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Abstract

School bonds provide an important mechanism of financing school capital projects. Bonds are paid back via future property taxes, which may or may not be associated with an increase in tax rates. Bond issues require voter support in local elections. Therefore, identifying factors related to bond approval is of great interest to school officials. This dissertation evaluates the literature on school bond elections, identifies methodological problems, and provides empirical applications to address these concerns.

Chapter 1 presents an overview of current conditions of public school infrastructure and financing schemes in the United States. Underfunding of school facilities remains a problem. Generally, the funding burden for school capital expenses falls upon states and local districts. Many states provide building aid in the form of lump-sum grants and matching grants (Duncombe and Wang, 2009). Eleven states do not have any building aid programs. In these states, districts rely on bonds to finance school facilities. Oklahoma is one of the eleven states that does not provide building aid. Since it is representative of the states with primary reliance on school bonds, it serves as a good case for investigating factors associated with school bond approval.

Chapter 2 focuses on voter turnout, an important factor associated with bond approval. The belief that high voter turnout reduces bond approval is widely held.

This chapter identifies a potential estimation problem in examining the effect of turnout in the previous literature. Specifically, turnout is likely to be correlated with other important socio-demographic variables related to bond approval. The existing literature, however, is based on naïve regression estimates, which do not properly account for this relationship. Using an instrumental variable approach, I find that voter turnout only plays a negligible role in explaining bond approval. My results question the efficacy of get-out-to-vote campaigns and other voter turnout strategies, and suggest that these efforts may not be warranted.

Chapter 3 highlights a potential selection problem in typical bond research. Specifically, school bond outcomes are observed conditional on the occurrence of bond elections. If unobservable attributes could potentially influence election participation and bond approval, then the characteristics of participating districts may not be representative of all school districts. Results from the existing literature may be suspect due to selectivity bias. As a result, I propose a two-stage model that distinguishes the bond approval (outcome stage) from the election participation (selection stage) and provides some insight regarding the effects of demographics in different stages. Even accounting for potential differences across school districts, selectivity bias is evident. To understand the mechanism by which election outcomes are achieved, self-selection needs to be given careful thought.

Chapter 4 explores the relationship between local property values and school bond approval. Property values, as a measure of property tax base, are generally viewed as an important financing resource for school capital expenses in the bond literature. In addition, school amenities associated with increased school capital spending are capitalized into local property values. Therefore, property values may be endogenous to school bond approval. The traditional ordinary least squares model may conceal the true relationship between the two due to conflicting effects. Following an instrumental variable approach, I find that property values negatively influences bond approval, and such a negative effect may reflect community heterogeneity.

Understanding and addressing the methodological problems in estimation is essential for informing policy related to school finance. My research explores interesting problems, addresses related concerns, and provides useful implications regarding school financing for policy makers.

Chapter 1: Motivation and Background

1.1. Public School Conditions in the U.S.

Ever since the National Center for Education Statistics (NCES) released a report in 1999, the physical conditions of the U.S. public schools continue to attract nationwide attention. The NCES report presented an overview of the inadequate public school infrastructure across the country and estimated that a total of $127 billion is needed to improve public school conditions. Another survey conducted by NCES in 2005 suggested that the physical conditions of buildings/size of classrooms had interfered with instruction to a moderate or major extent in one-fourth of the U.S. public schools, one-third of which depended on portable or temporary buildings (Digest of Education Statistics, 2009). Underfunding of school facilities continues to be a problem. Inadequate school infrastructure not only threatens student and teacher safety, but also hinders student learning (i.e. poor lighting in classrooms). In a speech given on February 14, 2011, President Obama emphasized the importance of building a 21st century educational infrastructure. The eroding conditions of U.S. public schools will remain at the forefront of national policy.

1.2 School Financing System in the U.S

Generally, the funding burden for school facilities falls upon states and local districts. States use a variety of mechanisms to finance school capital outlays, such as credit enhancement, state loans and building aid programs (Duncombe and Wang, 2009). The most common form of credit enhancement is to offer bondholders first claim on some part of state apportions that go to a district in case of default. It is meant to raise the credit rating of a school district. States also offer loans or guarantees to school districts in order to lower their borrowing costs.

While loans need to be paid back, state building aid does not. Building aid can be categorized into lump sum grants and matching grants. Some states use lump-sum grants, which are a fixed amount per student within a school district. Others use matching grants that require a contribution from local districts. The matching rate is set at a predetermined level and is different across states. Among the 50 U.S. states, 38 have state building aid programs, and Hawaii provides full state aid to its single school district. According to Table 1.1, 22 out of 38 states use matching grants, seven use lump-sum grants, and nine use both. Notably, eleven states do not provide state building aid for school capital outlay (Figure 1.1). As a result, funding responsibility for school facilities falls on local districts in these states.

The primary mechanism of financing school infrastructure locally is to issue bonds, which are paid back with interest via future property tax collections. Bond items are placed on ballots by district school boards for approval by local voters. Therefore, identifying strategies associated with bond approval is of great importance for securing school revenues and improving school conditions, especially for districts without state building aid.

Oklahoma is one of the eleven states that does not provide state building aid. It has a total of 539 public school districts. School budgets rely on federal, state, and local apportions. While school revenues are mainly spent on instruction, administration and student support, little is apportioned for capital expenses. Compared with other states, per pupil capital outlay is low in Oklahoma, which ranks 45th among the 50 U.S. states (Figure 1.2). Consequently, Oklahoma serves as a good case study since it is representative of states with primary reliance on school bonds.

1.3 School Bond Election Literature

The process of conducting a school bond election consists of several steps: 1) a bond is proposed by district school board; 2) local voters vote on the bond and 3) if more than a certain percent of the voters cast 'yes' votes,[1] the bond is issued. Because school bonds are financed via future property taxes and bond issues require voter support, district, bond, voter, and election characteristics are used to explain bond outcomes in the literature.

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[1] The rates vary across states, e.g. 55% in California (Rueben and Cerdán, 2003) and Nebraska; 60% in Oklahoma, Iowa, Mississippi, New York, South Dakota, Washington, and West Virginia; 2/3

Despite the strong interest in school finance elections (budget and tax),[2] limited studies focus on bonds. Table 1.2 presents an overview of these studies, all of which are conducted at the district level. Theobald and Meier (2002) identify many factors relevant for school bond outcomes in Texas, including demographics, school needs, costs, and financial resources within a district. Similarly, Rueben and Cerdán (2003) find that voter support for school bonds varies with election timing, issuing purposes, and district regions. Beckham and Maiden (2003) highlight the importance of technology expenditure. Bond approval is found to increase with the percent of revenues specified for technology support.

Button and Rosenbaum (1989) examine the impact of elderly population on school bond approval in Florida, which has a large population of resettled retirees. Senior citizens are believed to be opponents of school bonds because they are unlikely to benefit from school capital spending, and such economic self-interest is reflected in their voting behavior. This is known as the "grey peril" hypothesis. Button and Rosenbaum distinguish senior permanent residents from those recent arrivals and find that bond passing likelihood rises with the population of senior permanent residents who might be loyal to local communities.

[2] See for instance: Cataldo and Holm, 1983; Button, 1993; Tedin, Matland, and Weiher, 2001; Sielke, Dayton, Holmes, and Jefferson, 2001; Ehrenberg, Ehrenberg, Smith, and Zhang, 2002; Crader, Holloway, and A Stauffacher, 2002; Davis and Tyson, 2003; Berkman and Plutzer, 2004; Johnson, 2008.

Locale differences (e.g. urban, suburban, and rural areas) are also relevant for school bond outcomes. Lentz (1999) defines the land use typology (locale) in Illinois on the basis of property tax composition and studies bond approval within each locale group. Suburban and small rural districts are likely to provide greater voter support for school bonds because the land use is relatively homogenous in these areas in Illinois. For instance, 73% of the land is agricultural in small rural areas, and 82% is residential in suburbs. Property-owners bear the same property taxes in these communities, so they are likely to share similar views about school capital expenses.

Maher and Skidmore (2008) evaluate the effect of a policy change on school bond outcomes. Due to a new school-financing scheme implemented in Wisconsin in 1996-1997, the main funding burden of school expenditure was shifted from local districts to state governments. This favorable change leads to a reduction in school tax price[3] in some districts, and thus increases the probability of passing school bonds.

Bowers, Metzger, and Militello (2010) investigate the differences in passing likelihoods between new bonds and re-submitted bonds following a discrete time hazard design. A bond is considered to be resubmitted if it is placed on a ballot again within a certain period (i.e., 12 months) since its last failure. It is found that new bonds are more likely to pass, compared to re-submitted bonds.

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[3] It is defined as the amount needed from local property tax revenue, for the purpose of rising school spending by $1 (Maher and Skidmore, 2008).

Among these aggregate studies of bond outcomes, two common empirical approaches are used: Logistic and Ordinary Least Squares (OLS) regressions. In the Logistic Regressions, the dependent variable is a dichotomous variable set to one for bond success and zero otherwise. See, for example, research by Theobald and Meier (2002) and Bowers Metzger, and Militello (2010). In terms of the OLS regressions, the dependent variable is bond approval share in an election. For instance, see papers by Button and Rosenbaum (1989) and Beckham and Maiden (2003). Compared with the dichotomous variable where only two outcomes are observed, the approval share provides more information about the extent of voter support for school capital projects. Hence, in my study, the approval share is the outcome variable of primary interest. The limited dependent variable approach is studied as a complement to my main investigation.

To date, limited empirical research has been done in the area of school bond elections. This dissertation evaluates the literature on school bond elections, identifies methodological problems, and provides empirical applications to address these concerns.

Table 1.1: Capital spending per pupil across U.S. states by building aid category

State building aid			No state building aid ($451.55)
Lump sum grants ($729.88)	Matching grants ($607.95)	Both ($567.00)	
Arizona	Alaska	Alabama	Idaho
Florida	California	Arkansas	Iowa
Hawaii*	Connecticut	Colorado	Louisiana
Indiana	Delaware	Kentucky	Michigan
South Carolina	Georgia	Minnesota	Missouri
Tennessee	Illinois	Mississippi	Nebraska
Utah	Kansas	Montana	Nevada
West Virginia	Maine	New Mexico	North Dakota
	Maryland	North Carolina	Oklahoma
	Massachusetts	Ohio	Oregon
	New Hampshire		South Dakota
	New Jersey		
	New York		
	Pennsylvania		
	Rhode Island		
	Texas		
	Vermont		
	Virginia		
	Washington		
	Wisconsin		
	Wyoming		

Source: Duncombe and Wang (2009); School District Finance Survey for School Year 2006-07, FY2007, US Department of Education.

Note: Hawaii provides full state building aid on school capital outlay.

Table 1.2: School bond studies conducted at the district level

Author and Year	Publication	Data	Dependent Variable	Explanatory Variables	Estimation Method	Conclusion	Contribution
Button & Rosenbaum (1992)	Research on Aging	Florida, 1969-1988, 56 school bonds	Percent of yes votes	Social demographic, situational, and political factors	OLS regression	The population of permanent senior residents is positively associated with the school bond success.	Permanent senior residents are distinguished from recent arrivals.
Lentz (1999)	Journal of Education Finance	Illinois, 892 school finance referenda, 1981-1989,	Percent of yes votes	Educational culture, tax protest, capacity to pay, voter turnout	OLS regression	Suburban and small rural districts have the highest share of voter approval in school bond elections due to homogenous land use in these areas. Bond success is associated with past experience, small increase in tax rate, avoidance of general election, and responsiveness to local economic situation	Land use typology is defined according to its property tax compositions.
Theobald & Meier (2002)	Annual National Meeting of the Midwest Political Science Association	Texas, 1997-2001, 695 school bonds	Dichotomous variable, success=1, fail=0	School needs, costs, district resources, self-interest factors and demographics	Logistic regression	Many factors are relevant for bond success, including demographics, school needs, costs, resources, and self-interest factors;	Factors associated with bond success are identified.

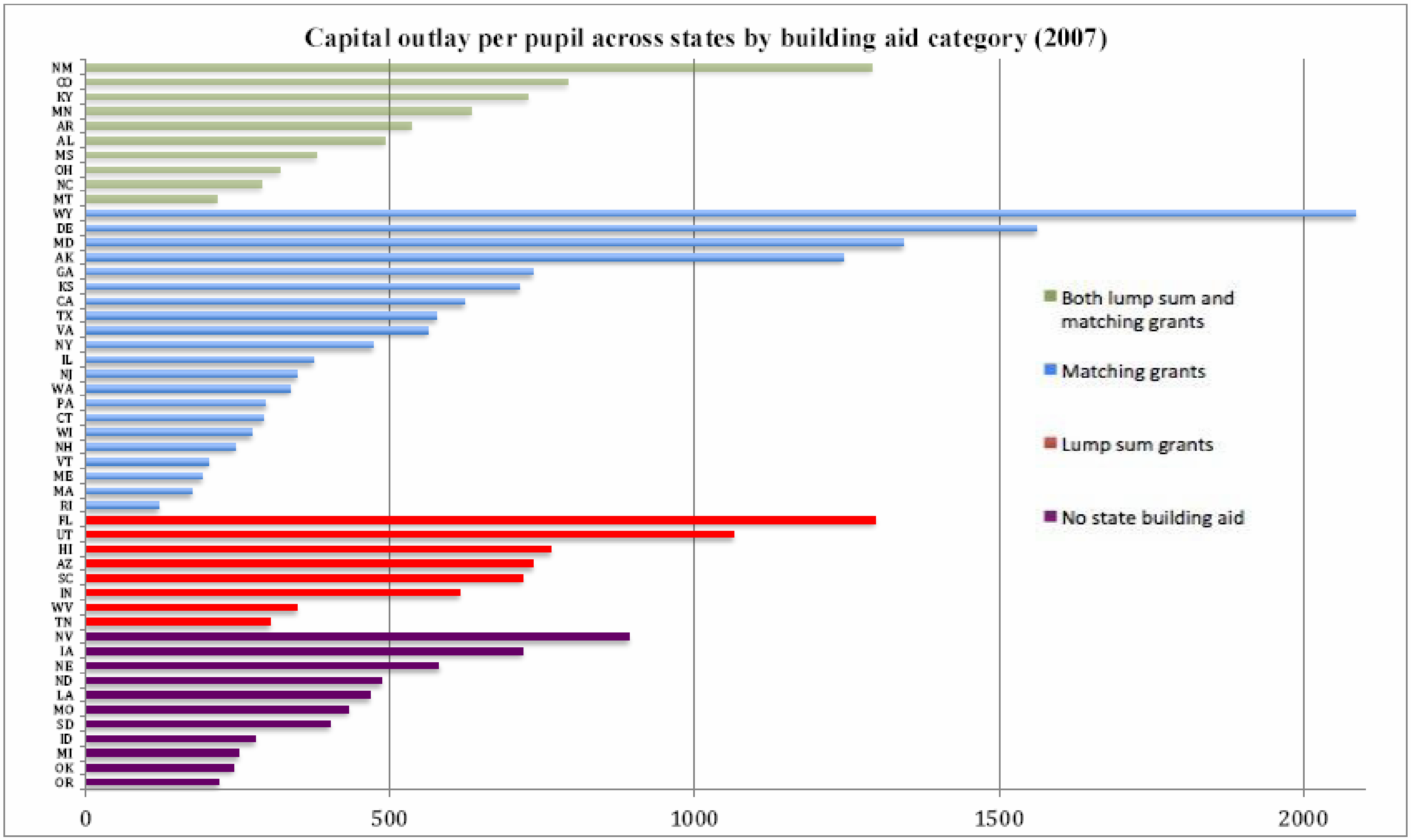
Table 1.2 continued

Author and Year	Publication	Data	Dependent Variable	Independent Variables	Estimation Method	Conclusion	Contribution
Beckham and Maiden (2003)	Journal of Education Finance	Oklahoma, 523 school bonds, fiscal year 95-96 through 99-00	Percent of yes votes, dichotomous variable, success=1, failure=0;	Bond amounts, district size, year effect, and election timing	OLS and logistic regression	Bond approval increases with the percent of revenue specified for technology support.	The importance of technology expenditure is highlighted.
Rueben and Cerdán (2003)	Public Policy Institute of California.	California, 1986-2002, 726 bonds	The number of bond measures proposed, passage rates, and per pupil capital revenue	Regional demographics	OLS regression	Voter support varies with bond types, election timing, issuing purposes, and school district regions.	A comprehensive examination of local finance elections is conducted.
Maher and Skidmore (2008)	Public Finance Review	Wisconsin, 1991-2004, 1343 bonds	Probability of passing, Dichotomous variable, success=1, fail=0	Median voter variables and agenda setting variables	OLS and logistic regression	Favorable change in school-financing scheme reduces school tax price and increases the probability of passing bonds.	The effect of the new school-financing scheme on bond outcomes is evaluated.

Table 1.2 continued

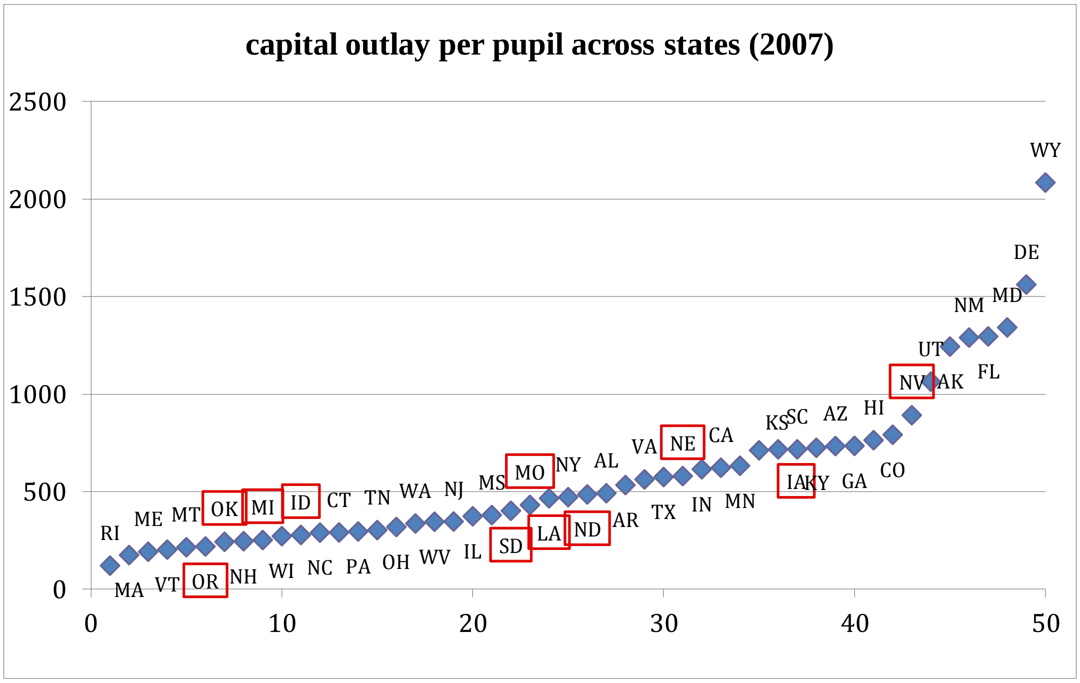
Author and Year	Publication	Data	Dependent Variable	Independent Variables	Estimation Method	Conclusion	Contribution
Bowers, Metzger, and Militello (2010)	Educational Policy	Michigan, 2000-2006, 505 school bonds	Dichotomous variable, success=1, failure=0;	Bond amount, district size, location, time	Discrete time hazard logistic regression	Bonds attempted at the first time are most likely to pass, but the probability falls when they are re-submitted.	New bonds and re-submitted bonds have different passing likelihoods.
Bowers, Metzger, and Militello (2010)	Journal of Education Finance	Michigan, 789 school bonds, 1998-2006	Dichotomous variable, success=1, failure=0;	Ten important factors: bond amount, district enrollment, location, long term debt, students receiving free lunch, population with a high school degree, election day, voter turnout, technology wording, and number of bond proposals on ballot;	Discrete time hazard logistic regression	Among the ten factors, amount of long-term debt and late election days are positively associated with the probability of passing, enrollment and tech content have no significant effect, while the rest are negatively related to bond passage.	New bonds and re-submitted bonds have different passing likelihoods.
Gong (2012)	NA	Oklahoma, 1997-2009, 662 bonds	Approval share, Dichotomous outcome, success=1, fail=0	Demographics, school needs, bond and election attributes	OLS and Probit regressions	Understanding and addressing the methodological problems in estimation is essential for informing policy related to school finance.	Correct model specifications are important.

Figure 1.1



Source: School District Finance Survey for School Year 2006-07, FY2007, U.S. Department of Education.

