Asymmetry in Local Government Responses in Growing vs. Shrinking Counties: The Case of Education Finance[a]

Abstract

Spending for k-12 education in the United States increased by more than 220% between 1972 and 2012, faster than can be explained by population growth (a 48% increase), growth in median household income (a 32% increase), or changes in other economic, demographic, and institutional variables. Importantly, school spending nearly doubled in places that experienced ongoing population decline. In this paper, analysis reveals asymmetric responses in school spending to changes in school age population growing and shrinking counties. This research increases understanding of why education spending tends not to shrink in the face of ongoing declines in school age population, a situation that exists in about 25% of counties.

Key Words: Education finance; asymmetry, declining; growing

JEL Code: H71

1. Introduction

Between 1972 and 2012 spending for k-12 education in the United States (US) grew by 220%, much faster than can be accounted for by changes in income and demographics. Over the past several decades numerous researchers have sought to explain the underlying factors that drive the growth of government in industrialized countries. Berry, et al. (2012) conducted a detailed empirical analysis of US local government spending growth over the 1962-2002 period using data aggregated to the county level. The authors demonstrated that economic, demographic, and institutional factors explain a significant portion of growth. Despite this, their evaluation reveals that these factors do not fully explain growth in government over this period. In this sense, Berry, *et al.* (2012) is similar to earlier empirical studies in that the typical socio-economic variables motivated by models of government (Median Voter—Bowen and Black, 1957; Leviathan—Brennan and Buchanan, 1980) as well as other considerations do not fully explain the US local government growth experience. Interestingly, Berry, *et al*. (2012) also show that the unexplained growth phenomenon exists even in places experiencing population decline.

The purpose of this paper is to offer an examination of the US local government growth experience with a focus on k-12 education finances over the 1972-2012 period, where I test for potential asymmetries in how education spending is influenced by changes in population and school age population in counties where population is shrinking, stable, and growing. As a prelude to the full analysis, I find significant asymmetries in how education spending responds to changes in the proportion of school age children in the population, while controlling for a range of economic, demographic and institutional factors. Education spending in growing places is much more responsive to changes in school age population than in shrinking places. That is, spending tends to increase rapidly with growth in school age population, but is unresponsive to

decreases in school age population. The evaluation offers insight for both urban core and rural places experiencing long-term chronic decline, where local leaders must make difficult choices in maintaining quality educational services affordably.

The next section offers a review of the most relevant literature on the growth of government with a focus on education finance. Section 3 discusses the data and empirical approach used in this evaluation. Section 4 presents the empirical analysis and findings, and section five concludes.

2. Literature Review

In this section, I offer a review of research on the growth of government, emphasizing the experience of local governments in the United States. I also discuss several of the most relevant articles from the education finance literature. I conclude the section by offering a summary of two primary explanations for why we might observe asymmetric responses to population change in growing and shrinking places: 1) wages and employment tend to be unresponsive to the downward pressures associated with population decline; and 2) upward pressure by bureaucrats to increase spending during periods of growth and resistance to budget reductions during periods of decline. Consider first the literature on local government growth.

2.1 Growth in Local Government

Economists often frame the demand for government services in the context of the median voter model. Starting with Bowen (1943) and Black (1958), economists asserted that a community's choice of public services under majority rule depends on the median of the individual demands: Under restrictive conditions, majority rule generates a political equilibrium that reflects the preferences of the median voter. This general framework was used by

Borcherding and Deacon (1972), Bergstrom and Goodman (1973), and many others to demonstrate that a jurisdiction's demand for public services depends upon the income of the median voter, the median (tax) price of the public good, and the preferences of the median voter, as well as other variables that capture the demand side of the political process. A wide range of empirical research has usefully applied the median voter model to examine government spending levels and priorities. Changing community economic and demographic forces ought to play a primary role in changing government spending levels and priorities.

The present work follows this general line of thinking by considering a number of socio-economic and demographic variables in an effort to explain education revenue/expenditure growth, including median household income, household income in the top 10^{th} percentile, poverty rate, the proportion of adults with a BA degree, county population, the share of county households with a single female head, the share of county population over the age of 65 and under 18, and the share of county population that is white/Caucasian. Rising median incomes as well as the rising incomes of the top 10% of income earners and higher levels of education may lead to greater demand for educational services, and vice versa. Increasing single female-headed households are expected to reduce education spending. Population change, as well as the share of the population under the age of 18, is expected to be positively related to education spending, whereas the share of the population over the age of 65 is expected to be negatively related to education spending. I have no *a priori* expectation regarding the how the share of the population that is Caucasian is related to spending.

Brennan and Buchanan (1980) offer another framework for thinking about growth of government that is worthy of consideration. According to Brennan and Buchanan (2012), government may have "leviathan" powers, and thus citizens call for legal constraints to limit

government power to tax and issue debt.[1] Since the 1970s, legislative and referenda processes have been used extensively across the states to enact new limitations on local governments' ability to tax and spend.[2] It is, therefore, important to include explanatory variables that characterize the imposition of newly imposed constraints on local government spending. However, as noted by Blankenau and Skidmore (2002), the imposition of tax and expenditure limits (TEL) often coincides with school finance reform (SFR), which significantly reduced local control over education spending and increased reliance on intergovernmental transfers. In fact, a number of new TELs on schools were imposed with the specific purpose of reducing local control over education taxes and spending. Taking these developments into consideration, I incorporate information on TELs as well changes in school finance that occurred during the period of analysis. Public sector employees may also seek to increase bargaining power over citizens and thus create "leviathan" powers through the support of strong public sector unions. To counteract such pressures, a number of states have enacted "Right to Work" (RTW) laws, which weaken the negotiating power of public sector unions; state and local government employees are not required to pay union dues in RTW states (Reed 2003). As discussed in more detail in the next section, I control for these three institutional features as well as changes in the number of school districts when analyzing the growth of k-12 revenues and spending. While this body of research informs the types of variable that help to explain government growth, it does not offer context for assessing the asymmetry issue, which is the focus of the present paper.

Of particular interest is the idea that the responsiveness of local government spending may differ in shrinking places relative to growing places. Berry, et al. (2012) have documented the tendency for local governments to grow, even when population is in decline. Further, there

[1] See Mueller, chapter 21 (2003) and Oates (1989) for more detailed discussions.
[2] See Skidmore (1999) for a review of the literature on TELs.

are numerous cases across the country in which this tendency has resulted in dire fiscal conditions. The goal of the present research is to improve understanding of this asymmetry: Why is it that shrinking places often fail to correspondingly reduce the size and scope of government? One possible explanation is proposed by Niskanen (1975): Bureaucrats seek to maximize their own personal benefits by seeking ever-larger budgets. In this context, bureaucrats may place upward pressure to increase spending during periods of growth, and to resist budget reductions during periods of decline. Baumal's "cost disease" (1993) may also be a contributing factor in driving the costs of education services higher, even in shrinking places.

