Funding, Investment and Wealth Equalization Across Texas Public School Districts

Melinda Petre[*][†] and Parth Venkat[‡][§]

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Abstract

We study how school districts respond to funding changes under a wealth equalization policy, using an instrument to exogenously identify funding changes. We find that property-rich districts reduce their tax rates and issue debt for capital expenditures after the state recaptures some of their funding with the intent to redistribute it to property-poor districts. In contrast, when property-poor districts receive additional funding, this spending correlates with investments, such as employing more and better teachers. These results imply that properly recaptured and redistributed funds may increase quality in property-poor districts.

1 Introduction

Despite being one of the biggest spenders on education per student in the world (OECD (2014a)), students score significantly lower on mathematics and reading assessments compared to other developed countries (OECD (2014b)). One potential driver of these differences might be differential access to resources in wealthy and less wealthy school districts. These

[*]Department of Economics, Dartmouth College

[†]melindapetre@utexas.edu. The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305B120013 to the University of California, Irvine (PI: Greg Duncan). The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

[‡]Department of Finance, McCombs School of Business, University of Texas at Austin

[§]Parth@utexas.edu. The Securities and Exchange Commission disclaims responsibility for any private publication or statement of any SEC employee or Commissioner. This article expresses the authors' views and does not necessarily reflect those of the Commission, the Commissioners, or other members of the staff. We thank Jonathan Cohn, Billy Grieser, Zac Liu, Gonzalo Maturana, Jordan Nickerson and Ben Zhang for their comments. We also thank various Texas Government agencies and DrillingInfo for providing data. All errors are our own.

differences contribute to achievement gaps across schools (Hanushek (2006a)). Could different allocations of funding across public schools help bridge achievement gaps between students throughout the United States? In particular, understanding if wealth equalization policies help schools and students is critical for assessing their value and potential for bridging achievement gaps. To gain insight into how financial resources could be more efficiently allocated, we study how Texas school districts with different wealth levels invest funds. Specifically, we study how both property-rich and property-poor districts respond to increased funding under a wealth equalization policy, using an instrument to exogenously identify changes in wealth for property-rich districts.

Texas offers an ideal setting to study allocation and investment of school funds. First, Texas public schools educate nearly 10% of all public school students in the United States (Imazeki and Reschovsky (2003)). Second, Texas school districts are independent units which provides a unique opportunity to study district revenue and investment decision-making. Districts generate revenue by directly taxing residents and have local superintendents who independently oversee expenditures. Third, Texas keeps detailed and complete data on district property wealth, taxation, revenue, expenditures, payroll, and state-mandated district-wealth transfers. This data allows us to measure payroll, teacher headcount, teacher pay, teacher experience, and teacher education and consider changes in these measures as proxies for investment in quality. We study a rich 14-year panel of over 1,000 districts and focus on the top and bottom of the wealth distribution because they are impacted most by a wealth equalization policy (the Robin Hood Plan).

The Robin Hood Plan captures local revenue from wealthy districts with the intent to redistribute these funds to property-poor districts (Hoxby (2001), Hoxby and Kuziemko (2004)) . Our findings suggest that property-rich districts respond strategically to this policy. Specifically, in the year after having funds recaptured, property-rich districts are 70% more likely to lower their tax rates, thereby reducing recaptured funds. These districts also increase their debt, which is not subject to recapture, by 60% primarily order to fund capital expenditures, which can reduce recapture when spent on specific facilities. In addition, rich districts are openly frustrated with the recapture policy. (See, Collier (2016), for example.)

Since funding and taxation decisions are endogenous, we use the number of horizontal wells–wells which were reactivated after the discovery of hydraulic fracturing–within a district to instrument for district tax revenue since school districts in Texas directly tax oil value. We find that the inception of a single horizontal well is related to a local revenue increase of 10% (around $1000 per student). With sub-sample regressions of the first stage, we show that the instrument is significant in predicting revenue increases in property-rich districts but not the property-poor districts, suggesting a local average treatment effect. In the second stage regressions we show that districts that receive cash windfalls from new wells, reduce their tax rates, issue debt to fund capital expenditures, and do not spend more money on teachers. The regressions suggest that property-rich districts exhibit strategic behavior with respect to recapture. Due to the lack of power in the instrument, these results do not tell provide information about property-poor districts.

These results rely on some strong assumptions, in particular, that other than through their impact on revenue, new horizontal wells should not affect the district tax level, debt, or expenditure decisions. Specifically, new oil wells do not change the voting behavior of districts. For example, oil booms do change demographics if young, childless men are the primary migrants during times of oil booms, we need the presence of these individuals to not impact the voting behavior of a district. While there is evidence that young men migrate to Texas, voter participation in local elections is very low (Ura and Murphy (2018), for example). In addition, these are usually conservative districts that remain conservative. Part of this may be because resource booms create non-resource related jobs at a higher rate which would mean that jobs for other groups would grow as well as jobs due to oil production (Weber (2012)). Finally, the joint hypothesis of tax avoidance combined with debt financing for new construction is not consistent with young men wanting to gut schools.

Next, we provide suggestive evidence that the strategic behavior of property-rich districts limiting recapture matters because property-poor districts can use the funds. First, we show that property-rich districts raise more revenue and spend more per student even after wealth equalization, suggesting that wealth equalization is not complete. Second, property district wealth is positively correlated with several proxies for academic quality, such as overall payroll, teacher count, teacher pay, and teacher subject concentration, suggesting that differences in spending matter. Third, we show that changes in funding are positively correlated with changes in these proxies for quality suggesting on average districts do use funds to try and improve quality. Finally, we show the third effect is significantly stronger property-poor districts than property-rich districts implying that when the property-poor districts receive additional funding, they invest in becoming more like property-rich districts. While the relationship between funding and changes in quality is not significant for districts in the top decile, a 10% increase in revenue to a bottom decile district corresponds statistically significant increases in proxies for quality, such as a 5% increase in payroll, a 3.5% increase in teacher count, a 0.4% increase in teacher pay, and a 3.5% drop in the subjects taught by a single teacher. While these results do not have the strength of an instrument, the regressions are run with district fixed effects which mitigates some omitted variable concerns. Taken together these correlations suggest that the strategic behavior of rich-districts negatively impacts the poorest districts, which might invest recaptured funds to become more like property-rich districts.

Our work has policy implications that apply to public education funding within Texas. Since our results suggest that the poorest districts might be putting additional funding to good, use, then governments should strongly consider policies to improve school funding. Second, if funding heterogeneity exists, then wealth equalization policies should not create perverse incentives limiting redistribution.

The remainder of this paper is as follows. First, we discuss our contributions to the literature in Section 2. Next we give context, describing Texas public schools in Section 3. A discussion of our data and empirical strategy follow, in Sections 4 and 5, respectively. Finally, we discuss our results and conclude in Sections 6 and 7.

