen as less risky to investors, a sign that the bonds credit ratings influenced investor behavior.

If, on the heels of the Great Recession, credit ratings had lost their capacities to inform government decision making, changes in credit ratings would not have spurred action by such parties including subsequent bond issuance. Adelino, Cunha, and Ferreira (2017) utilize the Moody's recalibration to determine its effect on a range of county-level economic characteristics. Using the recalibration event as a treatment variable, they conclude that local governments which experienced credit upgrades issued more debt, reduced their costs of borrowing, and increased debt-financed public spending. On its face, these results may appear counterintuitive. For example, a March 2010 Moody's Rating Implementation Guide stated:

> Market participants should not view the recalibration of municipal ratings as rating upgrades, but rather as a recalibration of the ratings to a different rating scale. This recalibration does not reflect an improvement in credit quality or a change in our credit opinion for rated municipal debt issuers. Instead, the recalibration will align municipal ratings with their global scale equivalent (Moody's, 2010).

[6] House Hearing "Credit Rating Agencies and the Financial Crisis," transcript available from the U.S. Government Printing Office at https://www.govinfo.gov/content/pkg/CHRG-110hhrg51103/html/CHRG-110hhrg51103.htm

In other words, the Moody's statement attempted to make clear that opinion regarding the credit worthiness of upgraded bonds and their respective issuers should not have changed due to the recalibration event.

Adelino et al. (2017) provide empirical evidence contradicting the Moody's statement in their study of local municipal governments and county governments. First, they find that upgraded government entities increase their bond issuance. Compared to local municipal governments that did not experience recalibration, upgraded governments increased their bond issuance 16% to 20% from April 2010 to March 2013 relative to the prior four years. To analyze county-level bond issuance, the authors construct a variable measuring the share of local municipal governments per county that witnessed recalibration. They find that for a one standard deviation increase in recalibration share, bond issuance increased 3.1%. Second, they analyzed the effect of recalibration on local public expenditure and public employment. They find that for a one standard deviation increase in recalibration share, local government expenditure and employment increased 0.5%. Third, they examined potential spillover effects in the private sector due to increased public expenditure and employment after recalibration. They find that for a one standard deviation increase in recalibration share, private employment increased 0.3% and private income increased 0.5%, both heterogeneously by employment sectors, including a 1% increase in private employment in the educational services sector.

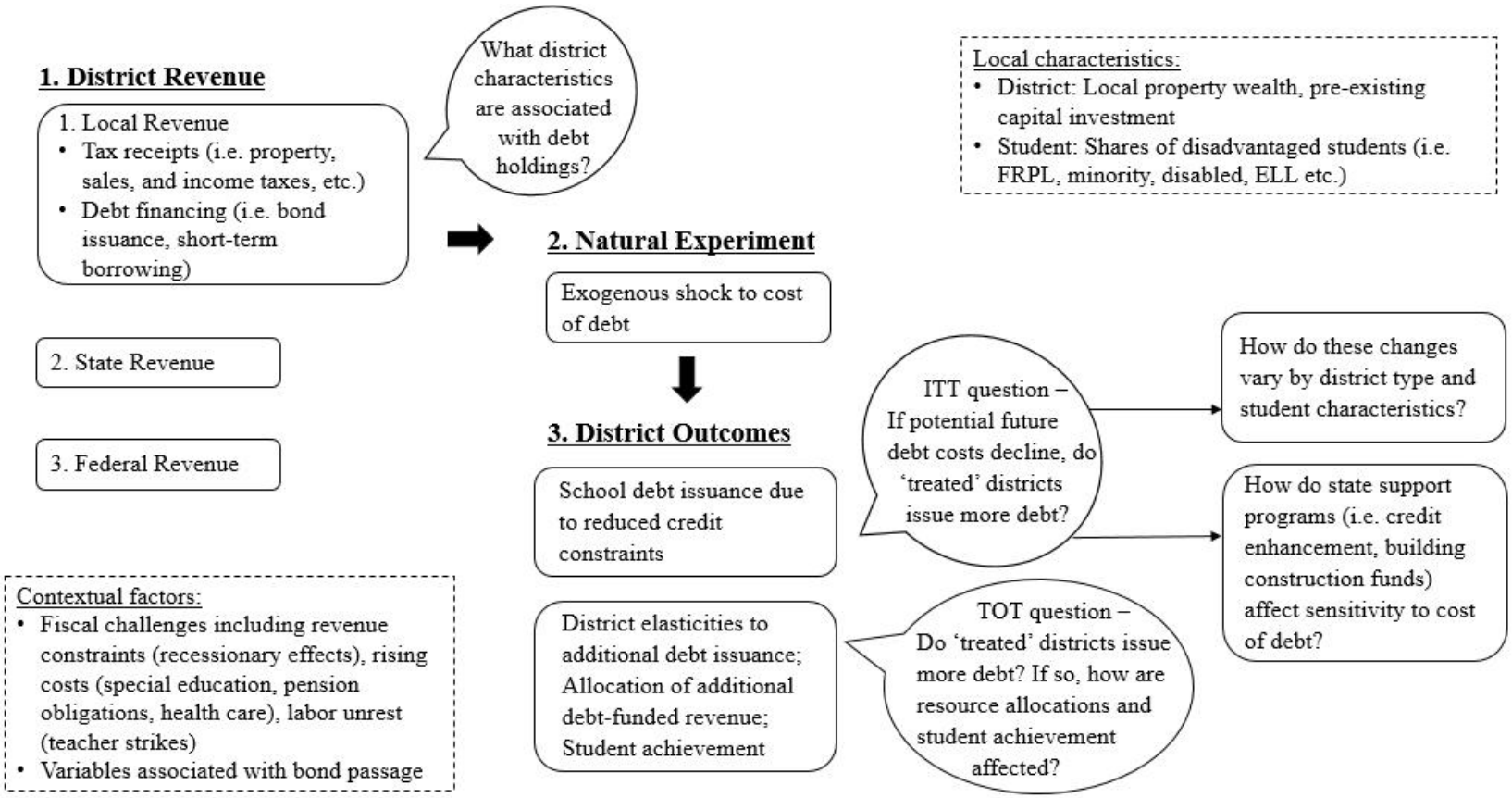
Following Adelino et al. (2017), I extend this work to study school district debt issuance and to examine in which district contexts credit upgrades may have been most important. Examined within a sample of public school districts, the natural experiment provides a unique setting to analyze a change in the cost of debt issuance rather than

analyses of changes in underlying district characteristics which typically motivate changes to credit ratings. In this capacity, the Moody's recalibration introduces exogenous variation to district costs of debt. This variation enables the isolation of debt costs as a variable in district debt issuance and subsequent resource provision.

Logic Model

Figure 7 outlines a logic model spanning from local district revenue generation, an introduction of an exogenous shock to the cost of debt, district outcomes stemming from the shock, and variables and contexts which may affect relevant district financial and academic outcomes.

Figure 7. Logic Model



Recall that local revenue, revenue derived from local taxation and debt issuance, is the only revenue source directly controlled and generated by local municipal entities, be they school districts or other municipal bodies on behalf of their local school districts. First, districts may raise revenue through various forms of taxation or through certain types of user or impact fees, revenues permitted in approximately 12 states (Ely, 2014). Local property taxes produce the greatest share of local tax revenue while additional local taxes also are levied on a limited basis on income and various sales categories in particular jurisdictions (Loeb, 2001). Next, local municipal entities may raise funds through debt issuance. It is important to note that any debt incurred must be repaid through other revenue sources, typically through local taxation. Debt issuance, however, enables districts to reap large infusions of resources in the short term while agreeing to repay investors with interest, typically achieved through bond issuance, over long periods of time (Bowers & Lee, 2013). Districts primarily utilize two types of bonds, general obligation and revenue bonds, bond terms which refer to how a district proposes to secure the bond. General obligation bonds, the vast majority of school district bond issuance, are secured through a district's general revenue capacity, whereas revenue bonds, bonds utilized less frequently by school districts, are secured through specific revenue sources (Denison, Yan, & Zhao, 2007).

Next, an exogenous shock to the cost of district debt is introduced. The shock, the Moody's 2010 municipal credit rating 'recalibration,' serves as a natural experiment to evaluate district response to an easing of a credit constraints through exogenous credit rating improvement. A subset of districts' credit scores improved, enabling comparison to those districts whose credit ratings did not improve. In typical circumstances, a change in

a district's credit rating reflects a change in one or more of a range of district characteristics including the strength of the local tax base, existing liabilities, local employment, and demographic factors (Denison, Yan, & Zhao, 2007). A high rating reflects strong underlying district characteristics pertaining to district repayment capacity while a low rating reflects a degree of uncertainty in a district's repayment capacity. Bond purchasers, therefore, demand higher interest payments to purchase riskier bonds in compensation for their adoption of risk, interest payments which increase the cost of debt holdings for school districts. As a result of this natural experiment, many districts witnessed exogenous credit rating upgrades, thus enabling analyses of a change in the cost of debt issuance rather than analyses of changes in underlying characteristics which typically motivate changes to district credit ratings.

I address the following research questions in this chapter:

4. What districts characteristics are associated with debt issuance?
5. Do school districts issue more debt when it becomes cheaper to do so?
    a. If so, which school districts are particularly sensitive to changes in their costs of debt?
6. What are the elasticities of district revenues and expenditures with respects to additional debt issuance?
7. Does additional debt issuance influence student mathematics and English language arts achievement?

Data and Sample

I construct a public school district-level panel dataset for the 2005-2006 through 2014-15 school years, the final year of available national district-level finance data. The panel includes characteristics pertaining to districts, the demographics and achievement of their students, and local county economic characteristics from the Common Core of Data (CCD) through the U.S. Department of Education's National Center for Education Statistics (NCES), the U.S. Census, and the U.S. Department of Labor and the Stanford Education Data Archive (SEDA).