The present research expands our understanding of this phenomenon by: 1) Considering a wide array of socioeconomic factors within the long-term 1972-2012 timeframe, with a focus on changes in population and school age population, 2) examining the growth of five education revenues and expenditure categories, and 3) using a flexible empirical specification that allows coefficient estimates on total population and school age population to differ across shrinking, stable, and growing counties. Before turning to the data and empirical analysis, it important to consider the several elements of the more specific literature on education finance.

2.2 Education Finance

The discussion here focuses on two aspects of an expansive education finance literature: 1) Effects of changing demographic factors on education spending, and 2) the effects of changing institutions such as tax and expenditure limits and school finance reform on education spending. While it is beyond the scope of this paper to offer a comprehensive review of this large literature, I discuss a subset of research that is most relevant to the present work.

Several articles examine the implications of changing the demographic make-up of communities on education spending. [3] For example, Harris, et al. (2001) consider the role of the changing age structure of the population in education spending. Using a panel of public school districts, they find that an increasing proportion of the elderly have modest negative effects on local education spending. Epple, Romano, and Sieg (2012), Figlio and Fletcher (2011) also examined the role of demographic change in school spending. Epple, et al. (2012) focus on intergenerational conflict, emphasizing the importance of the older generation's mobility. Figlio and Fletcher (2011) also consider the role of the growing elderly population in school spending, finding that increases in the number of the elderly aging in place is associated with reduced education spending. The majority of studies such as these focus on the impact of an aging population on education spending, though they consider other changing demographic trends as well.

Imazeki and Reschovsky (2003) discuss the challenges of financing education in rural areas, given the small size and often shrinking populations in rural school districts. They estimate cost functions across rural and non-rural places in Wisconsin and Texas, concluding that, though the cost structures are similar across rural and non-rural school districts, small district size, high poverty rate, and a high burden of special needs all lead to higher costs in many rural areas. Finally, Corcoran and Evans (2010) consider the role of income inequality in the support of public education, finding that 12% to 22% of the increase in school spending over the 1970-2000 period was attributable to rising income inequality.

There is also a large literature on how changing institutions affect education spending. First, there is a body of research on how the "tax revolt" and the emergence of new limitations

[3] See, for example, Poterba (1998), Harris, Evans, and Schwab (2001), Ladd and Murray (2001), and Grob and Wolter (2007).

on local government tax and spending powers beginning in the 1970s affected education spending. Much of this literature is summarized in the aforementioned article by Blankenau and Skidmore (2002), as well as Mullins and Wallin (2004).[4] While there is a significant challenge in identifying causal relationships between the imposition of tax and expenditure limitations (TELs) and changes in education spending, research generally supports the idea that the imposition of new TELs on local governments corresponds with reductions in local broad-based taxes (property taxation) and increased reliance on state aid, as well as other types of revenue such as user charges.

Beginning in the 1970s, the majority of states experienced legal challenges to their school finance systems on the basis that inequities in funding violated state constitutions. Beginning with a major ruling in California (*Serranno v. Priest*, 1971 and 1976), a series of court rulings across the nation regarding equity in school finance led to significant changes in school funding. The primary goal of the rulings was to reduce disparities in funding per pupil across school districts. Generally, existing research concludes that school finance reforms (SFR) led to reductions in reliance on local property taxes, and to increased reliance on state government resources in funding local schools.[5] In addition, researchers such as Evans, Murray, and Schwab (1998) show that SFR significantly reduced disparities in per pupil spending across school districts. However, as noted by Yinger (2004) and Hoxby (1998) the nature of reforms and their impacts differ greatly across the states. Researchers such as Fahy (2008) also examined the role of education finance reform in determining education spending in particular states. Fahy (2008)

[4] Kenyon (2008) offers an excellent discussion of the interrelationships between, and evolution of, property taxes and school finance.
[5] See Yinger (2004) for an excellent summary of the impacts of school finance reforms across the nation.

considered the role of state aid in improving equity across schools, finding limited overall effectiveness.

Within the context of the changing landscape of education finance, a relevant and open question is the degree to which changes in education spending affected school performance and longer-term student outcomes. The recent works of Jackson, Johnson, Persico (2016), Hyman (2017), and Lafortune, Rothstein, Schanzenbach (2018) offer compelling evidence using exogenous variation in school spending to show significant positive effects on student outcomes. Increases in school spending appear to result in significant improvements in student outcomes. With school finance reforms, increases in education spending tended to occur in lower spending school districts, and was the result of state level redistribution of resources. This discussion may be of particular relevance to the present paper in that shrinking rural counties have increased stressors associated with maintaining public service levels such as education—one policy option that may help to avert negative educational outcomes in declining places is to ensure an adequate level of school spending from higher levels of government.

With the exceptions of Berry, et al. (2012) and Das and Skidmore (2018), researchers have not considered potential asymmetry in local government spending across growing and shrinking places. Nevertheless, there is a rationale for the idea that we ought to observe asymmetries. My primary hypothesis is that education spending is less responsive to declines in school-age population than to school-age population growth. When overall and school age population is growing, both operating and capital spending increase in order to meet increased demand for educational services. However, when overall and school-age population (and thus the demand for educational services) is in decline, operational spending, such as labor costs, may become unresponsive as the number of households and students shrink. Further, capital

maintenance costs cannot easily be cut without risking depreciation/neglect. There may also be other types of inertia that limit cuts to spending in shrinking places. For example, wages are sticky downward, and eliminating excess labor is often difficult. Baumal's cost disease framework suggests that increasing costs on educational service provision, even in shrinking places. Further, the work of Niskanen (1975) suggests that bureaucrats would push for spending increases during periods of growth, but resist cuts during periods of decline. Thus, the responsiveness of education spending to population change in shrinking places is likely to be less than in growing places. For similar reasons, asymmetry is also expected with changes in the overall population. For these reasons, I hypothesize that the analysis will demonstrate asymmetry in responses to changes in population and school-age population in places that are expanding versus places that are in decline. While the empirical analysis does not explicitly measure the degree to which the aforementioned factors are driving the asymmetry, it is able to document the degree to which asymmetry is present, which offers a significant contribution of our understanding of this phenomena.