2 Literature Review

Since Texas educates so many of the nation's students, education policy is heavily debated in the state and in the literature (Patterson (2004), Hanushek (2003), Hanushek (2010), Imazeki and Reschovsky (2003), for example).[1] Hoxby and Kuziemko (2004) and Hoxby (2001) predict the demise of Texas' Robin Hood Plan based on poorly aligned incentives for richer districts and predict that the wealth equalization plan will not be optimal as a result. We build upon this work by instrumenting wealth at the district level with a strong instrument to quantify the extent of strategic behavior and predict the implications of this behavior for school quality. Hyman (ming) and Zimmer and Jones (2005) study the impact of a similar reform in Michigan–Proposal A–which boosts funding in lower spending districts without decreasing funding by higher spending districts. This reform differs from the Texas reform in that it does not take funds from wealthier districts to improve poorer district funding. Zimmer and Jones (2005) find that wealthier districts become more reliant on debt financing. Hyman (ming) looks at the long run effects of the reform on educational attainment and finds that students exposed to an additional $1000 of per student per year

[1] Imazeki and Reschovsky (2004) use data from Texas to understand the additional costs of implementing new standards under The No Child Left Behind Act of 2001, finding that the costs of reaching these new standards substantially exceed the additional federal funding. Cortes and Friedson (2010) study the impact of Texas' top 10% rule on property tax values, finding that households reacted strategically to this policy by moving to neighborhoods with lower-performing schools, increasing property values in those areas, and that these strategic reactions were influenced by the number of local schooling options available: areas that had fewer school choices showed no reaction to the Top 10% Plan. Plummer and Pavur (2009) use the establishment in 1993 of a maximum 1.5 percent property tax for use of funding on maintenance and operations in Texas to understand the short and long-run impacts of the resulting changes in school funding. They find that some districts helped cushion the rate limits impact on their expenditures with funding from debt-related tax revenues and that for districts that did not, student test scores are lower and the rate limit causes a persistent decrease in school quality.

funding experienced a 3.0 percentage point increase in college enrollment and a 2.3 percentage point increase in degree receipt. Marchand and Weber (2017) finds that as a result of shale boom in Texas, greater spending went to capital projects and servicing debt, not funding for teachers. This pushed teachers to private schools, increasing teacher turnover and resulting in lower test scores.

A parallel issue to school funding is how districts achieve equality in school quality (Corcoran et al. (2008) and Corcoran and Evans (2008), for example). One goal of school reforms is to increase the quality of low-performing schools. Many papers investigate these ideas.[2] Lafortune et al. (2016) use an event study design to look at the impact of school finance reforms in the 1990s on low income schools. Specifically, they find that as a result of reforms, schools reduce class sizes and renovate buildings that are in poor shape. Our findings that the Robin Hood Plan decreased class sizes in property-poor districts are consistent with these. Lafortune et al. (2016) also finds that increases in achievement resulting from reforms take time to appear. Confirming these results under the Texas reform is beyond the scope of our paper.

On a related note, increases in natural resource markets may impact schooling decisions of young men, as the opportunity cost of being less educated may decrease. In addition, the opportunity cost of moving for a job for less educated workers might also change. Together, these might change the workforce in an area experiencing an oil boom. For example, Weber (2012) analyzes the natural gas boom in Colorado, Texas, and Wyoming during the 1990s, finding that a 1 million dollar increase in the value of gas production lead to 2.35 new jobs in the county of production and that the increase in employment within counties was 1.5% of the pre-boom level. Many authors have investigated both of these issues. In particular,

[2]For example, Hanushek and Lindseth (2009) investigate the school funding and achievement puzzle, tracing the history of school reform efforts and concluding that the principal focus of both courts and legislatures on ever-increasing funding has done little to improve student achievement. Similarly, Hanushek (2006b) provides a meta analysis of papers using court cases to reallocate school funding, finding that no approach can provide a reliable answer to the question "how much do adequate schools cost?" Hill and Kiewiet (2014) find that in California, court-case induced equalization reforms (e.g. Serrano v. Priest 1971) do not help diminish the strong, persistent association between the wealth of a school district and educational quality. Murray et al. (1998) conclude that equalization decisions lead to both lower levels of inequality and higher per-pupil expenditures. Hill and Kiewiet (2011) find that these results are not robust to additional data and specifications, finding that court rulings in California might have reached the limit of achievable equalization. Nechyba (2006) looks at state finance policies of two varieties: funding traditional local public schools and channelling funds to school entrepreneurs. Nechyba (2006) concludes that state policies should aim for a balance between the two types of policies to address equity concerns. Plummer et al. (2007) look at the risk of default among school districts using the information relevance of governmental financial statements published under Governmental Accounting Standards Board Statement No. 34 (GASB No. 34). For their sample of school districts, evidence suggests that information from the government-wide Statement of Net Assets and a measure of modified-accrual earnings provide the best information for explaining default risk.

Black et al. (2005) find that high school enrollment in Kentucky and Pennsylvania were countercyclical during the 1970s and 1980s coal booms and bust and Emery et al. (2012) find that natural resource booms change the timing of schooling rather than decreasing the total accumulation of human capital. Morissette et al. (2015) find that increased wages due to oil price increases reduce university enrollment and bring young less educated people to the labor market.

One concern is that changing demographics resulting from in migration might change the voting population. However, Weber (2014) finds that the addition of one natural gas related job leads to more than one non-natural gas related job in southern counties within the United States, and that these additional jobs did not change the average adult education level of communities. Similarly, Cascio and Narayan (2015) find that an increase in fracking increases the relative demand for low skilled male labor and increased high school dropout rates for men, but little support for fracking resulting in migration of 17 to 18 year old boys. If similar ideas are true for oil related jobs, then it would mitigate concerns about changes in the voting population within school districts.

3 Texas Public School Districts

We begin by outlining characteristics of districts and their funding which make them ideal to study.

3.1 District Independence

In Texas, almost all school districts are independent.[3] This means that districts are separate governing entities encompassing all elementary, middle and high schools within a defined geographic area which are not controlled by a municipality, county or state. Districts are run by elected school boards who have full authority to hire and fire superintendents who have spending authority.[4] This provides heterogeneity in funding and spending both across districts and over time.

[3]http://en.wikipedia.org/wiki/Independent_school_district

[4]Texas teacher unions are some of the weakest in the nation which facilitates heterogeneity of teacher employment outcomes. Texas prohibits collective bargaining across districts and the Texas State level National Education Association and American Federation of Teachers facilitates have the 2nd least resources per teacher in the nation. http://www.edexcellencemedia.net/publications/2012/20121029-How-Strong-Are-US-Teacher-Unions/20121029-Union-Strength-Texas.pdf. As of November 14, 2014.

3.2 District Taxation

All business and residential property within the school district are subject to property taxation. Each year, a property is assessed and a market value is assigned. The district chooses a tax rate and collects a levy which encompasses the districts local funding.

The tax rate is comprised of two individual rates, Maintenance & Operations (M&O) and Interest and Sinking (I&S). M&O rates are subject to state level controls while I&S rates have local flexibility. The combination of the two results in significant heterogeneity across time and districts. Rates are set through votes and both boards and residents can put rate increases or decreases on the ballot. Districts can also control taxation levels by providing homestead exemptions to offset tax increases in times of rising home prices.

In 2006, Texas passed a property tax relief law which was modified in 2009 and 2011. This greatly reduced M&O tax rates and provided a new structure for funding.

3.3 School Funding

Texas district funding is complex and outlined in detail on the Texas Education Agency (TEA) website.[5] We simplify the mechanisms below, including only the elements and features relevant to this study.

Texas law mandates that districts receive equal access to revenue per student, considering all state and local tax revenues after acknowledging student and district cost differences.[6] To determine the level of funding, each district calculates the weighted average daily attendance (WADA) by counting the number of students who show up to school each period. Enrollments are adjusted for several factors including: needs for special education, pregnancy related services, career and technical education, English as a second language, gifted and talented education, public education grants, transportation and military dependents. There are also adjustments made for school size and for some capital expenditures like the creation of new instructional facilities. Based on the districts' WADA, the state determines a funding level for the district.