Figure 1.2



Source: School District Finance Survey for School Year 2006-07, FY2007, US Department of Education.

Note: States without building aid are highlighted (with boxes). These states as a whole have lower per pupil capital spending on average.

Chapter 2: Does Voter Turnout Matter for School Bond Outcomes?

2.1. Introduction

This chapter examines the role of voter turnout in explaining school bond election outcomes. Turnout, measured as the proportion of electorate voting in an election, is widely believed to be negatively associated with bond approval. Individuals mostly likely to vote for school bonds are those more vested in school activities, such as teachers, school officials, parents, and PTA members. The voting power of these likely supporters diminishes as voter turnout from the general population increases. When not held in conjunction with national or state general elections, turnout for school bond elections is relatively low because only individuals with a strong enough interest bother to vote. Consequently, school administrators give careful attention to factors related to voter turnout. For instance, they tend to schedule special elections for school bonds to avoid other ballot items and target supportive voter groups via get-out-to-vote campaigns.

Unfortunately, a concern associated with the previous literature is that the role of voter turnout may be misleading. A typical model of school bond approval includes turnout as well as other social demographic factors related to bond outcomes. A problem arises if voter turnout is correlated with these factors. For example, voter turnout and the percent of population with a high school degree are included in the empirical model of Bowers, Metzger, and Militello (2010). If less educated citizens are less likely to vote, then there is collinearity between the two variables. Similar correlation exists between turnout and other explanatory factors, such as district average income, educational attainment, locale, etc. Collinearity is not a big issue as long as turnout is not a perfect combination of other explanatory variables.

In addition, omitted variable bias is another concern. Turnout may be correlated with omitted variables that are related to bond approval, e.g. the percent of families whose children attend private schools. If these families are likely to go to polls and vote against public school spending, then ordinary least squares (OLS) estimates would be inconsistent. Other potential omitted variables include average length of residence and percent of childless families. Furthermore, unobserved characteristics, such as attitude toward taxation, may impact bond approval as well as voter turnout decisions.

To the extent that voter turnout is potentially correlated with omitted and/or unobserved characteristics, the assumption of independence between explanatory variables and error term is violated. The previous research does not account for this potential correlation, so the results may be misleading concerning the turnout effect.

Accordingly, I use an instrumental variable (IV) approach to isolate the role of voter turnout from other social demographic factors and to see if the previous estimates are robust to accounting for these concerns.

My study contributes to the literature and policy realm by investigating the de-facto turnout-approval relationship using the outcomes of 662 school bond elections from Oklahoma between 1997 and 2009. Using an ordinary least squares approach as a benchmark, a negative and significant relationship is found between voter turnout and bond approval. In contrast, using an instrumental variable approach, no significant correlation is identified. This evidence questions the importance of voter turnout and suggests that efforts to promote turnout among target groups may not be warranted.

2.2 Literature on Voter Turnout in School Bond Elections

The theory underlying the turnout-approval relationship is the median voter model (Black, 1948), where the preference of the median voter dominates voting outcomes. In terms of school bonds, a super majority approval (60%) is required for bond issues. Therefore, preference of the 60-percentile voter determines the outcomes of bond elections. Nevertheless, school officials are capable of scheduling special elections and targeting specific voter groups, so the median voter of the targeted groups may be different from that of the whole population. Accordingly, the preference of the median voter may change as voter turnout varies, so do school bond outcomes.

Turnout fluctuates considerably across school bond elections. The substantial differences in turnout rates and diverging election outcomes have attracted enormous research interest. Many studies explore and investigate the empirical connection between voter turnout and bond approval. The results are inconclusive (Table 2.1).

Piele and Hall (1973) summarize the findings of early research (1950-1970), which examines the turnout-approval relationship in both school bond and budget elections. Among the eighteen studies, half find a significant and negative relationship, six find an insignificant one, and three find contradictory results. The majority of early studies supports the belief that high voter turnout reduces bond approval. After examining the quality of data used in these studies, such as the type of elections, number of elections, geographic coverage, time period, and unit of analysis, Piele and Hall conclude that bond approval falls with voter turnout. High turnout implies community conflict, which may bring out demographic groups that are likely to oppose school capital spending.

Although the negative relationship between voter turnout and bond approval is widely accepted, other studies also find evidence of a positive relationship in large districts in metropolises, e.g., Cleveland, Detroit, and Grand Rapids.[4] One possible explanation is the incremental turnout theory developed by Spinner (1967). According to the theory, election failures are most likely to occur at intermediate turnout levels due to an increased participation of tax opponents. As voter turnout continues to rise, potential 'yes' voters will outnumber tax opponents, and a positive turnout-approval relationship may emerge.

Stone (1965) considers the relationship between high turnout and bond outcomes to be indeterminate. Although he conducts his research in the context of political elections, his theory applies to school finance elections. High turnout inevitably includes (political) in-activists who are poorly informed. Because their preferences are volatile and hard to predict, so are the election outcomes.

To reconcile the diverging research findings, Hamilton and Cohen (1974) suggest that the turnout-approval correlation is not robust. In fact, it depends on the composition of the electorate, especially the voter characteristics at low and high turnout levels.

Notably, early research (50s-70s) generally examines the turnout-approval relationship on the basis of summary statistics and data comparisons. However, these methods do not rule out the potential influence of other relevant factors, e.g. district

[4] The research is summarized in Hamilton and Cohen (1974, p76).

demographics, so the corresponding results are likely to change when relevant factors are included.

Recent studies investigate the relationship using regression analysis, accounting for potential important factors in a more comprehensive way. Lentz (1999) defines a school district's locale (urban, suburban, and rural areas) according to its property tax composition and studies bond approval within each locale category. Among the factors that influence bond approval, she finds that a referendum is less likely to pass if it is held on the same date as a general (primary) election, where voter turnout is remarkably high. Though high turnout may bring out the median voters of the voting population, these voters may be disinterested in school capital spending and are not in favor of school bonds.

Bowers, Metzger, and Militello (2010) employ a design of discrete time hazard to investigate the different passing likelihoods between new bonds and resubmitted bonds, using data from Michigan. During their examination, a significant and negative relationship emerges between voter turnout and bond outcomes. This evidence is consistent with the conventional wisdom that low turnout is associated with a greater chance of bond approval. Results from recent studies (Lentz, 1999; Bowers, Metzger, and Militello, 2010) support the majority findings of early research.

Unfortunately, a potential estimation problem exists when studying the impact of voter turnout in the previous literature. Specifically, turnout is likely to be correlated with other important social demographic variables related to bond approval. A naïve OLS approach does not account for this potential correlation. Therefore, an IV method is used to reveal the true turnout-approval relationship.

2.3. Empirical Specification

2.3.1 Model

At the school district level, the baseline model is specified as follows:

$$Approval_{it} = \beta_0 + \beta_1 voterturnout_{it} + \beta_2 X_{it} + \varepsilon_{it} \qquad (2.1)$$

The unit of observation is a school bond election held in school district i in year t. The variable *Approval* is the share of yes votes in a school bond election. It indicates the extent of voter support for school capital expenses. The variable ε_{it} is an error term, and the set X_{it} includes factors associated with bond approval, such as district demographics, school needs, and bond/election characteristics. Turnout is one of the explanatory factors that are relevant for school bond approval.

2.3.2 Data

My Oklahoma bond data come from two sources. The primary source is hand-collected data, generously provided by Rogers and Burge.[5] Their data collection efforts entailed going to the county election boards, digging through records to pull out local fiscal ballots, and collecting detailed bond information at the school district level. Although the bond data have a small geographic coverage (17/77 counties in Oklahoma),[6] the district level bond records are almost complete in covered areas.

The second source is a consulting company, Stephen H. McDonald and Associates. The company helps many school districts issue bonds in Oklahoma and collects information from districts that use its service. Although the provided data cover a wider geographic area (482/539 districts in all 77 counties in Oklahoma), the information is selective rather than comprehensive regarding bond elections in the state. For instance, according to Rogers and Burge, there are a total of 645 school bond elections held in 17 counties between 1997 and 2009, while the consulting company only documents 294 of them (Figure 2.1). Therefore, the company data

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[5] Rogers and Burge are professors at the Department of Economics, University of Oklahoma.

[6] Most of Oklahoma's population is located in these seventeen counties, including Canadian, Cleveland, Creek, Grady, Kingfisher, Lincoln, Logan, McClain, Oklahoma, Okmulgee, Osage, Pawnee, Payne, Pottawatomie, Rogers, Tulsa, and Wagoner.

may be problematic to the extent that observations are not randomly collected.[7] Therefore, I combined bond data from both sources to get more complete coverage for the counties covered by Rogers and Burge.

Notably, a school bond election may include multiple bond measures. If each initiative item is treated as an independent observation, the information contained by measures on the same ballot would be highly correlated, e.g., number of total votes and yes votes. In addition, the district demographic variables used to explain bond outcomes are the same for those measures. To address these concerns, multiple bond measures on the same ballot are consolidated into a single representative bond, calculated as the weighted average according to their issuing values. This approach puts greater weight on the more expensive bonds. The final sample includes 662 school bond elections from 17 counties (151 districts) between1997 and 2009. Table 2.2 displays the number of (consolidated) bond elections held in each school district during the sample period, and Figure 2.2 shows the distribution.

Typically, there are two types of bonds: general capital bonds and transportation bonds. General capital bonds are issued for diverse purposes, such as facility improvement, restoration, new construction, and the purchasing of new equipment, while transportation bonds are issued only for one purpose: school

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[7] Even though the company data are representative, it's not desirable for my analysis. When constructing the lags of turnout as instruments (section 2.3), incomplete data are a big problem.

buses/vans. On average, capital bonds have larger issuing values than transportation bonds ($2,014 vs. $274 per pupil), and the number of elections for capital bonds is twice as many as that of the transportation bonds (662 vs. 332).[8] Given the diverse issuing purposes, higher issuing values, and larger number of elections, capital bonds are examined separately from transportation bonds (Sample 1). In the robustness checks section, both types of bonds are studied (Sample 2 and 3).

The variable of primary interest, voter turnout, has been measured in different ways in the literature (Geys, 2006): (1) number of total votes divided by the voting age population; (2) number of total votes divided by the size of electorate (registered voters); and (3) absolute number of votes cast. Among these, the first one is the most commonly used due to the ease of constructing it with official data. Therefore, voter turnout is constructed in the same way in this study. However, my data only cover the voting age population (18 and above) in the census year (2000). To approximate the voting population in other years, total population is multiplied by the voting age ratio in 2000.

In addition to voter turnout, other explanatory variables (X_{it}) related to bond approval include district demographics, school needs, and bond (election) characteristics. Oklahoma school district demographics are obtained from the Office

[8] Although both types of bonds are likely to be on the same ballot, half of the bond elections only include capital bonds.

of Accountability, which reports community characteristics, school educational processes, and student performance in its publication: *School and District Report Card.* Table 2.3 details the variable descriptions and sources, and Table 2.4 displays the summary statistics.

District demographic variables include property values, debt service, district locale, etc. Property values reflect the financial resources in a school district. Studies suggest that the probability of passing school bonds increases with the available resources, that is, property values (Lentz, 1999; Theobald and Meier, 2002; Maher and Skidmore, 2009). Debt indicates an unbalanced budget, which raises the need for additional support, though voters are reluctant to expand debt if the current size is large (Theobald and Meier, 2002).

School district locale ranges from "big city" to "rural" as defined by the National Center for Education Statistics (NCES). Bowers, Metzger, and Militello (2010) divide all school districts into three categories, urban/suburban, town, and rural districts. In contrast, my study has more detailed locale specifications, e.g., *city, suburb, rural fringe, rural distant, rural remote, town fringe, and town distant*.[9] My sample (151 districts) has almost complete coverage of suburban/urban areas but

[9] 40 out of 662 bond elections were held in urban districts, including small and big cities. Because the number of observations is limited, they are combined into one *city* category, as are the small, medium and large suburbs. The rest of the categories follow the NCES classification.

only partial coverage of town/rural areas. Out of 539 public school districts in Oklahoma, the sample includes all suburban districts (16), 6 of the 9 city districts, 9 of the 12 town fringe districts, 13 of the 49 town distant districts, 38 of the 63 rural fringe districts, 65 of the 202 rural distant districts, and 10 of the 149 rural remote districts.

Locale differences are relevant for school bond outcomes. The composition of property tax base may vary on the basis of district locale. For instance, rural areas rely on agricultural property in the tax base, while urban districts depend on business and residential property. As the composition of the property tax base varies, voter support may fluctuate since owners of different types of property may have diverging views regarding school capital spending (Lentz, 1999).

Another indicator, “no high school”, implies districts that do not offer secondary education. 28 out of the 151 school districts in my sample do not have a high school (Table 2.5). These districts are small in terms of population size (1,823 vs. 22,595 on average). Therefore, they share the upper grade educational services with neighboring unified school districts, which provide education to children of all school ages.

School needs are captured by enrollment growth rate (Lentz, 1999; Zimmer and Jones, 2005) and student density, both of which are expected to be positively associated with bond approval. A high enrollment growth rate implies a big increase in student population. Therefore, districts may require more capital spending to accommodate the increased demand. The growth rate measures the relative school demand, and the absolute demand is captured by student density, which is defined as the number of students per square mile within a school district. On average, urban/suburban areas have denser student populations (10722.58 vs. 1173.57 per sq. miles). Accordingly, districts in these areas may request capital spending more frequently in order to meet the need.

Bond and election characteristics include issuing values and years since the last bond election. According to the previous research (Theobald and Meier, 2002; Bowers, Metzger, and Militello, 2010), bond support falls as issuing values rise. Years measure the time interval between the last and current school bond elections. It is anticipated to be positively associated with bond approval since a longer period suggests that school districts haven't requested support recently.

2.3.3 Instrumental Variable (IV) Approach

Given the potential correlation between voter turnout and other observed and/or unobserved characteristics, an instrumental variable approach helps isolate the role of turnout from other demographic variables. A possible instrument is the lag of voter turnout. Voting is habitual, and past voting behavior helps predict future voting behavior. Based on a Meta-analysis of 83 empirical studies conducted at various levels of aggregation (school district, municipality, state, and country), Geys (2006) finds that previous voter turnout is positively associated with current turnout. The positive relationship is also supported in an individual level study (Matsusaka and Palda, 1999).

My sample starts in 1997. To obtain the lag of turnout, bond information is traced back to 1990, and two lags are constructed. *Lag 1* refers to the turnout in the previous bond election in the same district rather than a strictly one-year lag, and *Lag 2* refers to the turnout in the bond election before the previous one.[10] Out of 662 bond elections, 59 do not have enough lags (lag 2) to be included in the analysis. Therefore, my analysis is based on a smaller sample (603).

Another possible instrument is weather. Gomez, Hansford, and Krause (2007) investigate the relationship between weather conditions and voter turnout at the county level. Based on fourteen U.S. presidential elections, they find that election day bad weather (rain or snow) deters voter participation due to inconvenience. On the other hand, after examining four consecutive Canadian national elections at the individual level, Matsusaka and Palda (1999) do not find evidence of a negative

[10] On average, the previous bond election happened 2.5 years ago, and the election before the previous one occurred 4.6 years ago.

correlation between inclement weather[11] and voter turnout. In fact, Knack (1994) suggests that a strong sense of civic duty drives people to vote in elections regardless of the high voting cost associated with bad weather.

Though the relationship between weather and turnout is not clear (It may be weakly correlated), weather is considered as a potential instrument in my study. Daily weather information is acquired from Oklahoma Mesonet (www.mesonet.org), and several measures are constructed. To obtain weather conditions at the school district level, weather stations are matched to district boundaries using ArcGIS software. Mesonet sites are layered on top of the school districts to create a "buffer" of 30 km around each Mesonet station. This buffer range was chosen so that most districts would have one Mesonet station within their boundaries. If a school district has only one station located within its boundary, weather information is obtained from that station (Figure 2.3). If there are more than one station, data are averaged. For districts that do not lie within the 30-mile range, data from the nearest station are used. Table 2.6 displays the corresponding weather station(s) for each school district in 17 counties.

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[11] Matsusaka and Palda (1999) use various factors to measure the election day weather conditions, including the mean, minimum, and maximum daily temperature, the deviation of the election day temperature from the monthly average, and the amount of precipitation.

Weather variables include daily rainfall (Gomez, Hansford, and Krause, 2007), the absolute deviation of daily temperature from the normal average of the date (Knack 1994) and the absolute deviation from the monthly average (Matsusaka and Palda, 1999). When daily temperature is too far away from the average, weather is likely to be bad and voter participation may be deterred. However, a cool day in summer or a warm day in winter may actually encourage people to go out and vote. Since the absolute deviation variables do not specify whether a temperature is below or above the average, the deviation effects on voter turnout may cancel out, resulting in insignificant estimates. Therefore, to distinguish from those special cases (cool summer and warm winter), a variable indicating extreme weather circumstances is added to the model. A dummy is set to one if the maximum daily temperature is greater (smaller) than 90 (30) degrees and zero otherwise. Extremely warm (cold) weather is expected to discourage voter turnout and this usually occurs in August/September (January). However, school semesters also begin in these months, and parents are more engaged in school related activities. In fact, turnout rates are higher in these months. For instance, in my sample, average turnout is 17.5% for January, August, and September, and 13% for other months, though the difference is not statistically significant. Turnout is also high in November (17%). School bond elections concur with general elections in this month, but bond elections are scheduled on the third Tuesday in order to avoid general elections (Oklahoma Statutes). Given these concerns, a dummy is included to isolate the month effect from the weather effect. It is set to one if a bond election is held in January, August, September, and November, and zero otherwise.[12] Table 2.7 presents the summary statistics of weather variables.

To validate the application of the IV estimation technique, I employ a Hausman test to examine the correlation between voter turnout and other unobserved and/or omitted characteristics.

2.3.3.1 Validation of the Instrumental Variable Approach

Turnout is regressed on the proposed instruments and explanatory variables to obtain the residuals, which are added to the baseline model. The coefficient on the residual in the augmented OLS regression is statistically significant (Table 2.8), suggesting that turnout and the error are correlated. Thus, the OLS estimates are inconsistent, and an IV approach is appropriate for estimating the turnout effect.

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[12] The dummy is used to capture the high turnout rates in those months due to the beginning of new school semesters and general elections. Turnout in these months is considered as a whole and compared with that in other months. Additionally, a set of twelve-month dummies (categorical dummies) is also studied. The dummy set and the single dummy contribute similarly to the overall explanatory power of the model. So, the categorical month effect is fully captured by the single dummy.

2.3.3.2 Under-identification and Weak Instruments Tests

A valid instrument must be correlated with the variable that needs to be instrumented, voter turnout in this case. To test this condition, current turnout is regressed on the suggested instruments and other explanatory variables. Instruments include the lag of voter turnout and weather. Table 2.9 presents the results. The estimated coefficients of lags are positive and statistically different from zero. The weather instruments, however, are not important in explaining voter turnout.[13] This suggests that weather impacts turnout slightly, consistent with the findings of Matsusaka and Palda (1999). Given the strong correlation between the instruments (lags) and voter turnout, the null hypotheses of the under-identification and weak instruments tests can be rejected.

2.3.3.3 Over-identification Test

A second condition is that the instruments should be exogenous to the bond approval equation. To evaluate this condition, residuals obtained from the baseline model are regressed on the instruments and explanatory variables. The estimated coefficients are not different from zero, with a Hansen J statistic of 0.067 (P value:

[13] The month dummy is significant, but it captures the month effect rather than the weather effect.

79%, Table 2.9). As a result, the null hypothesis that instruments are exogenous to the bond equation cannot be rejected.

The analysis presented here suggests that the proposed instruments (lags) are valid and an IV approach produces consistent estimates. Accordingly, *lag 1* and *lag 2* will be used to instrument voter turnout in the analysis to follow.

2.4. Results

2.4.1 Empirical Results

Table 2.10 reports the results. Time effects are included in all regressions. Estimated coefficients of independent variables have the expected signs related to bond approval. Column (1) presents the OLS estimate, which is negative and significant; consistent with the conventional wisdom that high turnout reduces bond approval. A one percent increase in the voter turnout rate corresponds to a 0.23 percent decrease in bond approval share.

Nevertheless, such estimates are inconsistent due to the potential correlation between voter turnout and other omitted and/or unobserved characteristics. Reliable IV estimates are reported in columns (2) and (3), where lags of turnout are used as instruments. Coefficients of the instrumented turnout approach zero and fail to attain the standard levels of statistical significance (-0.007/-0.004, Table 2.10). The substantial declines in the magnitudes of estimates indicate that voter turnout only plays a negligible role in explaining bond approval.