3. Data and Empirical Approach

Data on local government education revenues and expenditures come from the United States Census of Governments. Local school fiscal data from independent school districts are aggregated to the county level.[6] In total, 2,752 counties are included in the analysis. The data are

[6] School districts sometimes overlap multiple counties, and multiple school districts are often found within a single county. Regarding school districts that overlap multiple counties, the Census of Governments makes no attempt to pro-rate the data based on government boundaries. Instead, data for a school district is assigned to the county where it is headquartered. Due to the nature of the data collected from The Historical Finance Data Base of Individual Local Governments, only independent school districts are included in the analysis; these are a type of school district that operates as an independent entity separate from county, municipality, township, special district, and state governments. They possess their own taxing authority and provide local government finance data separate from other government types. Therefore, we are unable to separate dependent school district revenue and expenditures, especially intergovernmental revenues to schools in counties and municipalities that have direct authority over

available in five-year intervals (1972, 1977, 1982, 1987, 1992, 1997, 2002, 2007, and 2012. To examine asymmetry in the impacts of the explanatory variables on education revenues and expenditures, I create three indicator variables: The variable Shrink identifies counties with declining population over the 1972-2012 period (about 24% of counties); the variable Stable identifies all counties that had between -5% and +5% growth over the period (10% of counties), and the variable Grow identifies counties with positive population growth greater than 5% over the period (66% of counties).[7] These indicator variables are then interacted with the population and school age population variables . A limitation of using county level data is that the analysis is unable to capture intra-county variation in education spending across school districts. Further, we are not able to capture factors such as the advent of charter schools and school choice on school spending; researchers such as Buerger and Bifulco (2019) and other have shown the introduction of charter schools and school choice to have meaningful effects on both student composition and costs; controlling or county trends in the first-difference specification should help to address potential omitted factors. An advantage of the county level data, however, is that the examination is nationwide, and is conducted over a long period of time. Further, we are able to include a wide range of explanatory variables not available if one were to use school district level data. Last, although we could potentially define growing, stable, and shrinking over shorter periods, my primary objective is to examine the long-term responses to growth vs. decline. There are trade-offs in decisions to use certain types of data and periods of analyses; despite the inherent limitations of county level data, the analysis offers new insights into the dynamics of school spending across space and over time.

school districts. In total 291 counties with dependent school districts, many of which are in Virginia, Tennessee, and North Carolina are not included in the analysis, nor are dependent school districts that can be found within counties that predominantly have independent school districts.

[7] Eleven counties were omitted because their data were missing for some of the years included in the analysis.

The logarithmic specifications are based on the following equation:

$$\Delta Rev_{itj} = Shrink * \Delta Pop_{it}\alpha_1 + Stable * \Delta Pop_{it}\alpha_2 + Grow * \Delta Pop_{it}\alpha_3 + Shrink * \Delta SchoolAge_{it}\alpha_4 + Stable * \Delta SchoolAge_{it}\alpha_5 + Grow * \Delta SchoolAge_{it}\alpha_5 + \Delta Dem_{it}\beta_1 + \Delta Econ_{it}\beta_2 + \Delta Inst_{it}\beta_3 + c_i + t_t + e_{it} \quad (1)$$

where Δ***Rev*** represents the change in the natural logarithm of the education revenue (or expenditure) for county i between periods t and t-1 for revenue (expenditure) category j, Δ***Pop*** represents changes in the natural logarithm of population, Δ***SchoolAge*** represents changes in the proportion of school age population, Δ***Dem*** represents a vector of other demographic variables that include the percentage of households headed by a single female, the percentage of the population over the age of 65, and percentage of the population that is white, Δ***Econ*** represents a vector of economic variables that include the change in natural logarithm of median household income, the change in the natural logarithm of the income of the top 10% of households, and the change in the poverty rate, and Δ***Inst*** is a vector of institutional variables which includes variables that indicate change in RTW status, the change in the number of tax and expenditure limitations (TEL), the change in number of school finance reform efforts (SFR), and the change in the number of school districts.[8] t is vector of time indicator variables, and c represents a vector of county fixed effects, which accounts for unobserved community trends that have effects on education spending. This is a first-difference specification that controls for county-specific trends with county fixed effects as well as overall national trends with time indicator variables. Data sources and definitions are provided in Appendix Table A. Summary statistics for all explanatory variables are presented in Tables 1 and 2 for declining and growing counties

[8] Caution is warranted in the interpretation of the coefficients on the TEL, SFR, and RTW variables because policy changes such as these are potentially endogenously determined. Unfortunately, identifying valid instruments within a panel data framework is challenging. TEL, SFR, and RTW are included in the analysis primarily as control variables because previous research demostrates their importance in determining the education spending growth.

respectively. Tables 3 and 4 present summary statistics of the education finance variables for shrinking and growing counties.

Note that, because this is a first-difference estimation, the coefficient estimates are formed by the within-county variation in the independent variables. Thus, it is the within-county changes in the independent variables upon which the coefficients are generated. In the case of the institutional variables, the coefficients are being estimated by the changes in the status of the institutions; over this long period of time we have many changes in RTW, TEL, SFR, and the number of school districts across the states. It should also be recognized that the nature of TELs and SFR differ considerably from state to state. Amiel, et al. (2009) and Mullins and Wallin (2004) catalog TELs and the major characteristics that define them for all states over time. The approach I use is to identify every new TEL that is imposed on schools in every state. While I identify every change in the status to TELs over time, this measure does not capture the various TEL characteristics, and thus measures the average effect of TELs on school revenue and spending growth. I also include the variable "State TEL", which again measures every new TEL on state government that is imposed in each state. To clarify, two TEL variables are included in the analysis: State TEL and School TEL. Similarly, the SFR variable includes every court-ordered and legislative change in SFR status, but it does not capture the important differences across states in SFR characteristics as cataloged by researchers such as Yinger (2004) and Hoxby (2001). This variable also measures the average effect of SFR across the states and over time. Note that these variables are primarily used as controls, though the estimates may reveal useful interesting coefficient estimates.

To assess the differences in the effects of the population and school age population variables on the dependent variables, I interact each variable with the Shrink, Stable, and Grow

indicator variables. More specifically, Shrink is an indicator equal to 1 if the county experienced population decline of more than -5% over the period of analysis and zero otherwise. Stable is an indicator variable equal to 1 if population change was between -5% and +5% over the period, and zero otherwise. Grow is an indicator equal to 1 if the county experienced positive population growth of more than 5% over the period of analysis, and zero otherwise. With this framework, one can determine whether the coefficients for population and school age population differ across shrinking, stable, and growing counties. The regression estimates use a technique in which the standard errors are clustered at the county level to address both temporal autocorrelation and cross-sectional correlation.[9] Education expenditure/revenue categories included in j are: Total education expenditure/revenue from all overlying jurisdictions (Table 5, column 1), own source revenues (Table 5, column 2), intergovernmental transfers from state and federal governments (Table 5, columns 3), expenditure on current operations (Table 5, column 4), and expenditures on capital outlays (Table 5, column 5). These regressions enable one to see how the changing population and school age population education finances differ across shrinking, stable, and growing counties, while controlling for a wide range of economic, demographic, and institutional factors.