Figure 1 is from the TEA handbook on school funding and outlines the framework for district funding. The horizontal line–$59.97–is the required level of funding per WADA. The lower boxes are the local share while the higher boxes are the state share. The first district generates very little local revenue so the state fills in the gap. The third district generates too much revenue so the state recaptures funds. The policy of recapturing funds from the

[5] http://tea.texas.gov/Finance_and_Grants/State_Funding/Chapter_41_Wealth_Equalization/Chapter__41_Wealth_Equalization/

[6] Texas Education Code, 42.001(b)

property-rich schools and redistributing to property-poor schools is the Texas Robin Hood plan.

[INSERT FIGURE 1 HERE]

Figure 2 below shows a more complex representation of the tax scheme.

[INSERT FIGURE 2 HERE]

The horizontal axis is the M&O rate after the property tax relief bill of 2006. A district is free to choose any rate above $1.00. Districts choose rates at or below $1.17 because any funds generated above this M&O rate are recaptured. To a certain level up to the first $1.00 a district can keep all its own funds. If a district can not cover its own Tier 1 demand, the state fills in the gap (the rest of the green box). The system allows for districts to set tax rates and keep a portion of local revenues. For example, the first 6 cents of taxation above $1.00 are kept in full by the district. As a result, most districts have at least a tax rate of $1.06. The district keeps a percentage of the next 11 cents. If the Tier I limit is met, the remaining funds are recaptured.

4 Data

4.1 Income Statement Data

Our primary data are district level income statements compiled from the Texas Education Agency. For each district from 2000-2013, the dataset contains a breakdown of the four revenue sources: local, state, federal and other revenue.[7]

Figure 3 provides a snapshot of the revenue side of the income statement for one district year. Available spending for districts to spend is called revenue. Funds collected by the districts are called receipts. The difference is that receipts include equity transfers which are the funds recaptured by the state.[8]

[INSERT FIGURE 3 HERE]

Figure 4 shows the breakdown of expenses from the same income statement. Total expenditures are broken into payroll expenses, other operating expenses, debt services and capital outlays.[9]

[INSERT FIGURE 4 HERE]

[7]Where other revenue is defined as local revenues realized as a result of services rendered to other school districts.

[8]We focus on "All Funds" and not "General Funds" as our interest is in total funding available to the district.

[9]Other operating costs includes all non-payroll operating costs including but not limited to professional and contracted services and supplies and materials.

4.2 Property Tax Data

We compiled school district level property tax data from the Texas Comptroller's office.

[INSERT FIGURE 5 HERE]

In each year, observations are by taxing-unit. Taxing-units are mapped to districts with some aggregation. The key variables are market value, taxable value, maintenance and operations (M&O) rate, interest and sinking fund (I&S) rate, total rate, and levy. Market value is the sum of all assessed property value within the district. This is the primary measure of district wealth. Largely due to caps on tax increases in times of rising prices (homestead exemptions), the entire market value of a property is not taxable, so the relevant tax base is the taxable value. Importantly, we have measures of M&O rates which make up tier 1 funding and I&S rates which fund facilities. The total rate is the weighted sum of both and is used to calculate levies and available local revenue for the district. Levy is the taxable value multiplied by the levy rate. Market value and taxable value are self-reported rates from the comptroller's office and levy is calculated.

Levy is highly correlated with the sum of local revenue plus equity transfer from the income statement data. Data was merged on common district identifiers.[10]

Figure 6 plots the time series of the major variables from the main dataset.

[INSERT FIGURE 6 HERE]

The solid lines (left axis) are the market value and taxable value per student. The dashed lines are the levy, revenue and expenses per student. Texas property values have increased over time. While the growth slowed during the Great Recession, values still increased. The effect of the property tax relief act occurred just before the recession. First, market value and taxable value start to diverge as the increase in owners' taxable bases were limited. Second, most districts lowered base property tax values from 1.5% to 1% as seen in the kink in levy per student. While districts could still raise I&S rates, there was a reduction across the board. Finally, revenue and expenses per student move together until towards the end of the sample when they diverge. This divergence is due to districts greatly increasing their debt issuance so that funding stays the same (proceeds from debt sales are not considered revenue) while expenses (due to debt service payments) increase.

4.3 Teacher Data

Investment proxies for quality come from a third dataset also from TEA. This data contains information on all public school employees for 11 of the 14 years in the sample.[11] At the

[10] In cases where there are multiple observations for one taxing unit, we use taxable value weighted averages for Rate.

[11] Only about half of all public school employees are teachers and most non-teachers are teacher's aides.

district level, we compute total payroll, teacher count, pay per teacher, pay per non-teacher, students per class ratios, percentage of teachers with advanced (Masters or PhD) degrees, average teacher qualities such as experience, tenure and age, the average subjects a single teacher teaches (a proxy for a teacher's ability to focus on one subject), and spending on management such as superintendents and principals.

While these proxies do not directly measure improved student outcomes such as test scores, graduation rates or college admissions, they are reasonable proxies for quality investments. Determining the highest return to investments is outside of the scope of this paper; however, improving along these dimensions are proxies for good management.

4.4 District Characteristics

Our panel consists of 1035 districts.[12] The average district includes 7 schools and enrolls 4310 students. Districts collect \$10,600 per student and spend \$11,200 per student on average. Of that \$10,600, districts collect \$5000 locally and keep \$4000, transfer almost \$1000 and receive almost \$5000 back from the state. Payroll is the largest expense but interest on debt and capital expenditures are also large. We report summary statistics in the rest table of the Appendix.

4.5 Recapture Data

We collect data from the Texas Education Agency on funding recaptured from property-rich districts. We merge this data at the district level with income statement data to verify that recapture correlates highly with equity transfer. Less than 10% of districts have funds recaptured and the amount recaptured is only sizeable for the wealthiest districts.

4.6 Oil Data

We obtained data on all oil wells in the state of Texas from Drilling Info. We only include horizontal wells which result from newer technology and capture more unexpected oil findings and wealth. We map each well to its nearest district based on their latitude and longitude. Then, we sum the total number of active wells in each year for each district. We use the time series of horizontal wells within a district to instrument for district revenue because district revenue might be endogenous.

[12]Most of these districts are in all 14 years of the sample.

5 Empirical Strategy

Our main results investigate the impact of the Robin Hood Plan on tax rates in property-rich districts. That is, we are concerned with how districts change their tax rates in response to having funds recaptured. Because tax rates are endogenous, we instrument district revenue with new oil reserves discovered under hydraulic fracturing. Our main results are presented using two stage least squares estimates. In the first stage, we estimate the impact of new wells, λ, on revenue in district d at time t, while controlling for district and time fixed effects.

$$\text{revenue}_{dt} = \delta + \lambda \text{wells}_{dt} + X_d + \phi_t + \nu_{dt} \tag{1}$$

In the second stage, we estimate the impact of revenue estimated in the first stage on the local tax rate in district d and time t, while controlling for district and time fixed effects. Standard errors are clustered at the district level. Here, we care about the coefficient on $\widehat{\text{revenue}}$, β, which tells how the tax rate changes with revenue.

$$\text{tax rate}_{dt} = \alpha + \beta \widehat{\text{revenue}}_{dt} + X_d + \gamma_t + \epsilon_{dt} \tag{2}$$

This estimation strategy relies on the instrument, wells, being highly correlated with revenue but not impacted by the factors which make revenue endogenous. In the first stage, we establish a strong relationship between revenue and wells (instrument relevance). Since the application of hydraulic fracturing is not related to tax policy, we would expect that the instrument meets the exclusion restriction. We discuss both of these conditions in detail in the results section.

In addition to estimating the impact of revenue on tax rates for the whole sample, we look within the wealthiest districts to understand the local average treatment effect (LATE) on those districts most likely to change their tax rates in response to the Robin Hood Plan.