First, I draw a number of variables from the NCES Local Education Agency Finance Survey, or the F-33. These variables include detailed revenue (i.e. local, state, federal), expenditure (i.e. instructional, capital, salaries), and debt (long- and short-term holdings and issuance) variables. Additional district characteristics include student enrollment, school counts and district urbanicity (i.e. urban, suburban, town, or rural). District demographic characteristics include the percentage of students who receive free- or reduced-priced lunch, the percent of minority students, the percentage of students who receive individualized education plans (IEP), and the percentage of students identified as English language learners (ELL). As in Chapter 2, I restrict the sample to exclude observations which likely contain erroneous F-33 data.

Next, I draw several variables from federal datasets to account for local economic characteristics which may be associated with district debt issuance and holding. I include data pertaining to employment and wages from the U.S. Bureau of Labor Statistics Local Area Unemployment (LAUS) program and Quarterly Census of Employment and Wages (QCEW). From LAUS, the variables include the total labor force, total employed and

unemployed, and the unemployment rate. From QCEW I draw total and average wages. From the U.S. Census Building Permits survey I include the number of building permits issued and the value of building construction. Each of the economic variables are measured at the county level; data pertaining to the included economic indicators typically are not collected on an annual basis at the school district level.

I draw student achievement data from the Stanford Education Data Archive (SEDA). Available achievement data is limited to the 2008-09 through 2014-15 school years. Achievement data include math and English language arts which aggregate school-level performance in grades three through eight to the district level. The SEDA achievement data are placed on a common scale, the National Assessment of Education Progress (NAEP) thus rendering the scores comparable both within and across states and over time (see Reardon, Kalogrides, & Ho, 2017).

Finally, from Moody's I obtain a list of recalibrated school district bonds. The Moody's recalibration created three types of district designations: 1) Districts with Moody's bond ratings which were upgraded in 2010; 2) Districts with Moody's bond ratings which were not upgraded in 2010; and 3) Districts without outstanding Moody's bond ratings in 2010 which, by default, did not witness credit upgrades. Whereas Adelino et al. (2017) utilize the recalibration event to generate a continuous variable measuring the fraction of a county's local governments which witnessed credit upgrades, the following analyses focus exclusively on school districts; I assign a treatment indicator to districts whose bonds were upgraded.

Table 4 summarizes the district demographic characteristics by Moody's recalibration status. On average, districts with outstanding Moody's bond ratings (both

those with recalibrated credit ratings and those without) are larger, more urban and suburban, and less rural, than those districts without outstanding credit ratings at the point of Moody's recalibration.

Table 4. District Characteristics, by Moody's Credit Rating Recalibration Status

	All Districts	Not Rated	Rated, Not Recalibrated	Rated, Recalibrated
Enrollment	3,768.23 (12,522.50)	1,554.53 (3,822.19)	4,695.24 (16,243.23)	6,908.99 (15,770.16)
School Count	7.23 (18.07)	4.11 (6.48)	8.35 (22.77)	11.79 (23.12)
FRPL	0.445 (0.222)	0.481 (0.222)	0.411 (0.212)	0.375 (0.222)
ELL	0.047 (0.100)	0.040 (0.098)	0.059 (0.111)	0.048 (0.091)
IEP	0.138 (0.049)	0.141 (0.055)	0.136 (0.043)	0.137 (0.044)
Minority	0.196 (0.250)	0.172 (0.242)	0.225 (0.268)	0.186 (0.224)
Math Achievement	254.51 (13.84)	253.56 (14.07)	255.56 (12.69)	257.05 (14.50)
English Language Arts Achievement	235.62 (13.66)	233.99 (14.22)	236.03 (12.63)	239.90 (12.59)
Urban	0.058	0.024	0.072	0.118
Suburban	0.212	0.124	0.272	0.380
Town	0.187	0.154	0.233	0.186
Rural	0.543	0.698	0.423	0.316
Districts	11,470	5,487	4,169	1,814

Notes: District characteristics are for the 2009-10 school year. Mean (standard deviation) of district characteristics reported; for geographic characteristic (urban, suburban, rural, and town), proportion of sample indicated. Minority is the proportion of a district's students who are Black or Hispanic. Math and English language arts achievement scores represent district average National Assessment of Educational Progress (NAEP) scores, measured on a scale of 0 to 300.

Table 5 outlines district debt, revenue, and expenditure characteristics by district Moody's recalibration status. While the three types of districts appear similar in terms of their respective per-pupil revenues and expenditures, their debt usage is quite different. Districts with an outstanding Moody's credit rating in 2010 held approximately two and half times the long-term debt compared to districts without an active credit rating. I consider those districts with an outstanding Moody's rating that was not recalibrated to offer the best comparison to those that were recalibrated for two reasons. First, unrated districts had no possibility of 'treatment' and, thus, were not subject to any exogenous variation introduced by the natural experiment. Second, unrated districts maintain different financial practices, issuing and holding substantially less debt than the remaining districts.

Table 5. District Debt, Revenue, and Expenditure Characteristics

	All Districts	Not Rated	Rated, Not Recalibrated	Rated, Recalibrated
Local Revenue	6,739.36 (5,008.42)	6,474.11 (4,938.36)	6,901.90 (4,747.53)	7,974.52 (5,900.47)
State Revenue	6,422.91 (5,696.79)	6,497.65 (3,248.65)	6,478.67 (3,162.99)	6,156.54 (3,016.87)
Federal Revenue	1,687.85 (1,303.67)	1,943.44 (1,611.03)	1,501.73 (914.08)	1,290.62 (965.70)
Total Revenue	14,850.12 (5,122.00)	14,915.20 (5,423.86)	14,882.30 (4,684.56)	15,421.68 (5,493.05)
Total Expenditures	15,008.30 (5,696.79)	15,049.91 (5,985.48)	14,994.46 (5,321.26)	15,700.20 (6,010.14)
Long-Term Debt Holdings	7,749.46 (10,373.23)	4,355.33 (11,159.83)	11,085.32 (9,127.45)	11,223.35 (8,594.02)
Long-Term Debt Issued	927.82 (3,008.77)	665.60 (2,951.70)	1,142.47 (3,111.16)	1,273.80 (3,197.39)
Short-Term Debt Holdings	291.19 (1,681.72)	163.11 (1,379.66)	423.95 (1,669.53)	468.55 (2,529.04)
Debt Service Payments	333.95 (392.32)	187.53 (338.61)	475.07 (409.25)	489.42 (380.52)
Districts	11,470	5,487	4,169	1,814

Notes: District characteristics are for the 2009-10 school year. Mean (standard deviation) of district characteristics reported. Long- and short-term debt holdings are measured at the end of the 2009-2010 school year. All finance variables reported on a per-pupil basis and are inflation adjusted ($2017).

Empirical Approach

The aforementioned natural experiment motivates the following empirical approaches and their respective statistical models in order to analyze the effects of a reduction in the cost of school district debt issuance. The natural experiment avails a unique opportunity to examine the role of cost of debt in district revenue provision.

District Fixed Effects

First, a fixed-effects model using a simple ordinary least squares approach may estimate the association of various district characteristics with debt issuance and debt outstanding. Predictor variables include district and student characteristics including student demographic characteristics including shares of free- and reduced-priced lunch students, English language learner students, students with an individualized learning plan, and minority students, district characteristics including urbanicity, school count, and enrollment, and local county economic characteristics including per-capita wages and unemployment rates. This model includes district and state-by-year fixed effects. District fixed effects are included to account for unobserved time-invariant district characteristics which may affect district finances including district debt issuance. State-by-year fixed effects are included to account for unobserved characteristics which may exist within a state and year which may also affect district finances. Such unobserved factors may include new statewide policies or statewide economic shocks. In addition, many of the following specifications also control for time-varying economic indicators which may be associated with local recession intensity due to factors associated with the Great Recession and other economic shocks.[7]

1) $Y_{it} = \beta_0 + \beta_1(\text{Urbanicity}_i) + \beta_2(\text{Enroll}_i) + \beta_3(\text{SchoolCount}_i) + \beta_4(\text{FRPL}_i) + \beta_4\text{ELL}_i) + \beta_5(\text{IEP}_i) + \mathbf{Z}_{it}\boldsymbol{\omega} + \theta_i + \delta_{st} + \varepsilon_{it}$

where: Y represents per-pupil district debt holdings for district *i* in year *t*; **Z** represents a vector of time-variant economic indicators; θ_i are district fixed effects; δ are state-by-year

[7] Shores and Steinberg (2018) find that 76% of the variance of recession intensity occurred within rather than across states during the Great Recession.

fixed effects; Standard errors are clustered at the district level to account for the interdependence of the error term within districts across time.

Difference-in-Differences

Second, analysis using a difference-in-differences approach may estimate the average effect of recalibration on debt issuance by comparing those districts exogenously affected by the Moody's recalibration event to unaffected districts. Analogous to an intent-to-treat analysis, this approach estimates district response to a change in the landscape of their future costs of debt by comparing districts whose potential costs were exogenously reduced, districts whose credit rating improved, to those whose costs remained the same, district whose credit rating did not change. The associated statistical model is as follows:

2) $Y_{it} = \beta_0 + \beta_1(Recalibrated_i) + \beta_2 Post_t + \beta_3(Recalibrated_i * Post_t) + \mathbf{X_{it}}\boldsymbol{\varphi} + \mathbf{Z_{it}}\boldsymbol{\omega} + \theta_i + \delta_{st} + \varepsilon_{it}$

where: Y represents per-pupil district debt issuance for district *i* in year *t*; *Recalibrated* is a time-invariant indicator for whether district *i* experienced a Moody's credit rating recalibration in 2010; *Post* is a dummy variable indicating the post-Moody's recalibration period, such that observations in the pre-reform period (2005-06 through 2009-10 school years) take on a value of zero, and observations after the Moody's recalibration event (2010-11 through 2014-15 school years) take on a value of one; **X** represents a vector of time-varying district characteristics pertaining to student attributes (i.e. shares of students receiving free- or reduced-priced lunch, shares of English language learners, and shares

of disabled students, etc.) and district attributes (i.e. enrollment, urbanicity, staff-student ratios, etc.); and the remaining variables are defined as in the first equation.