Before turning to the econometric analysis, consider Figures 1 and 2, which illustrate trends over time in per-capita local government revenue, own-source revenue, intergovernmental transfers, median household income, population, and school age population. From the graphs it is clear that median household income grew more slowly across both growing and shrinking counties than did education revenues/expenditures. In 2002 median household income began to fall in both growing and shrinking counties. Growth in education spending slowed greatly

[9] The Stata procedure for panel corrected standard errors is used.

between 2007 and 2012 across the nation. Finally, population declined in shrinking counties, but grew elsewhere. Figure 3 offers a map of population change in shrinking, stable, and growing counties. As one might expect, many of the shrinking counties are found in the rural mid-section of the country, whereas the growing counties are in the south and along the coasts. However, with the exception of California, Florida, Utah and a few of the small east coast states, shrinking counties exist in every state across the nation. Note that most shrinking counties experienced growth in education revenues and expenditures despite experiencing reductions in population and school age population, and only modest growth in median income over the period. This descriptive summary information provides context for understanding the estimates generated from the regression analysis, which is discussed next.

4. Empirical Analysis

Before considering the regression results, some caution is warranted in assigning causality to the coefficient estimates due to potential endogeniety of the regressors. Changes in school spending could very well lead to changes in population and school age population, or the imposition of new fiscal rules. For reference, in specifications not presented but available upon request, I estimated regressions similar to those presented except population and school age population were introduced as lagged terms. These estimates are similar to those presented in the paper. In sum,the evaluation offers a useful and informative evaluation of important trends across shrinking, stable, and growing counties. Consider the estimates presented in Table 5, which include regressions for total education revenues/expenditures (column 1), intergovernmental revenue (column 2), own source revenue (column 3), operating expenditures (column 4), and capital expenditure (column 5). The regressions explain between 4% and 25% of the variation in

the regressions. Note that a low adjusted R^2 is not uncommon in this type of regression model. The data are first differenced and then estimated using the fixed effects technique so that average growth (decline) in each county is captured with the county fixed effects. The variables in the regressions capture the remaining variation in growth (decline), and thus the low adjusted R^2. An advantage of this approach is that it offers very robust coefficient estimates that are unlikely to be biased by omitted factors or spurious correlations.

In the total education revenue/expenditure regression, the coefficient on population is similar for shrinking, stable, and growing counties, and this is generally true in the intergovernmental revenue, own-source revenue, operating expenditures, and capital expenditure regressions. This finding suggests that revenues and expenditures are not responding differentially to changes in population across shrinking, stable, and growing counties. However, we observe significant differentials across shrinking, stable, and growing places in response to changes in school age population. Total revenue/expenditure is very responsive to changes in school population within stable and growing places, but is unresponsive in shrinking places. The drivers of this result appear to be own-source revenues and capital spending. In these regressions, own-source revenue and capital spending appear to increase when school age population declines. The negative coefficient on school age population for shrinking counties in the own-source regression is counter balanced by the positive coefficient (though not statistically significant) on the same variable in the intergovernmental revenue regression. These findings confirm the hypothesis that there is significant asymmetry in responses to changes in school age population in shrinking vs. stable and growing counties. The findings regarding the school-aged proportion of the population are consistent with the *a priori* expectations.

Consider coefficients on the control variables. In general, increases in median income correspond with increases in education spending. However, this result appears to be driven by associated increases in intergovernmental transfers. Growth in the income of the top 10% also drives spending increases, but here it seems to be the result of increased own source or local spending. Controlling for income neither increases poverty nor the percent of adults with at least a college degree are significant determinants of education spending. However, increases in the number of female-headed households and the elderly are associated with reductions in spending. Turning to the institutional variables, the adoption of right-to-work laws is associated with reduced spending. TELs imposed on state governments reduce intergovernmental transfers to schools, but lead to increased own-source spending; however, the net effect on education spending is negative. On the other hand, new TELs imposed on school districts reduce own-source spending but are associated with increases in intergovernmental transfers. The net effect on total education spending is negligible. School finance reforms lead to increases in intergovernmental transfers and reductions in own-source spending, but the net effect on overall spending is positive. Again, I stress that researchers such as Hoxby (2001) have shown significant differential effects depending on the nature of the reforms; our evaluation only offers an estimate of the average effect. Finally, changes in the number of school districts are positively associated with changes in spending.

The findings presented in the paper are robust to alternative specifications and estimation methods. In the reported estimations, the Shrink, Stable, and Grow variables are not time varying, rather they are based on population change over the entire period of analysis. In estimations that are available upon request, Shrink, Stable, and Grow are allowed to vary over Census periods; these estimates are similar to those presented and are therefore not discussed

further. I also considered estimates in which there were three separate categories of counties—shrinking, moderate growth, and high growth. These estimates are consistent with those presented. In terms of estimation methods, in addition to the first-difference specification—with the added county indicator variables to control for county specific growth trends—I also estimated a straight first-difference specification as well as a two-way fixed effects specification with county-specific time trends. These regressions are generally consistent with the primary estimates discussed here. For reference, I report the two-way fixed effects regressions with county-specific time trends in Appendix B. The estimates generated from the other approaches are available from the author upon request.

5. Implications and Conclusions

This study offers an examination of the growth of K-12 education revenues and spending over the 1972-2012 period using detailed fiscal data for most counties in the United States. A key objective of the analyses is to increase understanding of why school spending continues to grow even in the face of declining population and school age population. Over the period of analysis, about 10% of US counties experienced population decline of more than -5%, where most declining counties are rural. The evaluation presented in this paper offers some new insight. First, education revenue/expenditure is more responsive to changes in school age population in growing places than in declining places. This finding is consistent with the theoretical discussion; eagerness in expansion and then resistance in making cuts to labor and capital make it easier to increase spending during periods of growth, but more difficult to cut spending in the face of decline.