The results are surprising given the careful attention given to voter turnout by school officials. In fact, one of the school bond campaign strategies is to target specific voter groups for the purpose of support. For instance, it is common practice to encourage PTA members to call other parents to remind them to vote. My results cast doubt on the conventional wisdom that turnout matters and suggest that bond approval is mostly driven by district social-demographic factors. Accordingly, efforts to solicit support from targeted voters may not be warranted.

Relating to district locale, IV regressions produce similar coefficients as the OLS results. Districts in rural fringe areas have the highest bond approval shares, while urban districts have the lowest (0.687 vs. 0.617, column (2), Table 2.10). In contrast, other studies find that urban districts are more likely to support school capital expenses (Zimmer and Jones, 2005; Bowers, Metzger, and Militello, 2010). Different findings between this and other studies may reflect the underlying differences in samples (Oklahoma vs. Michigan bonds). Nevertheless, my results are in line with the findings of Lentz (1999), which support the view that small rural areas are more likely to pass school referenda due to homogenous land use in these communities.[14] Property owners who bear the same property taxes (agricultural) are likely to have similar opinions about school bonds.

The estimated coefficients of other variables change slightly under the IV specifications. The two variables that capture school needs, enrollment growth rate and student density, are positively related to bond approval. As demand for school facilities rises, approval shares increase. Years since the last election also have a positive impact on bond approval. If a district waits a longer period to issue new bonds, voters tend to provide greater support for school bonds. Debt reflects a district's taxability (Bowers, Metzger, and Militello, 2010). If school districts tax themselves heavily in the past, they may support future taxes as well.

The rest of the explanatory variables are negatively related to bond approval, including bond-issuing value and the "no high school" dummy. Large bond issuing values reduce approval shares. Estimated coefficients are somewhat larger under the IV regressions (0.0405 vs. 0.073, column (2), Table 2.10). A one standard deviation increase in per pupil bonds value ($3240, column (2), Table 2.10) is associated with a decrease of 2.4 percent in bond approval shares. The "no high school" dummy indicates districts that only provide elementary education. Most of them are rural

[14] In Illinois, 73% of the land is agricultural in these small rural areas.

districts with a small population (1,823 vs. 22,595 on average) and are likely to have low demand for school capital expenses.

Other demographics, such as property value per pupil, educational attainment, poverty level, and pupil-teacher ratio, are also considered in the analysis to account for the potential differences across school districts, but none of them are significant at the conventional levels of statistical significance. To further investigate the turnout-approval relationship, several robustness checks are explored below.

2.4.2 Robustness Checks

Due to the differences in capital and transportation bonds, the previous analysis is conducted on the basis of capital bonds. In this section, samples are expanded to both types of bonds. Specifically, sample 2 combines bond measures (both capital and transportation bonds) on a single ballot into one representative bond by weighting their issuing values. The validation of the IV approach is shown in Table 2.11. Once again, the coefficient on the augmented residual is statistically significant. The first stage results and IV estimates are displayed in Tables 2.12 and 2.13, respectively. In addition, sample 3 treats each bond measure on a ballot as an independent observation. Because the information is highly correlated for measures on the same ballot, regression errors are clustered at the school district level. Table

2.14 confirms the application of the IV approach. Tables 2.15 and 2.16 repeat the regressions from Tables 2.9 and 2.10. Both coefficients on the instrumented voter turnout are close to zero and are highly insignificant. The negative turnout-approval relationship is not robust to the IV specifications.

Furthermore, the previous research typically adopts a limited dependent variable approach in examining school bond outcomes. To evaluate the importance of the specification of the outcome variable, a Probit regression is estimated. The dependent variable in this case is dichotomous, i.e., one for success and zero for failure.[15] Table 2.17 displays the estimation results using *lag1* and the month dummy as instruments.[16] Again, the IV estimates of voter turnout are small in magnitude and are not significant at the standard levels.

Results presented in this section demonstrate that the connection between voter turnout and bond approval is weak, and it is robust to various samples. Although a significant and negative relationship is found under the traditional OLS model, the relationship almost disappears under the IV specifications (Tables 2.10, 2.13, 2.16, and 2.27). To the degree that voter turnout and bond outcomes could be driven by the same set of social demographic factors, it is important to correct the estimation bias. The estimates of other explanatory variables change slightly.

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[15] In Oklahoma, a school bond passes if the approval share is greater than or equal to 60%.

[16] According to the Wald test statistics, instruments are exogenous to the bond approval equation.

2.5. Discussion and Conclusion

Voter turnout has been the focus of election policy for a long time. Numerous studies have explored the connection between voter turnout and school finance outcomes (Piele and Hall, 1973; Hamilton and Cohen, 1974). However, my study calls attention to the underlying relationship between voter turnout and other social demographic factors related to bond approval. Using unique Oklahoma school bond data, I find a potential modeling flaw that may contribute to the misleading policy conclusion regarding the importance of voter turnout. My results provide little support for get-out-to-vote campaigns and other voter turnout strategies.

Notably, my data are limited to 17 of 77 counties in Oklahoma. During the period of interest (1997-2009), 563/662 school bonds passed, authorizing a total bond value of $4.27 billion. Although fewer bonds were approved during the recent economic downturn (2007-2009), the average issuing value per pupil increased throughout the period (Figure 2.4). Bonds become increasingly important for local school finance and school conditions. Understanding the links between bond passage and relevant factors is essential for informing policy strategies, and proper model specification helps avoid advocating ineffective ones.

More broadly, the problem proposed here is not limited to school bond studies. It also applies to other elections of various types, e.g., elections for sales taxes, fluoridation, and hospitals. To the extent that voter turnout is potentially correlated with other social demographic factors related to election outcomes, misspecification problems are likely to arise. My study suggests the use of an instrumental variable approach to investigate the turnout effect in outcomes of interest.

Table 2.1: Literature on the relationship between voter turnout and bond outcomes

<table>
<tr><th rowspan="2">Voter Turnout</th><th colspan="2">Significant</th><th rowspan="2">Insignificant</th></tr>
<tr><th>Positive</th><th>Negative</th></tr>
<tr><td rowspan="2">Piele & Hall (1973)</td><td colspan="2">Spinner (1967), Marlowe (1970), Wills (1967-68)</td><td rowspan="2">Beal et al. (1966),
Turner (1968);
Murphy (1966);
Stone (1965);
Boskoff & Zeigler (1964);
Hanhn (1968);</td></tr>
<tr><td></td><td>Carter et al. (1960, 1961, 1966);
Lieber (1967);
Wentzel (1964);
Barbour (1966);
Goettel (1971);
Crider (1967);
Minar (1966);
Jordan (1966);
Dykstra (1964);</td></tr>
<tr><td rowspan="2">Hamilton & Cohen (1974)</td><td colspan="2">Spinner (1967)</td><td rowspan="2">Stone (1965);
Boskoff & Zeigler (1964);
The Oregan data (1972);</td></tr>
<tr><td>Ginocchio (1970);
Agger (1969);
Miller (1967);
Kearney & Hattington (1857);
Martin (1950);
Lamka (1957);
Sigel (1960);</td><td>Flinn (1970);
Levin (1960);
Carter & Savard (1961);
The California data (1968-1972);</td></tr>
<tr><td>Recent studies</td><td></td><td>Lentz (1999);
Bowers et al. (2010);</td><td>Gong (2012)</td></tr>
</table>

Table 2.2: Frequencies of consolidated school bond elections in 151 school districts in Oklahoma, 1997-2009

County	District	Number of bond elections	County	District	Number of bond elections
Canadian	Banner	3	Grady	Friend	4
Canadian	Calumet	2	Grady	Middleberg	3
Canadian	El Reno	5	Grady	Minco	5
Canadian	Maple	1	Grady	Ninnekah	4
Canadian	Mustang	8	Grady	Pioneer	2
Canadian	Piedmont	5	Grady	Rush Springs	8
Canadian	Riverside	1	Grady	Tuttle	4
Canadian	Union City	3	Grady	Verden	4
Canadian	Yukon	5	Kingfisher	Dover	3
Cleveland	Lexington	4	Kingfisher	Hennessey	3
Cleveland	Little Axe	5	Kingfisher	Kingfisher	3
Cleveland	Moore	8	Kingfisher	Lomega	3
Cleveland	Noble	3	Kingfisher	Okarche	4
Cleveland	Norman	10	Lincoln	Agra	5
Cleveland	Robin Hill	1	Lincoln	Carney	4
Creek	Allen-Bowden	4	Lincoln	Chandler	3
Creek	Bristow	3	Lincoln	Davenport	4
Creek	Depew	3	Lincoln	Meeker	4
Creek	Drumright	5	Lincoln	Prague	5
Creek	Gypsy	3	Lincoln	Stroud	3
Creek	Kellyville	4	Lincoln	Wellston	3
Creek	Kiefer	7	Lincoln	White Rock	1
Creek	Lone Star	6	Logan	Coyle	3
Creek	Mannford	6	Logan	Crescent	2
Creek	Mounds	6	Logan	Guthrie	7
Creek	Oilton	3	Logan	Mulhall-Orlando	4
Creek	Olive	2	McClain	Blanchard	5
Creek	Pretty Water	6	McClain	Byars	3
Creek	Sapulpa	8	McClain	Dibble	4
Grady	Alex	4	McClain	Newcastle	7
Grady	Amber-Pocasset	5	McClain	Purcell	3
Grady	Bridge Creek	6	McClain	Washington	2
Grady	Chickasha	7	McClain	Wayne	2

Table 2.2 continued

County	District	Number of bond elections	County	District	Number of bond elections
Oklahoma	Bethany	5	Payne	Ripley	2
Oklahoma	Choctaw/Nicoma Park	9	Payne	Stillwater	5
Oklahoma	Crooked Oak	7	Payne	Yale	2
Oklahoma	Crutcho	3	Pottawatomie	Asher	2
Oklahoma	Deer Creek	5	Pottawatomie	Bethel	3
Oklahoma	Edmond	12	Pottawatomie	Dale	2
Oklahoma	Harrah	6	Pottawatomie	Grove	4
Oklahoma	Jones	4	Pottawatomie	Macomb	6
Oklahoma	Luther	3	Pottawatomie	Maud	3
Oklahoma	Oakdale	8	Pottawatomie	Mcloud	2
Oklahoma	Oklahoma City	4	Pottawatomie	Pleasant Grove	2
Oklahoma	Putnam City	7	Pottawatomie	Shawnee	4
Oklahoma	Western Heights	6	Pottawatomie	South Rock Creek	2
Okmulgee	Beggs	4	Pottawatomie	Tecumseh	3
Okmulgee	Dewar	1	Pottawatomie	Wanette	3
Okmulgee	Henryetta	3	Rogers	Catoosa	6
Okmulgee	Morris	2	Rogers	Chelsea	3
Okmulgee	Okmulgee	1	Rogers	Claremore	6
Okmulgee	Preston	1	Rogers	Inola	6
Okmulgee	Schulter	3	Rogers	Justus-Tiawah	7
Okmulgee	Twin Hills	1	Rogers	Oologah-Talala	4
Okmulgee	Wilson	5	Rogers	Sequoyah	3
Osage	Anderson	2	Rogers	Verdigris	2
Osage	Avant	1	Tulsa	Berryhill	4
Osage	Barnsdall	2	Tulsa	Bixby	7
Osage	Bowring	2	Tulsa	Broken Arrow	9
Osage	Hominy	2	Tulsa	Collinsville	5
Osage	Mccord	2	Tulsa	Glenpool	6
Osage	Osage Hills	4	Tulsa	Jenks	13
Osage	Pawhuska	6	Tulsa	Keystone	4
Osage	Prue	6	Tulsa	Liberty	5
Osage	Shidler	5	Tulsa	Owasso	10
Osage	Woodland	3	Tulsa	Sand Springs	5
Osage	Wynona	3	Tulsa	Skiatook	4
Pawnee	Cleveland	3	Tulsa	Sperry	5
Pawnee	Jennings	2	Tulsa	Tulsa	4
Pawnee	Pawnee	3	Tulsa	Union	11
Payne	Cushing	6	Wagoner	Coweta	5
Payne	Glencoe	4	Wagoner	Okay	3
Payne	Oak Grove	2	Wagoner	Porter Consolidated	5
Payne	Perkins-Tryon	2	Wagoner	Wagoner	3

Source: Rogers and Burge, and Stephen H. McDonald and Associates

Explanatory Variables	Description and Source (1997-2009)
ADM (number of pupils)	ADM stands for average daily membership (hereafter ADM). It's a measurement of enrollment. If a student's name is on the current roll of a class, the student is said to be in membership. Summing the total number of days in membership over all students in a term and divided by the number of days in that term is the average daily membership. The final ADM is averaged over two terms in a school year.
Black	Fraction. Source: Oklahoma Office of Accountability.
Hispanic	Fraction. Source: Oklahoma Office of Accountability.
Native American	Fraction. Source: Oklahoma Office of Accountability.
Below poverty level	Fraction. Source: Oklahoma Office of Accountability.
College or above	Fraction. Source: Oklahoma Office of Accountability.
Debt per pupil	Measured in thousand. Source: Oklahoma Office of Accountability.
Property value per pupil	Measured in 100,000. Source: Oklahoma Office of Accountability.
Enrollment growth	Fraction, changes from the previous school year. Source: Oklahoma Office of Accountability.
Student density	Students per square miles in a district, measured in thousand. Source: Oklahoma Office of Accountability.
Pupil-teacher ratio	Students per full time employment teacher. Measured in 100. Source: Oklahoma Office of Accountability.
Population	Measured in 10,000. Source: Oklahoma Office of Accountability.
No high school	A dummy indicates school districts without high schools. Source: Oklahoma Office of Accountability.
Locale	Dummies. Source: National Center for Education Statistics (NCES), U.S. Department of Education
Weather variables	Source: Oklahoma Mesonet (http://www.mesonet.org)

Table 2.3 continued

Voter turnout	Fraction, constructed as total votes/voting age population. Source: Rogers and Burge (2010), Stephen H. McDonald and Associates.
Lag 1	Fraction, turnout in the last school bond election. Source: Rogers and Burge (2010), Stephen H. McDonald and
Lag 2	Fraction, turnout in the school bond election before the previous one. Source: Rogers and Burge (2010), Stephen H. McDonald and Associates.
Years	Years passed since last election. Source: Rogers and Burge (2010), Stephen H. McDonald and Associates.
Bond value per pupil	Measured in 10,000. Computed as total amount/ADM. Source: Rogers and Burge, Stephen H. McDonald and Associates, Office of Accountability.
Dependent Variable	
Approval share	Fraction, constructed as yes votes/total votes. Source: Rogers and Burge (2010), and Stephen H. McDonald and

Note: All variables are measured at the school district level. To interpret regression coefficients easily, variables are measured in 100, 1,000, 10,000, and 100,000, so the means of the explanatory variables and the dependent variables are on the same scale (between 0 and 1).

Table 2.4: Summary statistics of variables (1997-2009)

Variable	Mean	Std. Dev.	Min	Max
Panel A: School district characteristics				
Black	0.0531	0.1029	0	0.9880
Hispanic	0.0390	0.0513	0	0.5103
Native American	0.1809	0.1348	0	0.7115
Below poverty level	0.1218	0.0575	0.0172	0.3485
College degree or above	0.1994	0.1171	0.0308	0.5906
Debt service per pupil	0.3940	0.3688	0	2.3741
Property value per pupil	0.2704	0.1700	0.0649	1.2737
Enrollment growth	0.0086	0.0431	-0.2475	0.1967
Student density	0.6861	1.4195	0.0028	14.8275
Pupil-teacher ratio	0.1710	0.0215	0.0868	0.2230
Population	0.2010	0.3952	0.0041	2.9848
No high School	0.1200	0.3252	0	1
Panel B: Bond attributes				
Turnout rate	0.1408	0.0977	0.0062	0.8339
Lag 1	0.1490	0.1015	0.0071	0.8339
Lag 2	0.1507	0.1014	0.0197	0.8339
Approval share	0.7149	0.1143	0.2145	0.9726
Years	2.7232	1.9559	0	10
Bond value per pupil	0.2251	0.3230	0.0028	3.1722
Panel C: Locale dummies	Number of school districts in each locale category			
City				6
Suburb				16
Town fringe				9
Town distant				11
Rural fringe				34
Rural distant				59
Rural remote				10
Total number of observations				662

Source: Office of Accountability, National Center for Education Statistics

Table 2.5 Oklahoma school district types

District	County	District Type
Allen-Bowden	Creek	Elementary
Anderson	Osage	Elementary
Avant	Osage	Elementary
Banner	Canadian	Elementary
Bowring	Osage	Elementary
Byars	Mcclain	Elementary
Crutcho	Oklahoma	Elementary
Friend	Grady	Elementary
Grove	Pottawatomie	Elementary
Gypsy	Creek	Elementary
Jennings	Pawnee	Elementary
Justus-Tiawah	Rogers	Elementary
Keystone	Tulsa	Elementary
Lone Star	Creek	Elementary
Maple	Canadian	Elementary
Mccord	Osage	Elementary
Middleberg	Grady	Elementary
Oak Grove	Payne	Elementary
Oakdale	Oklahoma	Elementary
Osage Hills	Osage	Elementary
Pioneer	Grady	Elementary
Pleasant Grove	Pottawatomie	Elementary
Pretty Water	Creek	Elementary
Riverside	Canadian	Elementary
Robin Hill	Cleveland	Elementary
South Rock Creek	Pottawatomie	Elementary
Twin Hills	Okmulgee	Elementary
Verdigris	Rogers	Elementary
White Rock	Lincoln	Elementary

Table 2.5 continued

District	County	District Type
Agra	Lincoln	Unified
Alex	Grady	Unified
Amber-Pocasset	Grady	Unified
Asher	Pottawatomie	Unified
Barnsdall	Osage	Unified
Beggs	Okmulgee	Unified
Berryhill	Tulsa	Unified
Bethany	Oklahoma	Unified
Bethel	Pottawatomie	Unified
Bixby	Tulsa	Unified
Blanchard	Mcclain	Unified
Bridge Creek	Grady	Unified
Bristow	Creek	Unified
Broken Arrow	Tulsa	Unified
Calumet	Canadian	Unified
Carney	Lincoln	Unified
Cashion	Kingfisher	Unified
Catoosa	Rogers	Unified
Chandler	Lincoln	Unified
Chelsea	Rogers	Unified
Chickasha	Grady	Unified
Choctaw/Nicoma Park	Oklahoma	Unified
Claremore	Rogers	Unified
Cleveland	Pawnee	Unified
Collinsville	Tulsa	Unified
Coweta	Wagoner	Unified
Coyle	Logan	Unified
Crescent	Logan	Unified
Crooked Oak	Oklahoma	Unified

Table 2.5 continued

District	County	District Type
Cushing	Payne	Unified
Dale	Pottawatomie	Unified
Davenport	Lincoln	Unified
Deer Creek	Oklahoma	Unified
Depew	Creek	Unified
Dewar	Okmulgee	Unified
Dibble	Mcclain	Unified
Dover	Kingfisher	Unified
Drumright	Creek	Unified
Edmond	Oklahoma	Unified
El Reno	Canadian	Unified
Glencoe	Payne	Unified
Glenpool	Tulsa	Unified
Guthrie	Logan	Unified
Harrah	Oklahoma	Unified
Hennessey	Kingfisher	Unified
Henryetta	Okmulgee	Unified
Hominy	Osage	Unified
Inola	Rogers	Unified
Jenks	Tulsa	Unified
Jones	Oklahoma	Unified
Kellyville	Creek	Unified
Kiefer	Creek	Unified
Kingfisher	Kingfisher	Unified
Lexington	Cleveland	Unified
Liberty	Tulsa	Unified
Little Axe	Cleveland	Unified
Lomega	Kingfisher	Unified
Luther	Oklahoma	Unified
Macomb	Pottawatomie	Unified

Table 2.5 continued

District	County	District Type
Mannford	Creek	Unified
Maud	Pottawatomie	Unified
Mcloud	Pottawatomie	Unified
Meeker	Lincoln	Unified
Midwest City-Del City	Oklahoma	Unified
Millwood	Oklahoma	Unified
Minco	Grady	Unified
Moore	Cleveland	Unified
Morris	Okmulgee	Unified
Mounds	Creek	Unified
Mulhall-Orlando	Logan	Unified
Mustang	Canadian	Unified
Newcastle	Mcclain	Unified
Ninnekah	Grady	Unified
Noble	Cleveland	Unified
Norman	Cleveland	Unified
Oilton	Creek	Unified
Okarche	Kingfisher	Unified
Okay	Wagoner	Unified
Oklahoma City	Oklahoma	Unified
Okmulgee	Okmulgee	Unified
Olive	Creek	Unified
Oologah-Talala	Rogers	Unified
Owasso	Tulsa	Unified
Pawhuska	Osage	Unified
Pawnee	Pawnee	Unified
Perkins-Tryon	Payne	Unified
Piedmont	Canadian	Unified
Porter Consolidated	Wagoner	Unified
Prague	Lincoln	Unified