The central empirical model adds an additional element to the above specification, a difference-in-difference-in-differences estimation. This triple-difference estimation analyzes whether (and the extent to which) the effect of treatment was larger for a particular subset of treated units. There are two such district subsets I hypothesize may be more sensitive to the Moody's recalibration event, districts which do not have access to certain state policies which support capital investments, as outlined by Verstegen & Jordan (2009) and Ely (2012b, 2014).

First, over the past twenty years, a subset of states did not provide school facilities expenditure support to their local school districts.[8] As such, districts in these states did not receive any additional funding from non-local sources associated with improving or maintaining the physical infrastructures of their schools. Therefore, I hypothesize that these districts may be more sensitive to their respective costs associated with debt issuance and may respond to the Moody's recalibration event to a greater degree than other recalibrated districts. In other words, I might expect districts which are solely responsible for local infrastructure spending, investments typically funded through debt issuance, to be more sensitive to their respective costs of debt than districts only partially responsible for local infrastructure spending.

The second model subsets those states that have not historically offered any sort of credit enhancement program to local districts. Recall that state credit enhancement programs provide a backstop to investors in the case a district defaults on a bond. State

[8] These states include Idaho, Indiana, Louisiana, Michigan, Missouri, Nebraska, Nevada, Oklahoma, Oregon, South Dakota, Tennessee, and Wisconsin (Filardo, 2016).

credit enhancement programs typically guarantee some type of state funding stream to investors to secure their repayments above and beyond district capacities.

This triple-difference model is as follows:

3) $Y_{it} = \beta_0 + \beta_1 Recalibrated_i + \beta_2 Post_t + \beta_3(Recalibrated_i * Post_t) +$

$\beta_4(Recalibrated_i * Post_t * NoStateProgram_s) + \mathbf{X_{it}}\boldsymbol{\varphi} + \mathbf{Z_{it}}\boldsymbol{\omega} + \theta_i + \delta_{s\,t} + \varepsilon_{it}$

Next, I investigate the potential for heterogeneous response among districts whose characteristics may be hypothesized to relate to district debt issuance based on the differences in the prevailing amount of district debt holdings presented in Figures 3 and 4. These regressions examine any differential response to the Moody's recalibration event among districts measured by the quartiles of the proportion of free- and reduced-priced lunch students they serve and by their urbanicity (urban, suburban, town, rural).

Finally, the Great Recession, from December 2007 to June 2009, took place within the study's panel timeframe and presents a potential threat to the causal identification of recalibration on district debt issuance. As a placebo test, I estimate the effect of the Great Recession on district debt issuance. To do so, I drop observations after the Moody's recalibration occurred (2010-11 to 2014-15) and re-estimate equation 5) using the district types created by the recalibration event during the five year period leading up to the Great Recession. In this analysis, the school years 2008-09 and 2009-10 are considered the 'post' reform years during which the majority of the Great Recession took place.

Due to the differences in debt utilization between districts rated and not rated by Moody's at the time of recalibration in 2010, I create two samples to execute each of the aforementioned empirical approaches. The 'full sample' compares recalibrated districts to

a sample of districts which were both rated and not recalibrated and which were not rated in 2010. The 'restricted sample' compares recalibrated districts only to districts which were rated and not recalibrated, districts with very similar debt utilization practices in the pre-recalibration time period. In consideration of these similarities, I consider the restricted sample estimates to offer the most salient comparisons. Both sets of comparisons are included in the following regression results.

Instrumental Variables

To extend the prior analysis, I introduce an instrumental variables approach utilizing the same Moody's recalibration event in a two-stage least squares regression. This analysis examines the effect of additional debt issuance on district resources (per-pupil revenues, capital expenditures and instructional expenditures) due to Moody's recalibration. Analogous to a treatment-on-the-treated, the models isolate district debt issuance associated with the natural experiment to test whether it supplements or crowds out other district revenues by using Moody's recalibration in the post period as an instrument for debt issuance. If there is some degree of additional debt issuance associated with recalibration, the instrument will enable inquiry as to whether the additional debt issuance may supplement district capital expenditures through a flypaper effect, the express purpose of bond issuance, or crowd out existing capital expenditures and supplement instructional revenues. It will also enable analysis of effects on student achievement.

The IV model is as follows:

5) First stage: $D_{it} = \alpha_0 + \gamma Recalibrated_i * Post_t + \mathbf{X}_{ist}\mathbf{\Gamma} + \mathbf{Z}_{jst}\boldsymbol{\varphi} + \theta_i + \delta_t + \lambda_t + \varepsilon_{it}$

Second stage: $Y_{it} = \beta_0 + \beta_1 \hat{D}_{isjt} + \mathbf{X}_{ist}\mathbf{\Gamma} + \mathbf{Z}_{jst}\boldsymbol{\varphi} + \theta_i + \delta_t + \lambda_t + \varepsilon_{it}$

where: D_{it} is the per-pupil amount of debt issued in district *i* during school year *t*; $Recalibrated_i * Post_t$ represents the exogenous instrument predicting school district debt, Y_{it} represents per-pupil revenues, capital expenditures, and instructional expenditures, and district-wide student mathematics and reading achievement in district *i* during school year *t*; $\hat{D}_{it}$ represents the predicted amount of debt per pupil from equation 2), and the remaining variables are defined as in the prior equations. A variation of this model replaces the instrument $Recalibrated_i * Post_t$ with $Recalibrated_i * Post_t * NoStateCapEx_{s..}$ These models include log transformations of debt issuance and dependent financial variables in order to estimate elasticities with respect to debt issuance.

Results

Table 6 reviews the student demographic and district characteristics associated with long- and short-term debt issuance and capital expenditure in a district and state by year fixed effects model. On average, larger school districts, measured both by enrollment and number of schools, hold less long-term debt on a per-pupil basis. Urban districts carry less short-term debt. Finally, districts serving larger shares of ELL students spend more on capital expenditures.

.

Table 6. District Debt Holdings and Capital Expenditure

	Long-term Debt	Short-term Debt	Capital Expenditures
Enrollment (1000s)	-225.23***	18.78	-61.51
	(40.74)	(21.91)	(16.80)
FRPL	3.73	-0.49	-1.06
	(4.36)	(0.40)	(1.39)
IEP	-1.19	-1.30	-0.22
	(14.75)	(1.44)	(3.79)
ELL	1.90	-0.11	10.50***
	(6.54)	(0.74)	(3.88)
Minority	-0.85	0.47	-5.84
	(11.66)	(1.66)	(4.64)
School Count	-63.74***	4.27	-15.25
	(14.38)	(4.49)	(6.42)
Urban	-45.29	-56.48**	-13.45
	(196.97)	(25.70)	(84.62)
Rural	21.06	6.15	-93.74
	(139.01)	(22.21)	(60.55)
Town	110.53	-5.96	34.87
	(147.42)	(24.85)	(64.94)
Districts	109,223	109,233	109,233
Observations	11,470	11,470	11,470

Notes: Each column represents a separate regression. All regressions include district and state-by-year fixed effects. Coefficient estimates with robust standard errors clustered at the district level are reported. Geographic coefficients are estimated relative to suburban districts. Finance variables are reported on a per-pupil basis and are inflation adjusted ($2017). Asterisks indicate statistical significance at the 10% (*), 5% (**), and 1% (***) levels

Next, I explore the effect of the Moody's credit rating recalibration on district debt issuance. Recall the three districts types created by the Moody's recalibration event: 1) Districts whose outstanding credit ratings were recalibrated in 2010; 2) Districts whose outstanding rating credit ratings were not recalibrated in 2010; and 3) Districts which did not have outstanding Moody's credit ratings in 2010. Upon visual inspection of Figure 8,

the three district types exhibited similarly trending per-pupil debt holdings, conforming to the parallel trends assumption of a difference-in-differences empirical approach. From 2006 to 2010, each of the district types increased its average long-term debt holdings by approximately $1,000 per pupil.