Overall, the analysis offers new information that increases our understanding of the dynamics of education finance in growing and shrinking counties. Are the asymmetries identified in this analysis an efficient pattern of education finance dynamics? Should education spending fall when school age population declines as rapidly as it increases during periods of growth? While the empirical analysis does not offer clear answers to these questions, it sheds light on important education spending patterns that have been masked within standard regression analysis thus far. Considerations such as difficulties in cutting wages and employment to the downside, eagerness of bureaucracies to expand during periods of growth but resistance to cuts during periods of decline, and intergovernmental assistance formulae help to explain some of the observed asymmetries.

Local leaders in declining areas must deal with an ever-present tension. On the one hand, they may feel compelled to devote public resources in order to ensure the children in their communities receive high quality education. On the other hand, they must be careful not to over-burden decreasing numbers of households with rising taxes to pay for those services, which could further hasten the decline. The evaluation shows that, on average, local leaders were willing to increase spending as the number of school age children declined, presumably in an effort to maintain the quality of educational services. This tension between maintaining the quality of educational services and being sensitive to tax burdens is always present in shrinking communities; creativity and perhaps some intergovernmental assistance are required to affordably maintain essential public services during periods of chronic decline.

Figure 1: Declining Population Variable Trends

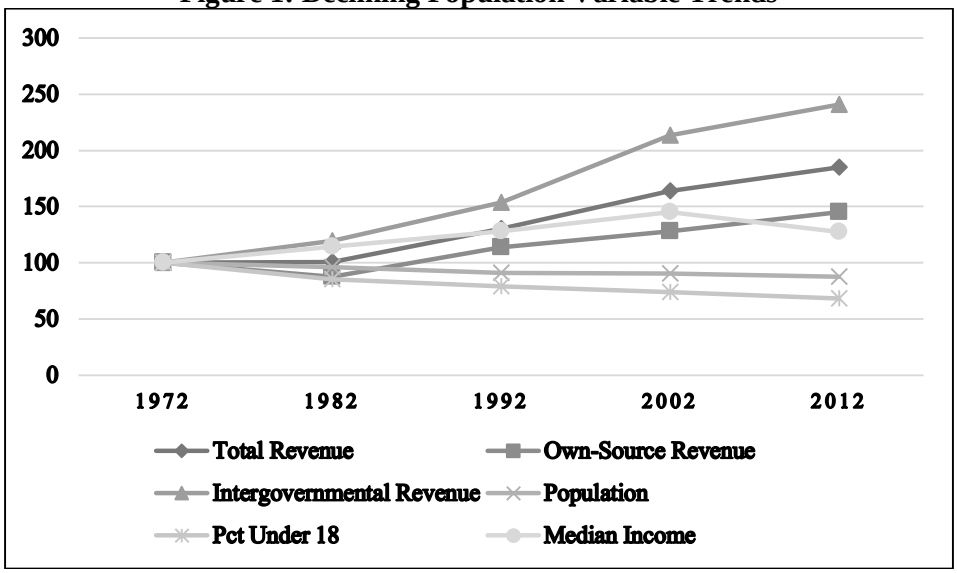

Figure 2: Growing Population Variable Trends

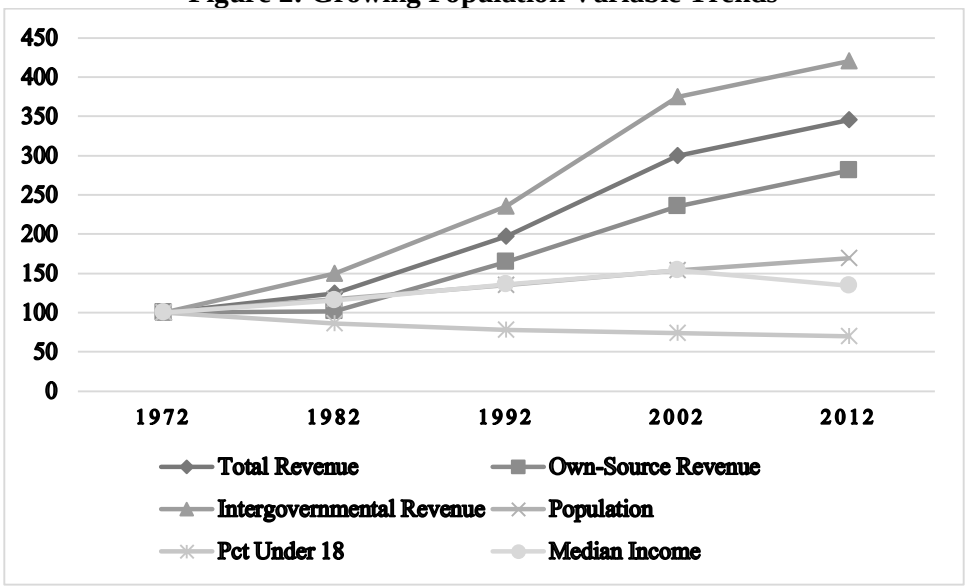

Figure 3: Percent Change in Real Per-Capita Total Education Revenue from 1972 to 2012