Finally, we investigate the impact of increased spending under the Robin Hood Plan on poorer districts' spending on proxies for school quality, like smaller class sizes and more educated and experienced teachers. We walk through each approach in turn below.

6 Results

6.1 Strategic Behavior of Property Rich Districts

We provide empirical evidence that property-rich districts strategically minimize recaptured funds under the Robin Hood Plan. These main results are found in Table 1.

[INSERT TABLE 1 HERE]

The variable of interest, funds recaptured, is equal to 1 in years in which a district has funds recaptured and equal to zero otherwise. As shown in Column 1, in years with recapture, districts have tax rates 3 basis points lower compared with those same districts in years with no recapture. Since districts choose rates between 1% and 1.17%, a change of 0.3% is economically large.

In Column 2, we run a logistic regression where the dependent variable is a dummy which equals 1 if the district lowered taxes in the following year. We find that within the top decile of property wealth being a district that has funds recaptured makes you 59% more likely to lower your taxes, controlling for the log of revenue, expenses and enrollment.[13] We restrict the sample to those districts that experience at least one change in recapture status by removing any districts that always have funds recaptured or never have funds recaptured. In Column 3 we run a placebo on past taxation changes in order to rule out tax trends unrelated to recapture.

In Columns 4 and 5 we show the effect of having funds recaptured on districts issuing debt and increasing capital expenditures. Results indicate that districts have almost 60% higher debt expense and 29% higher capital expenditures.[14] This is important because proceeds from debt are not subject to reclamation under the Robin Hood Plan.

All of these regressions are run with district fixed effects. As a result, the variation in the independent variable comes from districts who have some years with recaptured funds and some years without as opposed to districts that never or always have recaptured funds.

We test the results of the tax relief act directly because it could be that much of the variation driving these results is a consequence of districts resetting their taxes. Table 2 uses a difference-in-difference approach to compare wealthy districts who have had funds recaptured prior to the tax law change to districts that have not but are not property-poor (market value deciles 5-10).

[INSERT TABLE 2 HERE]

The important takeaway here is that districts who previously had funds recaptured reduce their tax-rates by over 2 basis points which coincided with a 23% drop in funds recaptured. Consistent with the above results, having funds recaptured before the policy change is consistent with large increases in debt and capital expenditures (80% and 40% respectively). Even with lower tax rates, property rich districts were able to increase revenue, payroll and teacher counts.

[13]Due to rounding in tax rate calculation, a drop has to be at least 1 basis point to be considered material.

[14]We observe debt expense not total debt. This is a reliable proxy for total debt because districts have minimal default risk so rates do not vary. Additionally, property-poor districts likely have a higher default rates than property-rich ones, which could only bias against the results.

6.2 Oil Data as an Instrument for Changing District Wealth

How worried should we be that our results are endogenous? The strategic behavior results could be consistent with other stories. For example, it could be that within districts, the electorate changes over time in a manner that makes it more likely to reduce tax rates and fund new capital expenditures of schools with new debt independent of recapture, while also driving property values up. If this happens simultaneously with the law changes, our results may be upwardly biased. To mitigate these sorts of concerns, we exploit oil shocks which provide exogenous windfalls of funds to schools. While Texas has a long history as an oil producer, new technology has revived older, dry wells. Through hydraulic fracturing, existing wells are horizontally drilled to access new oil reserves. Oil value is directly taxed by school districts. Using latitude and longitude we map active horizontal wells to school districts and use the number of active horizontal wells as an instrument for district revenue.

[INSERT TABLE 3 HERE]

In Table 3, we run a series of two stage least squares (2SLS) regressions where the independent variable of interest is the log of the district's local tax levy instrumented by the log of the number of wells within a district. Column 1 presents the first stage results, showing an increase in horizontal wells increases the local tax levy to school districts. One extra well is associated with an almost 10% increase in revenue collected from a district. This is an increase in $1000 per student for the wealthiest districts in Texas which collect $8000 dollars per student. The first stage F-Test provides evidence that the instrument is highly relevant. Other than through revenue, oil wells should not affect district taxation and debt decisions. Thus, our instrument satisfies the exclusion restriction. We test the results above using this clean source of variation in revenue.

Consistent with our results above, districts with oil windfalls lower their tax rates by 11 basis points. As shown in Columns 3 and 4, these districts have large increases in debt and capital expenditures. Finally, as shown in Columns 6 and 7, while these districts did increase spending, they reduce spending on teachers.

Because our study considers heterogeneity in the cross section of districts, it is essential to think about the local average treatment effect (LATE). We show in Table 4 that our shock affects richer districts much more than poorer districts. With some sub-sample regressions of the first stage, we show that the instrument only has meaning for property-richest districts. This is important because these regressions point to districts behaving strategically and not being capital constrained. However, if the property-poor districts changed their taxation behavior, it would be puzzling since these districts are not subject to recapture.

[INSERT TABLE 4 HERE]

6.3 Are Property-Poor Districts Capital Constrained?

In Figure 7 below, we divide the districts into deciles (market value categories) based on market value per student (1 being the poorest, 10 the richest) redefined annually. We plot the average total revenue and the average total expenses. Revenue is broken into four sources: local, state, federal and other. Expenses are broken into four categories: payroll, other operating, capital expenditures (capex) and debt expense.

[INSERT FIGURE 7 HERE]

[INSERT TABLE 5 HERE]

Figure 7 and Table 5 show that the levy is monotonically increasing in property wealth. The poorest decile collects under $2,000 per student while the wealthiest collect over $18,000 per student. Note that this is in spite of both the tax rate and the implied rate (levy over market value) being monotonically decreasing.[15] Under the Robin Hood Plan, excess local funds are recaptured by the state as equity transfers per student. The majority of districts had no funds recaptured while the wealthiest districts had on average over $8,000 recaptured per year. After recapture, local revenue (levy less recapture) is still monotonically increasing in market value category. In contrast, state revenue per student is monotonically decreasing by market value category with poorest districts receiving substantially more than property wealthy ones.[16] The result is that funding is relatively uniform per student for the bottom five deciles, but still increasing for the top five deciles. Total expenses are highly correlated with total revenue and therefore also increasing with property wealth. This implies that wealth equalization under the Robin Hood Plan reduces but does not eliminate funding heterogeneity. This is the first key finding.

[INSERT TABLE 6 HERE]

Table 6 shows that the funding heterogeneity shown above has material effects. Along the same market value categories, we investigate the impact of funding on four measures considered consistent with school quality. Students per class is defined as the average number of students assigned to each teacher.[17] Percentage of teachers with advanced degrees is defined as the number of teachers with a masters or a PhD divided the number of teachers in a district. Teacher experience is the average number of years a teacher has been working as a teacher (in any district). Finally, pay per teacher is the average total pay (not including benefits) an individual teacher receives. The first three–class size, teacher education and

[15] There are two primary drivers of the implied rate being lower than the statutory one. First, when property values increase, only a portion of the increase is taxable. Second, some districts are more effective at collecting tax than others.

[16] Recapture is sometimes greater and sometimes less than the State Revenue implying that some districts still on net get state funds while others subsidize the state.

[17] This also includes other roles teachers are paid for like coaching.

teacher experience–all increase in quality as property wealth increases. This is the second key finding: property-wealth is positively correlated with proxies for quality. Since property-poor districts may spend money differently because their students have different needs, this might not imply that schools are unequal.