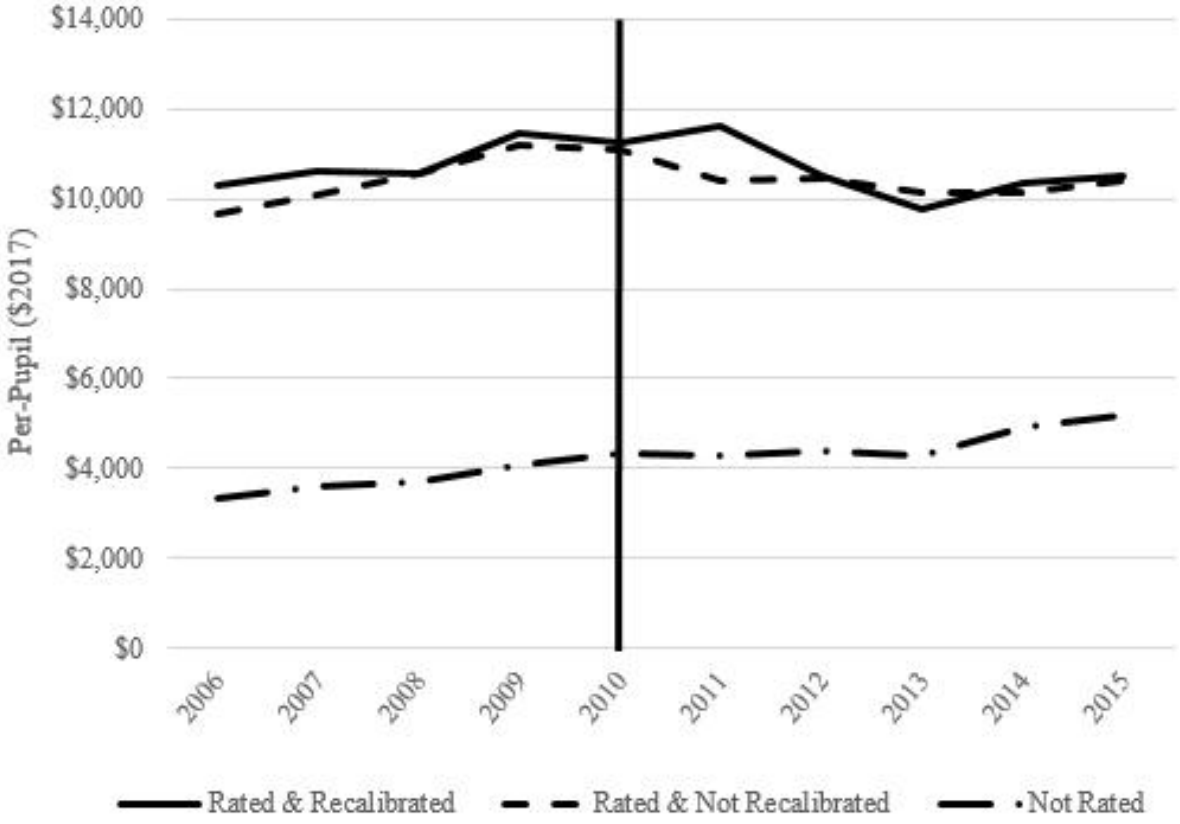


Figure 8. District Debt Holdings, by Moody's Credit Rating Status

Notes: Author's calculations from data retrieved from the NCES Local Education Agency Finance Survey. The year 2015 refers to the 2014-2015 school year. Long-term debt holdings are measured at the end of each school year and are reported on a per-pupil basis in inflation adjusted $2017. The vertical line in 2010 represents the year of Moody's recalibration. N=11,470 school districts.

Table 7 presents regression estimates leveraging the Moody's recalibration event. Specifications include district and state-by-year fixed effects with and without controls for district- and county-level covariates. Columns (1) and (2) present these estimates on

the full sample, the sample which includes all three district types described previously. The *Post*Recalibrated* estimate indicates that districts issued $143 dollars less per pupil in response to the recalibration event. The *Post*Recalibrated*No State CapEx* estimate indicates that districts in states without facilities capital expenditure support issued $265 to $373 more debt than their peer treated districts, on average, in states with such support.[9] Examining the sample restricted to those districts with outstanding Moody's credit ratings in 2010 in columns (3) and (4), districts did not issue more debt, on average, in response to exogenous improvements to their respective credit ratings on existing debt obligations. These null average treatment effects, however, mask considerable and important heterogeneity demonstrated by the triple difference. Average yearly per-pupil debt issuance was $300 higher in districts located in states which historically have not provided capital expenditure support to their respective districts, when controlling for district covariates.

[9] The results of an alternative triple-difference estimator are presented in Appendix Table A1. This setup maintains the notion that prevailing state capital expenditure support may influence a district's sensitivity to exogenous improvements to its credit rating. Duncombe and Wang (2009) list the following states which, in 2009, did not provide grants for district capital spending: Idaho, Iowa, Louisiana, Michigan, Missouri, Nebraska, Nevada, North Dakota, Oklahoma, Oregon, and South Dakota. The triple-difference estimations using this categorization presented in Appendix A1 are consistent with the results in Table 4.

Table 7. Effect of Recalibration, by State Capital Expenditure Access

	Full Sample		Restricted Sample	
District Debt Issuance (per-pupil)	**(1)**	**(2)**	**(3)**	**(4)**
*Post * Recalibrated*	-143.17**	-143.40*	17.50	-29.33
	(70.81)	(75.67)	(76.78)	(82.60)
*Post * Recalibrated * No State CapEx*	265.15*	372.58**	149.15	302.44*
	(158.56)	(156.84)	(180.98)	(180.78)
Observations	109,233		57,816	
Districts	11,470		5,983	
District Fixed Effects	X	X	X	X
State * Year Fixed Effects	X	X	X	X
District & County Characteristics		X		X

Notes: Each column represents a separate regression. Coefficient estimates with robust standard errors clustered at the district level are reported and are inflation adjusted ($2017). District and county characteristics include variables reported in table 3. Asterisks indicate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

The results highlighted in Table 7 are demonstrated visually in Figure 9. Among recalibrated districts, in the pre-Moody's recalibration period districts in states without capital expenditure support held approximately $2,500 less in per-pupil debt than districts in states which grant such support. This amount shrunk by approximately $1,500 by the end of the post-Moody's recalibration period, roughly the sum of $300 in issuance per year. Districts which receive state support declined in their debt holdings, perhaps as a reaction to difficult post-recessionary fiscal circumstances. Districts without such support continued issuing debt and maintained their debt holdings. Adelino et al. (2017) demonstrate similar findings in broader municipal government settings. Whereas treated

districts maintained or slightly increase their debt issuance in the three years following recalibration, untreated districts declined in their debt issuance.[10]

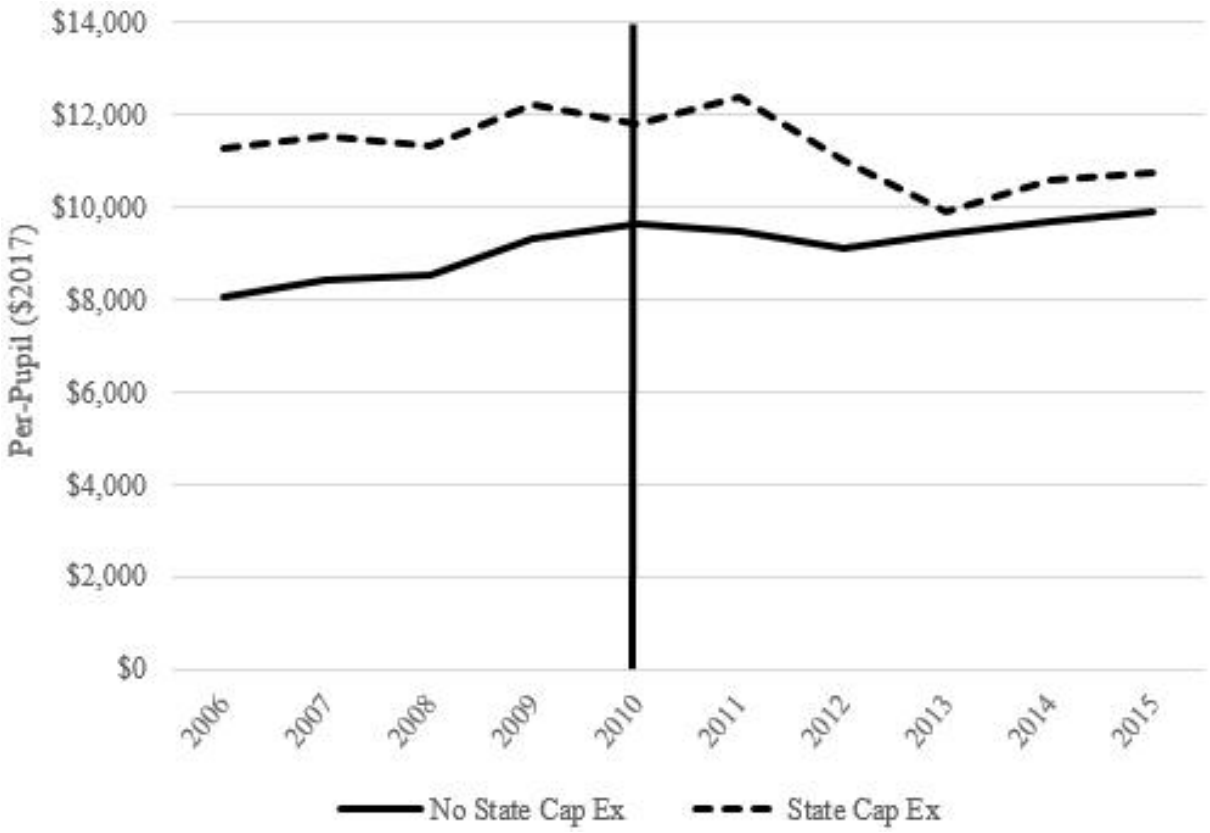


Figure 9. District Debt Holdings, by State Capital Expenditure Support (Recalibrated)

Notes: Author's calculations from data retrieved from the NCES Local Education Agency Finance Survey. The year 2015 refers to the 2014-2015 school year. Long-term debt holdings are measured at the end of each school year and are reported on a per-pupil basis in inflation adjusted $2017. The vertical line in 2010 represents the year of Moody's recalibration. N=5,983 school districts.

Next, I report the second set of results stemming from model (3), the second triple difference estimation. This model examines the response to recalibration by districts in states without credit enhancement programs. Districts in the full and restricted samples

[10] In the years following the Great Recession, district capital expenditures in states that support such local investments declined relative to districts in states that lack such programs. Whereas a $500 to $600 per-pupil gap in capital expenditures between district types emerged in the early to late 2000s, the gap has all but disappeared in recent years. See Figure A1 for further details.

and across states with and without district credit enhancement programs do not appear sensitive to the recalibration event, on average.

Table 8. Effect of Recalibration, by State Credit Enhancement Access

	Full Sample		**Restricted Sample**	
District Debt Issuance (per-pupil)	**(1)**	**(2)**	**(3)**	**(4)**
*Post * Recalibrated*	-134.29	-82.56	-17.57	28.72
	(93.46)	(94.12)	(106.05)	(108.09)
*Post * Recalibrated * No Credit Enhancement*	69.41	28.11	110.71	6.24
	(126.86)	(132.62)	(140.57)	(147.45)
Observations	109,233		57,816	
Districts	11,470		5,983	
District Fixed Effects	X	X	X	X
State * Year Fixed Effects	X	X	X	X
District & County Characteristics		X		X

Notes: Each column represents a separate regression. Coefficient estimates with robust standard errors clustered at the district level are reported and are inflation adjusted ($2017). District and county characteristics include variables reported in table 3. Asterisks indicate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Tables 9 and 10 investigate the extent to which the estimates provided in Table 7 may vary across district characteristics, specifically among quartiles of districts measured by students who receive free- or reduced-priced lunch and by district urbanicity, respectively. Among the third quartile of districts measured by their respective shares of disadvantaged students in states who do not give capital expenditure support, treated districts issued considerably more debt, $677 more ($712 in the full sample), than other rated districts. Districts serving the smallest share of disadvantaged students and suburban districts may issue more debt in states that do not offer capital expenditure support than their counterfactual peers, though these estimates are imprecisely estimated in the restricted sample.