Table 2.5 continued

District	County	District Type
Preston	Okmulgee	Unified
Prue	Osage	Unified
Purcell	Mcclain	Unified
Putnam City	Oklahoma	Unified
Ripley	Payne	Unified
Rush Springs	Grady	Unified
Sand Springs	Tulsa	Unified
Sapulpa	Creek	Unified
Schulter	Okmulgee	Unified
Sequoyah	Rogers	Unified
Shawnee	Pottawatomie	Unified
Shidler	Osage	Unified
Skiatook	Tulsa	Unified
Sperry	Tulsa	Unified
Stillwater	Payne	Unified
Stroud	Lincoln	Unified
Tecumseh	Pottawatomie	Unified
Tulsa	Tulsa	Unified
Tuttle	Grady	Unified
Union	Tulsa	Unified
Union City	Canadian	Unified
Verden	Grady	Unified
Wagoner	Wagoner	Unified
Wanette	Pottawatomie	Unified
Washington	Mcclain	Unified
Wayne	Mcclain	Unified
Wellston	Lincoln	Unified
Western Heights	Oklahoma	Unified
Wilson	Okmulgee	Unified
Woodland	Osage	Unified
Wynona	Osage	Unified
Yale	Payne	Unified
Yukon	Canadian	Unified

Source: American Community Survey, US Census Bureau, available at http://factfinder2.census.gov/

Table 2.6: Mesonet station(s) for school districts in Oklahoma (17 counties)

County	District	Station(s)
Canadian	Banner	El Reno
Canadian	Calumet	El Reno
Canadian	El Reno	El Reno
Canadian	Maple	El Reno
Canadian	Mustang	Minco
Canadian	Piedmont	El Reno
Canadian	Riverside	El Reno
Canadian	Union City	Minco
Canadian	Yukon	El Reno
Cleveland	Lexington	Washington, Byars
Cleveland	Little Axe	Norman
Cleveland	Moore	Norman
Cleveland	Noble	Norman
Cleveland	Norman	Norman
Cleveland	Robin Hill	Norman
Creek	Allen-Bowden	Bixby
Creek	Bristow	Bristow
Creek	Depew	Bristow, Oilton
Creek	Drumright	Oilton
Creek	Gypsy	Bristow
Creek	Kellyville	Bristow
Creek	Kiefer	Hectorville
Creek	Lone Star	Bixby
Creek	Mannford	Oilton
Creek	Mounds	Hectorville
Creek	Oilton	Oilton
Creek	Olive	Oilton
Creek	Pretty Water	Hectorville
Creek	Sapulpa	Bixby

Table 2.6: continued

County	District	Station(s)
Grady	Alex	Ninnekah, Chickasha
Grady	Amber-Pocasset	Chickasha, Minco
Grady	Bridge Creek	Minco, Norman
Grady	Chickasha	Chickasha
Grady	Friend	Chickasha
Grady	Middleberg	Norman
Grady	Minco	Minco
Grady	Ninnekah	Ninnekah
Grady	Pioneer	Chickasha
Grady	Rush Springs	Acme
Grady	Tuttle	Minco
Grady	Verden	Chickasha, Minco
Kingfisher	Cashion	Kingfisher, Guthrie
Kingfisher	Dover	Kingfisher
Kingfisher	Hennessey	Kingfisher, Marshall
Kingfisher	Kingfisher	Kingfisher
Kingfisher	Lomega	Kingfisher
Kingfisher	Okarche	Kingfisher, El Reno
Lincoln	Agra	Perkins, Chandler
Lincoln	Carney	Perkins, Chandler
Lincoln	Chandler	Chandler
Lincoln	Davenport	Chandler
Lincoln	Meeker	Chandler, Shawnee
Lincoln	Prague	Chandler, Shawnee
Lincoln	Stroud	Chandler
Lincoln	Wellston	Chandler
Lincoln	White Rock	Shawnee
Logan	Coyle	Marena
Logan	Crescent	Guthrie, Marshall

Table 2.6: continued

County	District	Station(s)
Logan	Guthrie	Guthrie
Logan	Mulhall-Orlando	Marshall, Blackwell
Mcclain	Blanchard	Norman
Mcclain	Byars	Byars
Mcclain	Dibble	Washington
Mcclain	Newcastle	Norman
Mcclain	Purcell	Washington
Mcclain	Washington	Washington
Mcclain	Wayne	Washington
Oklahoma	Bethany	Oklahoma City West
Oklahoma	Choctaw/Nicoma Park	Spencer
Oklahoma	Crooked Oak	Spencer
Oklahoma	Crutcho	Oklahoma City East
Oklahoma	Deer Creek	Oklahoma City North
Oklahoma	Edmond	Oklahoma City North
Oklahoma	Harrah	Spencer
Oklahoma	Jones	Spencer
Oklahoma	Luther	Spencer
Oklahoma	Midwest City-Del City	Oklahoma City East
Oklahoma	Millwood	Oklahoma City North
Oklahoma	Oakdale	Oklahoma City North
Oklahoma	Oklahoma City	Spencer
Oklahoma	Putnam City	Spencer
Oklahoma	Western Heights	Norman
Okmulgee	Beggs	Hectorville
Okmulgee	Dewar	Okmulgee
Okmulgee	Henryetta	Okmulgee
Okmulgee	Morris	Okmulgee
Okmulgee	Okmulgee	Okmulgee
Okmulgee	Preston	Okmulgee, Hectorville

Table 2.6: continued

County	District	Station(s)
Okmulgee	Schulter	Okmulgee
Okmulgee	Twin Hills	Okmulgee
Okmulgee	Wilson	Okmulgee
Osage	Anderson	Bixby, Oilton
Osage	Avant	Skiatook
Osage	Barnsdall	Wynona
Osage	Bowring	Foraker
Osage	Hominy	Wynona, Blackwell
Osage	Mccord	Burbank, Wynona
Osage	Osage Hills	Copan, Wynona
Osage	Pawhuska	Foraker, Skiatook
Osage	Prue	Wynona, Foraker
Osage	Shidler	Newkirk
Osage	Woodland	Burbank
Osage	Wynona	Wynona, Oilton
Pawnee	Cleveland	Pawnee
Pawnee	Jennings	Oilton
Pawnee	Pawnee	Pawnee, Perkins
Payne	Cushing	Oilton, Pawnee
Payne	Glencoe	Stillwater
Payne	Oak Grove	Oilton
Payne	Perkins-Tryon	Perkins
Payne	Ripley	Perkins
Payne	Stillwater	Stillwater, Pawnee
Payne	Yale	Oilton
Pottawatomie	Asher	Byars
Pottawatomie	Bethel	Shawnee
Pottawatomie	Dale	Shawnee
Pottawatomie	Grove	Shawnee
Pottawatomie	Macomb	Shawnee

Table 2.6 continued

County	District	Station(s)
Pottawatomie	Maud	Bowlegs
Pottawatomie	Mcloud	Shawnee
Pottawatomie	Pleasant Grove	Bowlegs
Pottawatomie	Shawnee	Shawnee
Pottawatomie	South Rock Creek	Shawnee
Pottawatomie	Tecumseh	Shawnee
Pottawatomie	Wanette	Byars
Rogers	Catoosa	Claremore
Rogers	Chelsea	Claremore, Nowata
Rogers	Claremore	Claremore
Rogers	Inola	Inola
Rogers	Justus-Tiawah	Claremore
Rogers	Oologah-Talala	Claremore
Rogers	Sequoyah	Claremore
Rogers	Verdigris	Claremore
Tulsa	Berryhill	Bixby
Tulsa	Bixby	Bixby
County	District	Station(s)
Tulsa	Broken Arrow	Bixby
Tulsa	Collinsville	Skiatook
Tulsa	Glenpool	Bixby
Tulsa	Jenks	Bixby
Tulsa	Keystone	Oilton
Tulsa	Liberty	Hectorville
Tulsa	Owasso	Claremore
Tulsa	Sand Springs	Bixby, Oilton
Tulsa	Skiatook	Skiatook
Tulsa	Sperry	Skiatook
Tulsa	Tulsa	Bixby, Skiatook
Tulsa	Union	Bixby
Wagoner	Coweta	Porter
Wagoner	Okay	Porter
Wagoner	Porter Consolidated	Porter
Wagoner	Wagoner	Porter

Source: Oklahoma Mesonet, available at www.mesonet.org

Table 2.7: Weather variables (1997-2009)

Weather Variable	Mean	Std. Dev.	Min	Max
Temp. Dev. from monthly average (F)	5.9552	4.9049	0.0016	22.2323
Temp. Dev. from normal average of the date (F)	0.4940	2.7354	0	25.4604
Extreme weather circumstance dummy	0.0608	0.2392	0	1
Month dummy (m=1, 8, 9, 11)	0.2272	0.4194	0	1
Rain	0.0777	0.2978	0	3.4000
N				662

Source: Oklahoma Mesonet

Note: F denotes Fahrenheit

Table 2.8: Verification of the IV approach: a Hausman test (Sample 1)

	Approval Share	
Variables	Lag 1 Column (1)	Lag 2 Column (2)
Residual	-0.3236	-0.29
	(0.0989)***	(0.1376)***
Turnout	-0.007	0.004
	(0.1043)	(0.1311)
Density	0.0094	0.008
	(0.0026)***	(0.0028)***
Years	0.0145	0.0161
	(0.0029)***	(0.0032)***
Enrollment growth	0.3438	0.3814
	(0.115)***	(0.1198)***
Bond value per pupil	-0.0738	-0.0741
	(0.0174)***	(0.018)***
Debt per pupil	0.0476	0.0423
	(0.0185)**	(0.0175)**
No high school	-0.0445	-0.041
	(0.0206)**	(0.0235)*
City	0.6172	0.6358
	(0.0289)***	(0.0297)***
Suburb	0.6538	0.6655
	(0.0221)***	(0.0256)***
Town fringe	0.643	0.6582
	(0.0361)***	(0.0334)***
Town distant	0.6643	0.6679
	(0.0237)***	(0.0263)***
Rural fringe	0.687	0.6958
	(0.0286)***	(0.0302)***
Rural distant	0.6287	0.6371
	(0.0297)***	(0.0353)***
Rural remote	0.5979	0.597
	(0.04)***	(0.0445)***
N	625	561
R2	0.2212	0.2367

The unit of observation is a consolidated bond election held in a school district in a year. The sample only includes capital bonds. Under column (2), sample size reduces because *lag 2* (voter turnout) is not available for all observations (64/625). Estimates are reported with robust clustered errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 2.9: First stage results (Sample 1)

Variables	Turnout Lag 1 Column (1)	Lag 2 Column (2)
Lag turnout	0.4872	0.354
	(0.0535)***	(0.0381)***
Month dummy	0.0223	0.0248
	(0.0088)**	(0.008)***
Density	0.0009	0.0005
	(0.0011)	(0.0015)
Years	-0.0094	-0.0082
	(0.0021)***	(0.0027)***
Enrollment growth	-0.0068	-0.0167
	(0.0592)	(0.0803)
Bond value per pupil	0.0818	0.0751
	(0.0143)***	(0.0165)***
Debt per pupil	-0.0247	-0.0255
	(0.0103)**	(0.0111)**
No high school	0.0134	0.014
	(0.0126)	(0.0142)
City	0.0335	0.0098
	(0.0199)*	(0.0229)
Suburb	0.0506	0.028
	(0.0158)***	(0.0169)*
Town fringe	0.0646	0.0429
	(0.0176)***	(0.0171)**
Town distant	0.0642	0.0331
	(0.0181)***	(0.0188)*
Rural fringe	0.0605	0.0416
	(0.0152)***	(0.0152)***
Rural distant	0.1027	0.0884
	(0.0203)***	(0.0199)***
Rural remote	0.1229	0.1094
	(0.0227)***	(0.0288)***
N	625	561
R2	0.55	0.4708

Table 2.9 continued

	Turnout	
Variables	Lag 1 Column (1)	Lag 2 Column (2)
Test Statistics		
Under identification test (Kleibergen-Paap rk LM stat)	21.011***	18.216***
Weak identification test (Kleibergen-Paap rk Wald F stat)	63.593***	45.608***
Over identification test (Hansen J statistic)	0.067	0.269

The unit of observation is voter turnout in a school bond election. The sample only includes consolidated capital bonds. Under column (2), sample size reduces because *lag 2* (voter turnout) is not available for all observations (64/625). Estimates are reported with robust clustered errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 2.10: IV results (Sample 1)

	Approval share		
	OLS	IV	
		Lag1	Lag2
Variables	Column (1)	Column (2)	Column (3)
Turnout	-0.2319	-0.007	0.004
	(0.0599)***	(0.1065)	(0.1243)
Density	0.0092	0.0094	0.008
	(0.0027)***	(0.0027)***	(0.0028)***
Years	0.0128	0.0145	0.0161
	(0.0027)***	(0.0028)***	(0.0033)***
Enrollment growth	0.3489	0.3438	0.3814
	(0.1167)***	(0.112)***	(0.115)***
Bond value per pupil	-0.0546	-0.0738	-0.0741
	(0.0158)***	(0.0175)***	(0.0184)***
Debt per pupil	0.0405	0.0476	0.0423
	(0.0182)**	(0.0182)***	(0.0174)**
No high school	-0.0368	-0.0445	-0.0410
	(0.0202)*	(0.0209)**	(0.0233)*
City	0.6378	0.6172	0.702
	(0.0282)***	(0.0303)***	(0.0359)***
Suburb	0.679	0.6538	0.7317
	(0.0209)***	(0.0221)***	(0.0276)***
Town fringe	0.6754	0.643	0.7244
	(0.0347)***	(0.0366)***	(0.0393)***
Town distant	0.697	0.6643	0.7341
	(0.0199)***	(0.0247)***	(0.0297)***
Rural fringe	0.7184	0.687	0.762
	(0.025)***	(0.0287)***	(0.0315)***
Rural distant	0.6772	0.6287	0.7033
	(0.0235)***	(0.0302)***	(0.0349)***
Rural remote	0.6521	0.5979	0.6632
	(0.0333)***	(0.0409)***	(0.0425)***
N	625	625	561
R2	0.21	0.19	0.2035

The unit of observation is a consolidated bond election held in a school district in a year. The sample only includes capital bonds. Under column (2), sample size reduces because *lag 2* (voter turnout) is not available for all observations (64/625). Estimates are reported with robust clustered errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 2.11: Verification of the IV approach: a Hausman test (Sample 2)

	Approval Share	
Variables	Lag 1 Column (1)	Lag 2 Column (2)
Residual	-0.2298	-0.2691
	(0.1029)**	(0.1348)**
Turnout	-0.0851	-0.0191
	(0.107)	(0.1336)
Density	0.0081	0.0067
	(0.0033)**	(0.0033)**
Years	0.0143	0.0168
	(0.0031)***	(0.0033)***
Enrollment growth	0.3579	0.3854
	(0.1073)***	(0.1098)***
Bond value per pupil	-0.0797	-0.0795
	(0.0193)***	(0.0185)***
Debt per pupil	0.0479	0.0429
	(0.0188)**	(0.0173)**
No high school	-0.0301	-0.0321
	(0.0227)	(0.0228)
City	0.6401	0.6523
	(0.0303)***	(0.0305)***
Suburb	0.6716	0.6756
	(0.022)***	(0.025)***
Town fringe	0.6671	0.6716
	(0.0354)***	(0.0326)***
Town distant	0.6843	0.676
	(0.0236)***	(0.0258)***
Rural fringe	0.7036	0.7041
	(0.0282)***	(0.0292)***
Rural distant	0.6584	0.6493
	(0.0301)***	(0.0353)***
Rural remote	0.6376	0.6245
	(0.0392)***	(0.0421)***
N	662	603
R2	0.2055	0.2271

The unit of observation is a consolidated bond election held in a school district in a year. The sample includes both capital and transportation bonds. Under column (2), sample size reduces because *lag 2* (voter turnout) is not available for all observations (59/662). Estimates are reported with robust clustered errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 2.12: First stage results (Sample 2)

	Turnout	
	Lag 1	Lag 2
Variables	Column (1)	Column (2)
Lag turnout	0.4617	0.3506
	(0.0482)***	(0.0432)***
Month dummy	0.0234	0.0252
	(0.0087)***	(0.0078)***
Density	0.0009	0.0006
	(0.0012)	(0.0016)
Years	-0.0088	-0.0082
	(0.002)***	(0.0025)***
Enrollment growth	-0.0426	-0.018
	(0.0541)	(0.0755)
Bond value per pupil	0.0829	0.079
	(0.0147)***	(0.0167)***
Debt per pupil	-0.0211	-0.0245
	(0.0098)**	(0.0103)**
No high school	0.0103	0.0167
	(0.0119)	(0.0142)
City	0.0352	0.0423
	(0.0191)*	(0.0221)*
Suburb	0.0545	0.063
	(0.0143)***	(0.0167)***
Town fringe	0.0691	0.0774
	(0.0157)***	(0.0177)***
Town distant	0.0683	0.0715
	(0.0164)***	(0.0196)***
Rural fringe	0.0655	0.0769
	(0.0133)***	(0.0166)***
Rural distant	0.1074	0.1218
	(0.0174)***	(0.0221)***
Rural remote	0.1314	0.1454
	(0.0238)***	(0.0283)***
N	662	603
R2	0.52	0.4642

Table 2.12 continued

	Turnout	
Variables	Lag 1 Column (1)	Lag 2 Column (2)
Test Statistics		
Under identification test(Kleibergen-Paap rk LM stat)	24.209***	20.092***
Weak identification test (Kleibergen-Paap rk Wald F stat)	91.346***	41.169***
Over identification test (Hansen J statistic)	0.046	0.022

The unit of observation is voter turnout in a school bond election. The sample includes consolidated capital and transportation bonds. Under column (2), sample size reduces because *lag 2* (voter turnout) is not available for all observations (59/662). Estimates are reported with robust clustered errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 2.13: IV results (Sample 2)

	Approval share		
	OLS	IV	
		Lag1	Lag2
Variables	Column (1)	Column (2)	Column (3)
Turnout	-0.2517	-0.0851	-0.0211
	(0.0582)***	(0.1068)	(0.1216)
Density	0.008	0.0081	0.0077
	(0.0033)**	(0.0033)**	(0.0035)**
Years	0.0131	0.0143	0.0172
	(0.0029)***	(0.0031)***	(0.0031)***
Enrollment growth	0.3582	0.3579	0.3428
	(0.1056)***	(0.103)***	(0.1056)***
Bond value per pupil	-0.065	-0.0797	-0.0683
	(0.0172)***	(0.0194)***	(0.0163)***
Debt per pupil	0.0433	0.0479	0.0375
	(0.0182)**	(0.0184)***	(0.0156)**
No high school	-0.0254	-0.0301	-0.0439
	(0.0214)	(0.0227)	(0.0244)*
City	0.6541	0.6401	0.6361
	(0.0286)***	(0.0313)***	(0.0293)***
Suburb	0.6895	0.6716	0.667
	(0.0202)***	(0.0218)***	(0.024)***
Town fringe	0.6900	0.6671	0.6687
	(0.0326)***	(0.0354)***	(0.0291)***
Town distant	0.708	0.6843	0.6683
	(0.019)***	(0.024)***	(0.0273)***
Rural fringe	0.7259	0.7036	0.7039
	(0.0237)***	(0.0279)***	(0.0293)***
Rural distant	0.693	0.6584	0.6484
	(0.0225)***	(0.03)***	(0.0343)***
Rural remote	0.6773	0.6376	0.6102
	(0.0299)***	(0.0386)***	(0.0417)***
N	662	662	603
R2	0.2	0.19	0.2

The unit of observation is a consolidated bond election held in a school district in a year. The sample includes both capital and transportation bonds. Under column (2), sample size reduces because *lag 2* (voter turnout) is not available for all observations (59/662). Estimates are reported with robust clustered errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 2.14: Verification of the IV approach: a Hausman test (Sample 3)