[INSERT TABLE 7 HERE]

In Table 7, we run log on log regressions to isolate investment and revenue sensitivities. We include district fixed effects to understand how districts respond to funding changes and year fixed effects to account for Texas' growth trend throughout the sample. We also cluster standard errors by district. Schools spend more money, hire more teachers at slightly higher pay rates and hire more educated and experienced teachers. Districts also reduce the number of subjects taught by teachers, which could improve efficiency by allowing teachers to specialize. In the last three regressions, we show that schools spend funds in ways that may not be as beneficial to student achievement. Districts increase pay to their superintendents and top administrators and increase athletic spending when they have more revenue to spend.[18]

[INSERT TABLE 8 HERE]

In Table 8, we split results into quintiles and present the top and bottom quintiles using the same market value categories. Property-poor districts and property-rich districts respond to new cash by increasing spending. Poor districts payroll expense is significantly (economically and statistically) more sensitive to new revenue than that of rich districts. Similarly, property-poor districts add more teachers, increase their pay more and have teachers teach less subjects. This provides the third key finding: property-poor districts invest more in measures which proxy for quality.

These three results together provide evidence that poor districts are capital constrained and the strategic behavior by rich districts has real effects. First, in spite of wealth equalization, property-poor districts spend less per student than property-rich districts. Second, property-wealth is associated with higher levels of quality. Finally, property-poor schools' spending is more sensitive to funding shocks along those measures of quality. Together, this is evidence that property-poor schools are capital constrained and would use funding in beneficial ways.

6.4 Threats to Identification and Other Possible Explanations

Booming oil industries do induce migration, which may call into question our estimation strategy if the boom changes the voting behavior in districts. If more childless young men,

[18] We define administrators as superintendents, assistant superintendents, principals, assistant principals, and other non-teachers with similar wage profile.

who may value schools less and be less willing to pay higher property taxes, move into districts as a result of the boom, then the changing voter base might be responsible for changing tax rates, rather than a response to the Robin Hood Plan. This seems plausible as there is documented evidence that oil booms do lead to migration of young men. (See, for example, Ura and McCullough (2016).) If more young men migrated as a result of fracking, then it could create demographic shifts in the voting population.[19] Weber (2014) finds that the addition of one natural gas related job leads to more than one non-natural gas related job in southern counties within the United States, and that these additional jobs did not change the average adult education level of communities. While natural gas is a different industry, we might expect young men to respond similarly in the natural gas and oil industries because the education requirements and job demands would be similar. Taken together, these papers support the idea that district voting behavior is unlikely to change as a result of in migration by young men or changes in educational choices of young men.

While the migration of childless men is a real impact of the boom, we do not believe this is the driver of our results for several reasons. First, we present a joint hypothesis that the strategic behavior leads to a reduction in tax rates and an increase in debt financing to fund capital expenditures. While reducing taxes is consistent with a desire to "gut" schools, an increase in debt financing to build new learning facilities is not. Capital raised via debt could weakly substitute for capital raised through taxes to a taxpayer who does not care about schools, but is not interchangeable to a strategic voter in that while debt financing is tied to the project or building it was raised for, it is treated differently with respect to the Robin Hood act. Only tax receipts are subject to recapture while some of these projects impact the formula that sets the Weighted Average Daily Attendance (WADA) that the Robin Hood Tax system is based on. For instance, building new instructional facilities increases the WADA which is important because it reduces revenue per WADA, and thus your recapture. (See, for example Agency (2019) and Division (2019).) As seen in Table 1, there are districts which are subject to recapture in some years and not others. These are the districts which change their tax rates after recapture, and for which the LATE is identified. This may be a power issue, as there are not many ex-ante property-poor districts that get these cash flow shocks but voters who do not care about schools would support lower taxes regardless whereas strategic voters would care if their funds were likely to be recaptured.

Additionally, while oil booms do cause migrations, they are often temporary. However, net migration into the state of Texas has been growing. (See, for example, DeVore (2017),

[19] Cascio and Narayan (2015) find little support for fracking resulting in migration of 17 to 18 year old boys even though fracking increases the relative demand for low skilled male labor and increased high school dropout rates for men.

Ura and McCullough (2016), McPherson and Wright (2017), and Rice (2018)). Specifically, about 1.4 million people moved to Texas from April 1, 2010 to July 1, 2016 (McPherson and Wright (2017)). The sources of residents varied by county: with large cities receiving most of new residents from out of state and smaller, rural counties receiving most of the new residents from within the state (McPherson and Wright (2017)). However, the majority of Robin Hood revenue comes from wealthier, city schools (Collier (2016)).

Finally, these migrations do not create a political shift in the communities. Small Texas towns were highly conservative prior to any migration and remain so after. In fact, Texas politically is still highly polarized, with cities tending more liberal and rural areas more conservative. (See, for example, Pulliam (2016), Schnurman (2016), and Feldman and Claborn (2018).) In addition, young migrant men often do not update their voter registration, are less likely to vote in local elections, or invest in the local community (own property). In addition, Texas has low rates of voter turnout. (See, for example, Young (2018), Ura and Murphy (2018), Murray (2018), Ramirez (2018), Capps (2016), and of State (2018).)

7 Conclusion

We study how Texas school districts with different wealth levels invest funds. Specifically, we study how both property-rich and property-poor districts respond to a wealth equalization policy (the Robin Hood plan). To address endogeneity, we use the number of horizontal wells within a district to instrument for district tax revenue. We show that an increase in horizontal wells is related to an increase in tax revenue for school districts. In particular, the inception of a single horizontal well is related to a local revenue increase of 10% (an increase of around $1000 per student). Outside of revenue, wells should not affect district tax level, debt, or expenditure decisions.

We find property-rich districts respond strategically to this policy in ways that reduce recaptured funds. Specifically, in the year after having funds recaptured, property-rich districts lower their tax rates thereby reducing recaptured funds and issue debt to fund new capital expenditures, which are not subject to recapture under the Robin Hood Plan. We show that for districts in the top decile there is little relationship between funding and changes in quality whereas in the bottom decile a 10% increase in revenue corresponds with increases in proxies for quality, including a 5% increase in payroll, a 3.5% increase in teacher count, a 0.4% increase in teacher pay, and a 3.5% drop the subjects taught by a single teacher. We conclude the strategic behavior of rich-districts negatively impacts the poorest districts, who invest recaptured funds to become more like property-rich districts.

Our work has two policy implications for public education funding within Texas and more broadly in the United States. First, if districts are capital constrained and can put new funds to good use, governments should strongly consider policies to improve school funding. Second, if funding heterogeneity exists, wealth equalization policies should not create perverse incentives limiting redistribution.