Table 9. Effect of Recalibration, by District FRPL Quartiles

District Debt Issuance (per-pupil)	Full Sample				Restricted Sample		
	Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**
*Post * Recalibrated*	-29.73 (136.50)	-63.34 (144.94)	-128.80 (170.72)	-205.09 (147.62)	75.07 (154.43)	49.49 (152.27)	24.22 (197.18)
*Post * Recalibrated * No State CapEx*	696.28* (372.26)	34.50 (340.64)	711.51** (309.66)	32.68 (264.95)	504.06 (389.93)	-158.97 (374.55)	677.23* (390.35)
Observations	27,289	27,326	27,301	27,317	18,747	15,329	12,918
Districts	2,867	2,868	2,868	2,867	1,939	1,605	1,332
District Fixed Effects	X	X	X	X	X	X	X
State * Year Fixed Effects	X	X	X	X	X	X	X
District & County Characteristics	X	X	X	X	X	X	X

Notes: Each column represents a separate regression. Coefficient estimates with robust standard errors clustered at the district level are
inflation adjusted ($2017). FRPL quartiles categorize districts into quartiles measured by the proportion of students in a district who
reduced-priced lunch as measured in the 2009-2010 school year. District and county characteristics include variables reported in ta
indicate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table 10. Effect of Recalibration, by District Urbanicity

District Debt Issuance (per-pupil)	Full Sample				Restricted Sample			
	Urban	**Suburban**	**Town**	**Rural**	**Urban**	**Suburban**	**Town**	**Rural**
*Post * Recalibrated*	11.61 (173.75)	-230.65* (112.26)	121.04 (262.00)	-73.60 (159.04)	-5.19 (197.75)	-170.65 (134.61)	333.85 (284.46)	130.02 (174.96)
*Post * Recalibrated * No State CapEx*	113.11 (398.20)	645.31* (349.16)	-43.76 (394.22)	252.52 (296.23)	249.19 (481.60)	432.30 (386.97)	-302.66 (437.72)	325.73 (342.65)
Observations	6,128	24,169	20,082	58,854	5,049	17,807	12,566	22,394
Districts	644	2,518	2,154	6,154	522	1,842	1,302	2,317
District Fixed Effects	X	X	X	X	X	X	X	X
State * Year Fixed Effects	X	X	X	X	X	X	X	X
District & County Characteristics	X	X	X	X	X	X	X	X

Notes: Each column represents a separate regression. Coefficient estimates with robust standard errors clustered at the district level are reported and are inflation adjusted ($2017). District urbanicity is determined in the 2009-2010 school year and is reported by CCD. Asterisks indicate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Finally, I conduct a placebo test to examine the effect of the Great Recession by dropping the post-Moody's recalibration period and re-estimating the difference-in-differences empirical approach with the school years 2008-09 and 2009-10, the heart of the Great Recession, as the *Post* years of analysis. Comparing recalibrated districts to those not recalibrated by Moody's, both in the full and restricted samples, I do not find any evidence of differences in debt issuance across district types.

Table 11. Effect of Recalibration, Placebo Test

	Full Sample		**Restricted Sample**	
District Debt Issuance (per-pupil)	**(1)**	**(2)**	**(3)**	**(4)**
*Post * Recalibrated*	-65.48 (103.23)	-77.32 (120.32)	70.87 (112.59)	70.62 (113.43)
*Post * Recalibrated * No State CapEx*	-105.88 (233.19)	95.74 (263.56)	-39.97 (273.85)	-37.13 (274.15)
Observations	54,878		28,581	
Districts	11,470		5,983	
District Fixed Effects	X	X	X	X
State * Year Fixed Effects	X	X	X	X
District & County Characteristics		X		X

Notes: Each column represents a separate regression. Coefficient estimates with robust standard errors clustered at the district level are reported and are inflation adjusted ($2017). Asterisks indicate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table 12 presents the first set of IV results. Panel A uses the interaction term, the Moody's recalibration in the post period (the 2010-11 to 2014-15 school years), as an instrument for district debt issuance. District decisions to issue debt may be driven by a range of endogenous district characteristics. The instrument isolates district debt issuance associated with the exogenous variation due to the Moody's recalibration. In the fully-specified model presented in column (2), a one percent increase in debt issuance generates a 0.1% increase in total per-pupil revenues. These additional revenues are spent not on capital expenditures, however, but on instructional expenditures. Instructional expenditures have a 0.18% elasticity to an additional one percent increase in debt issuance, suggesting a crowd out effect of debt issuance on capital expenditure.

Panel B adds the triple-difference interaction term in the prior analysis, a dummy variable for states that do not provide capital expenditure support to their local districts. As in the previous analysis, a similar story emerges though in a larger magnitude. A one percent increase in debt issuance generates a 0.19% increase in per-pupil revenues. Although the effect size on capital expenditures grows to 0.19, its standard error is large, suggesting the effect on capital expenditures is unclear. The effect on instructional expenditures, on the other hand, is precisely estimated at 0.2% for a one percent increase in debt issuance.

Table 12. Elasticities with Respect to Debt Issuance

	(1)	(2)
Panel A: Moody's Recalibration		
Per-Pupil Revenues	0.081* (0.048) 0.104** (*F* = 16.79)	0.096* (0.075) 0.111** (*F* = 11.52)
Capital Expenditures	0.226 (0.414) 0.100* (*F* = 16.73)	-0.073 (0.425) 0.108** (*F* = 11.52)
Instructional Expenditures	0.165* (0.087) 0.104** (*F* = 16.79)	0.184* (0.097) 0.111** (*F* = 11.52)
Panel B: Moody's Recalibration * NoCapEx State		
Per-Pupil Revenues	0.184** (0.077) -0.136 (*F* = 15.53)	0.190*** (0.068) -0.223** (*F* = 11.24)
Capital Expenditures	0.238 (0.331) (-0.142) (*F* = 15.49)	0.194 (0.270) -0.233** (*F* = 11.26)
Instructional Expenditures	0.209** (0.088) -0.136 (*F* = 15.53)	0.200*** (0.070) -0.234* (*F* = 11.26)
Observations	109,233	
Districts	11,470	
Year Fixed Effects	X	X
District Fixed Effects	X	X
State Fixed Effects	X	X
District & County Characteristics		X

Notes: Each column within a panel represents a separate regression. First, coefficient estimates with robust standard errors clustered at the district level are reported and are inflation adjusted ($2017). Next, the instrumental variables and F-statistics are reported. Asterisks indicate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Finally, Table 13 reviews the effects of additional debt issuance on student achievement, replacing the dependent variable of the two-stage least squares regression with district-level mathematics achievement and English language arts achievement. There is no clear evidence that the modest positive elasticities of total per-pupil revenues and instructional revenues with respect to additional debt issuance improved district-wide student achievement. In column (2) only a weak instrument produces a marginally statistically significant finding.

Table 13. Effect of Recalibration on Student Achievement

	Math		ELA	
	(1)	**(2)**	**(3)**	**(4)**
Moody's Recalibration	13.04 (12.03) 0.081 (*F* = 21.10)	15.59 (17.86) 0.068 (*F* = 8.09)	-1.01 (2.40) 0.082 (*F* = 20.78)	-1.92 (3.34) 0.069 (*F* = 7.98)
Moody's Recalibration * NoCapEx State	7.20 (4.86) -0.171 (*F* = 18.66)	4.57* (2.44) -0.325 (*F* = 7.91)	0.70 (1.47) -0.205 (*F* = 18.47)	0.77 (1.00) -0.360** (*F* = 7.87)
Observations	50,103	50,103	50,145	50,145
Districts	10,459	10,459	10,478	10,478
District & County Characteristics		X		X
District Fixed Effects	X	X	X	X
State Fixed Effects	X	X	X	X
Year Fixed Effects	X	X	X	X

Notes: Each column within a panel represents a separate regression. First, coefficient estimates with robust standard errors clustered at the district level are reported and are inflation adjusted ($2017). Next, the instrumental variables and F-statistics are reported. Asterisks indicate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Discussion

Leveraging the Moody's credit rating recalibration event prior to the 2010-2011 school year, I find that districts with cheaper access to debt issuance did not issue more debt in the post period, on average. Certain state-level capital expenditure support policies, however, may influence district sensitivity to costs of debt. Districts which experienced recalibration in states which historically have not received capital expenditure support from their state governments did display sensitivity to improvements in their credit ratings. Conversely, lack of access to credit enhancement programs does not appear to influence credit rating sensitivity. These finding suggest that districts who bear the greatest burden of the share of cost associated with capital improvement, districts who must finance it entirely themselves, are particularly sensitive to the cost of such financial outlays. Districts which serve a large share of disadvantaged students, though not the largest share, also appear to be sensitive to the cost of their capital improvement projects. It remains unclear if district geographic characteristics may interact with district sensitivity to cost of debt.

Districts subject to the recalibration exhibited a moderately positive elasticity with respects to debt issuance. These districts increased their respective per-pupil revenues by 0.1% for every 1% increase in debt issuance, suggesting a slightly positive elasticity of per-pupil revenues with respect to additional (less expensive) debt issuance. This estimate is twice as large in states that do not provide capital expenditure support to local districts. It appears, however, that districts do not spend these additional revenues directly on capital expenditures. Instead, they maintain their levels of capital expenditure and apply additional revenues to supplement instructional revenues. This suggests that additional

debt issuance may crowd out existing capital expenditures. Finally, there was no effect of Moody's recalibration detected on district-wide student math or English language arts achievement. These achievement findings are not unexpected given the modest elasticity of instructional expenditures to additional debt issuance.