	Approval Share	
Variables	Lag 1 Column (1)	Lag 2 Column (2)
Residual	-0.2372	-0.2621
	(0.0947)**	(0.1222)**
Turnout	-0.0622	-0.0211
	(0.1037)	(0.1258)
Density	0.0086	0.0077
	(0.0037)**	(0.0037)**
Years	0.0141	0.0172
	(0.0029)***	(0.003)***
Enrollment growth	0.342	0.3428
	(0.1037)***	(0.1054)***
Bond value per pupil	-0.0698	-0.0683
	(0.0158)***	(0.0156)***
Debt per pupil	0.0406	0.0375
	(0.017)**	(0.0157)**
No high school	-0.0456	-0.0439
	(0.0231)**	(0.024)*
City	0.6319	0.6361
	(0.0286)***	(0.0285)***
Suburb	0.6668	0.667
	(0.0203)***	(0.0237)***
Town fringe	0.6716	0.6687
	(0.0298)***	(0.0291)***
Town distant	0.677	0.6683
	(0.0246)***	(0.0262)***
Rural fringe	0.7063	0.7039
	(0.0281)***	(0.0287)***
Rural distant	0.6574	0.6484
	(0.0301)***	(0.0341)***
Rural remote	0.6292	0.6102
	(0.0402)***	(0.0411)***
N	1034	956
R2	0.208	0.2298

The unit of observation is a bond measure on a ballot. There are multiple measures per ballot. The sample includes both capital and transportation bonds. Under column (2), sample size reduces because *lag 2* (voter turnout) is not available for all observations (78/1034). Estimates are reported with robust clustered errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 2.15: First stage results (Sample 3)

	Turnout	
Variables	Lag 1 Column (1)	Lag 2 Column (2)
Lag turnout	0.4295	0.3364
	(0.0389)***	(0.0508)***
Month dummy	0.0257	0.0264
	(0.0103)**	(0.0089)***
Density	-0.0019	-0.0018
	(0.0021)	(0.0023)
Years	-0.0081	-0.0073
	(0.0018)***	(0.0022)***
Enrollment growth	-0.0297	-0.044
	(0.0534)	(0.0706)
Bond value per pupil	0.0637	0.0602
	(0.0135)***	(0.0145)***
Debt per pupil	-0.0118	-0.0122
	(0.0099)	(0.0105)
No high school	0.0161	0.0206
	(0.0122)	(0.0144)
City	0.0561	0.064
	(0.019)***	(0.0226)***
Suburb	0.0684	0.076
	(0.0142)***	(0.0181)***
Town fringe	0.0744	0.0822
	(0.0141)***	(0.018)***
Town distant	0.0853	0.0884
	(0.0163)***	(0.0217)***
Rural fringe	0.0739	0.0859
	(0.0144)***	(0.0196)***
Rural distant	0.1174	0.1326
	(0.0166)***	(0.0233)***
Rural remote	0.146	0.1575
	(0.0286)***	(0.0338)***
N	1034	956
R2	0.48	0.4341

Table 2.15 continued

	Turnout	
Variables	Lag 1 Column (1)	Lag 2 Column (2)
Test Statistics		
Under identification test(Kleibergen-Paap rk LM stat)	25.466***	21.805***
Weak identification test (Kleibergen-Paap rk Wald F stat)	101.433***	30.875***
Over identification test (Hansen J statistic)	0.201	0.096

The unit of observation is voter turnout in a school bond election. The sample includes both capital and transportation bonds. Under column (2), sample size reduces because *lag 2* (voter turnout) is not available for all observations (78/1034). Estimates are reported with robust clustered errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 2.16: IV results (Sample 3)

	Approval Share		
	OLS	IV	
		Lag1	Lag2
Variables	Column (1)	Column (2)	Column (3)
Turnout	-0.2424	-0.0622	-0.0191
	(0.0536)***	(0.1015)	(0.1279)
Density	0.0079	0.0086	0.0067
	(0.0037)**	(0.0035)**	(0.0034)**
Years	0.0131	0.0141	0.0168
	(0.0027)***	(0.0028)***	(0.0034)***
Enrollment growth	0.3413	0.342	0.3854
	(0.1021)***	(0.1019)***	(0.1065)***
Bond value per pupil	-0.058	-0.0698	-0.0795
	(0.0146)***	(0.0163)***	(0.0189)***
Debt per pupil	0.0378	0.0406	0.0429
	(0.0166)**	(0.0166)**	(0.0172)**
No high school	-0.04	-0.0456	-0.0321
	(0.0222)*	(0.0235)*	(0.0227
City	0.6512	0.6319	0.6523
	(0.0266)***	(0.0291)***	(0.0314)***
Suburb	0.6875	0.6668	0.6756
	(0.0178)***	(0.0206)***	(0.0242)***
Town fringe	0.6968	0.6716	0.6716
	(0.0281)***	(0.0298)***	(0.0319)***
Town distant	0.7048	0.677	0.676
	(0.0188)***	(0.025)***	(0.0259)***
Rural fringe	0.7308	0.7063	0.7041
	(0.0234)***	(0.0282)***	(0.0285)***
Rural distant	0.6951	0.6574	0.6493
	(0.0217)***	(0.03)***	(0.0344)***
Rural remote	0.6726	0.6292	0.6245
	(0.0303)***	(0.0395)***	(0.0416)***
N	1034	1034	956
R2	0.2	0.19	0.2

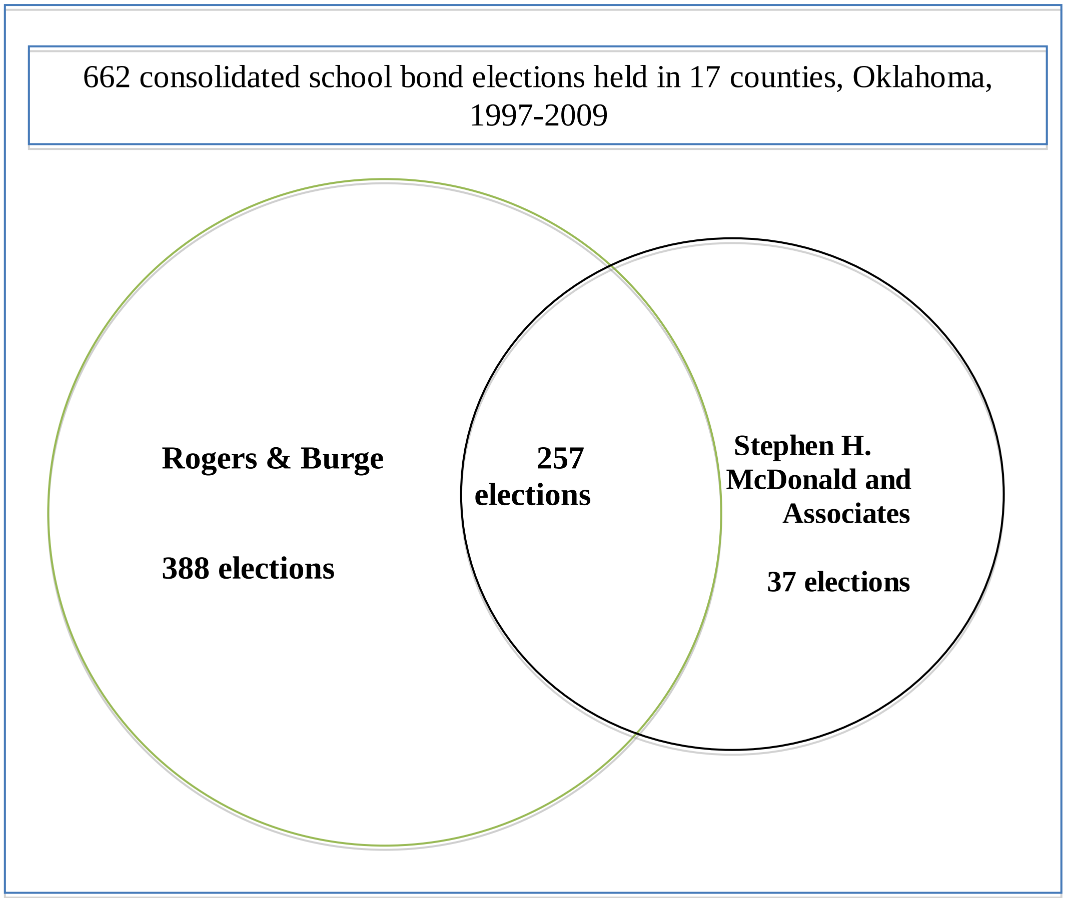
The unit of observation is a bond measure on a ballot. There are multiple measures per ballot. The sample includes both capital and transportation bonds. Under column (2), sample size reduces because *lag 2* (voter turnout) is not available for all observations (78/1034). Estimates are reported with robust clustered errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 2.17: Probit results for different samples

	Bond Outcome		
Variables	Sample 1	Sample 2	Sample 3
Probit			
Turnout	-2.6584	-2.6099	-2.2840
	(0.8757)***	(0.8529)***	(0.8063)***
IV Probit			
Turnout	-0.0465	-0.3485	-0.1016
	(1.826)	(1.9542)	(1.9801)
Density	0.4416	0.4102	0.3714
	(0.2305)*	(0.2339)*	(0.2046)*
Years	0.1001	0.0932	0.1222
	(0.0384)***	(0.0411)**	(0.042)***
Enrollment growth	2.9421	3.0103	2.1504
	(1.4033)**	(1.3966)**	(1.3422)
Bond value per pupil	-0.4827	-0.6114	-0.5695
	(0.2658)*	(0.2846)**	(0.247)**
Debt per pupil	0.7611	0.8069	0.7521
	(0.2973)***	(0.2995)***	(0.2783)***
No high school	-0.4457	-0.3923	-0.5523
	(0.285)	(0.2778)	(0.2727)**
City	-1.0105	-1.0604	1.2357
	(0.8332)	(0.8254)	(0.5021)**
Suburb	0.0412	-0.1317	0.9523
	(0.5687)	(0.5736)	(0.6381)
Town Fringe	-0.195	-0.3188	1.6429
	(0.504)	(0.4959)	(0.7068)**
Town Distant	0.7031	0.5611	1.5637
	(0.4389)	(0.4332)	(0.6565)**
Rural Fringe	0.4468	0.2788	1.2122
	(0.3989)	(0.3904)	(0.7319)*
Rural Distant	0.0694	-0.0417	1.2459
	(0.3181)	(0.2981)	(0.8175)
Constant	1.4109	1.7125	-0.7228
	(0.7311)*	(0.7645)**	(0.688)
N	625	662	1034
R2	0.1686	0.1636	0.1603

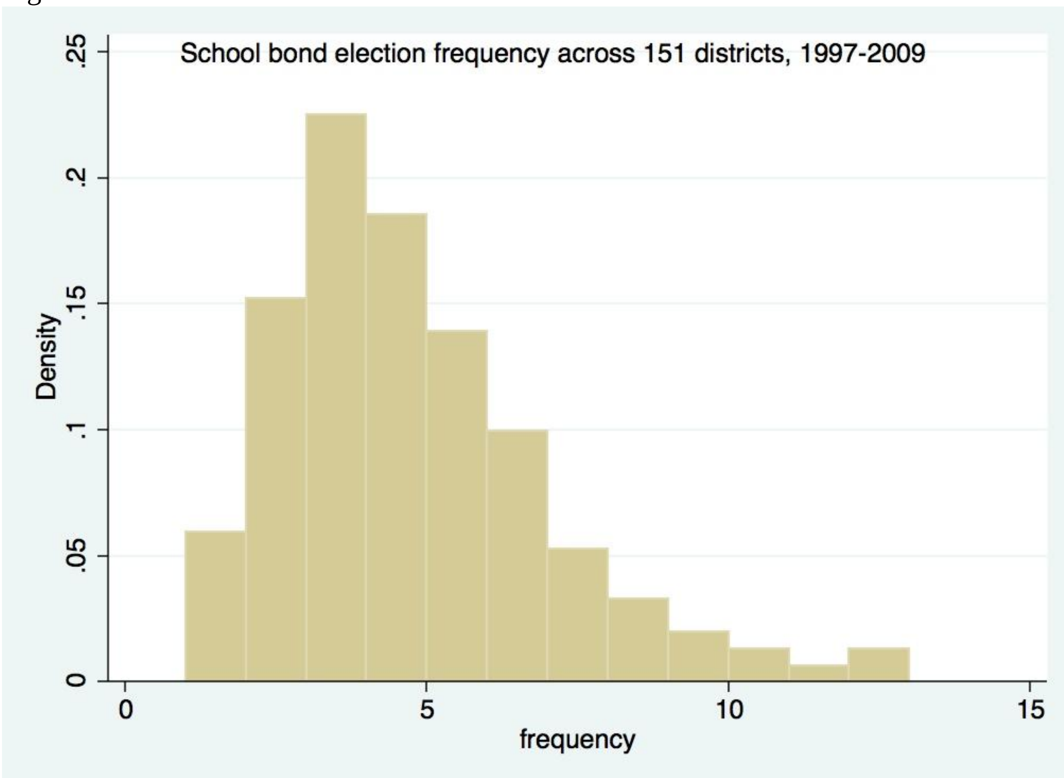
The unit of observation is a bond election held in a school district in a year. The dependent variable is dichotomous, i.e., one for success and zero for failure. A school bond passes if the approval share is greater than or equal to 60% in Oklahoma. Estimates are reported with robust clustered errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Figure 2.1



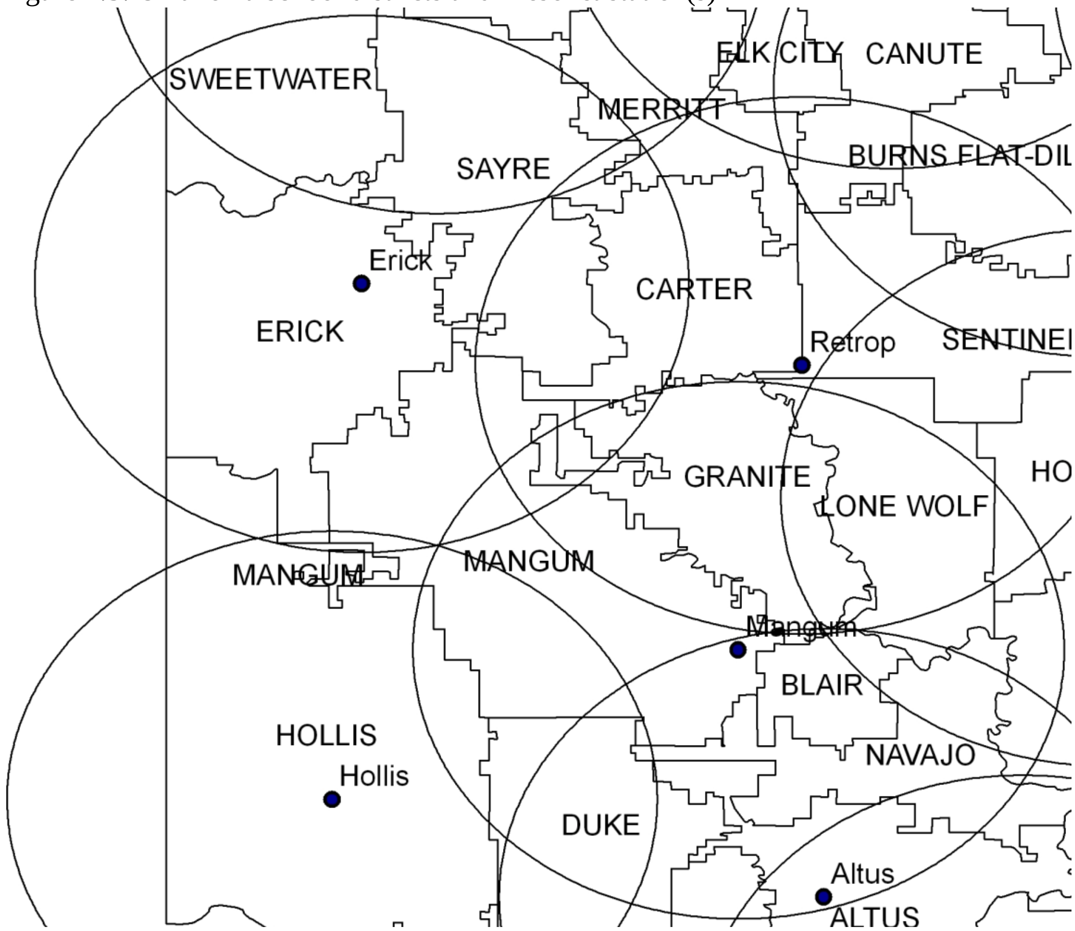
Note: The data include all school bonds collected by Rogers and Burger, and part of the bonds (limited to 17 counties) collected by the consulting company, Stephen H. McDonald and Associates.

Figure 2.2



Source: Rogers and Burge (2010), and Stephen H. McDonald and Associates.

Figure 2.3: Oklahoma school districts and Mesonet station(s)

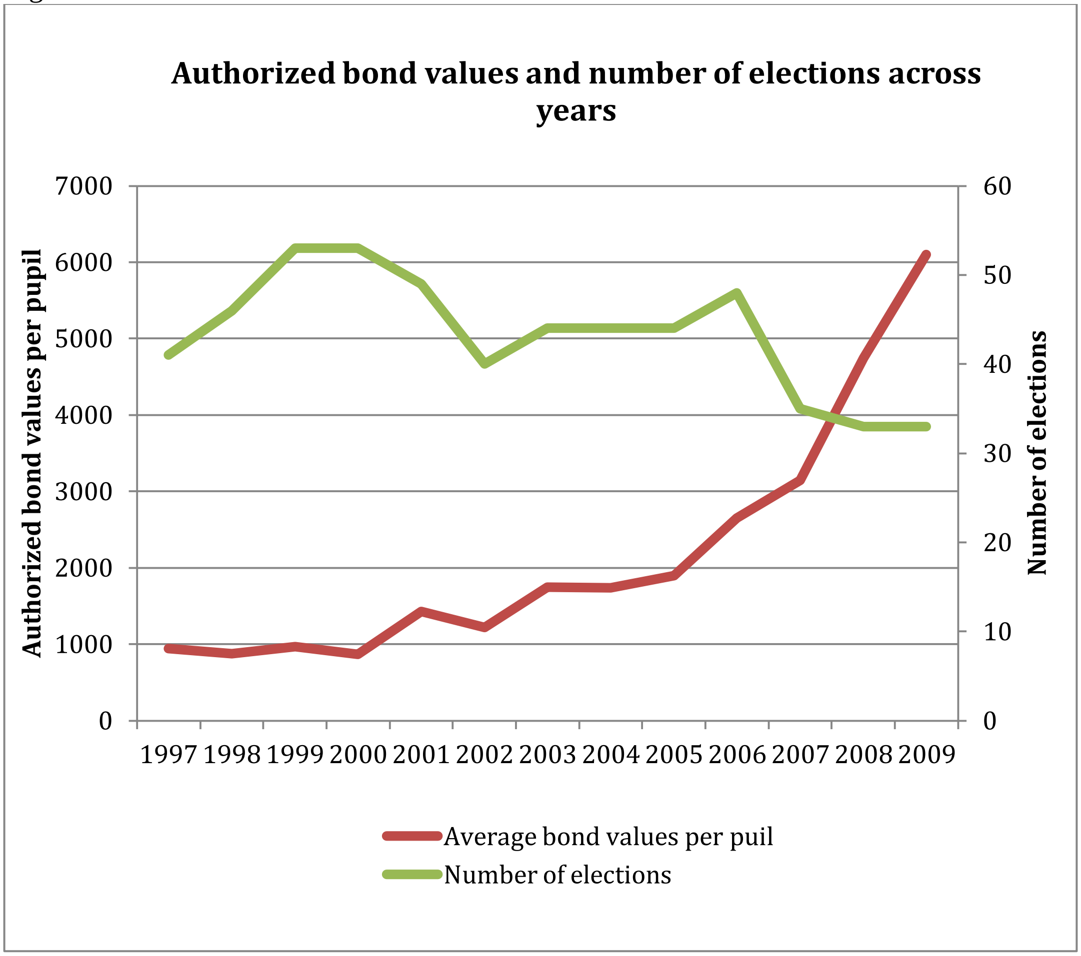


Each block is a school district, with district name in capital letter. Black points indicate Mesonet stations. Circles are the coverage of each weather station, with a radius of 30 km.

Scenario 1: For school districts like Erick, weather data are obtained from the station located within its boundary (Erick).

Scenario 2: For school districts like Magnum, Mesonet station(s) are located on the boundary. Therefore, weather data are averaged from station Erick and Magnum.

Figure 2.4



Source: Rogers and Burge (2010), and Stephen H. McDonald and Associates.

Chapter 3: Self-selection and School Bond Approval

3.1 Introduction

In the school bond literature, research usually focuses on school districts that have bond elections, and conclusions are drawn based on observed bond outcomes. In fact, such results are more accurately interpreted as conditional results, that is, outcomes are observed conditional on the occurrence of bond elections.