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A Figures

Figure 1: Simple Model of Funding and Recapture

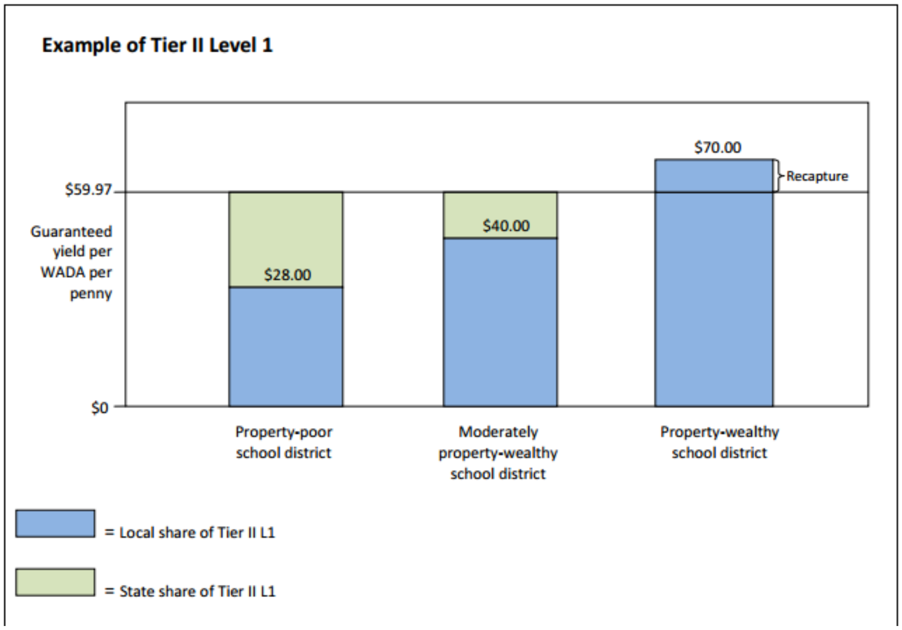

Figure 2: More Detailed Model of Funding and Recapture

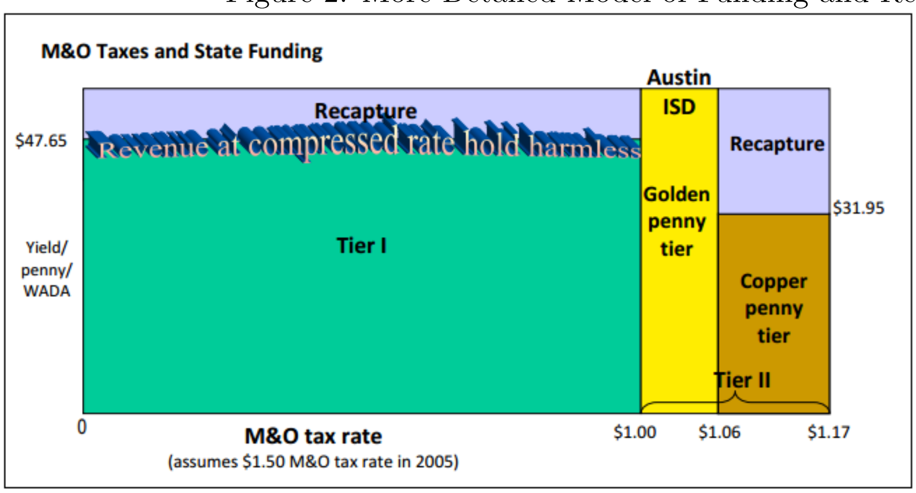

Figure 3: Income Statement–Revenue

			District			
	General Fund	**%**	**Per Student**	**All Funds**	**%**	**Per Student**
Receipts						
Total Revenue	684,182,349	100.00%	7,934	931,639,616	100.00%	10,804
Local Tax	554,155,420	81.00%	6,426	655,957,425	70.41%	7,607
Other Local and Intermediate	6,985,888	1.02%	81	21,067,141	2.26%	244
State*	101,842,960	14.89%	1,181	106,915,944	11.48%	1,240
Federal	21,198,081	3.10%	246	147,699,106	15.85%	1,713
* State Fiscal Stabilization Fund	0	0.00%	0	0	0.00%	0

* This amount represents the amount of Foundation School Program funding that was financed by Federal State Fiscal Stabilization Fund funds distributed under
the American Recovery and Reinvestment Act of 2009. This funding is included in the state category of the total revenue reported above.

Total Receipts	805,963,899	100.00%	9,346	1,169,913,296	100.00%	13,567
Total Revenue	684,182,349	84.89%	7,934	931,639,616	79.63%	10,804
Equity Transfers	120,069,626	14.90%	1,392	120,069,626	10.26%	1,392
Total Other Resources	1,711,924	0.21%	20	118,204,054	10.10%	1,371

Figure 4: Income Statement–Expense

Disbursements						
Total Expenditures						
BY OBJECT	691,680,927	100.00%	8,021	987,772,307	100.00%	11,455
Payroll	590,541,701	85.38%	6,848	690,894,468	69.94%	8,012
Other Operating	99,469,098	14.38%	1,153	149,578,504	15.14%	1,735
Debt Service	812,565	0.12%	9	97,084,073	9.83%	1,126
Capital Outlay	857,563	0.12%	10	50,215,262	5.08%	582

Figure 5: Tax Data

CAD #	CAD Name	Taxing Unit #	Taxing Unit Name	Market Value	Taxable Value	M&O Rate	I&S Rate	Total Rate	Levy
001	Anderson	001-000	Anderson County	3,065,459,421	2,317,821,292	0.458900	0.052100	0.511000	11,841,494
001	Anderson	001-902	Cayuga Independent School District	480,392,005	339,300,459	1.040000	0.000000	1.040000	3,529,896
001	Anderson	001-903	Elkhart Independent School District	304,958,029	183,040,768	1.170000	0.000000	1.170000	2,147,293
001	Anderson	001-904	Frankston Independent School District	360,362,889	264,130,617	1.040000	0.056000	1.096000	2,894,872
001	Anderson	001-906	Neches Independent School District	154,678,869	98,563,369	1.040000	0.278000	1.318000	1,301,450