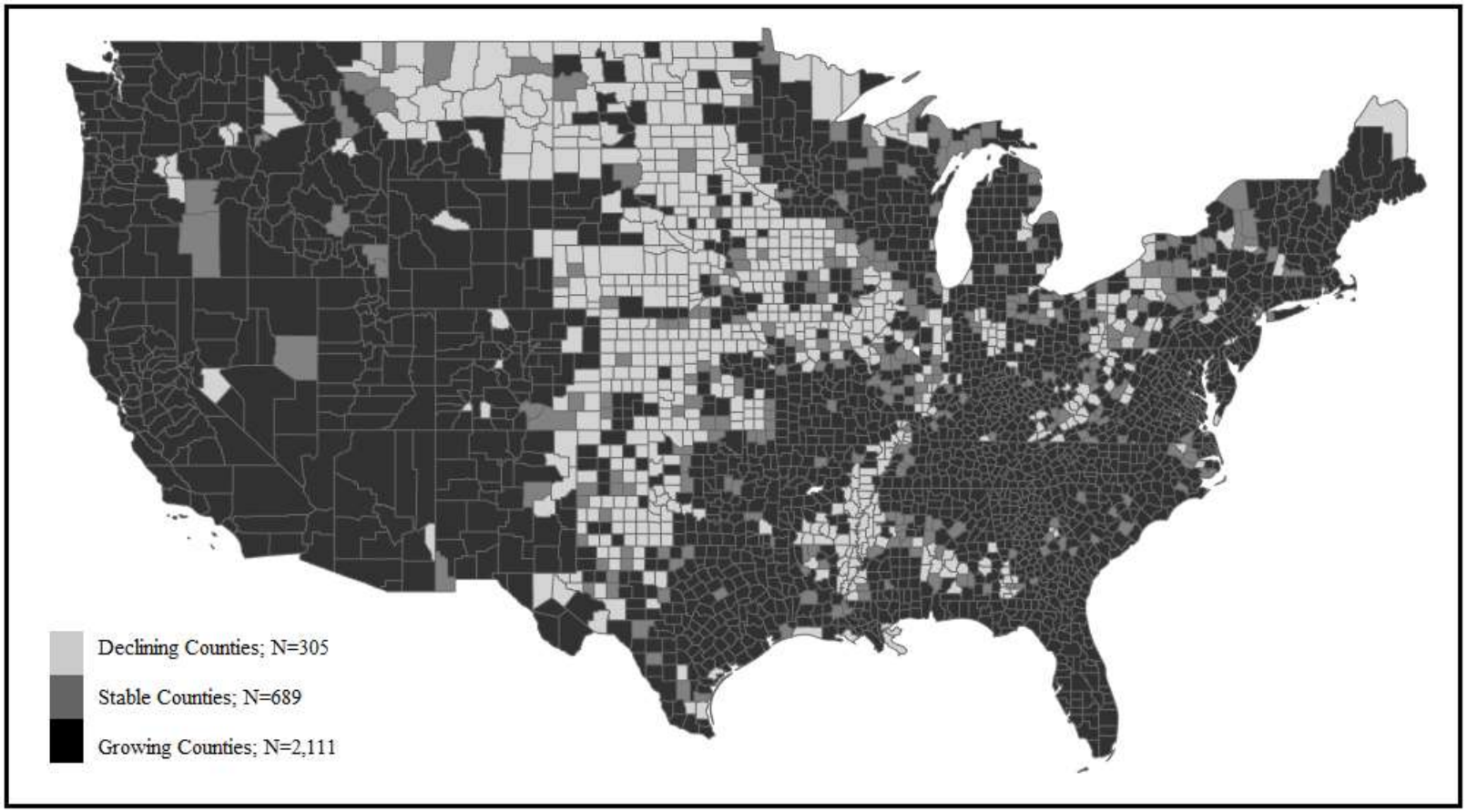

Table 1: Declining Population Control Variables

	1972	1982	1992	2002	2012
Economic					
Median Income	30,740	35,152	39,366	44,638	39,230
	(7,211)	(6,538)	(7,033)	(7,383)	(7,246)
Top Ten Income	65,558	70,382	81,362	104,265	142,669
	(11,824)	(9,111)	(11,855)	(14,458)	(18,048)
Poverty Rate	0.167	0.138	0.139	0.127	0.168
	(0.096)	(0.069)	(0.072)	(0.063)	(0.066)
Pct BA Degree	0.071	0.103	0.122	0.149	0.171
	(0.023)	(0.029)	(0.034)	(0.044)	(0.054)
Demographic					
Population	48,575	46,630	44,365	43,910	42,595
	(246,942)	(232,161)	(225,892)	(229,363)	(222,006)
Female HH Rate	0.067	0.076	0.088	0.097	0.105
	(0.031)	(0.039)	(0.049)	(0.051)	(0.056)
Pct Over 65	0.131	0.151	0.170	0.172	0.176
	(0.037)	(0.038)	(0.038)	(0.035)	(0.035)
Pct Under 18	0.337	0.287	0.267	0.249	0.230
	(0.039)	(0.032)	(0.029)	(0.026)	(0.027)
Pct White	0.915	0.902	0.891	0.871	0.862
	(0.164)	(0.166)	(0.171)	(0.177)	(0.179)
Institutional					
Right to Work	0.584	0.605	0.613	0.640	0.657
	(0.493)	(0.489)	(0.487)	(0.480)	(0.475)
State TELs	0	0.147	0.260	0.405	0.461
	-	(0.355)	(0.526)	(0.623)	(0.737)
School TELs	0.923	1.545	1.914	2.017	1.506
	(0.458)	(0.707)	(0.892)	(0.932)	(0.766)
School Finance Reform	0.171	0.537	1.327	1.932	2.363
	(0.377)	(0.641)	(1.096)	(1.178)	(1.368)
School Districts	5.917	5.241	4.877	4.295	4.098
	(8.319)	(7.609)	(7.313)	(6.994)	(7.624)

Standard deviation in parentheses. Adjusted to 2009 dollars.

Table 2: Growing Population Control Variables

	1972	1982	1992	2002	2012
Economic					
Median Income	33,043	38,094	45,010	50,780	44,277
	(8,450)	(8,240)	(10,964)	(11,890)	(11,503)
Top Ten Income	68,018	75,057	93,707	120,682	146,496
	(12,596)	(12,301)	(17,832)	(22,482)	(17,373)
Poverty Rate	0.162	0.122	0.121	0.116	0.168
	(0.087)	(0.059)	(0.063)	(0.054)	(0.060)
Pct BA Degree	0.084	0.122	0.145	0.175	0.199
	(0.045)	(0.060)	(0.073)	(0.085)	(0.092)
Demographic					
Population	65,186	76,596	87,944	100,363	110,383
	(203,921)	(231,462)	(272,542)	(305,225)	(328,984)
Female HH Rate	0.078	0.088	0.101	0.108	0.122
	(0.025)	(0.028)	(0.032)	(0.034)	(0.039)
Pct Over 65	0.107	0.118	0.129	0.131	0.140
	(0.035)	(0.035)	(0.036)	(0.034)	(0.036)
Pct Under 18	0.339	0.291	0.266	0.252	0.236
	(0.038)	(0.034)	(0.034)	(0.032)	(0.034)
Pct White	0.889	0.878	0.866	0.841	0.828
	(0.146)	(0.141)	(0.143)	(0.148)	(0.151)
Institutional					
Right to Work	0.517	0.538	0.555	0.580	0.611
	(0.500)	(0.499)	(0.497)	(0.494)	(0.488)
State TELs	0	0.231	0.411	0.624	0.719
	-	(0.421)	(0.599)	(0.669)	(0.823)
School TELs	0.834	1.594	1.985	2.225	1.594
	(0.583)	(1.004)	(1.071)	(1.213)	(0.974)
School Finance Reform	0.064	0.584	1.363	2.024	2.408
	(0.245)	(0.666)	(1.178)	(1.230)	(1.470)
School Districts	5.683	5.526	5.405	5.170	5.304
	(7.378)	(7.163)	(6.933)	(6.675)	(6.917)

Standard deviation in parentheses. Adjusted to 2009 dollars.