The decision to have a school bond election may be partly related to school bond approval since something unobservable, such as stronger tastes for educational spending, may encourage school districts to hold bond elections as well as to support school capital expenses. Therefore, the characteristics of participating districts may not be representative of the population of all school districts. Districts choose to put themselves into bond elections (self-selection), and standard regression models may produce biased estimates and misleading conclusions for policy makers. To the extent that observed bond approval is systematically related to the election participation, results from existing research are suspect due to selectivity bias.

Generally, studies explore the issue of self-selection at the individual level (e.g. women's participation in labor market (Heckman, 1977)), while my research adds to the bond literature by investigating the selectivity bias at the district level in a panel setting.[17] By emphasizing the participation in school bond elections I propose a two-stage model that distinguishes election participation from school bond approval. Using bond data from seventeen counties in Oklahoma between 1997 and 2009, I

[17] Though the panel is unbalanced and short, I control for district heterogeneity.

find evidence of self-selection, suggesting that districts may not be randomly selected into a sample. Understanding the nature of the bias in estimation is essential for informing school financial policy.

3.2 Self-Selection in the Voting Literature

Notably, there is scant research on self-selection in the school bond literature. In contrast, the issue has been well studied in the voting literature at the individual level. Table 3.1 presents the various methods used to examine the effect of self-selection on voting outcomes. Among these studies, the unit of observation is an individual voter. Self-selection becomes a problem when voters' behaviors are different from those of nonvoters. Usually, voters are known to be older, better educated, and wealthier. To the extent that those who go to polls are not representative of the voting population, election outcomes and resulting policies may be biased and skewed towards the preference of voters.

Bennett and Resnick (1990) investigate the difference between voters and nonvoters regarding their policy opinions, partisanships, and ideologies. They find that the effect of nonvoting on democracy is minor in the U.S., but nonvoters do have a preference for some domestic issues, such as increasing expenditure on health, welfare, and education.

Highton and Wolfinger (1999) consider the group of nonvoters to be heterogeneous. For instance, nonvoters are young, mobile, less educated, and poor. Despite the diverse composition of nonvoters, none of these groups form a majority and dominate the political preference of nonvoters. Therefore, election outcomes are unlikely to vary even if nonvoters were to vote.

Citrin et al. (2003) suggest that voters and nonvoters differ in the probability of voting for democrats and republicans in senate elections in California. To control for self-selection, they equalize the turnout rates among different income and racial groups by simulating the voting behaviors of nonvoters based on observed individual characteristics. Their simulated election outcomes only change in the closely contested cases, while others remain unaffected.

Dubin and Rivers (1989) employ a two-stage model to examine self-selection in voting. Voter turnout and voter choice make up two stages. By comparing the corrected estimates to the uncorrected ones, Dubin and Rivers find that the revised estimates do not switch signs, but the magnitudes change somewhat.

So far, the previous studies indicate that high turnout from nonvoters only alters voting outcomes modestly in general (senate) elections, though it may change election outcomes at the local level where voter turnout is evidently smaller (Hajnal, Lewis and Louch, 2002).

The literature on self-selection in school-related elections is limited. Rubinfeld and Thomas (1980) investigate a school tax levy proposed in a Detroit suburb. The levy was defeated in May but later approved in June 1973. By surveying the local electorate, Rubinfeld and Thomas compare the probability of voting yes between voters and nonvoters. The differences were not significant.

Berry and Gersen (2010) analyze the outcomes of school board elections in California using a natural experiment. According to a change in the election code in

1986, school board elections previously scheduled in odd years (off cycle elections) could concur with federal and/or state elections in even years (on cycle elections). Because the federal and/or state elections generally attract more voters, turnout rates in the concurrent school board elections rose substantially (by 150%). However, such change had a minor effect on educational and policy outcomes, e.g. student performance and teacher salaries.

As displayed in Table 3.1, various methods are used to examine the impact of self-selection on voting outcomes at the individual level. My work departs from the voting literature by focusing on self-selection in school bond elections at the district level in a panel setting.

3.3 Empirical Specification

3.3.1 Model

Selectivity bias arises from the potential that school districts may not be randomly selected into a sample since unobserved characteristics may systematically influence school bond approval and election participation. Accordingly, a two-stage model is used to isolate the bond approval stage from the election participation stage as follows.

$$s_{it} = 1\ [Z_{it}\theta + \delta_i + v_{it} > 0] \qquad (3.1)$$

$$y_{it} = E\ (X_{it}\beta + \alpha_i + u_{it} \mid s_{it} = 1) \qquad (3.2)$$

Equation (3.1) is known as the selection equation. The indicator s_{it} is a dichotomous variable. It is set to one if a school district has bond election(s) in a given year and zero otherwise. The same bond data introduced in the previous chapter are used here. The sample includes school bond elections held in 151 school districts in Oklahoma between 1997 and 2009 (13 years). Because this indicator is observed for all school districts during the sample period, the selection analysis includes a total of 1963 observations ($151*13=1963$). The variable δ_i captures district heterogeneity and Z_{it} consists of factors related to election participation, i.e. years since the last election and past bond success.

Equation (3.2) is known as the outcome equation. It includes 643 observations where school bond approval is observed conditional on the occurrence of bond elections ($s_{it}=1$).[18] The dependent variable y_{it} is the approval share, defined as the percent of yes votes in a school bond election. Similarly, the variable α_i reflects district heterogeneity, and X_{it} includes factors associated with bond approval, i.e. bond attributes, school needs, and district demographic factors. Variable descriptions and summary statistics are presented in Chapter 2, Tables 2.3 and 2.4.

To the extent that observed bond approval may not be independent of election participation, the current sample may not be representative of the underlying population. In a cross sectional setting, the unobserved factors work through the error term. The conditional expectation of the error term is included to account for the potential selectivity bias, and it is known as the inverse mills ratio (Heckman,

[18] Bond elections held in the same year are combined into one observation (19/643). To correct for selection bias, inverse mills ratios would be added to the baseline model. For observations in the same year, the ratios are exactly the same. To avoid that, multiple elections held in the same district in a year are consolidated.

1977). In a panel setting, the unobserved elements may work through the district heterogeneity (fixed effect) and/or the error term, and two additional terms are needed: the conditional expectation of the district fixed effect, and the conditional expectation of the error term. Because it is computationally burdensome to construct the two additional terms (Ridder, 1990), Verbeek and Nijman (1992) propose selection tests that do not require specifying the selection mechanism. Conditional on the assumption that the selection determinants are time invariant, the fixed effect (FE) estimates are more robust than the random effect (RE) estimates. Based on this notion, Verbeek and Nijman propose a selection test that compares the FE and RE estimates of balanced and unbalanced panel regressions.[19] Statistical difference among these estimates may indicate selectivity bias. Similarly, Kyriazidou (1997) uses first differencing to get rid of the time invariant selection determinants. Either fixed effect or first difference accounts for the selection issue to the extent that factors influencing self-selection are constant over time. However, at the meantime, these estimation methods also remove the effect of other relevant factors, e.g., district locale, which is a point of interest in this study.

In addition, my sample is unique in the sense that the panel is balanced for the selection analysis (1963) but unbalanced and short for the outcome analysis (643). Due to the nature of the data, it's not appropriate to allow for different slope coefficients across groups (fixed effect) since the number of regressors would go to infinity. Consequently, I follow the procedures detailed in Wooldridge (1995), where a pooled OLS is used to circumvent the above-mentioned problems and produce

[19] There are four sets of estimates, fixed effect estimates of balanced and unbalanced panel regressions, and random effect estimates of balanced and unbalanced panel regressions.

consistent estimates. Wooldridge (1995) specifies district heterogeneity as a function of the observed characteristics in each year. While this approach uses too many degrees of freedom in estimation,[20] my specification is different in the manner that heterogeneity is explained by the time averages of the observed demographic factors (Mundlak, 1978).

3.3.2 Data

During the sample period (1997-2009), some school districts had bond elections every year and others less often, with an average of 4.26 elections per district (643/151=4.26). Table 2.3 in Chapter 2 presents the bond election frequency for each school district during the sample period, and Figure 2.2 shows the distribution.

Basic demographic factors are compared between districts with bond election frequencies above the average (>4) and those with election frequencies below the average (<=4). Due to the large standard deviations, some statistics of the two groups are not different from each other (Table 3.2). On average, districts with election frequencies above the average have larger overall population (19,000 vs. 9,650), denser pupil distribution (88.2 vs. 19.2 per square mile), and higher enrollment growth rate (1.15% vs. 0.45%). However, the per-pupil bond-issuing value is actually lower (1,970 vs. 2,321), suggesting that school capital expenses may be underfunded in these communities. Other demographics such as educational attainment, income, debt, pupil-teacher ratio, and property values are not statistically

[20] According to my sample, an independent variable would expand to 13 (1997-2009) variables following the Wooldridge approach. This may not be desirable for estimation in a shot panel.

different between the two groups. Therefore, it is likely that some districts request school capital spending more frequently via bonds because they have larger student populations to accommodate.

In addition, school districts with election frequencies above the average are concentrated in urban/suburban areas, e.g. four out of six urban districts and fourteen out of sixteen suburban districts are above the average. While districts with election frequencies below the average are clustered in rural areas, i.e. 48 out of 62 rural distant districts and eight out of ten rural remote districts.

3.4 Results

According to the two-stage selection model, results are reported in Table 3.3. Column (1) shows the first stage selection analysis following a pooled probit, and column (2) displays the second stage outcome analysis using a pooled ordinary least squares. Time effects are included in both stages. To see whether self-selection is a problem in my sample, inverse mills ratios are computed according to the selection equation and then added to the outcome regression. The estimated coefficient of the ratio is highly significant, with a P value of 0% (T stat: 4.32, column (2), Table 3.3). Rho, the correlation between the error terms from the two stages (Equations 3.1 and 3.2), is big (rho: 0.7647), suggesting that the two bond stages are strongly correlated. Therefore, the null hypothesis of no selection bias can be rejected.

Even controlling for the potential differences across school districts (e.g., demographics, time effects, and heterogeneity), selectivity bias is evident. The result implies that districts may diverge in unobserved characteristics, such as preferences in educational spending. To the extent that observed bond approval is partly related to election participation, it is important to give careful attention to self-selection. Failure to account for selectivity bias would lead to inconsistent estimates, which may provide wrong implications for school finance policy.

An important determinant of both bond approval and election participation is district locale. The effect is interesting. School district locale ranges from large city to rural remote. The category omitted in the analysis is city. Concerning the selection stage, large urban districts are more likely to have bond elections than small rural areas (column (1), Table 3.3). A possible reason is that student populations grow faster in urban districts (Oklahoma, 1.15% vs. 0.45%), which may request school capital spending more frequently in order to accommodate the increase demand. In addition, small and large districts may use different tactics. Elections are costly in terms of manpower to draft, develop, and campaign bonds, but the costs could be less binding for large urban districts. Therefore, they may have bond elections more frequently.

Relating to the outcome stage, rural fringe and suburban areas tend to provide greater support for school bonds, compared to urban districts (column (2), Table 3.3). The results are consistent with the findings of the previous studies (Lentz, 1999; Maher and Skidmore, 2009). Lentz (1999) suggests that land use is relatively homogeneous in small rural and suburban districts in Illinois. Therefore, it is easier to reach agreements in those homogenous communities. The two-stage selection model reveals more information regarding the locale effect on school bond elections.

Nevertheless, the data oversample urban/suburban districts in Oklahoma, so the results should be interpreted with caution.

Another interesting factor, past bond success, impacts the selection stage significantly. The variable is coded one if the last school bond passed in the same district and zero otherwise.[21] According to the selection stage, past bond success lowers the probability of having bond elections in the near future (-0.9313, column (1), Table 3.3). Districts are less likely to issue new bonds if they gained support recently. Nevertheless, as time goes by, school districts tend to have new bond elections regardless of the previous results: the factor, years, is positively associated with the probability of having new bond elections (0.1849, column (1), Table 3.3). Cellini, Ferreira, Rothstein (2010) suggest that authorizing a bond negatively influences the probability of passing future bonds, and the effect would last for five years. In contrast, my results imply that past bond success lowers the chance of having new bond elections but not the probability of passing new bonds, and such influence would also lasts for five years (0.9313/0.1849=5, column (1), Table 3.3).

Other explanatory variables, such as voter turnout, bond value, student density and enrollment growth influence bond approval but not election participation. All estimated coefficients have the expected signs. The first two capture bond attributes, which negatively impact bond approval. The latter two are measures of local school needs, and are positively associated with bond approval. The 'no high school' dummy indicates districts that only provide elementary

[21] A school bond is considered as a success if the approval share is greater than or equal to 60% (the super majority rule in Oklahoma). On average, the last bond election happened 2.5 years ago. Nevertheless, the factor is not available for all observations, so a dummy is included to account for those with missing values (20/643).

education. These districts are relatively small in terms of population size. Compared with other school districts, they are less likely to engage in bond elections. Out of 28 districts without a high school, only four have bond election frequencies that are above the average.

The two-stage selection model distinguishes between the bond outcome stage and the election participation stage, providing some insight regarding the effects of demographics in different bond stages. Even accounting for the potential differences across school districts (e.g. demographics, time effects, and heterogeneity), there is selectivity bias. To the degree that school bond outcomes are observed conditional on the occurrence of bond elections, self-selection deserves more attention in empirical modeling.

3.5 Discussion and Conclusion

The empirical approach used in this study explores the concern that school districts may select themselves into bond elections. Observed bond approval is partly related to the decision to have a bond election. Therefore, the sample may not be representative of the underlying population of school districts. According to the selection test, the estimated coefficient of the inverse mills ratio reaches the conventional levels of statistical significance, implying that there exists selectivity bias. Ignoring self-selection, estimates are inconsistent, and conclusions may be misleading for districts that plan to finance school spending via future bond issues.

One might be concerned that self-selection should be accounted for in the analysis of my previous chapter. In fact, accounting for selectivity bias, the estimates of voter turnout change slightly, and the results presented in Chapter 2 are robust to self-selection.

To this point, I have maintained the assumption that school districts select themselves into bond elections, and observed bond approval is related to election participation. More broadly, the proposed self-selection problem is not limited to the framework of school bonds. In fact, it applies to elections of various types (e.g., elections for metropolitan government reform, recreational facilities, and sales taxes) since it is a potential problem in a wide range of policy studies. To gain a better understanding of the mechanism by which election outcomes are achieved, self-selection need to be given careful thought.

Table 3.1: Empirical approaches used to examine the effect of self-selection on voting outcome

	Level of Aggregation	Empirical Approach				
		Comparison of Characteristics	Simulation	Survey (Counter-factual)	Natural Experiment	Two-stage selection model
General elections	Individual level	Bennett & Resnick (1990)				
		Highton & Wolfinger (1999)				
			Citrin et al. (2003)			
						Dubin & Rivers (1989)
School related elections	Individual level			Rubinfeld & Thomas (1980)		
	District level				Berry & Gersen (2010)	
						Gong (2012)

Table 3.2: Comparison of demographic factors

	Districts with election frequencies below average (94)				Districts with election frequencies above average (**57**)			
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Pupil Density	19.2	40.75	0.34	266.22	88.23	189.58	0.65	1304.8
Total Population	9650	41210	410	297100	19240	27000	820	113400
Enrollment growth rate	0.005	0.0583	-0.258	0.3317	0.012	0.0377	-0.127	0.2277
Bond Value Per Pupil	2321	3005	73	25186	1970	3232	47	31106
Poverty Level	0.14	0.0492	0.0184	0.2645	0.117	0.0596	0.0253	0.3116
College Degree or above	0.158	0.0532	0.0702	0.4481	0.21	0.1116	0.0391	0.5093
Debt	266.2	141	0	774.6	476.2	399.9	59.2	2486.4
Income	35940	6870	25040	60530	41110	12080	22900	94340
Pupil-teacher Ratio	16.03	1.83	10.53	20.8	17.47	1.74	12.53	20.88
Property value per pupil	26010	16360	6220	87520	26010	13340	7340	81620
Approval share	0.722	0.1198	0.2145	1	0.725	0.1081	0.329	0.9382
Number of districts in each locale category								
City				2				4
Suburb				2				14
Town Fringe				3				6
Town Distant				8				5
Rural Fringe				23				12
Rural Distant				48				14
Rural Remote				8				2
No high school dummy				24				4

Source: Oklahoma Office of Accountability and National Center for Education Statistics

Table 3.3: A two-stage selection model

	Selection/ Election participation	Outcome/ Bond approval
Variables	Column (1)	Column (2)
Inverse mills ratio		0.0987
		(0.0229)***
Density		0.0109
		(0.0037)***
Enrollment growth		0.2649
		(0.0934)***
Bond value per pupil		-0.0676
		(0.015)***
Turnout		-0.2
		(0.0548)***
No high school	-0.4696	
	(0.098)***	
Past bond success	-0.9313	
	(0.1114)***	
Years	0.1849	0.0161
	(0.0199)***	(0.0033)***
Dummy	-0.426	-0.1297
	(0.1913)**	(0.0374)***
Suburb	0.1786	0.0578
	(0.1726)	(0.023)**
Town fringe	0.0289	0.0585
	(0.1924)	(0.0274)**
Town distant	-0.4304	0.0502
	(0.1864)**	(0.0295)*
Rural fringe	-0.3632	0.0527
	(0.1697)**	(0.0271)**
Rural distant	-0.4516	0.0364
	(0.1631)***	(0.0268)
Rural remote	-0.5136	0.0083
	(0.1991)***	(0.0332)
Constant	0.2773	0.5351
	(0.2422)	(0.0419)***

Table 3.3 continued

Variables	Approval Share	
	First Stage/Selection Column (1)	Second Stage/Outcome Column (2)
District heterogeneity		
Debt _average	0.4264	0.09
	(0.1389)***	(0.0204)***
College degree or above _average	3.4648	-0.009
	(1.3946)**	(0.07)
N	1963	643
R2	0.1173	0.202
Rho		0.7647

Note: The unit of observation is a consolidated capital bond election held in a school district in a year. Estimates are reported with robust clustered errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Chapter 4: Do Rich Districts Support Public School Bonds?

4.1 Introduction

This chapter explores the relationship between local property values and school bond approval. Bonds are financed via future property taxes, which are collected on the basis of property values following several steps. First, a county assessor appraises the market value of a property based on its land and improvement values. Next, the market value is multiplied by the assessment ratio in order to obtain the assessed value. Then, if the property owner is qualified for exemptions, certain amounts are deducted from the assessed value, and the remaining is the taxable value. Finally, a property tax rate, measured in mills, is applied to the taxable value to calculate the tax bill. The whole procedure is detailed in Figure 4.1.

Generated property tax revenues are used to provide local public goods and services, such as schools, libraries, and government projects. On average, 70% of the tax revenues are apportioned for public schools (Oklahoma Tax Commission, 2012). Among these school revenues, up to five mills may be collected for the purpose of school capital expenses, in other words, bonds (Article X, Section 9B, Oklahoma Constitution).

4.1.1 One-way: from Property Values to School Bond Approval

School bonds provide an important mechanism of financing school capital outlays. To issue bonds, voter support is needed in local elections, and property values, as a measure of property tax base, are commonly used to explain bond outcomes in the literature. Usually, a high property value implies a large tax base. To raise the same amount of money via bonds in homogenous communities, the average tax burden is smaller for districts with high property values, compared to those with low property values. Therefore, property values are found to be positively associated with school bond approval (Theobald and Meier, 2002; Maher and Skidmore, 2009). The positive relationship is also supported in Lentz's study, where voter support increases with an expanded property tax base, measured by the percentage change in equalized assessed valuation (EAV) from the prior year. However, EAV per capita, another factor that captures the economic conditions of a school district, is negative and significant in the same regression. Lentz (1999) argues that property values are generally low in those districts in her sample, so the associated property tax rates might already be high in order to compensate for the small tax bases. While high current rates are not desirable for future school taxation, bond approval falls. Other studies also find property values to be negatively associated with school bond success, but the estimated coefficients are insignificant (Rueben and Cerdán, 2003; Zimmer and Jones 2005; Maher and Skidmore, 2008). Similarly, as is documented in my previous research (Chapter 2), property values fail to attain the standard levels of statistical significance when used in the bond approval analysis. Consequently, the literature regarding the relationship between property values and bond approval is inconclusive.

4.1.2 Other Way: from School Capital Expenses (Bonds) to Property Values

Bonds are meant to finance school capital expenses. More capital spending is associated with better school facilities, and improved school facilities are good for student safety as well as student learning. These school amenities are capitalized into local property values. Property owners are concerned with public school spending largely due to property capitalization.