Figure 6: Time Series of Tax and Income Statement Data

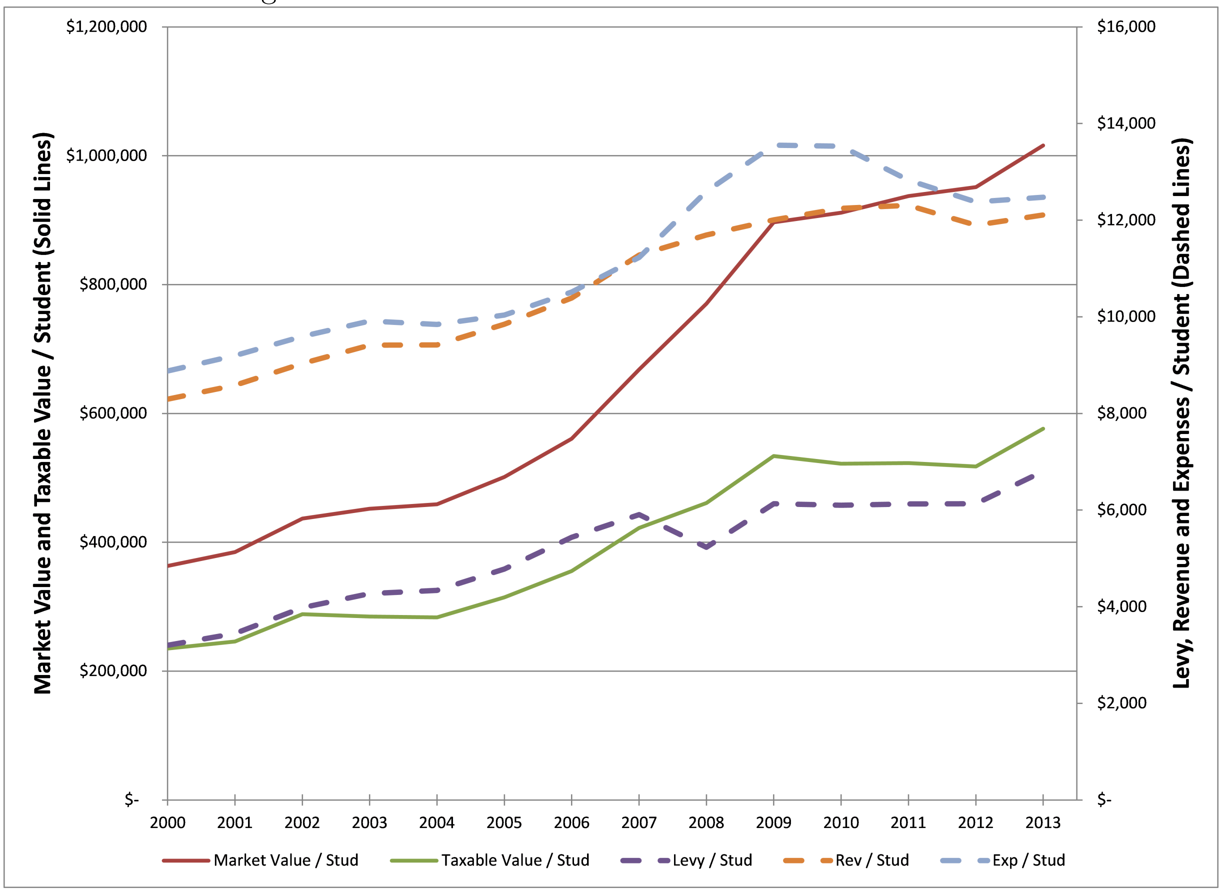

Figure 7: Revenue Sources and Expenses by Market Value Categories

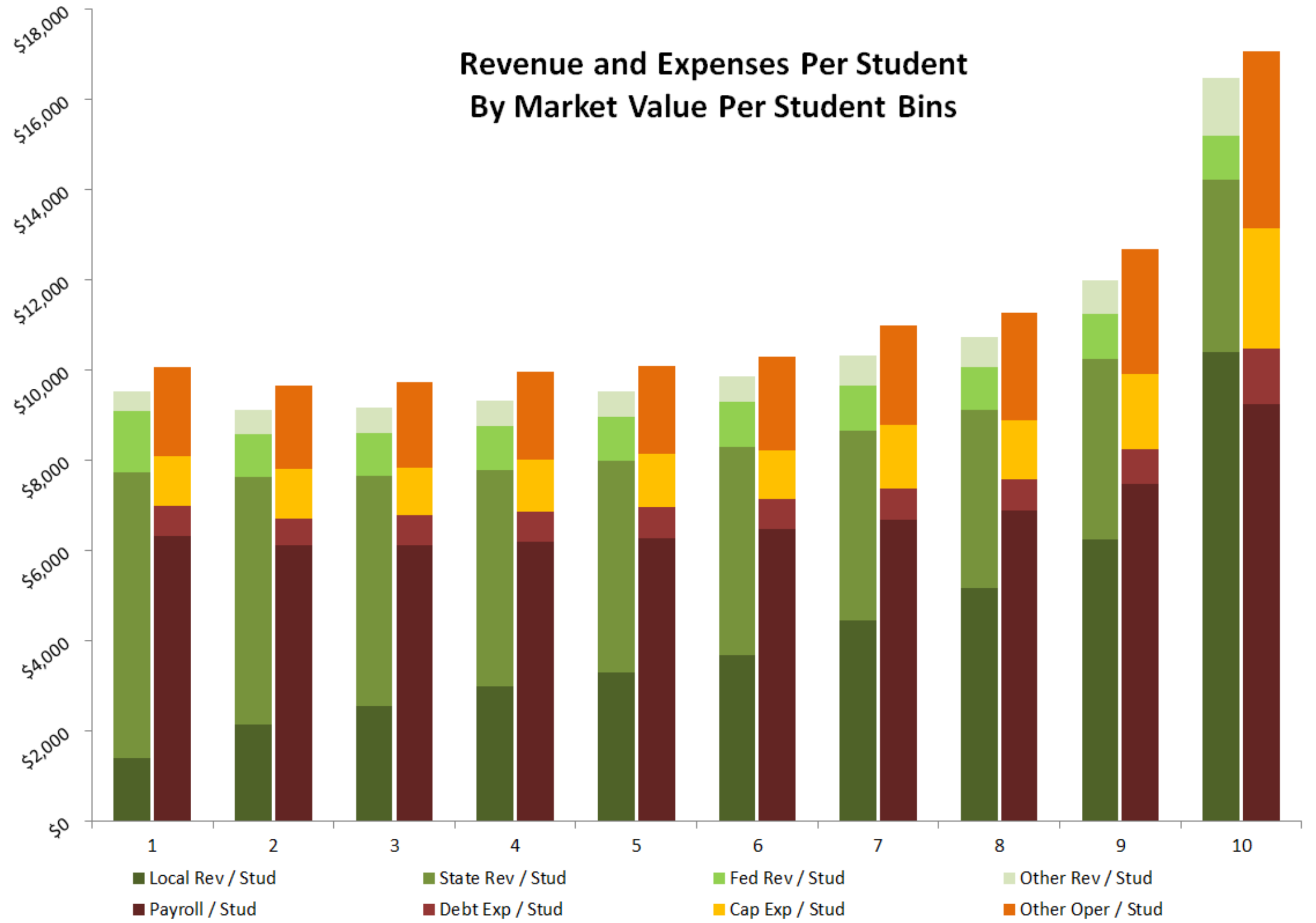

Table 1: Property Rich District Strategic Behavior

	(1)	(2)	(3)	(4)	(5)
	Tax Rate	Lower Tax Rate Next Year	Lower Tax Rate Prev Year	Debt Expense	Capital Expense
District has Funds Recaptured	-0.0317***	1.586*	1.019	0.592**	0.285**
	(-4.392)	(1.846)	(0.0764)	(2.544)	(2.116)
Total Revenue	0.0727***	2.999**	0.170***	5.403***	4.805***
	(3.843)	(2.137)	(-3.735)	(9.451)	(15.55)
Total Expenses	0.0958***	1.334	2.593***		
	(16.30)	(0.591)	(2.987)		
Total Payroll Expenses				-3.962***	-2.420***
				(-6.053)	(-6.100)
Total Other Expenses				-0.470**	0.296*
				(-2.273)	(1.874)
Enrollment	-0.0405**	0.262***	2.067*	0.598	-0.198
	(-2.330)	(-4.615)	(1.805)	(0.957)	(-0.556)
Observations	14,400	712	606	14,400	14,395
R-squared	0.869			0.750	0.562
Market Value Cat	All	10	10	All	All
Rich Change Filter	No	YES	YES	NO	NO

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Regressions include year and district fixed effects. T-statistics are reported in parenthesis. Standard errors are clustered at the district level. Expense, revenue and enrollment variables in logs. Columns (2) and (3) present results from logistic regressions and therefore; odds ratios are displayed.

Table 2: Tax Policy Affect on Strategic Behavior

	(1) Tax Rate	(2) Log Equity Transfer	(3) Log Debt Expense	(4) Log Capital Expense	(5) Log Total Revenue	(6) Log Payroll Expense	(7) Log Teacher Count
Recap Before '06 X Post '06	-0.0231**	-0.235	0.801*	0.483*	0.0595***	0.0432***	0.0269***
	(-2.042)	(-0.595)	(1.834)	(1.666)	(3.465)	(4.822)	(2.870)
Std Log Enrollment	0.0575	0.291	3.179**	3.463**	0.958***	0.738***	0.760***
	(1.282)	(0.197)	(2.042)	(2.120)	(10.84)	(8.593)	(10.23)
Observations	2,464	2,464	2,464	2,463	2,464	2,464	2,458
R-squared	0.939	0.901	0.856	0.666	0.996	0.999	0.999

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Regressions use year and district fixed effects. Standard errors are clustered at the district level. Control group restricted to districts in market value categories 5-10. Robust t-statistics in parentheses.