Chapter 4

DISCUSSION AND POLICY IMPLICATIONS

Introduction

This study seeks to expand the body of empirical evidence pertaining to debt financing in public school districts, a topic which has received scant attention in the education finance literature. In recent years, much scholarship has explored district response to state and federal education finance policies which affect district revenues, particularly for school districts consisting of large disadvantaged student populations. I address a gap in the literature regarding school district revenue provision through debt issuance and explore the role of credit constraints on district debt issuance, resource provision, and student achievement potentially stemming from such credit constraints. Utilizing a robust district-by-year panel dataset and a unique natural experiment, I seek to provide novel empirical evidence for policymakers and district administrators as they consider local and state policies to support the effective distribution of district revenues across sets of diverse school districts. While districts may weigh competing financial priorities including contentious labor negotiations, pension obligations, and equitable and adequate resource distribution, facilities quality remains an ongoing concern. In the future, an improved understanding of the determinants and outcomes associated with district debt issuance may help inform a range contemporary debates including the equitable distribution of school resources, the challenges posed by constrained budget outlays, and district financial commitments related to pension obligations and labor contracts.

Existing Evidence

Amid long-standing growth in public educational expenditures, the empirical literature has focused on the policy effects of state and federal education finance policies, many of which have attempted to redress historical inequities in per-pupil funding and educational disadvantage. These policies have directed a greater share of state funds to districts serving larger shares of disadvantaged students many of which have been found to improve student achievement and shrink achievement gaps (i.e. Jackson, Johnson, and Persico, 2016; Lafortune, Rothstein, and Schanzenbach, 2016). Local school districts, however, only directly control their locally derived revenues, funds made up of local tax receipts and borrowed funds. The majority of borrowed funds are obtained through debt issuance, funds which typically support school district capital expenditures.

A series of recent studies have contributed to an emerging body of evidence regarding the effects of capital investments in school facilities on a host of important outcomes including student achievement, attendance, enrollment, and property values, outcomes relevant to a range of interested parties and research disciplines. Employing a range of rigorous statistical methods applied to regional natural experiments, several studies have generated causal estimates related to school facilities investments. The majority of these studies have found modestly positive effects of facilities construction on student achievement. Examining New Haven, Connecticut, Nielson and Zimmerman (2011) find a 0.21 standard deviation improvement in reading scores six years after students moved to a new or improved school building. Hong and Zimmer (2016) studied bond elections in Michigan and found improved reading proficiency rates of approximately 0.1 to 0.3 standard deviations five to seven years after bond passage.

Conlin and Thompson (2017) studied school construction program in Ohio finding 0.1 percentage point increase in proficiency rates per $1,000 in per-pupil value of capital stock improvement four years after facilities completion. Lafortune and Schonholzer (2018) examined a capital improvement program in Los Angeles and found a 0.1 standard deviation improvement in math and 0.05 standard deviation improvement in reading four years after facilities investment.

Some studies, on the other hand, have found very small positive effects or null results of the impact of facilities construction on student achievement. In California, Cellini, Ferreira, and Rothstein (2010) found less than 0.1 standard deviation improvements in math and reading among third graders, effects which emerged six years after bond passage and dissipated in the decade thereafter. In Texas, Martorell, Stange, and McFarlin (2016) found no achievement improvements within six years of bond passage, though some evidence of small positive results were detected among disadvantaged students. In a metanalysis reviewing school capital and construction spending, Jackson (2018) identifies each of these aforementioned studies, concluding that with some modestly positive effects detected, some null results, and a lack of negative findings, the balance of evidence suggests a positive, yet heterogeneous, effect of school capital investment on student achievement.

Studies also have highlighted the relationships between school facilities improvement and other important outcomes. These outcomes pertain to students, including health, attendance, and enrollment, teachers, including their job satisfaction, and communities, including local housing value. While the majority of these findings lack the same research designs to support causal identifications to make definitive claims

about specific programs and policies, there is suggestive evidence that school facilities quality is important beyond student standardized test scores.

Parallel to studies examining the effects of school facilities improvements, studies have examined district financing mechanisms used to fund such capital expenditures, namely district bond passage. For example, in Michigan, Bowers, Metzger, and Militello (2010) found smaller bonds, bonds proposed in larger districts, bonds in urban and suburban locales (rather than towns and rural areas), and first bond requests (as opposed to subsequent requests offered for vote) were more likely to gain local voter approval.

Trends and Empirical Evidence

Over the past two decades, school districts increasingly have utilized debt financing as a means of local revenue provision, doubling their average per-pupil debt holdings and significantly increasing their debt service expenditures in the process. Debt financing typically funds capital expenditures, important investments in districts seeking to improve their physical school environments particularly in districts serving larger shares of disadvantaged students where schools are more likely to be overcrowded and of lesser physical quality. Districts of varying student characteristics and policy contexts, however, do not utilize debt in the same manner.

This paper examines trends in district debt utilization and district sensitivity to cost of debt informed by credit ratings. District cost of debt is a central aspect of local educational revenue provision for a number of reasons. While district debt funds important investments in school capital improvement, districts pay interest on their debt holdings, payments which may crowd out other educational expenditures. On the other

hand, if costs of debt are too high, districts may not pursue debt issuance to the extent they would were it cheaper. Evidence of district sensitivity to costs of debt, therefore, may inform policymakers interested in supporting school expenditures including capital investments.

In Chapter 2 I review a series of trends related to district debt utilization. On a per-pupil basis, districts hold over two and half times as much long-term debt today than two decades ago, an upward trend that was interrupted by the Great Recession and appears to have resumed in the years since. These upward trends are shared by each quartile of districts measured by their shares of disadvantaged students, though most significantly, on a percentage basis, by the most disadvantaged districts. Districts of all geographic characteristics have significantly increased their debt holdings, though suburban districts may have slowed this trend over the past decade. Finally, districts of all credit scores also have significantly increased their debt holdings, most over twofold in twenty years.

In Chapter 3, I leverage a natural experiment, a 2010 Moody's municipal credit rating recalibration which improved a subset of school district bond credit ratings across the country. In normal circumstances, changes to district credit ratings are informed by changes to district characteristics including local economic activity, existing debts, and leadership quality (Hildreth & Miller, 2002) factors largely endogenous to prevailing district traits. The Moody's recalibration event enables the analysis of analyze exogenous variation associated with district credit ratings in order to directly estimate the effects of cheaper debt issuance instead of analysis of the effects of changes in some underlying district characteristic which may influence district credit scores.

On average, I find that districts which experienced the natural experiment do not issue more debt than their unaffected peer districts. Breaking down the effect among recalibrated districts, however, I find that in states where districts historically have not received capital expenditure support from their respective state governments, recalibrated districts issued more debt, over $300 per pupil annually in the five-year period following recalibration. These effects were most pronounced in districts serving large shares of disadvantaged students, though not the largest shares, as measured by proportions of students who receive free- or reduced-priced lunch. There does not appear to be a clear relationship between district geographic characteristics and sensitivity to the costs of debt issuance. Districts also display a slightly positive elasticity of per-pupil revenues with respect to additional debt issuance. These additional revenues, however, appear to have been allocated to instructional expenditures rather than to capital expenditures. Student achievement in math and English language arts were not affected by these budgetary decisions.

Policy Implications

The findings presented in this paper indicate that policies governing state support of local district capital expenditures affect the degree to which districts may be sensitive to the cost of their debt issuance. These effects were witnessed most significantly in districts in states which do not support local capital expenditures, particularly in districts which serve large shares of disadvantaged students. These findings hold considerable policy relevance as districts and states grapple with crucial decisions concerning long-term capital improvement, especially in districts in the greatest need of facilities

improvement to support efforts to improve equitable student growth. State policies pertaining to school capital investments, including direct financial support of district expenditures and credit enhancement programs have grown in popularity in recent years but have not been adopted in each state (Verstegen & Jordan, 2009; Ely, 2012b, Ely, 2014).

The Moody's credit rating recalibration offers a unique natural experiment to examine district sensitivity to the costs of debt. While the recalibration event does not represent an important policy consideration unto itself, it avails an opportunity to examine district debt practices, specifically the role of cost-driven credit constraints, in a setting where costs of debt may be disentangled from underlying district characteristics. It is also important to note the point in history when the recalibration occurred, specifically in the aftermath of the Great Recession. Over this time period, average school district per-pupil expenditures declined for the first time in three decades as local and state governments navigated difficult revenue constraints. The Moody's recalibration in the spring of 2010 occurred a year after the conclusion of the Great Recession, though financial effects continued for several years. In this context, these findings may offer particular relevance in environments of constrained local and state budgets.

The notable magnitude of school district debt usage suggests it deserves the attention of policymakers in state and local governments. Outstanding obligations now average over $29 million per district, nearly $8,000 per pupil or approximately $400 billion nationwide. In an unconstrained environment, districts could issue debt without the need to weigh decisions to cut other important expenditures due to debt service costs. In practice, however, districts pay interest on their outstanding debt, interest which has

grown to constitute over 2% of district per-pupil expenditures, on average, and a larger portion in certain districts. State policies should consider if these costs disincline districts to spend on important educational inputs. As national policy debate concerning infrastructure investments gains increased attention (i.e. McNichol, 2016), additional evidence regarding the determinants of school district debt issuance may help inform state governments seeking to support capital investments in their respective districts. Considering the longstanding literature regarding school facilities quality, it would appear unlikely that schools will cease in their needs for substantial capital investments in the near future. Therefore, scrutiny of the processes by which districts finance these costs should inform policymakers interested in implementing such investments in their local districts.