Table 3: Declining Population Local Government Education Spending

	1972	1982	1992	2002	2012
Total Revenue	50,358	50,840	65,758	82,495	93,206
	(292,916)	(262,250)	(348,497)	(440,048)	(524,989)
Own-Source Revenue	29,327	25,674	33,449	37,608	42,584
	(199,381)	(144,470)	(222,724)	(265,181)	(304,513)
Intergovernmental Revenue	21,031	25,166	32,309	44,887	50,622
	(97,818)	(120,434)	(132,799)	(185,455)	(233,862)
Current Operations	41,547	42,242	55,848	67,530	74,505
	(211,608)	(207,846)	(274,882)	(346,760)	(410,416)
Capital Outlays	3,162	2,146	3,926	8,302	7,424
	(18,321)	(8,127)	(18,944)	(50,847)	(40,030)

Standard deviation in parentheses. Adjusted to 2009 dollars, in thousands.

Table 4: Growing Population Local Government Education Spending

	1972	1982	1992	2002	2012
Total Revenue	59,773	74,302	117,966	179,262	206,626
	(215,303)	(240,112)	(383,564)	(591,457)	(640,240)
Own-Source Revenue	32,122	32,789	52,807	75,628	90,314
	(132,313)	(95,120)	(158,018)	(238,219)	(271,658)
Intergovernmental Revenue	27,651	41,513	65,159	103,634	116,313
	(85,897)	(162,563)	(259,152)	(388,536)	(411,449)
Current Operations	49,891	61,065	97,440	144,708	167,260
	(182,095)	(197,928)	(313,193)	(466,797)	(500,710)
Capital Outlays	5,236	4,632	10,956	22,979	17,252
	(16,823)	(14,035)	(35,174)	(81,975)	(63,091)

Standard deviation in parentheses. Adjusted to 2009 dollars, in thousands.

Table 5: Local Government Education Regressions: First Differenced Variables with Fixed Effects

	Total Revenue	Own-Source Revenue	Intergovernmental Revenue	Current Operations	Capital Outlays
ln(Population)					
Declining Units	0.931***	1.250***	0.640***	0.685***	2.501***
	(0.140)	(0.150)	(0.231)	(0.0870)	(0.770)
Stable Units	0.909***	1.322***	0.663***	0.797***	0.984
	(0.167)	(0.265)	(0.232)	(0.125)	(0.876)
Growing Units	1.008***	1.395***	0.654***	0.886***	2.537***
	(0.0535)	(0.0840)	(0.0827)	(0.0414)	(0.270)
Pct Under 18					
Declining Units	-0.119	-1.316**	0.879	0.369	-3.969**
	(0.324)	(0.516)	(0.726)	(0.287)	(1.835)
Stable Units	1.826***	0.0497	3.661***	1.448***	7.885***
	(0.430)	(0.688)	(0.765)	(0.371)	(2.569)
Growing Units	1.946***	3.005***	2.233***	1.755***	6.839***
	(0.213)	(0.430)	(0.399)	(0.186)	(1.173)
Other					
ln(Median Income)	0.122**	-0.000512	0.250**	0.0353	0.668**
	(0.0586)	(0.0411)	(0.106)	(0.0246)	(0.279)
ln(Top Ten Income)	0.106***	0.170***	-0.0120	0.0373*	0.815***
	(0.0279)	(0.0446)	(0.0531)	(0.0206)	(0.152)
Poverty Rate	-0.0718	0.0347	0.194	0.00640	-0.141
	(0.147)	(0.188)	(0.252)	(0.0919)	(0.757)
Pct BA Degree	0.0771	0.108	0.161	0.0827	0.256
	(0.135)	(0.115)	(0.208)	(0.0588)	(0.641)
Female HH Rate	-0.134***	-0.245**	-0.0503*	-0.131***	-0.671
	(0.0478)	(0.115)	(0.0288)	(0.0229)	(0.538)
Pct Over 65	-1.115***	-0.619	-1.152**	-1.404***	-0.571
	(0.325)	(0.437)	(0.499)	(0.289)	(1.555)
Pct White	-0.494***	0.0554	-0.562***	-0.424***	-1.160**
	(0.0815)	(0.148)	(0.146)	(0.0683)	(0.528)
Right to Work	-0.0468***	0.0393***	-0.109***	-0.0532***	-0.197**
	(0.00867)	(0.0139)	(0.0107)	(0.00796)	(0.0797)
State TEL's	-0.00704*	0.0177**	-0.0301***	-1.16e-05	-0.0756***
	(0.00422)	(0.00818)	(0.00715)	(0.00312)	(0.0282)
School TEL's	-0.00222	-0.0572***	0.0419***	0.00108	0.00210
	(0.00194)	(0.00365)	(0.00371)	(0.00142)	(0.0133)
School Finance Reform	0.0270***	-0.0105**	0.0635***	0.00981***	0.0157
	(0.00235)	(0.00426)	(0.00422)	(0.00182)	(0.0162)
School District Number	0.0176***	0.0130***	0.0170***	0.0193***	0.00913
	(0.00310)	(0.00340)	(0.00461)	(0.00298)	(0.00970)
Constant	0.102***	0.0126	0.207***	0.127***	0.0832*
	(0.00897)	(0.0147)	(0.0157)	(0.00734)	(0.0474)
Observations	21,976	21,976	21,973	21,975	21,867
R-squared	0.205	0.070	0.153	0.255	0.042
Number of Units	2,752	2,752	2,751	2,752	2,752

Dependent variables in log form. Cluster-robust standard errors in parentheses. Time fixed effects included.
***p<0.01, **p<0.05, *p<0.1

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Appendix A: Data Variables, Definitions, Sources and Methods