Table 3: Oil Shock Instrumental Variable Regressions

	(1) Log Levy	(2) Tax Rate	(3) Log Debt Expense	(4) Log Capex	(5) Log Equity Transfer	(6) Log Payroll Expenses	(7) Log Teacher Count
Log(Active Hznt Wells + 1)	0.0963***						
	(7.854)						
Log Levy (Instr.)		-0.110***	4.144***	2.882***	4.080***	-0.0703***	-0.130**
		(-3.223)	(3.791)	(4.549)	(3.476)	(-2.579)	(-2.216)
Std Log Enrollment	0.777***	0.210***	-0.875	0.666	-2.839**	1.157***	1.031***
	(14.41)	(6.241)	(-0.893)	(1.079)	(-2.487)	(23.72)	(15.88)
Std Log Total Students							0.123***
							(9.876)
First Stage F-Test	66.472						
Observations	14,394	14,393	14,393	14,388	14,393	14,393	11,311
R-squared	0.988	0.741	0.037	0.024	0.124	0.815	0.529

***p< 0.01, **p< 0.05, *p< 0.1

Regressions use year and district fixed effects. Standard errors are clustered at the district level. Robust t-statistics in parentheses.

Table 4: Relevance and Local Average Treatment Effect

Dependent: Levy	(1) All	(2) top Quint	(3) 2nd Quint	(4) 3rd Quint	(5) 4th Quint	(6) bot Quint	(7) All
Active Wells in District + 1	0.0963***	0.124***	0.0248*	0.0266**	0.0180	0.00513	0.167***
	(8.153)	(6.192)	(1.879)	(2.123)	(1.612)	(0.252)	(9.574)
wellcat1							-0.217***
							(-6.643)
wellcat2							-0.164***
							(-8.158)
wellcat3							-0.129***
							(-6.423)
wellcat4							-0.103***
							(-5.171)
Std Log Enrollment	0.777***	0.552***	1.117***	1.498***	1.473***	1.208***	0.783***
	(14.96)	(4.976)	(10.81)	(15.04)	(14.68)	(9.329)	(14.86)
Observations	14,393	2,845	2,842	2,825	2,833	2,864	14,393
R-squared	0.988	0.981	0.994	0.997	0.997	0.995	0.988

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Variables are in logs. Regressions use year and district fixed effects.

Standard errors are clustered at the district level. Robust t-statistics in parentheses.

Table 5: Local Funding Varies with Wealth

Market Value Bin	Market Value / Stud	Rate	Implied Rate	Levy / Stud	Equity Transfer / Stud	Local Rev / Stud	Total Rev / Stud	Total Exp / Stud
1	143,045	1.43%	0.98%	1,377	0	1,402	9,529	10,069
2	222,016	1.43%	0.97%	2,137	-	2,153	9,114	9,644
3	268,676	1.42%	0.95%	2,516	-	2,544	9,171	9,720
4	315,796	1.42%	0.95%	2,945	0	2,980	9,318	9,953
5	369,279	1.42%	0.91%	3,259	3	3,294	9,528	10,101
6	434,946	1.39%	0.87%	3,634	9	3,675	9,862	10,304
7	532,839	1.39%	0.87%	4,461	68	4,450	10,313	10,991
8	694,801	1.36%	0.82%	5,437	313	5,174	10,739	11,267
9	1,030,000	1.34%	0.76%	7,222	1,060	6,245	11,993	12,684
10	2,639,000	1.27%	0.78%	18,383	8,149	10,395	16,476	17,063
Mean	663,968	1.39%	0.89%	5,130	957	4,228	10,602	11,177
Stand Dev	1,126,015	0.21%		7,308	4,923	3,501	4,037	4,916

Table 6: Material Effects of Wealth Disparity

Market Value Bin	Payroll Per Student	Students / Class	Pay Per Teacher	% Teachers With Adv Degrees	Teacher Experience
1	6,326	14.86	39,436	16.0%	11.5
2	6,113	14.07	38,556	16.8%	12.2
3	6,120	14.09	38,622	17.4%	12.3
4	6,192	14.06	38,672	17.9%	12.4
5	6,277	13.73	38,462	17.7%	12.5
6	6,485	13.19	38,410	17.6%	12.5
7	6,677	12.89	38,618	18.1%	12.5
8	6,889	12.18	38,349	17.2%	12.9
9	7,476	11.45	38,277	17.1%	13.0
10	9,234	9.43	38,649	18.3%	13.5
Mean	6,778	13	38,606	17.4%	12.5
Stand Dev	1,878	4,037	4,646	8.6%	2.5

Table 7: Schools Invest to Improve "Quality"

	(1)	(2)	(3)	(4)	(5)	(6)
	Payroll Expense	Teacher Count	Avg Teacher Pay	% Teachers with Adv Degrees	Avg Subjects Taught	Students / Class
Total Revenue	0.295***	0.170***	0.0442***	0.105**	-0.0768***	-0.0685***
	(10.68)	(7.668)	(6.226)	(2.334)	(-3.206)	(-3.036)
Teacher Exp			0.0618***	0.332***	-0.0465**	0.0436
			(6.085)	(5.859)	(-2.164)	(1.397)
Teacher Age			0.116***	0.809***	-0.123	-0.207**
			(4.164)	(4.699)	(-1.500)	(-2.286)
Teacher Tenure			0.0108*	0.00160	0.0786***	0.0385**
			(1.654)	(0.0458)	(5.811)	(2.224)
Total Students	0.0482***	0.106***	-0.00778	0.0133	0.967***	0.381***
	(5.607)	(10.54)	(-1.164)	(0.372)	(27.28)	(11.31)
Enrollment	0.687***	0.750***	0.0617***	0.0454	-0.777***	0.0911
	(11.37)	(16.31)	(3.642)	(0.426)	(-15.30)	(1.601)
Observations	11,318	11,318	11,312	11,009	11,312	11,312
R-squared	0.998	0.998	0.901	0.705	0.824	0.808

***p< 0.01, **p< 0.05, *p< 0.1

Variables are in logs. Regressions use year and district fixed effects.

Standard errors are clustered at the district level. Robust t-statistics in parentheses.

Table 8: Effects Stronger in Property-Poor Districts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Log Expenses		Log Payroll		Log Teacher Count		Average Teacher Pay		Average Subjects Taught	
	Poor	Rich	Poor	Rich	Poor	Rich	Poor	Rich	Poor	Rich
Total Revenue	0.652***	0.610***	0.510***	0.0915***	0.353***	0.0462	0.0430***	0.0260	-0.391***	0.00268
	(6.164)	(7.542)	(4.194)	(2.775)	(4.269)	(1.167)	(2.792)	(1.534)	(-5.183)	(0.0739)
Teacher Exp							0.0316	0.109***	-0.114*	-0.0673
							(1.566)	(3.694)	(-1.655)	(-0.997)
Teacher Age							0.125	0.0760	0.200	-0.0517
							(1.559)	(0.851)	(0.785)	(-0.209)
Teacher Tenure							0.0371***	0.00927	0.106*	0.0886**
							(3.027)	(0.749)	(1.960)	(2.447)
Total Students	0.0500	0.0452	0.0457**	0.0117	0.0513**	0.115***	-0.00460	-0.0433*	1.400***	0.808***
	(1.191)	(0.515)	(2.289)	(0.652)	(2.572)	(3.996)	(-0.417)	(-1.665)	(16.79)	(6.872)
Enrollment	0.345**	0.237**	0.624***	0.469***	0.806***	0.570***	0.0230	0.0195	-0.305*	-0.862***
	(2.078)	(2.106)	(4.428)	(4.633)	(7.039)	(5.461)	(0.445)	(0.628)	(-1.749)	(-6.847)

***p< 0.01, **p< 0.05, *p< 0.1

Variables in logs. Regressions use year and district fixed effects. Standard errors are clustered at the district level. Robust t-statistics in parentheses. Rich and poor defined as top and bottom decile market value decile annually.