APPENDIX

Table A1. Effect of Recalibration, by State Capital Expenditure Access, Alternate Sample

	Full Sample		Restricted Sample	
District Debt Issuance (per-pupil)	**(1)**	**(2)**	**(3)**	**(4)**
*Post * Recalibrated*	-159.52**	-159.87**	12.02	-35.52
	(73.00)	(78.21)	(78.74)	(84.95)
*Post * Recalibrated * No State CapEx*	292.93**	384.32***	155.46	287.57*
	(146.23)	(146.13)	(168.21)	(168.79)
Observations	109,223		57,816	
Districts	11,470		5,983	
District Fixed Effects	X	X	X	X
State * Year Fixed Effects	X	X	X	X
District & County Characteristics		X		X

Notes: Each column represents a separate regression. Coefficient estimates with robust standard errors clustered at the district level are reported and are inflation adjusted ($2017). Asterisks indicate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Figure A1. District Capital Expenditures, by Levels of State Support

Notes: Author's calculations from data retrieved from the NCES Local Education Agency Finance Survey. The year 2015 refers to the 2014-2015 school year. Capital expenditures are measured on a per-pupil basis in inflation adjusted $2017. The dashed line represents district averages of capital expenditures in districts where states provide some measure of capital expenditure support to local districts. The solid line represents district averages of capital expenditures in states without such capital expenditure support programs for local districts. The vertical bands represent periods of economic recession from March 2001 to November 2001 and December 2007 to June 2009.

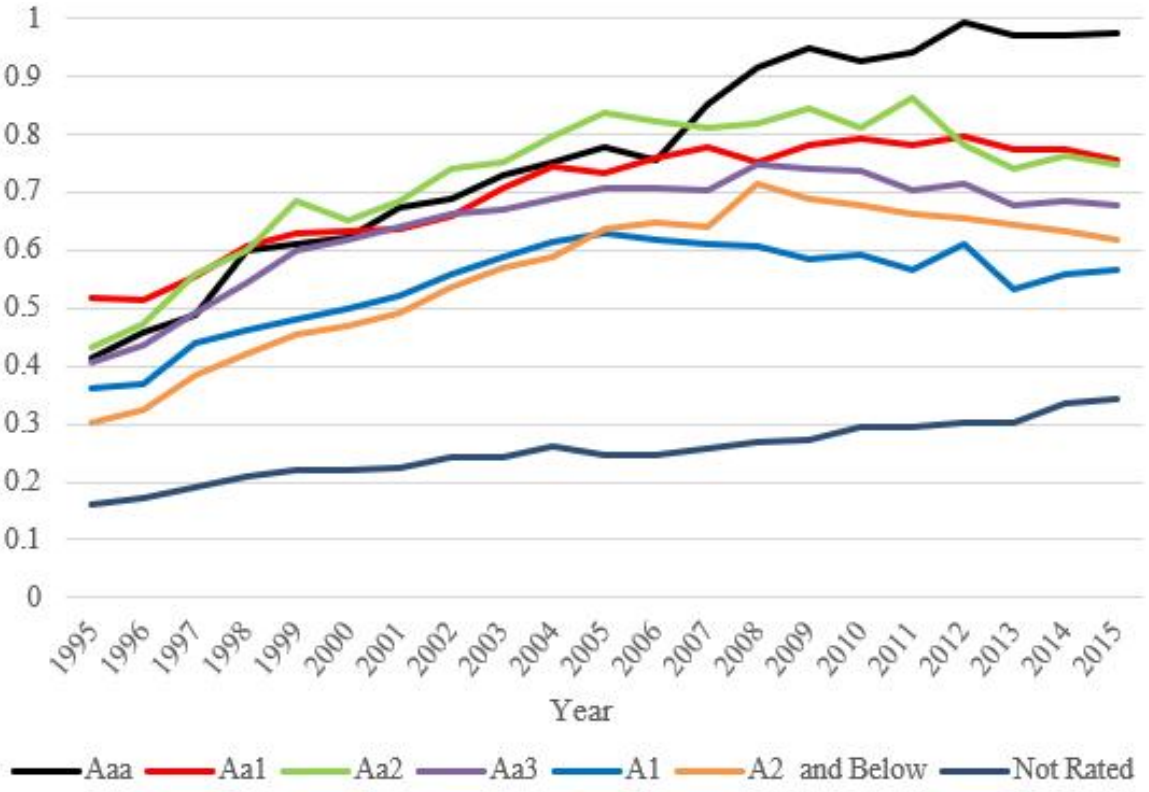


Figure A2. Ratio of District Long-term Debt to Total Revenues, by Moody's Credit Rating

Notes: Author's calculations from data retrieved from the NCES Local Education Agency Finance Survey. The year 2015 refers to the 2014-2015 school year. Capital expenditures are measured on a per-pupil basis in inflation adjusted $2017. A district's credit rating reflects its highest available bond rating in April 2010.

BIBLIOGRAPHY

Adelino, M., Cunha, I., & Ferreira, M. A. (2017). The economic effects of public financing: Evidence from municipal bond ratings recalibration. *The Review of Financial Studies*.

Ammar, S., Duncombe, W., Jump, B., & Wright, R. (2004). Constructing a fuzzy-knowledge-based-system: An application for assessing the financial condition of public schools. *Expert Systems with Applications*, 27(3), 349-364.

Arsen, D., & Davis, T. (2006). Taj Mahals of decaying shacks: Patterns in local school capital stock and unmet capital need. *Peabody Journal of Education*, *81*(4), 1-22.

Bayer, P., Ferreira, F., & McMillan, R. (2007). A unified framework for measuring preferences for schools and neighborhoods. *Journal of Political Economy*, *115*(4), 588-638.

Bellinger, D. C., Stiles, K. M., & Needleman, H. L. (1992). Low-level lead exposure, intelligence and academic achievement: a long-term follow-up study. *Pediatrics*, *90*(6), 855-861.

Berner, M. M. (1993). Building conditions, parental involvement, and student achievement in the District of Columbia public school system. *Urban Education*, *28*(1), 6-29.

Bowers, A. J., & Lee, J. (2013). Carried or defeated? Examining the factors associated with passing school district bond elections in Texas, 1997-2009. *Educational Administration Quarterly*, *49*(5), 732-767.

Bowers, A. J., Metzger, S. A., & Militello, M. (2010). Knowing the odds: Parameters that predict passing or failing school district bonds. *Educational Policy*, *24*(2), 398-420.

Bowers, A. J., & Urick, A. (2011). Does high school facility quality affect student achievement?: A two-level hierarchical linear model. J*ournal of Education Finance*, *37*(1), 72-94.

Branham, D. (2004). The wise man builds his house upon the rock: The effects of inadequate school building infrastructure on student attendance. *Social Science Quarterly*, *85* (5), 1112-1128.

Brunner, E., Hyman, J., & Ju, A. (2018). *School Finance Reforms, Teachers' Unions, and the Allocation of School Resources* (No. 2018-11).

Brunner, E. J., & Rueben, K. (2001). Financing new school construction and modernization: Evidence from California. *National Tax Journal*, 527-539.

Bryant, S. D. (2004). Lead- contaminated drinking waters in the public schools of Philadelphia. *Journal of Toxicology: Clinical Toxicology, 42*(3), 287-294.

Buckley, J., Schneider, M., & Shang, Y. (2005). Fix it and they might stay: School facility quality and teacher retention in Washington, DC. *Teachers College Record, 107*(5), 1107-1123.

Card, D., & Payne, A. (2002). School finance reform, the distribution of school spending, and the distribution of student test scores. *Journal of Public Economics*, 83(1), 49–82.

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), 215-261.

Chakrabarti, R., Livingston, M., & Roy, J. (2014). Did cuts in state aid during the Great Recession lead to changes in local property taxes? *Education Finance and Policy*, 9(4), 383-416.

Coleman, J. S. (1966). Equality of educational opportunity.

Conlin, M., & Thompson, P. N. (2017). Impacts of new school facility construction: An analysis of a state-financed capital subsidy program in Ohio. *Economics of Education Review*, *59*, 13-28.

Cornaggia, J., Cornaggia, K. J., & Israelsen, R. D. (2017). Credit ratings and the cost of municipal financing. *The Review of Financial Studies*, *31*(6), 2038-2079.

Darling-Hammond, L. (2003). Keeping good teachers: Why it matters, what leaders can do. *Educational Leadership*, *60*(8), 6-13.

Dee, T. S., Jacob, B., & Schwartz, N. L. (2013). The effects of NCLB on school resources and practices. *Educational Evaluation and Policy Analysis*, 35(2), 252-279.

DeMarco, T., & Perlovsky, I. (2018). State School District Credit Enhancement Programs. *Fidelity Capital Markets.* Obtained from www.fixedincome.fidelity.com (February 22, 2018).

Denison, D. V. (2001). Bond insurance utilization and yield spreads in the municipal bond market. *Public Finance Review*, *29*(5), 394-411.

Denison, D. V., Yan, W., & Zhao, Z. J. (2007). Is management performance a factor in municipal bond credit ratings? The case of Texas school districts. *Public Budgeting & Finance*, *27*(4), 86-98.

Downes, T. A., & Shah, M. P. (2006). The effect of school finance reforms on the level and growth of per-pupil expenditures. *Peabody Journal of Education*, *81*(3), 1-38.

Downes, T. A., Dye, R. F., & McGuire, T. J. (1998). Do limits matter? Evidence on the effects of tax limitations on student performance. *Journal of Urban Economics*, *43*(3), 401-417.

Duncombe, W., & Wang, W. (2009). School facilities funding and capital-outlay distribution in the states. *Journal of Education Finance*, 324-350.

Durán-Narucki, V. (2008). School building condition, school attendance, and academic achievement in New York City public schools: A mediation model. *Journal of Environmental Psychology*, *28*(3), 278-286.

Dye, R. F., McGuire, T. J., & McMillen, D. P. (2005). Are property tax limitations more binding over time?. *National Tax Journal*, 215-225.

Dye, R. F., and Reschovsky, A. (2008). "Property Tax Responses to State Aid Cuts in the Recent Fiscal Crisis." *Public Budgeting & Finance* 28 (2), 87–111.

Ely, T. L. (2012). No Guaranties: The Decline of Municipal Bond Insurance. *Public Budgeting & Finance*, *32*(1), 105-127.