Cellini, Ferreira, and Rothstein (2010) evaluate the economic returns of investing in school facilities on various school outputs, including student performance, housing prices, and district income/racial composition. Compared with student test scores, housing prices measure school output in a better way since benefits, such as student safety and health, are also included. These amenities associated with improved school facilities are capitalized into local housing prices, but may not be reflected in student performance. Generally, school impacts are hard to isolate from the numerous environmental/socioeconomic elements related to outcomes. In order to identify the effects of school capital investments, Cellini, Ferreira and Rothstein use a regression discontinuity design that compares school bonds passed and failed by close margin. It is found that bond initiatives raise local housing prices by six percent two or three years after bond passage, and such positive effect would last for a decade. On the contrary, bond passage has minor impact on local racial/income composition and ambiguous effect on student test scores.

The research relating to the effect of school capital investments (bonds) on local housing prices is limited, so it is worth looking at the literature that focuses on the relationship between general school spending and property values. Oates (1969) investigates the empirical connection between property taxes and property values. He finds that increased property tax rates depress property values. However, if collected tax revenues are used to increase local public spending, public schools in particular, the benefits associated with the spending may offset the depressive effect on property values. People take into account the level of local public services (primarily public schools) when they decide where to locate.

Hilber and Mayer (2009) examine how property capitalization can influence public school spending in Massachusetts. By looking at areas where little developable land is available, they use land supply as a proxy for capitalization and find that residents vote to increase school expenditure at a faster rate in those communities. The results support the idea that property capitalization drives public school spending.

Numerous studies have further explored the relationship between school quality and housing prices (Black, 1999; Figlio and Lucas, 2004). For the purpose of this research, they are not closely related and are not discussed. The presented literature concentrates on the relationship between property values and school spending (Figure 4.2). Among these studies, some focus on the effect of property values as an important financing source for school capital expenses (bonds), and others show the impact of school (capital) spending on local property values due to capitalization. Consequently, property values may be endogenous to school bond approval. The previous studies do not account for this endogenous relationship and simply use an ordinary least squares (OLS) approach to examine the role of property values in explaining school bond approval. Therefore, the results may be suspect concerning the impact of property values.

Based on this notion, my study complements the literature by exploring the endogenous relationship between property values and bond approval. Using cross sectional bond data from Oklahoma (2005-2009 five-year estimates), an ordinary least squares (OLS) regression produces a highly insignificant relationship following the previous research. In contrast, using an instrumental variable (IV) approach, the endogenous effect of property values is disentangled. The IV estimate is much larger in magnitude and is significant at the conventional levels of statistical significance. An interesting finding of this study is that property values are negatively signed, implying that there may be less support for school bonds in districts with higher property values. In fact, the negative effect of property values may reflect community heterogeneity to some extent. My study offers a better understanding of the relationship between property values and bond approval.

The rest of the chapter is organized as follows: section 4.2 specifies the empirical model and data, section 4.3 discusses the results, and section 4.4 concludes.

4.2 Empirical Specification

4.2.1 Model

To identify the effect of property values on school bond approval, a baseline model is proposed at the district level:

$$Approval = \beta_0 + \beta_1 property\, value + \beta_2 X + \varepsilon \tag{4.1}$$

The dependent variable *Approval* is the share of yes votes in a school bond election. It indicates the extent of voter support for school capital spending. The set X includes factors associated with bond approval, such as district demographics, school needs, and bond/election characteristics. Property values are used as one of the explanatory factors that are relevant for school bond approval. Chapter 2 details the variable descriptions and summary statistics (Tables 2.3 and 2.4).

4.2.2 Data

Since property values may be endogenous to bond approval, appropriate instruments are needed for the endogenous factor. Research suggests that physical features of structures, such as square footage, lot size, age, bedrooms, bathrooms, garage, and air conditioning, are significant determinants of property values[22] (Black, 1999; Bogarta and Cromwell, 2000; Zietz, Zietz, and Sirmans, 2007; Dehring, Depken, and Ward, 2008). Therefore, these features are used to identify the true effect of property values on school bond approval. Per pupil property value is obtained from the Office of Accountability (Oklahoma), which reports community characteristics, school educational processes, and student performance in its publication: *School and District Report Card*.

Physical features of structures at the district level are collected from the American Community Survey (ACS) of the U.S. Census Bureau. The ACS provides nationwide data about communities' demographics, social economics, and housing characteristics. Typically, the ACS reports three types of data: one-year, three-year,

[22] To be accurate, physical features of structures are important determinants of housing values, which make up the majority of property values.

and five-year estimates, all of which represent data collected over some specific time periods. The one-year estimates are available for areas with populations of 65,000 or more. For small geographic areas, such as cities, school districts, and census tracts, the ACS surveys too few households to provide reliable yearly data. Therefore, data from multiple years are pooled together to obtain the three-year and five-year cross sectional estimates for those jurisdictions. In fact, data precision improves. For instance, the five-year estimates are reported with the smallest margin of errors. Every year, the ACS surveys nearly three millions addresses, two thirds of which respond. By the end of 2009, the ACS had surveyed 15 million addresses, and the first five-year estimates (2005-2009) were published in 2010. For school districts in Oklahoma, because the average population is relatively small (15,079), only five-year estimates are available. Hence, the 2005-2009 estimates are used in my study.

Physical features of structures includes the year the structure was built, the number of units in structure, rooms, bedrooms, kitchen facilities, plumbing facilities, heating fuels, telephone service, and vehicles. All of them are reported in percentages at the school district level. Concerning the year when a structure was built, it is further categorized into seven groups: structures built after 2000, 1990-1999, 1980-1989, 1960-1979, 1940-1959, and before 1939. Relating to the number of units in a structure, those with one, two, and more units are separately identified. The numbers of rooms, bedrooms, and vehicles are also separately identified. In terms of the heating fuel used, structures are classified as those that use utility gas, bottled/tank/LP gas, electricity, fuel oil/kerosene, coal/coke, other fuels, and no fuel. Regarding the home facilities, the percent of structures with complete plumbing, kitchen, and telephone services are reported at the school district level, respectively. Table 4.1 shows the summary statistics.

Because physical features of structures are five-year and cross-sectional estimates, bond data are consolidated accordingly. School bond information and sources are presented in Chapter 2. Multiple bond elections held in the same district between 2005 and 2009 are combined into one bond according to their issuing values.[23] The final sample includes 132[24] observations, that is, one representative school bond per district per time period (2005-2009).

4.2.3 Instrumental Variable (IV) Approach

4.2.3.1 Validation of the instrumental variable approach

To validate the application of the IV approach, I employ a Hausman test to examine if property values are endogenously determined in the bond approval equation. Property values regressed on the proposed instruments (physical features of structures) and other explanatory variables. The residuals are added to the baseline model, with a coefficient that is statistically different from zero (Table 4.2). This sensitivity test indicates that the OLS estimates are inconsistent, so an IV approach is necessary.

[23] 226 bonds are consolidated into 132 representative bonds.

[24] There are a total of 151 school districts in seventeen counties in Oklahoma. Not all of them had bond elections during the period.

4.2.3.2 Under-identification Test

A valid instrument must be correlated with the endogenous variable, property values in this case. To test this condition, physical features of structures and other demographic variables are used to explain property values. As can be seen in Table 4.3, various features are significant determinants. Physical conditions, such as the number of rooms and bedrooms in a structure, are positively associated with property values, while characteristics, such as using fuel oil/kerosene as heating materials, is negatively related to property values. Therefore, the under-identification hypothesis can be rejected according to the test statistic (37.257, P value: 0%, Table 4.3).

4.2.3.3 Over-identification Test

A second condition is that the instrument should be exogenous to the bond approval equation. To check this condition, residuals from the baseline model are regressed on the proposed instruments (physical features of structures) and explanatory variables. The resulting estimates are not different from zero, with a Hansen J statistic of 5.513 (P value: 59.76%, Table 4.3), so the null hypothesis that the instruments are exogenous to the bond outcome equation cannot be rejected.

Consequently, the proposed instruments are valid and an IV approach produces consistent estimates. Physical features of structures will be used to instrument property values in the analysis to follow.

4.3 Results

4.3.1 Ordinary Least Squares Regression

Following the baseline model (Equation 4.1), results of the ordinary least squares (OLS) regression are shown in column (1), Table 4.4. The OLS estimate of property values is small (-0.0556) and insignificant (p value: 22%), suggesting that property values have a minor effect on bond approval. This result is in line with the findings of the previous studies, where the coefficient of property values is negative and insignificant (Rueben and Cerdán, 2003; Zimmer and Jones 2005; Maher and Skidmore, 2008). To obtain a clearer picture of the relationship between property values and school bond approval, the endogenous factor is instrumented, and a two-stage IV approach is employed.

4.3.2 Instrumental Variable Regression

Consistent IV estimates are reported in column (2), Table 4.4. Several differences are worth noting between the OLS and IV models. IV regression yields an estimate that is much larger in absolute value (-0.2368 vs. -0.0556). Although the standard errors are larger under the IV regression, the estimated coefficient of property values is statistically significant (P value, 2.4%). Also notable in the IV model is that property values are negatively signed, implying that districts with high property values may provide less voter support for school bonds. The results are contrary to those of Theobald and Meier (2002), who identify a positive relationship between property values and bond passage following an OLS approach. Nevertheless, my results are in line with the findings of an early study summarized by Piele and Hall (1973): communities with higher average owner-occupied housing values tend to have greater negative votes in school financial elections, including tax and bond elections (Mcmahon, 1966). It is through the analysis of endogeneity that an important relationship is revealed. The results raise interesting questions regarding homeowners' voting behaviors and rationales.

It is confusing that bond approval falls with property values. A possible reason is that communities with high property values may be relatively more heterogeneous than those with low property values. There are two types of heterogeneity: difference in the composition of property tax base (agricultural, residential, commercial, and industrial property) and dispersion in values (property values, housing values, and income). By including district locale, the first type of heterogeneity is accounted for to the extent that the composition of property tax base varies as district locale changes. The second type of heterogeneity is the focus of my study. Bonds are paid back via future property taxes, which are collected on the basis of property values. Due to the difference in property values, the tax bill associated with bond issues may be unevenly distributed among property owners, and rich families may bear the big portion of the costs. Nevertheless, the educational benefits enjoyed by students do not differ according to their tax payments. When costs exceed benefits, these rich families may provide less support for public school bonds. If high property values are associated with community heterogeneity, then bond approval falls with property values since it is hard to reach an agreement in a heterogeneous community.

To see if this justification holds true, the relationship between property values and community heterogeneity is explored. Heterogeneity is measured by the housing value dispersion[25] within a school district. An indicator is constructed as the difference between the upper (75%) and lower (25%) housing value quartiles divided by the median (Rockoff, 2010). Including the dispersion indicator in the bond approval analysis, I find that it is negatively and significantly associated with bond approval (-0.067, P value: 2.7%, column (1), Table 4.5), while the coefficient of property values becomes insignificant (-0.167, P value: 15%, column (1), Table 4.5). As a result, it is highly likely that property values influence school bond approval through the channel of community heterogeneity.

To visualize the relationship, bond approval and dispersion are plotted against property values (Figures 4.3 and 4.4). At first, bond approval falls with property values largely due to community heterogeneity since dispersion rises with property values. However, as property values continue to increase, dispersion decreases, and communities become more homogenous. Meanwhile, bond approval rises. To some extent, the relationship between property values and bond approval may capture the effect of community heterogeneity.

Lentz (1999) offers another explanation to justify the negative effect of property values on bond approval. She argues that the property values may be generally low in the school districts in her sample. To compensate for the small tax bases, current tax rates might already be high in these communities. While high rates are not desirable for future school taxation, bond approval falls. To test for this

[25] Dispersion in property values is not available. Therefore, this factor is used instead since housing values are a big part of property values.

possibility, tax rates are plotted against property values. According to Figure 4.5, as property values increase, tax rates rise. Including tax rates in the bond approval analysis, the factor is highly insignificant (P value: 39.3%), consistent with the findings of Maher and Skidmore (2009). However, the coefficient of property values remains negative and significant (-0.2158, P value: 8.1%, column (2), Table 4.5). As a result, tax rates do not appear to explain the negative effect of property values.

Consequently, property values may influence school bond approval negatively due to community heterogeneity. In contrast, bond success has a positive effect on local property values due to capitalization (Cellini, Ferreira, and Rothstein, 2010). The traditional OLS model may capture both effects that are in opposite directions, so the resulting estimate approaches zero (-0.0556, column (1), Table 4.4). The uncorrected OLS model may conceal the relationship between property values and bond approval due to the mixed directions of influences. Once the process is disentangled, I find that bond approval falls with property values.

4.3.3 Robustness Checks

To ensure that the results reflect the underlying relationship between property values and school bond approval, several robustness tests are explored. The ACS data are published with margin of error (MOE), which suggests that with a 90% chance, the reported estimates would fall into the range (mean-MOE, mean+MOE). In this section, I use the lower bound (mean-MOE) and upper bound values (mean+MOE) of physical features to re-examine the effect of property values. Regressions in Table 4.4 are repeated, and similar results hold. Under the IV specifications, the estimates are much larger in absolute values and are closer to the standard levels of statistical significance (-0.2215, P value: 2.1%, Table 4.6, and -0.2506, P value: 1.8%, Table 4.7). Results of the bound values analysis are consistent with those of the mean value.

In addition, compared with property values, one might be concerned that housing values may capture the two-way effect between local taxable resources and school bond approval in a better way. First, school amenities are capitalized into housing prices since quality education makes local housing more attractive. Second, physical features of structures are more closely associated with housing values rather than property values, which not only include the building values (improvement values), but also the land values. Third, property values are more comprehensive than housing values since property contains residential, commercial, industrial, and public estates. As a result, in this section, housing values are used to explain school bond approval instead of property values, despite the fact that school taxes associated with bond issues are collected on the basis of property values.

The ACS provides five-year estimates on aggregate owner occupied housing values, which are divided by student populations to get the per pupil level data. Features of owner-occupied housing units are used to identify the effect of housing values on bond approval. Regardless of the fact that the physical features capture the variations in housing values in a better way, the regression matrix is almost singular. The analogous OLS estimate of housing values is extremely small (-6.79e-06) and highly insignificant (99%), while the IV estimate approaches -0.0145, with a P value of 18.3%. The substantial increase in the magnitude of IV estimate is astonishing, but the results should be interpreted with caution. Furthermore, apart from the per pupil level housing values, average housing values are also studied in the bond approval analysis. Once again, the estimate improves under the IV specification, both in magnitude (-0.0147 vs. -0.0279) and statistical significance (39.8% vs. 19.4%), though it fails to reach the standard level. Consequently, it is difficult to say whether the negative relationship between housing values and bond approval is robust, but the IV approach certainly sheds light on endogeneity.

4.4 Discussion and Conclusion

In this paper, I evaluate the importance of property values for explaining school bond approval. Accounting for endogeneity, a slightly negative relationship emerges, and it is different from what is generally expected.

While this study improves our understanding of the relationship between property values and bond approval, it also raises a lot of questions. For local public goods other than schools, such as hospitals, parks, and recreational services, do rich school districts provide support for these public projects? Does heterogeneity influence voting outcomes? Do these district vote in a similar manner as they do for school bonds? These questions are beyond the scope of my current work, but they are worth exploring in the future.

Table 4.1: Physical features of structures (percentages)

Variable	Mean	Std. dev.	Min	Max
Total occupied units	6.3411	16.7597	0.198	121.417
Number of units in structures				
1, detached	74.9182	10.3512	39	96.6
1, attached	1.1515	1.3361	0	6.5
2 apartments	0.9871	1.6393	0	9.1
3-4 apartments	1.1962	1.7073	0	8.2
5-9 apartments	1.6212	2.7502	0	16.4
10 or more apartments	2.2636	4.4281	0	23.1
Mobile home	17.8606	11.9131	0.8	45.7
Year the structure was built				
Later than 2000	12.5121	8.6916	0.7	44.8
1990-1999	16.0000	7.4504	0.9	36.7
1980-1989	17.6977	6.3736	2.4	37.5
1960-1979	31.0924	8.3354	10.3	52.9
1940-1959	13.5614	9.9414	0.8	54
Before 1939	9.1341	6.8467	0	30.7
Rooms				
1 room	0.3742	0.5629	0	2.4
2-3 rooms	5.3258	3.9324	0	21.6
4-5 rooms	42.9727	9.4340	7.1	73
6-7 rooms	38.5000	7.1350	16.9	53.7
8 or more rooms	12.8182	7.9028	0.6	69.7
Bedrooms				
No bedroom	0.4485	0.6172	0	2.7
1 bedroom	4.9962	4.1566	0	23.5
2-3 bedrooms	78.5780	8.0608	38.9	92.6
4 or more bedrooms	15.9780	7.5070	4.3	60.7
Complete facilities				
With complete plumbing service	99.5356	0.6029	96.4	100
With complete kitchen service	99.1780	0.9251	94.9	100

Table 4.1 continued

Variable	Mean	Std. dev.	Min	Max
Vehicles available				
No vehicle	3.7992	2.4671	0	10.1
1 vehicle	26.0439	8.3497	5.5	51.1
2 vehicles	41.1553	5.7722	29	55.4
3 or more vehicles	29.0061	8.6799	9.9	57.2
Telephone service available				
With telephone service	95.8394	2.6217	88	100
House heating fuel				
Utility gas	45.4992	22.4247	0.2	82.9
Bottled, tank, or LP gas	17.3424	13.7516	0	68
Electricity	30.5462	9.7939	9.4	62.8
Fuel oil, kerosene, etc.	0.4485	1.2796	0	9.3
Coal or coke	0.0068	0.0632	0	0.7
All other fuels	6.0121	7.4572	0	34.3
No fuel used	0.1424	0.2948	0	1.5
Total observations				132

Source: American Community Survey, 2005-2009 five-year estimates
Note: The sample is cross sectional. All features are measured in percentages at the school district level, and the total occupied units are measured in 1,000.