Variable	Definition
[1] Total Education Revenue	Total revenue received by k-12 schools aggregated to the county level.
[1] Own-Source Revenue	Revenue raised directly by k-12 schools aggregated to the county level.
[1] Intergovernmental Revenue	Revenue received by k-12 schools from other governmental units (primarily state and federal governments) aggregated to the county level.
[1] Operational Expenditures	Expenditures used by a k-12 schools to operate its normal operations aggregated to the county level.
[1] Capital Expenditures	Expenditures used by a governmental unit to acquire or upgrade capital assets aggregated to the county level.
[2] Population	Total number of persons inhabiting a county.
[2] Median Income	Income level that divides the income distribution into two equal groups for a county.
[2] Top Ten Income	Income level that defines the lower bound of the top ten percent income bracket for a county.
[2] Female HH Rate	Percentage of households that are female-headed in a county.
[2] Poverty Rate	Percentage of households with income below the poverty line in a county.
[2] Pct Over 65	Percentage of the population aged 65 years or older in a county.
[2] Pct Under 18	Percentage of the population aged 18 years or younger in a county.
[2] Pct BA Degree	Percentage of the population that have earned a bachelor's degree in a county.
[2] Pct White	Percentage of the population of the White race in a county.
[3] Right to Work	Statute that prohibits union security agreements. This variable equal 1 if a RTW law exists 1 a state, and 0 otherwise
[4,5] State TELs	Statutes that restrict the level of growth, or spending of a state governmental unit. This variable increases by 1 every time a new TEL is imposed, and is reduced by 1 if a TEL is eliminated.
[4,6,7] School TELs	Statutes that restrict the level of growth, or spending of local education governmental units. This variable increases by 1 every time a new TEL is imposed, and is reduced by 1 if a TEL is eliminated.
[8] School Finance Reform	Judicial or legislative acts that reform school funding rules. This variable increases by 1 every time a new SFR is imposed, and is reduced by 1 if a SFR is eliminated.
[2] Independent School Districts	The number of independent school districts within each county.

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Appendix A (continued)

Variable	Description and Method
Top Ten Income	Top ten income is defined as a top 10% (or 90th percentile) income level of U.S. households. As the U.S. Census does not provide the full income distribution at the local level, we restore an (approximate) income distribution using the reported number of households in each of 10 income categories. First, the upper limits of income distribution for each sample periods are estimated using the historical national-level household income trends. Assuming households are distributed uniformly within each income category, we get households distribution function across income levels and using this function we calculate the top ten percent income by targeting the income level where the area under the households' income distribution function above that income level is equal to 0.10*total households in a county.
Right to Work	Right to work statutes are defined as a dummy variable: 1 if a state has enacted a statute or constitutional amendment, and 0 if the state has not. The dummy variable applies to all types of local government units within a state.
Tax and Expenditure Limits	TELs are defined as account variables that capture the number of statutory limitation changes that affect a government unit over the period. The type of TEL or specific limits are not considered. The starting point in 1972 is 0. School TELs apply to counties with independent local school districts; counties without independent local school districts operate through counties, municipalities, townships, and special districts, therefore the TELs imposed on these jurisdictions are applied instead. State TELs apply to the state government.
School Finance Reform	The School Finance Reform variable is defined as a count variable that captures the number of legislative or judicial reforms within a given state. The starting point in 1972 is 0.
Independent School Districts	The School District variable is the number of independent school districts within a county, not the number of schools; the reporting methods of these counties and school districts vary. States, counties and municipalities that operate school districts as part of their own expenditures, rather than as independent school districts, are set to 0 because local government finance data does not provide this information.

Appendix B: Local Government Education Regressions – Two Way Fixed Effects with County-specific Time Trends

	Total Revenue	Own-Source Revenue	Intergovernmental Revenue	Current Operations	Capital Outlays
ln(Population)					
Declining Units	0.7675***	1.1347***	0.4890*	0.5980***	1.2311
	(0.1813)	(0.2016)	(0.2732)	0.0980	(0.8762)
Stable Units	0.7415***	1.1848***	0.8569**	0.8252***	0.1353
	(0.1826)	(0.2690)	(0.4101)	0.1811	(0.8305)
Growing Units	0.9765***	1.4211***	0.5989***	0.8954***	1.6803***
	(0.0547)	(0.0980)	(0.0961)	0.0442	(0.2409)
Pct Under 18					
Declining Units	1.0497***	-1.2744**	2.4011***	1.1323***	0.2994
	(0.3798)	(0.5802)	(0.7984)	0.3281	(1.9342)
Stable Units	2.9049***	0.2525	5.8002***	2.5403***	8.8420***
	(0.4395)	(0.7691)	(0.8839)	0.3943	(2.6188)
Growing Units	2.8128***	3.4711***	3.5745***	2.5047***	7.8884***
	(0.2471)	(0.5268)	(0.4623)	0.2071	(1.1503)
Other					
ln(Median Income)	0.0867	-0.0369	0.2125**	0.0126	0.4919**
	(0.0601)	(0.0485)	(0.1036)	0.0310	(0.2175)
ln(Top Ten Income)	0.1040***	0.1767**	-0.0530	0.0612**	0.7256***
	(0.0310)	(0.0557)	(0.0567)	0.0250	(0.1502)
Poverty Rate	-0.2286	0.0271	-0.1181	-0.0607	-1.0818
	(0.1577)	(0.2334)	(0.2601)	0.1118	(0.6936)
Pct BA Degree	0.0221	0.1208	-0.1345	0.0824	0.0861
	(0.1324)	(0.1643)	(0.2426)	0.0755	(0.6754)
Female HH Rate	-0.0775	-0.2172	0.0251	-0.0400	-0.4786
	(0.0688)	(0.1530)	(0.0591)	0.0309	(0.7477)
Pct Over 65	-1.0142***	-1.2482**	-0.4746	-1.1242***	-2.0351
	(0.3407)	(0.5483)	(0.7001)	0.2867	(1.4828)
Pct White	-0.4251***	0.1190	-0.4260**	-0.4634***	-1.0874**
	(0.0990)	(0.1654)	(0.1904)	0.0815	(0.4790)
Right to Work	-0.0105	0.1605***	-0.1003***	-0.0200**	-0.3007***
	(0.0116)	(0.0193)	(0.0160)	0.0097	(0.0769)
State TELs	0.0060	0.0157	-0.0288***	0.0063	-0.0834***
	(0.0053)	(0.0117)	(0.0101)	0.0045	(0.0269)
School TELs	-0.0093***	-0.0614***	0.0290***	-0.0038*	-0.0297**
	(0.0025)	(0.0052)	(0.0052)	0.0020	(0.0135)
School Finance Reform	0.0235***	-0.0336***	0.0656***	0.0169	-0.0176
	(0.0026)	(0.0047)	(0.0046)	0.0022***	(0.0153)
School District Number	0.0212***	0.0094**	0.0268***	0.0218	0.0216**
	(0.0032)	(0.0041)	(0.0048)	0.0031	(0.0091)
Constant	-9.681***	-61.021***	16.271***	-20.263***	42.478***
	(1.662)	(3.137)	(2.891)	(1.367)	(7.309)
Observations	24,733	24,733	24,731	24,732	24,659
R-squared	0.993	0.981	0.985	0.996	0.834
Number of Units	2,754	2,754	2,754	2,754	2,753

Dependent variables in log form. Cluster-robust standard errors in parentheses. Time fixed effects included.
***p<0.01, **p<0.05, *p<0.1