Ely, T. L. (2012). Indirect Aid for Uncertain Times: The Use of State Credit Enhancement Programs. *Municipal Finance Journal*, *33*(2).

Ely, T. (2014). Capital Financing for Education. I Brewer, D.J. & Picus, L.O. (Eds.) *Encyclopedia of Education Economics and Finance*. SAGE Reference. p. 101-105.

Evans, W. N., Schwab, R. M., & Wagner, K. L. (2018). The Great Recession and Public Education. *Education Finance and Policy*.

Evens, A., Hryhorczuk, D., Lanphear, B. P., Rankin, K. M., Lewis, D. A., Forst, L., & Rosenberg, D. (2015). The impact of low-level lead toxicity on school performance among children in the Chicago Public Schools: a population-based retrospective cohort study. *Environmental Health*, *14*(1), 21.

Figlio, D. N. (1997a). Did the "tax revolt" reduce school performance? *Journal of Public Economics*, *65*(3), 245-269.

Figlio, D. N. (1997b). Teacher salaries and teacher quality. *Economics Letters*, *55*(2), 267-271.

Filardo, M. (2016). State of Our Schools: America's K-12 Facilities 2016. *21st Century School Fund*.

Frankenberg, E. (2009). The demographic context of urban schools and districts. *Equity & Excellence in Education*, *42*(3), 255-271.

Gronberg, T. J., Jansen, D. W., & Taylor, L. L. (2011). The impact of facilities on the cost of education. *National Tax Journal*, *64*(1), 193.

Harris, M. H. (2003). Bond Ratings and Bond Insurance: Market and Empirical Analysis for School Districts. *Developments in School Finance: 2001–02*, 155.

Harris, M. H., & Munley, V. G. (2002). The sequence of decisions facing school district officials in the bond issuing process: A multistage model. *Journal of Education Finance*, 113-131.

Harris, M. H., & Munley, V. G. (2011). The Impact of Debt Limitations and Referenda Requirements on the Cost of School District Bond Issues. *Education*, *6*(4), 537-556.

Higgs, F. J., Mielke, H. W., & Brisco, M. (1999). Soil lead at elementary public schools: comparison between school properties and residential neighbourhoods of New Orleans. *Environmental Geochemistry and Health*, *21*(1), 27-36.

Hildreth, W. B., & Miller, G. J. (2002). Debt and the local economy: Problems in benchmarking local government debt affordability. *Public Budgeting & Finance*, *22*(4), 99-113.

Hines, J. R., & Thaler, R. H. (1995). The flypaper effect. *Journal of Economic Perspectives*, *9*(4), 217-226.

Hong, K., & Zimmer, R. (2016). Does Investing in School Capital Infrastructure Improve Student Achievement?. *Economics of Education Review*, *53*, 143-158.

Hoxby, C. (2001). All school finance equalizations are not created equal. Th*e Quarterly Journal of Economics*, 116(4), 1189–1231.

Ingersoll, R. M. (2001). Teacher turnover and teacher shortages: An organizational analysis. *American Educational Research Journal*, *38*(3), 499-534.

Jackson, C. K. (2018). *Does School Spending Matter? The New Literature on an Old Question* (No. w25368). National Bureau of Economic Research.

Jackson, C. K., Johnson, R. C., & Persico, C. (2016). The Effects of School Spending on Educational and Economic Outcomes: Evidence from School Finance Reforms. *The Quarterly Journal of Economics*, 131(1), 157-218.

Johnson, S. M., Kraft, M. A., & Papay, J. P. (2012). How context matters in high-need schools: The effects of teachers' working conditions on their professional

satisfaction and their students' achievement. *Teachers College Record*, *114*(10), 1-39.

Jones, J. T., & Zimmer, R. W. (2001). Examining the impact of capital on academic achievement. *Economics of Education Review*, *20*(6), 577-588.

Lafortune, J., Rothstein, J., & Schanzenbach, D. W. (2018). School finance reform and the distribution of student achievement. *American Economic Journal: Applied Economics*, *10*(2), 1-26.

Lafortune, J., & Schönholzer, D. (2018). Do School Facilities Matter? Measuring the Effects of Capital Expenditures on Student and Neighborhood Outcomes.

Leachman, M., Masterson, K., & Figueroa, E. (2017). A Punishing Decade for School Funding. *Center on Budget and Policy Priorities*.

Lewis, L., Snow, K., Farris, E., Smerdon, B., Cronen, S., & Kaplan, J. (2000). Condition of America's Public School Facilities: 1999. *Education Statistics Quarterly*, *2*(3), 42-46.

Loeb, S. (2001). Local revenue options for K-12 education. In J. Sonstelie & P. Richardson (Eds.), *School Finance and California's Master Plan for Education*.

Lutz, B. (2010). Taxation with representation: Intergovernmental grants in a plebiscite democracy. *The Review of Economics and Statistics*, *92*(2), 316-332.

Martorell, P., Stange, K., & McFarlin Jr, I. (2016). Investing in schools: capital spending, facility conditions, and student achievement. *Journal of Public Economics*, *140*, 13-29.

Maxwell, L. E. (2016). School building condition, social climate, student attendance and academic achievement: A mediation model. *Journal of Environmental Psychology*, *46*, 206-216.

McNichol, E. (2016). It's time for states to invest in infrastructure. *Washington DC: Center on Budget and Policy Priorities*.

Mendell, M. J., & Heath, G. A. (2005). Do indoor pollutants and thermal conditions in schools influence student performance? A critical review of the literature. *Indoor Air*, *15*(1), 27-52.

Moody's Investors Service. (2010). Recalibration of Moody's U.S. municipal ratings to its global rating scale.

National Commission on Excellence in Education. (1983). A nation at risk: The imperative for educational reform. *The Elementary School Journal*, *84*(2), 113-130.

Neilson, C. A., & Zimmerman, S. D. (2014). The effect of school construction on test scores, school enrollment, and home prices. *Journal of Public Economics*, *120*, 18-31.

Pagano, M., & Volpin, P. (2010). Credit ratings failures and policy options. *Economic Policy*, *25*(62), 401-431.

Parsons. (2017). School District of Philadelphia Facility Condition Assessment.

Ready, D. D., Lee, V. E., & Welner, K. G. (2004). Educational equity and school structure: School size, overcrowding, and schools-within-schools. *Teachers College Record*, *106*(10), 1989-2014.

Reardon, S.F., Kaolgrides, D. and Ho, A. (June 2017). Linking U.S. School District Test Score Distributions to a Common Scale. https://cepa.stanford.edu/sites/default/files/wp16-09-v201706.pdf

Reardon, S. F., Shear, B. R., Castellano, K. E., & Ho, A. D. (2017). Using Heteroskedastic Ordered Probit Models to Recover Moments of Continuous Test Score Distributions from Coarsened Data. *Journal of Educational and Behavioral Statistics*, 42(1), 3-45.

Shores, K. A., Candelaria, C. A., & Kabourek, S. E. (2019). Spending More on the Poor? A Comprehensive Summary of State-Specific Responses to School Finance Reforms from 1990–2014.

Simon, N. S., & Johnson, S. M. (2015). Teacher turnover in high-poverty schools: What we know and can do. *Teachers College Record*, *117*(3), 1-36.

Snyder, T. D., de Brey, C., & Dillow, S. A. (2016). Digest of Education Statistics 2015, NCES 2016-014. *National Center for Education Statistics*.

Steinberg, M. P., Quinn, R., Kreisman, D., & Anglum, J. C. (2016). Did Pennsylvania's statewide school finance reform increase education spending or provide tax relief?. *National Tax Journal*, *69*(3), 545.

Stevenson, K. R. (2006). Educational Trends Shaping School Planning and Design: 2007. *National Clearinghouse for Educational Facilities*.

Taylor Jr., H. L., McGlynn, L., & Luter, D. G. (2013). Public schools as neighborhood anchor institutions: The choice neighborhood initiative in Buffalo, New York. *Schools and urban revitalization: Rethinking institutions and community development*, 109-135.

Uline, C., & Tschannen-Moran, M. (2008). The walls speak: The interplay of quality facilities, school climate, and student achievement. *Journal of Educational Administration*, *46*(1), 55-73.

U.S. Department of Education (2005). *10 Facts About K-12 Education Funding*. Retrieved February 1, 2018, from https://www2.ed.gov/about/overview/fed/10facts/index.html

U.S. General Accounting Office. (1996). *School facilities: America's schools report differing conditions* (Report No. GAO/HEHS-96-103). Retrieved January 24, 2018, from www.gao.gov/assets/230/222833.pdf

U.S. Securities and Exchange Commission (2018). *Municipal Bonds*. Retrieved February 2, 2018 from https://www.investor.gov/introduction-investing/basics/investment-products/municipal-bonds

Verstegen, D. A., & Jordan, T. S. (2009). A fifty-state survey of school finance policies and programs: An overview. *Journal of Education Finance*, 213-230.

Wang, W., Duncombe, W. D., & Yinger, J. M. (2011). School district responses to matching aid programs for capital facilities: A case study of New York's building aid program. *National Tax Journal*, *64*(3), 759-794.

Yinger, J. (2009). Municipal Bond Ratings and Citizens' Rights. *American Law and Economics Review*, *12*(1), 1-38.

Zahran, S., Mielke, H. W., Weiler, S., Berry, K. J., & Gonzales, C. (2009). Children's blood lead and standardized test performance response as indicators of neurotoxicity in metropolitan New Orleans elementary schools. *Neurotoxicology*, *30*(6), 888-897.

Zhang, N., Baker, H. W., Tufts, M., Raymond, R. E., Salihu, H., & Elliott, M. R. (2013). Early childhood lead exposure and academic achievement: evidence from Detroit public schools, 2008–2010. *American journal of public health*, *103*(3), e72-e77.

Zimmer, R., & Jones, J. T. (2005). Unintended consequence of centralized public school funding in Michigan education. *Southern Economic Journal*, 534-544.