Table 4.2: Validation of the IV approach

Variables	Approval Share
Residual	0.2404
	(0.1162)**
Property value per pupil	-0.2368
	(0.1041)**
Years	0.0145
	(0.0028)***
Past bond success	0.1638
	(0.0222)***
Bond value per pupil	-0.047
	(0.0177)***
Enrollment growth	0.6654
	(0.4059)
Population	-0.0373
	(0.0197)*
College or above	0.4462
	(0.2615)*
Black	-0.1462
	(0.0631)**
Suburb	-0.0506
	(0.0388)
Rural remote	-0.1761
	(0.0449)***
Rural fringe	-0.0502
	(0.0441)
Rural distant	-0.0957
	(0.0425)**
Town fringe	-0.1067
	(0.0435)**
Town distant	-0.0915
	(0.0467)**
Constant	0.3506
	(0.214)
N	132
R2	0.5459

Note: the unit of observation is a consolidated school bond election held in district i. The sample is cross sectional. Estimates are reported with robust standard errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 4.3: First stage results

Variables	Property value per pupil
Fuel oil/kerosene/etc.	-0.0337
	(0.0063)***
4 bedrooms or more	0.0089
	(0.0046)**
8 rooms or more	0.0009
	(0.0036)
3 vehicles or more	0.0019
	(0.002)
Total occupied units	0.0089
	(0.0127)
All other fuels	0.0029
	(0.002)
Square miles	0.0004
	(0.0003)
College degree or above	1.2479
	(0.3047)***
High school diploma	1.1565
	(0.4717)**
Black	0.1529
	(0.1139)
Suburb	-0.108
	(0.1232)
Rural remote	-0.1086
	(0.1551)
Rural fringe	-0.1049
	(0.1391)
Rural distant	-0.0629
	(0.1415)
Town fringe	-0.1683
	(0.1302)
Town distant	-0.0509
	(0.1386)
Constant	-0.8361
	(0.3851)**

Table 4.3 continued

Variables	Property value per pupil
Test Statistics	
Under identification test (Anderson canon. Corr. LR statistic)	37.257***
Over identification test (Hansen J statistic)	5.513
N	132
R2	0.4916

Note: the unit of observation is a consolidated school bond election held in district i. The sample is cross sectional. Estimates are reported with robust standard errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 4.4: OLS and IV results

Variables	Approval Share	
	OLS	IV
Property value per pupil	-0.0556	-0.2368
	(0.047)	(0.118)**
Years	0.015	0.0145
	(0.003)***	(0.0032)***
Past bond success	0.1677	0.1638
	(0.0228)***	(0.0231)***
Bond value per pupil	-0.0523	-0.047
	(0.0191)***	(0.0183)***
Enrollment growth	0.6724	0.6654
	(0.4286)	(0.4526)
Population	-0.0285	-0.0373
	(0.0187)	(0.0221)*
College or above	0.1605	0.4462
	(0.1977)	(0.02721)*
Black	-0.1455	-0.1462
	(0.0506)***	(0.0457)***
Suburb	-0.0347	-0.0506
	(0.0407)	(0.0535)
Rural remote	-0.1772	-0.1761
	(0.0461)***	(0.0605)***
Rural fringe	-0.0431	-0.0502
	(0.0457)	(0.0593)
Rural distant	-0.0968	-0.0957
	(0.0441)**	(0.0581)*
Town fringe	-0.0866	-0.1067
	(0.0454)*	(0.058)*
Town distant	-0.0839	-0.0915
	(0.0496)*	(0.0621)
Constant	0.4593	0.3506
	(0.1955)**	(0.2324)
N	132	132
R2	0.5263	0.4662

Note: the unit of observation is a consolidated school bond election held in district i. The sample is cross sectional. Estimates are reported with robust standard errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 4.5: Explanation of the negative effect of property values

	Approval Share	
	Column (1)	Column (2)
Property value per pupil	-0.1667	-0.2158
	(0.1158)	(0.1238)*
Dispersion	-0.067	
	(0.0303)**	
Tax rate		3.5458
		(4.1518)
Years	0.0096	0.0085
	(0.0043)**	(0.0043)**
Past bond success	0.1944	0.1919
	(0.0225)***	(0.0246)***
Bond value per pupil	-0.0515	-0.0484
	(0.019)***	(0.0193)**
Enrollment growth	0.4801	0.5338
	(0.3968)	(0.4155)
Population	-0.0293	-0.0367
	(0.0381)	(0.0321)
College or above	0.1882	0.3597
	(0.3174)	(0.2976)
Black	-0.1641	-0.1594
	(0.0923)*	(0.1214)
Suburb	-0.0283	-0.0432
	(0.0491)	(0.0796)
Rural remote	-0.1327	-0.1533
	(0.0648)**	(0.0926)*
Rural fringe	-0.0076	-0.0228
	(0.0564)	(0.0893)
Rural distant	-0.0564	-0.0732
	(0.0561)	(0.0914)
Town fringe	-0.0719	-0.0918
	(0.0512)	(0.0916)
Town distant	-0.0519	-0.0709
	(0.0593)	(0.0915)
Constant	0.5452	0.3304
	(0.2778)**	(0.2416)
N	132	132
Adjusted R2	0.5072	0.4879

Note: the unit of observation is a consolidated school bond election held in district i. The sample is cross sectional. Estimates are reported with robust standard errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 4.6: IV results, upper bound values

Variables	Approval Share
Property value per pupil	-0.2215
	(0.1028)**
Years	0.0145
	(0.0031)***
Past bond success	0.1642
	(0.0228)***
Bond value per pupil	-0.0474
	(0.0181)***
Enrollment growth	0.666
	(0.4483)
Population	-0.0365
	(0.0218)*
College or above	0.4221
	(0.02496)*
Black	-0.1461
	(0.046)***
Suburb	-0.0493
	(0.0523)
Rural remote	-0.1762
	(0.0591)***
Rural fringe	-0.0496
	(0.0579)
Rural distant	-0.0958
	(0.0567)*
Town fringe	-0.105
	(0.0571)*
Town distant	-0.0909
	(0.0609)
Constant	0.3596
	(0.2221)
N	132
R2	0.476

Note: the unit of observation is a consolidated school bond election held in district i. The sample is cross sectional. Estimates are reported with robust standard errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Table 4.7: IV results, lower bound values

Variables	Approval Share
Property value per pupil	-0.2506
	(0.1135)**
Years	0.0148
	(0.0032)***
Past bond success	0.1633
	(0.0229)***
Bond value per pupil	-0.0479
	(0.0184)***
Enrollment growth	0.5869
	(0.4552)
Population	-0.0388
	(0.0227)*
College or above	0.4248
	(0.02565)*
Black	-0.1648
	(0.048)***
Suburb	-0.0616
	(0.0578)
Rural remote	-0.1788
	(0.0632)***
Rural fringe	-0.0596
	(0.0639)
Rural distant	-0.1055
	(0.0619)*
Town fringe	-0.114
	(0.0616)*
Town distant	-0.0975
	(0.0653)
Constant	0.4131
	(0.2366)*
N	132
R2	0.4624

Note: the unit of observation is a consolidated school bond election held in district i. The sample is cross sectional. Estimates are reported with robust standard errors in parentheses. ***, ** and * indicate significance at 1, 5 and 10% levels.

Figure 4.1: Calculation of property taxes

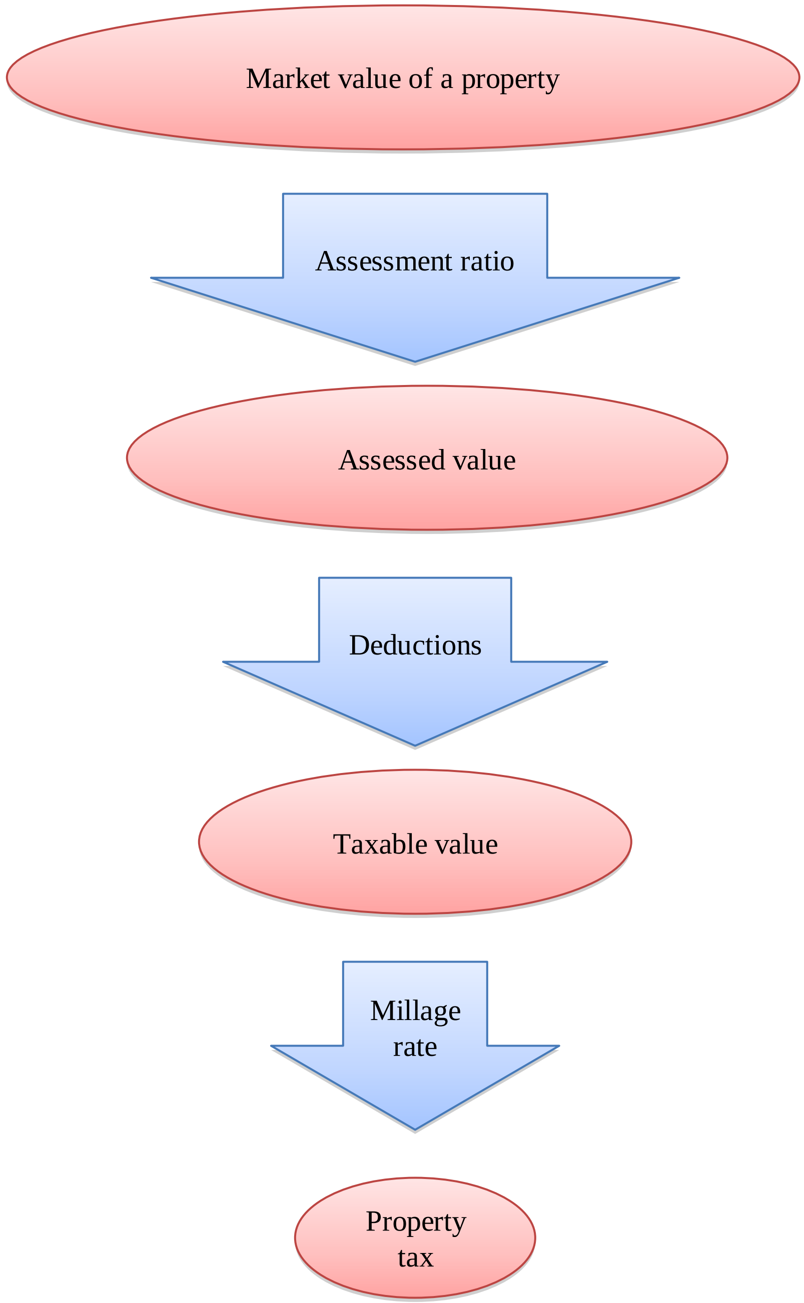


Figure 4.2: Literature on the relationship between property values and school bond approval

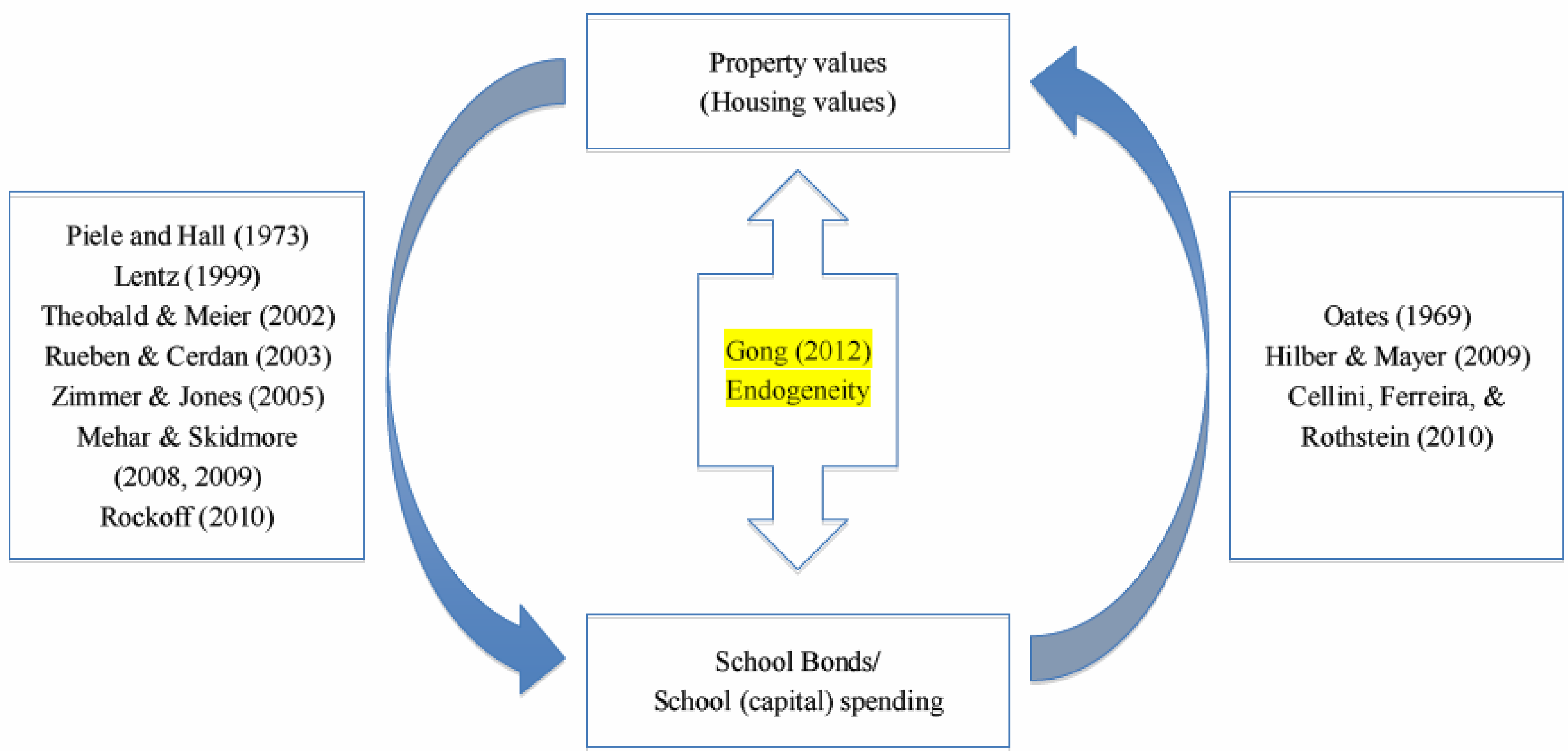
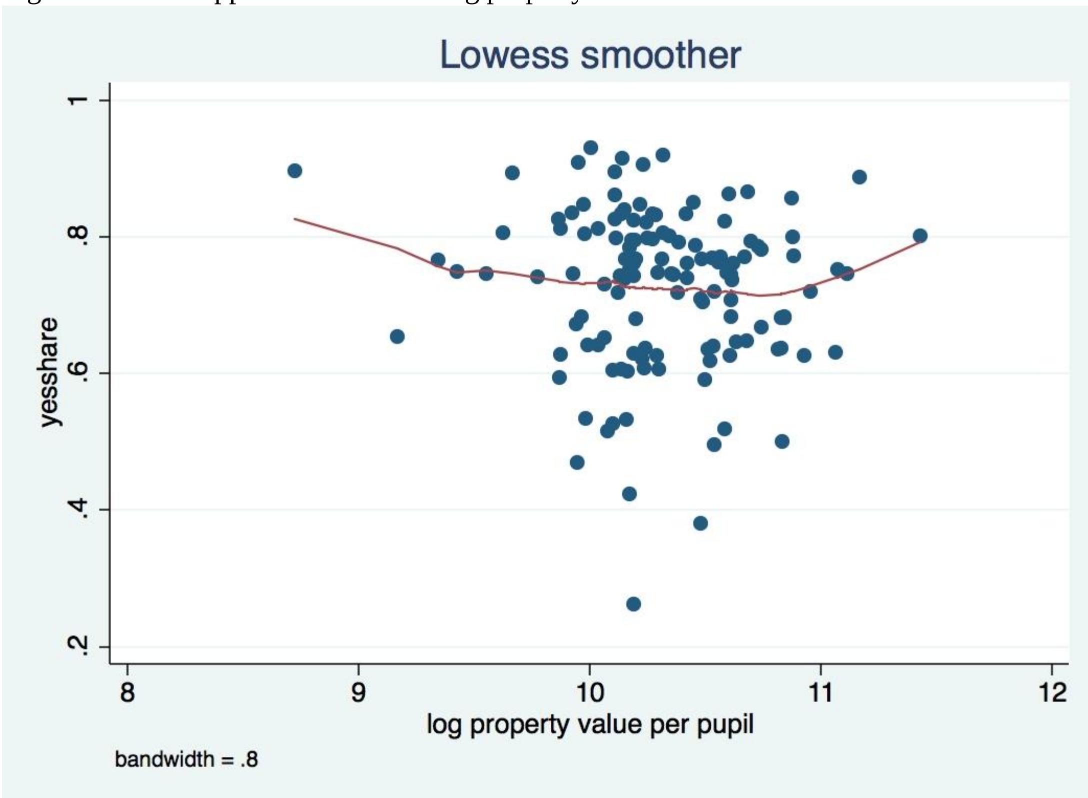
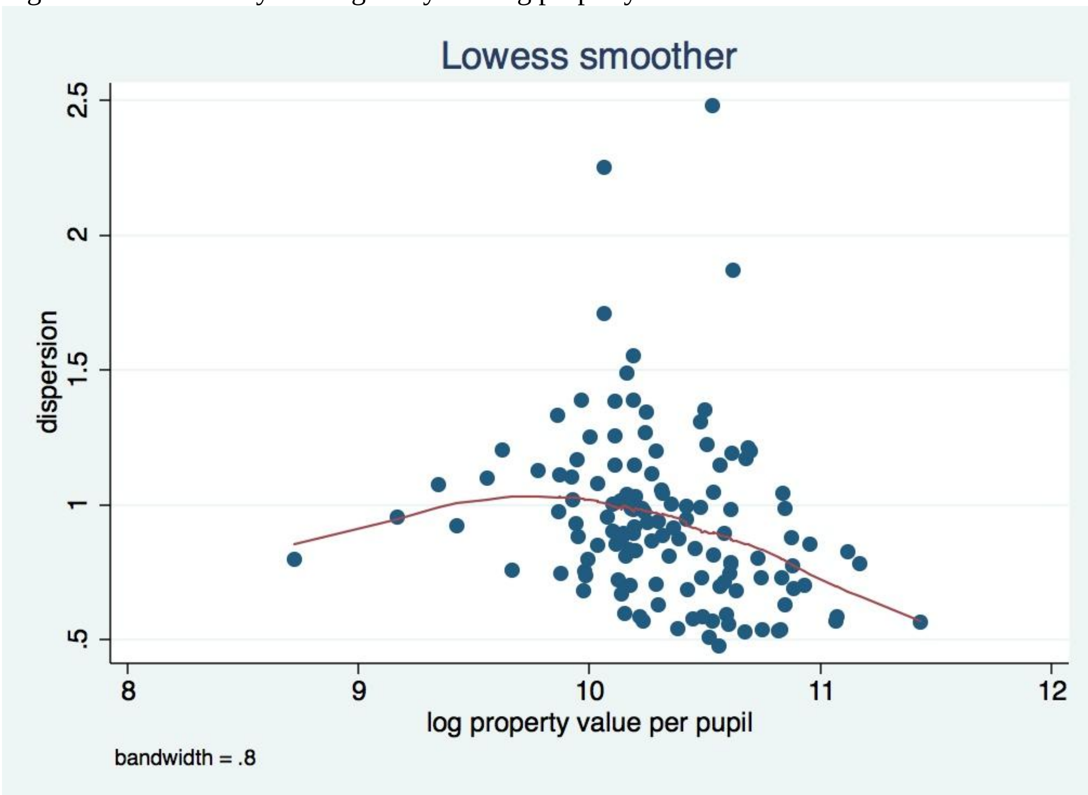


Figure 4.3 Bond approval shares and log property values



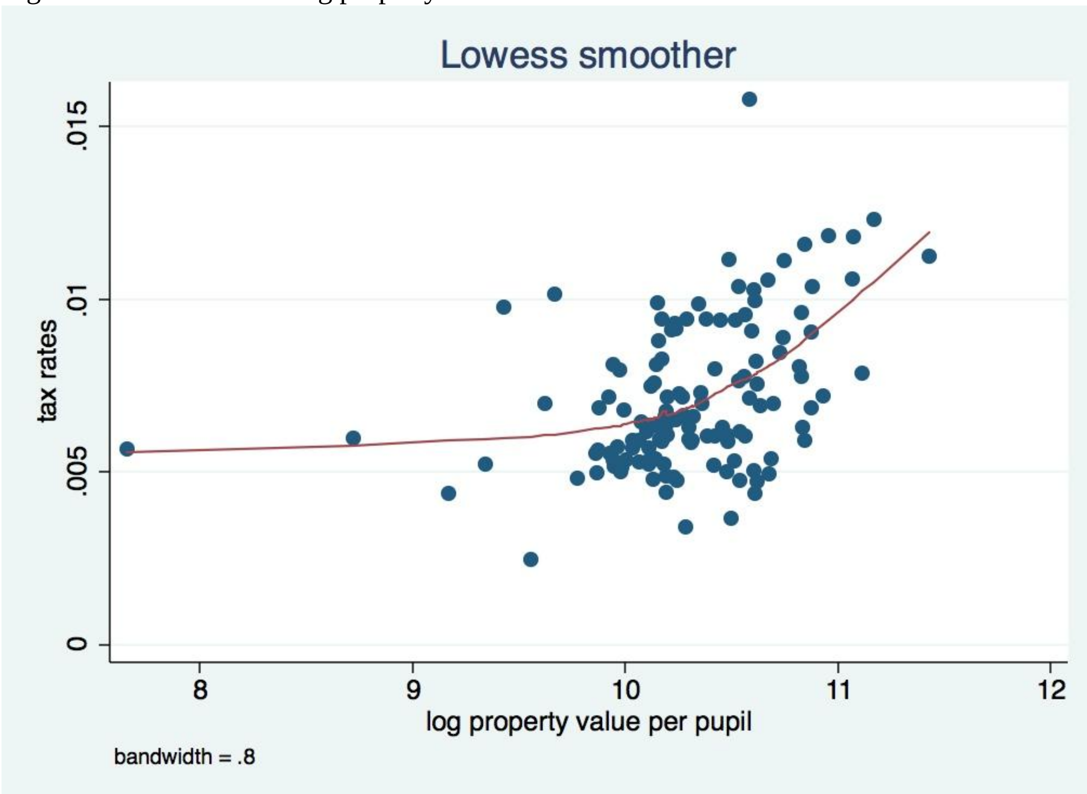
Source: Rogers and Burge (2010), Stephen H. McDonald and Associates, and American Community Survey, U.S. Census Bureau.
Note: the sample is cross sectional, with a total of 132 observations.

Figure 4.4 Community heterogeneity and log property values



Source: Rogers and Burge (2010), Stephen H. McDonald and Associates, and American Community Survey, U.S. Census Bureau.
Note: the sample is cross sectional, with a total of 132 observations.

Figure 4.5 Tax rates and log property values



Source: Rogers and Burge (2010), Stephen H. McDonald and Associates, and American Community Survey, U.S. Census Bureau.
Note: the sample is cross sectional, with a total of 132 observations

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